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MEDIA GALLERIES IN MOBILE DEVICES - GUIDELINES FOR AIDING FUTURE PROCUCT DECISIONS

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Mobile devices that can store and capture different kinds of media – pictures, video clips and audio – are becoming more popular and the amount of media files they can manage is increasing. The larger the amount of media gets, the more important it becomes to have a media gallery that has the right features and good usability.

Media galleries in computers have several features that enable users to manage their media in an easy, fast and enjoyable way. Files can be categorized according to different attributes, presented in numerous ways as well as shared and edited. These features can be learned from when media galleries for mobile devices are developed.

In this thesis, findings from existing media gallery applications and related research was complemented with usability evaluations of four focus products to accomplish a set of guidelines that can be used when future media galleries for mobile devices are designed and developed. The focus products were Series 60 applications Resco Photo Viewer, SplashPhoto, Nokia 6630 media gallery and Nokia Lifeblog.

The guidelines resulting from this thesis suggest among other things that users should be allowed to adjust the way the media files are presented, categorize, search and edit files and there should be proper context sensitive help available. In addition, the product should have fun features that surprise and captivate users.

Keywords: Media galleries, mobile devices, usability, usability evaluation

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Erilaisten mediatyyppien – kuvan, videon ja äänen – tallentamiseen ja hallintaan kykenevät mobiililaitteet ovat tulleet yhä yleisemmiksi. Samalla laitteiden varastointikapasiteetti on kasvamassa. Mitä suuremmaksi tiedostojen määrä kasvaa, sitä tärkeämpää on, että mediagalleriassa on oikeat toiminnot ja hyvä käytettävyys.

Tietokoneiden mediagalleriaohjelmissa on monia ominaisuuksia, jotka mahdollistavat niiden helpon, nopean ja miellyttävän käytön. Tiedostoja voi mm. luokitella eri ominaisuuksien mukaan, katsella monella eri tavalla sekä lähettää ja muokata. Näistä ominaisuuksista voi ottaa oppia, kun mobiililaitteiden mediagallerioita kehitetään.

Tämä diplomityö kokoaa havainnot olemassa olevista mediagallerioista sekä aikaisemmista tutkimusta ja tutkii lisäksi tarkemmin neljän tuotteen käytettävyyttä. Lopputuloksena syntyviä ohjeita voidaan käyttää apuna, kun tulevia mediagallerioita mobiililaitteisiin kehitetään. Painopistetuotteet olivat Series 60 -sovellukset Resco Photo Viewer, SplashPhoto, Nokia 6630 mediagalleria sekä Nokia Lifeblog.

Tutkimuksen tulosten perusteella suositellaan mm., että käyttäjien pitäisi pystyä säätelemään tiedostojen esitystapaa, luokitella, hakea sekä muokata tiedostoja, ja mediagalleriassa pitäisi olla kunnollinen ohje joka tilanteeseen. Lisäksi tuotteessa tulisi olla hauskuutta, joka yllättäisi ja kiehtoisi käyttäjiä.

Avainsanat: Mediagalleriat, mobiililaitteet, käytettävyys, käytettävyyden arviointi

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Jyväskylä, April 5, 2005

Severi Pahkala

Contents

Terms and abbreviations

GPS	Global Positioning System. The system enables pinpointing a geographic location of a receiver using 24 satellites that orbit the Earth.
Heuristic	A rule of thumb or a principle derived from experience.
Heuristic evaluation	A usability evaluation method for finding usability problems in a user interface design. The method is based on a certain set of heuristics.
Metadata	Data about data. Describes the content, quality and other characteristics of data. For example, date and location can be metadata of an image.
PDA	Personal digital assistant. A small mobile hand-held device that provides computing and information storage capabilities for personal or business use.
Series 60	A software platform for smartphones. It is built on the Symbian operating system.
Smartphone	A mobile phone that has special computer-enabled features not previously associated with phones, e.g. e-mail and Web browsing.
Softkey	A key that does not have a fixed function. In a mobile phone, softkey's function depends on the options shown on the display.
Usability	A measure of how effective, efficient and satisfactory a product is when it is used to achieve particular goals in a particular use context.

1 Introduction

Through even the smallest window the eye can reach the most distant horizon. (A. Bergman, Visual Realities, 1992.)

1.1 Media in mobile devices

With the introduction of smartphones and other portable multimedia devices people have the chance to carry media – pictures, music, video etc. – with them wherever they go. Different kind of mobile devices can be seen on the streets more and more; some people take pictures, some listen to music and others watch video clips with their devices. Camera phones have made it possible to take snap shots and video clips whenever and wherever because they are carried around more than traditional cameras.

Early mobile devices had so small memory capacity that the amount of media was restricted to a minimum, but with memory size increasing it is possible to have all your digital media with you in your mobile device. When the amount of media grows large, the way that media is presented becomes more important. If you had music tracks from hundreds of different artists, thousands of digital images and video clips from many years' time and maybe several audio notes, such items should be searched, viewed, listened and edited in an easy, fast and enjoyable way. That is why media galleries should have the right features and good usability and not just be a list of files the device contains.

1.2 Purpose of this work

The purpose of this Master's thesis is to find out what kind of media galleries mobile devices should have; what features should they contain and how they should be implemented to obtain good usability. These issues are studied and guidelines are created because the domain is still young and developing and there is a need for guidelines that help the product development.

This thesis is aimed for those who are involved in developing media gallery software for mobile devices. The results of this work can be used as guidelines when making

decisions about media galleries in future products. Another purpose of this work is to remind of the importance of usability issues when developing not only media galleries but also any other interactive software applications. In other words, the results of this work help in making future products' media galleries better for the users.

1.3 Scope

This Master's thesis concentrates on media galleries on mobile devices. Media galleries' main task is to present digital media to the user and this thesis studies how that media – pictures, audio and video – is and should be presented and managed. Media galleries are often linked seamlessly to media players which play audio and video. This thesis, however, is restricted to studying only media galleries while media players are left outside the scope. This is done to avoid the work expanding too large. Keeping the scope of the study narrow enables profound investigation whereas large scope would produce more superficial results.

The empirical part of this study concentrates on studying Series 60 applications on smartphones. The Series 60 platform is currently the leading smartphone platform in the world. It is licensed by some of the foremost mobile phone manufacturers in the world including LG Electronics, Lenovo, Nokia, Panasonic, Samsung, Sendo and Siemens. (www.series60.com)

1.4 Goals

The goal of this thesis is to make guidelines regarding future development of media galleries in mobile devices. Guidelines include usability as well as important features that galleries should and could have. Totally new features are not innovated but the best features of the current products are presented. The research problems of this study are the following:

- What features should a media gallery in a mobile device have?
- How to achieve good usability in a media gallery?
    - What are the most common usability problems in current media galleries?

By answering these questions, guidelines for developing new media galleries can be created. It is not attempted to make all-inclusive guidelines but rather indicative guidelines that create the basis for product development of future mobile media galleries.

1.5 Structure

Chapters 2 and 3 explain the background study that was done for this thesis. At first, in chapter 2, the basic theory concerning the thesis is explained and the methods are presented and argued. In addition, earlier researches and guidelines on the same subject matter are studied to obtain good background knowledge. In chapter 3, current media galleries in both mobile and computer platforms are reviewed and their noteworthy features are listed.

The most important parts of this Master's thesis are in chapters 4 and 5. These chapters – especially chapter 5 – should be the most interesting for those who work with mobile media galleries. Chapter 4 explains how the empirical part of this study, usability evaluations, was performed. Furthermore, the chapter introduces the four focus products that were evaluated and presents the main findings from these evaluations. Chapter 5 presents the guidelines that are the actual result of this study.

Finally, chapter 6 discusses the whole process and the results of this thesis. It evaluates the reliability of this study and suggests ideas for future research. At the end of this thesis the detailed results of the heuristic evaluations are presented in Appendix A.

2 Literature review

Literature was reviewed to obtain knowledge about what usability really is and how it is measured or evaluated in products. The objective was to find out which methods can and should be used for evaluating media gallery usability in this study. Related research was studied to learn what is already known and what is the starting point for this study. Reading existing standards and guidelines or recommendations helped to evaluate the usability of the focus products and they also created a basis for the guidelines that were created later on.

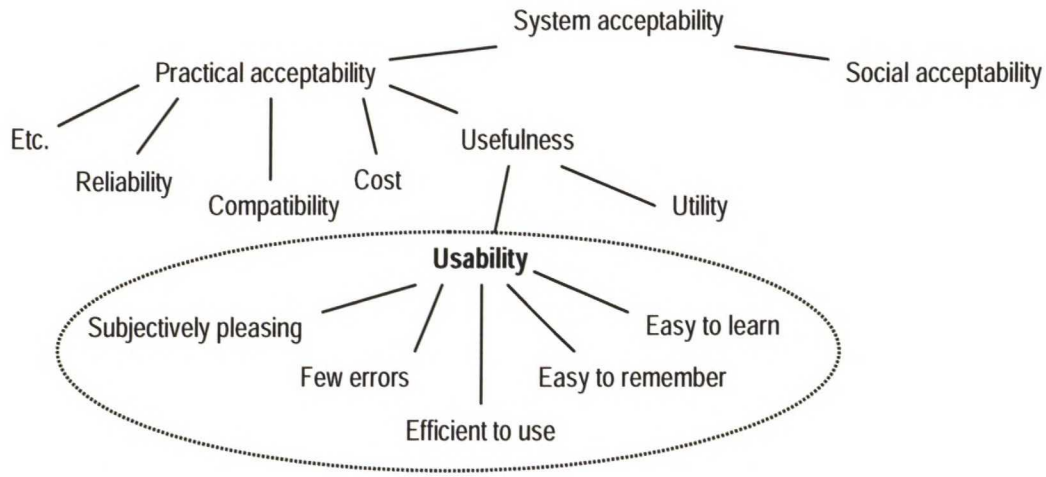
2.1 Usability

A designer or an engineer can think that their product is perfect and easy to use but what do the users think? Sometimes the users' so called mental model of a product varies greatly from the model that the designers have had when they have done the product. This can lead to a situation where designers and users see the user interface of a product differently; the designers may think that the product is very easy to use but that is irrelevant if the actual users consider the product awkward to use. Hence the designers and the engineers that develop a product should have at least some knowledge about the (presumed) users – who they are, what they know, what are their goals, what is their working environment etc. – to make the product usable.

Usability can be defined in many ways. The International Organization for Standardization, ISO, defines usability as effectiveness, efficiency and satisfaction with which specified users can achieve particular goals in a specified use context (ISO 9241-11). Like the definition states, usability is not just a property of a product but it is an attribute of interaction between the user and the product in a context of use (Karat 1997). In this Master's thesis the product is a media gallery and the context of use includes the mobile device containing the media gallery software, the users of the mobile device and the environment – both physical and social – that the product is used in. So it is important to keep in mind the use context when usability is evaluated.

Jakob Nielsen defines usability as a part of system acceptability and points out also learning, remembering and the fewness of errors as building blocks of usability (Picture 1). Thus the usability of a product is good if users can rapidly learn to use it

and get some work done with it (learnability), if the system can be remembered so that casual users do not have to learn everything again every time (memorability), if users make only few errors and can easily recover from them (errors), if the product can be used with high level of productivity (efficiency) and if users thinks that the product is pleasant to use (satisfaction) (Nielsen 1993, 24 – 26).



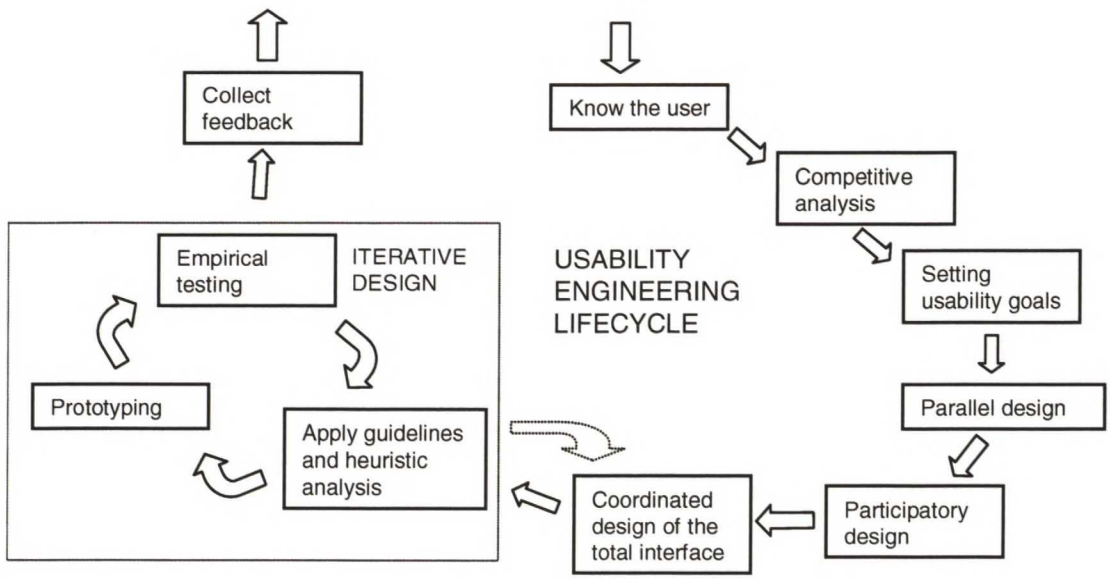
Picture 1. Nielsen defines usability as a part of system acceptability (Nielsen 1993, 25).

2.2 Usability engineering

Good usability can be achieved with usability engineering. The basis of usability engineering is knowing the user and the tasks of the user before starting to design something for the user. After that, design should be iterative so that the usability of the product is evaluated in several occasions with usability experts and actual users. The outcome of the evaluations should be used in improving the product. Usability evaluations should be carried out even with a finished product to get feedback for future products. Hence usability is not something to consider in the end of a product development process through user testing but it should remain a constant factor throughout the process. This whole system is called usability engineering lifecycle. (E.g. Faulkner 2000, Nielsen 1993)

The usability engineering lifecycle model is visualized in Picture 2. Before the actual building of a product begins, there are several phases. The starting point in the product development should be to get to know the hypothetic user. After that, it is useful to familiarize oneself with similar competing products already on the market. Such

competing products can even be used as prototypes in usability tests. Setting usability goals is important because with help of them it can be determined when the product is good enough and ready for use. Parallel design means that several designers or groups work separately designing their version of the product and its user interface. This way it is ensured that all ideas are considered before deciding the structure of product. Also end users can participate in the design process and verify that the solution is correct and suitable for them. Coordinated design of the total interface is needed to make sure that all the parts of the product, including support material, are consistent. This should be double-checked in the end of product development to avoid, for example, version dissimilarities in the product and the related operating instructions. When the actual building of the product is started, relevant standards and guidelines (like this thesis) should be applied. Usability of the product should be evaluated starting from the early mock-ups and prototypes. After the biggest usability problems are eliminated by usability inspections, the prototypes should be tested with users. Designing, prototyping, evaluating and testing should be continued iteratively until the usability goals are met. Finally, after the product is finished, feedback should be collected to get input for future products. (Nielsen 1993, 71-73)



Picture 2. The stages of the usability engineering lifecycle model (Nielsen 1993, 71-73). The iterative design phase is repeated until the usability goals are met. The order of the different phases does not have to be this and some of the phases can be left out according to resources available. This Master's thesis can be placed in the competitive analysis phase of the lifecycle.

This thesis can be seen as a part of the usability engineering lifecycle and the competitive analysis phase. Nielsen (1993, 78-79) explains that if there are several competing products on the market, they can be used in doing a comparative analysis. As a result, ideas for a new design and a list of ad hoc guidelines are achieved. The guidelines should tell which approaches seem to work and which should be avoided. Furthermore, Nielsen recommends reading trade press reviews for getting some insights into the usability characteristics and different approaches of many competing products. These reviews should be complemented with more thorough analysis and testing of a smaller number of important products. This methodology was implemented in this thesis; first, a larger amount of products were examined via press reviews and then a few focus products were evaluated more thoroughly. Finally, a list of guidelines was created.

2.3 Usability evaluation

Usability of a product or a system can be measured with various methods. These methods are usually divided into two categories: user testing which includes the participation of users and usability inspection which is done by usability experts without users (Riihiaho 2000, 7). User testing with real users of the product is the most important usability evaluation method because it provides direct information about real usability issues in the product that is tested. However, recruiting users and arranging user tests requires resources and often it is more realistic – with lower cost – to evaluate usability without users. (Nielsen 1993, 165)

It is not easy to measure product's usability in a reliable way. Measuring for example learnability, efficiency and satisfaction in real context of the product is in most cases expensive and time consuming and therefore often out of the question. As a result, usability evaluations are usually done out of the context and without real users which, however, can lead to a distortion in the results. (Karat 1997)

Although user testing and usability inspection share the same aim, that is, to identify the usability problems in a system, the actual results produced by each technique are quite different in kind. You could say that in many cases user testing reveals the symptom of a problem whereas for example heuristic evaluation identifies the cause of a problem. User testing is much more time consuming, but observing novice users

is still important because many problems are caused by users' knowledge or lack of it. (Doubleday et al 1997)

2.3.1 Finding the suitable usability evaluation method

Because the number of different usability evaluation methods is substantial, literature was reviewed to get information about what would be the suitable method to be used in this study.

According to Karat (1997), the following questions should be considered when choosing a usability evaluation method:

- What is the purpose of the evaluation? Is it intended to help a design in progress or is it done for benchmarking purposes?
- Who will be doing the evaluations? Are usability experts used or is the evaluation done with real users?
- What information is to be collected? Is the evaluation done to collect usability problems or to evaluate product performance?
- Who will be the audience? Are the evaluation results intended for product developers or the general public?
- How much resources are needed? How much time, money and people are available?

In this study, the purpose of the evaluations is to do benchmarking with several products and not help any particular design process. The output of the evaluations should be usability problems and positive findings and features. The results of the evaluations are intended to help product developers develop future products. Resources for the evaluations are limited with one evaluator working on a shoestring budget and a relatively tight schedule.

2.3.2 *Usability inspection methods*

Because the resources in this study were limited and it was the intention to evaluate several products, it was decided that the usability evaluations were done without users – using usability inspection methods. Furthermore, it would have been difficult to examine the whole user interfaces of the evaluated products in user tests because such tests are usually based on certain tasks. With a usability inspection method, it is easier to evaluate every part of the products. The characteristics and the outcome of different methods were compared and two most potential methods, heuristic evaluation and cognitive walkthrough, were investigated more thoroughly to find the suitable method for this particular study. Considered methods are described below and the method that was chosen will be more thoroughly presented later in the text.

2.3.2.1 *Heuristic evaluation*

Heuristic evaluation is based on setting the user interface against predefined guidelines or heuristics. The idea is that a good user interface should adhere the heuristics and so the usability of the user interface can be tested by comparing the elements of the interface to the heuristics. As an output of a heuristic evaluation, usability problems are identified.

Heuristics are not detailed but broad-based rules and they can be used regardless of the nature of a user interface. Nielsen (1990) states that heuristics are helpful in evaluating practically any kind of user interface, for example text-based or graphical interface. Jacob Nielsen's 10 heuristics and Ben Shneiderman's 8 golden rules are two set of heuristics that are well known and they are presented in Table 1 and Table 2 respectively. Many similarities can be found from these two sets of heuristics.

Table 1. Nielsen's 10 heuristics (Nielsen 1994, 30). These heuristics are based on the original nine heuristics (Molich and Nielsen 1990) that Nielsen later refined.

1. Visibility of system status	The system should inform the user about its state and warn the user before doing any potentially harmful operation. User actions should lead to clear changes on the user interface. Verbal feedback should be informative and constructive. When the response time of the system is long, there should be some kind of a progress indicator

	so that the user is never left in any doubt about the state of the system.
2. Match between system and the real world	The used terminology and the language should be understandable and familiar for users and not the language of information technology. In addition, interactions should be looked at from users' perspective and presented accordingly. Metaphors can help users to understand the user interface but they should be used with caution and considering e.g. cultural aspects.
3. User control and freedom	Users should be able to easily get out of any situation, interrupt an on-going operation and undo an action they have made in error. Exiting should not require going through an extended dialog. Undo and redo mechanisms should be supported and clearly visible.
4. Consistency and standards	The elements of the user interface should be consistent within the whole interface and also with other systems and standards. Same actions should have same kind of effects. Same information should be presented in the same way in different states of the user interface.
5. Error prevention	System should avoid states where users can potentially make errors. For example, selecting a file from a list is more recommendable than typing the name of the file because of potential spelling errors. Confirmation queries should be used when there is a risk of making an error with serious consequences.
6. Recognition rather than recall	It is easier for people to recognize than to recall from memory without help. Instructions should be available whenever appropriate. Users should be let to choose from items on the screen, like in menus, and not be forced to remember commands by heart. Users should be told what kind of input is needed. The user interface should be operated with a small set of rules that apply throughout the system, with features doing same kind of things in different situations, e.g. the paste command.
7. Flexibility and efficiency of use	Experienced users should be offered shortcuts so that the most common actions can be performed fast. Those shortcuts can be hidden from novice

	users if needed. Shortcuts to recent and commonly used files and commands should be offered where applicable.
8. Aesthetic and minimalist design	In an ideal user interface only the information that is needed is displayed and it is displayed at the time and place that it is needed. No irrelevant information should be displayed as it distracts users from the relevant information. Screen layouts should make good use of gestalt rules for human perception (e.g. Sinkkonen et al 2002, 102-106). Colors should be used wisely and no crucial information should be told solely with colors.
9. Help users recognize, diagnose, and recover from errors	When an error occurs, system should give a simple and polite error message that indicates the problem and helps the user to recover from it. The message should not contain any code that is not understandable for the user.
10. Help and documentation	Although the user interface should preferably be self-guiding and most people do not like to read manuals, there should be some kind of help available. Help should be related to the task, concrete, concise and easy to search.

Table 2. Shneiderman's 8 golden rules (Shneiderman 1998, 74 – 76).

1. Strive for consistency	Similar situations should require similar sequences of actions from the user, terminology should be identical in prompts, menus and in help and the layout should be consistent throughout the user interface. The number of exceptions, like confirmation of deleting, should be kept to minimum.
2. Enable frequent users to use shortcuts	Expert users appreciate abbreviations, special keys and hidden commands as well as short response times.
3. Offer informative feedback	Every user action should lead to a system response and major actions should have more substantial feedback than frequent and minor actions.

4. Design dialogs to yield closure	Action sequences should have a beginning, middle and an end. Completing the action should lead to an informative feedback that gives the user a satisfaction of accomplishment and knowledge of being able to move on.
5. Offer error prevention and simple error handling	The system should be designed in such way that serious errors can not be made at all. Errors can be prevented for example by not letting the user type letters in a numeric entry field. When an error is made, the system should offer simple and specific instructions for recovery. Erroneous input by the user should leave the system unchanged.
6. Permit easy reversal of actions	When the user knows that his or her actions are reversible, it relieves anxiety and encourages to explorative use of the system. Undoing should be available as much as possible.
7. Support internal locus of control	Experienced users should be made feel they are in control of the system; surprising system actions and inabilities to perform desired actions should be avoided. Users should generally be initiating actions rather than be responders to actions.
8. Reduce short-term memory load	Displays should be simple because human's short-term memory is very limited. Users should be allowed to have sufficient training time.

Heuristic evaluation should be done so that evaluators, each individually, inspect the user interface and when all are done, the results should be aggregated. A typical heuristic evaluation session lasts from one to two hours in which time the user interface should be inspected at least two times to do an in-depth study. The output of heuristic evaluation is a list of usability problems with references to the violated heuristics. The method does not directly produce solutions to the problems but the solution is often quite straightforward because the violated heuristic is known. (Nielsen 1994)

Nielsen and Molich (1990) tested the practical applicability of heuristic evaluation and found it to be a rather difficult method in practice. According to Nielsen and Molich, 3

to 5 evaluators should be used for optimal results and any additional resources should be allocated on evaluating the system with other methods. Evaluators do not necessarily have to be usability experts but they can also be experts on the evaluated product without any experience in usability engineering. Nielsen (1993) suggests that the best results are achieved if evaluators are double experts, i.e., in usability engineering and in the domain of interest.

2.3.2.2 Cognitive walkthrough

Cognitive walkthrough is a method for evaluating the usability of a user interface by analyzing the mental processes required of users when carrying out certain tasks with the product. The analysts performing the cognitive walkthrough first list one or more correct set of actions that are required to complete the tasks and then examine these sets and compare them to the context provided by the user interface. The analysts assess if hypothetic users would be able to complete the tasks or would they encounter problems. This way the reasons for the usability problems in the user interface are identified. It is important for the analysts to consider matters like user background knowledge because it affects the supposed actions of the users. (Lewis and Wharton 1997)

In the walkthrough session, each of the users' tasks is split into sub-tasks or actions that the user has to go through to perform the main task. The analysts examine one sub-task at a time and try to find answers to the following questions during the walkthrough (Wharton et al 1994):

1. Will the user try to achieve the right effect? Does the user see the task consisting of such sub-tasks the designer has presumed?

2. Will the user notice that the correct action is available? Can the user see the required controls or otherwise know what to do?

3. Will the user associate the correct action with the effect trying to be achieved? Are the used terms and the icons clear to the user?

4. If the user performs the correct action, will he or she see that the goal is nearer? Does the action lead to adequate feedback?

While inspecting the product, the analysts should write down problematic elements in the user interface. They should pay attention to assumptions about the users and their knowledge on the subject matter and record if they think that succeeding in some task requires knowledge the users presumably do not have.

Riihiaho (2000) recommends cognitive walkthrough to be used when evaluating walk-up-and-use systems i.e. products that should be easy to learn and self guiding, for example a cash machine. She also recommends using cognitive walkthrough method when smart products like mobile phones are evaluated.

2.3.2.3 Comparisons between methods

The cognitive walkthrough method is a usability inspection method that, above all, evaluates how specific tasks can be completed by hypothetic users (Lewis and Wharton 1997). It does not pay attention to subjective pleasingness of the use experience like heuristic evaluation does. When media galleries of mobile devices are being evaluated, however, satisfaction plays a critical role because we are most of all dealing with entertainment for the users.

Virzi (1997) suggests that a usability-expert review, where experts work individually identifying usability problems with or without specific guidelines, might be the most appropriate usability inspection method when the goal is to find as many usability problems as possible. On the other hand, Virzi says that when the goal is to estimate how easy it is to learn to use an interface, the cognitive walkthrough method could be the best solution.

The cognitive walkthrough method is more of a formative method or it is used to generate new ideas whereas summative methods like heuristic evaluation are used to evaluating existing systems (Wixon et al 1997). In that sense, cognitive walkthrough could be used to generate totally new approaches for media galleries. However, when creating guidelines, it might be safer that they are based on approved solutions rather than new and untried ideas.

In a study by Jeffries et al (1991), four groups of usability experts evaluated the same user interface, each with a different method: heuristic evaluation, software guidelines, cognitive walkthrough and usability testing where usability is tested by giving users

certain tasks and observing them. The results showed that heuristic evaluation found the most usability problems of all methods and, in addition, at the lowest cost in working hours. In another study by Karat et al (1992), usability testing was compared with team walkthrough and individual walkthrough. The results of the study showed that empirical usability testing delivered the best results out of these three alternatives and that team walkthrough worked better than individual walkthrough. Karat et al recommended walkthroughs to be used when resources are very limited and when the design is still in an early development phase.

2.3.2.4 Determining the method for this study

On the grounds of the studies presented above and the goals of this Master's thesis, heuristic evaluation was chosen to be used for evaluating the focus products. It seems that heuristic evaluation (1) enables finding a lot of usability problems, (2) can be set up easily which makes it possible to evaluate several products and (3) is suitable for evaluating user interfaces of finished products. The details of the method and how it is used in this study are presented in chapter 4.1.

Despite the fact that heuristic evaluation works best with several evaluators, it is a suitable method for this study because it is not essential to find every single usability problem of the evaluated products since the aim is not to improve the products – although it would be positive if the results of the evaluations led to improvements in future versions of the products. Instead, the object is to find out what kind of usability problems exist, what are the products' strengths and weaknesses and what should be taken into account when future products are developed.

2.4 Mobile context

The context of use should always be taken into account when the usability of products is evaluated. Evaluating products for mobile use requires understanding of the mobile context of use. Basically, it has to be noticed that the products can be used by anyone, anywhere and anytime. For example, the lighting, noise and temperature conditions can differ drastically depending on the environment in which the user is when he or she is using the product. (Ketola 2002, 73)

The mobile context of use sets requirements most of all to the hardware and ergonomics of the mobile device; the lights have to illuminate the display and the keys so that the device can be used in dark, the keys should be usable for fingers of different sizes whether they are covered with gloves or not, and the device has to endure rough use when it travels around with the user. Still, the requirements of the mobile context are considered in this study because software as well has to rise to the challenge that the context sets. For example, small font size and icons may work ok in office environment but be unsuitable for outside use.

2.5 How users use their digital images

Some research has been done about how people use their digital images – how do they capture them, store them, retrieve them and share them. In addition, some experimental software has been built to answer the needs of users. The articles presented below were inspected to obtain a better understanding of the tasks and needs of digital image users and to find different design solutions.

Wilhelm et al (2004) stated that because the amount and penetration of digital cameras, camera phones and other media capture devices is increasing, more personal digital media is being produced, especially digital photos. As people have more and more digital images, finding a specific image becomes more difficult. Thus, new ways to annotate digital media are needed and metadata should be used to ease image browsing and searching. Furthermore, users were asked about digital imaging and the interviewees said that they generally took a lot of pictures, kept some of them, shared a part of the ones they kept with other people and printed an even smaller group of those pictures. Participants said that they would usually only want to name those images that were good enough for sharing. Because of the cheapness of digital images, the amount of throwaways was very large.

In a study by Rodden and Wood (2003) most users said that they usually just changed the names of the folders but only few changed the names of single pictures, which was considered far less important. Annotation may not begin to seem important until some time after the capturing because when the images are recent and the situation is well remembered the pictures are self-explanatory. According to users, they would merely

like to annotate some of their pictures and annotating the whole collection would not be worth the effort.

Sorvari et al (2004) studied the meaningfulness and usefulness of metadata and the results showed that if meaningful context information would exist automatically, users would be very happy with it but they would not want to put too much effort in creating or editing the metadata themselves. The study showed that the most useful metadata attached to photos was the information about the people in the picture, location, date and occasion. Such metadata would allow better search and management capabilities for photos and most likely for other content – like music – as well. Rodden and Wood (2003) came in their study to the conclusion that names of people and places are usually the most important elements of the annotations of digital images.

Sarvas et al (2004) stated that sharing of mobile pictures has the same motives and uses as sharing of traditional pictures (e.g. showing travel pictures to friends and relatives or recalling shared events). In addition, new technology has brought along new ways of using digital images, for example documenting everyday life. Frohlich et al (2002) said similarly that digital pictures are mostly used to review and communicate experiences with others. They argued that people would like to use digital pictures more extensively as catalysts for conversation in extended family and friendship contexts and to improve individual relationships over distance and time.

In studies by Kuchinsky et al (1999) and Bederson (2001) it was brought out that users often browse images just for the pleasure of looking at them and without searching any particular ones. This is especially the case when personal photos are browsed – often with other people. Users enjoy finding some important shots randomly, i.e. when they are not searching for those particular pictures.

Kuchinsky et al (1999) created a product called FotoFile based on their analysis of existing products and their findings from user research. Their application is meant for organizing and managing consumer digital media, such as photos as well as audio and video recordings. They noticed that while users consider self-defined keywords useful and easy, the task of data entry when annotating media objects can be frustrating. Hence techniques to ease the task of manual annotation were created. For example, a

bulk annotation feature enabled selecting multiple objects and annotating them with one or more values effectively. In addition to self-defined keywords, objects had default metadata attributes, such as date, location, subject, people and description. Objects could also be set as favorites and they could be organized in albums. An interesting detail was that users could assign a representative image for the album (some kind of a cover picture) to enable fast visual recognition when browsing the albums.

Girgensohn et al (2003) considered the needs of digital image users when they created their photo management application. Their goal was to make organizing and browsing photos simple and quick, while retaining scalability to large collections. The application presented images in a table that could be re-ordered by any category. Different sub-categories were visually separated with a marker. The test users of the application liked the fact that they could see all their photos without having to open one folder at a time. Categories were assigned to an image automatically if such data was available (e.g. location with GPS data and people with automatic face recognition). Categorization was quickened by allowing bulk assignment of categories simply with drag and drop technique. Images could also be quickly rated (good – neutral – bad) with keyboard shortcuts. The application had two views: a tree structure with different categories as nodes and a calendar view with a regular monthly calendar type of layout where an icon was indicating how many images can be found under each date. To enable quick scrolling of images, the application cached image thumbnails so that the user did not have to wait for them to load but could scroll through the images without delay.

2.6 Existing guidelines and recommendations

Some articles and guidelines that grasp the same subject as this thesis are presented below. The results of this thesis are meant to complement these guidelines and concentrate specifically on media galleries in mobile devices.

Frohlich et al (2002) interviewed users of digital images and set, among others, the following requirements for future photoware technology: (1) easy photo sharing that would fulfill the need of sharing photos and discussing them at the same time; (2) instant photo sending and sharing that makes it possible to share and see almost live

pictures; (3) automatic or semi-automatic indexing and annotation of photos since people tend to forget details of the context in which photos are taken. It would also help if labeling was made as easy as possible for the user. Relating to this, Wilhelm et al (2004) noted that new photo album products like Adobe Photoshop Album 2, ACDSee 7 and Apple iPhoto utilize metadata (time, location etc.) for image management but most of the earlier programs assumed that image annotation happens well after capturing the image. However, the time lag and the change of context reduce the likelihood that users would annotate the images or remember the exact context of the image.

Shneiderman (2004) pointed out that user interfaces should be designed to be more fun for the products to win through on the highly competitive markets. According to Shneiderman, to reach fun-in-doing, designers must address the following three goals: (1) provide the right functions so that users can accomplish their goals, (2) offer usability plus reliability to prevent frustration from undermining the fun, and (3) engage users with fun-features. After (1) and (2) have been achieved, designers should add the extra touches and flourishes that delight and amuse the users. This can be done for example with colors, animations or sounds. However, one should be cautious because designers can easily go too far in using excessively bold colors, disturbing animations or annoying sounds. Carroll (2004) said that products are fun when they succeed in attracting, capturing and holding users' attention e.g. by arousing emotions not typically aroused in a given context. Fun can also be reached by surprising and challenging users. A design with colors, animations and sounds does not guarantee fun but the user interface should both arouse and intrigue; while distractions may initially be surprising, they tend to annoy users in the long run.

2.6.1 Guidelines for Series 60 platform

Specific guidelines for Series 60 platform were studied to learn what rules apply for Series 60 applications because they were evaluated in the empirical part of this study. The focus products were set against these guidelines when they were evaluated.

Series 60 UI Style Guide (2003) gives an overview of the Series 60 user interface describing the essential parts of it and giving instructions on how to use the interface elements in Series 60 applications – regardless of the product-specific hardware. The

document tells, for example, how different parts of the screen should be used, what kind of pop-up messages should be used in certain situations, what should be the typical functions of each of the standard keys, what kind of different navigation models should be used, how various lists and grids should behave and what they should contain, how text is edited and finally, how data editing and saving should work. The style guide had also some guidelines concerning image and multimedia viewers:

- An image viewer should, by default, initially scale an image so that it fills the available screen area.

- Viewing functions should be available in the options menu but the numeric keypad can be used for shortcuts to allow quick access to frequently used functions, such as zooming.

Series 60 Usability Guidelines for Enterprise applications (2004) advise what things should be considered when developing enterprise applications for Series 60 devices. The guidelines focus on basic mobile usability issues like navigation and information input and output. They are not merely restricted to enterprise applications but they can be applied for mobile applications in general. Comparing these guidelines with the heuristics presented in chapter 2.3.2.1 reveals again many similarities. The guidelines emphasize, among other things, the following issues that concern also mobile media gallery usability:

- Navigation should be as simple as possible and each screen should tell the user where he or she is and where he or she can go therefrom.

- User interface elements and basic rules of interaction should be those already familiar to the user. Thereby the application can be designed to work as the user expects it to work. Navigation key, softkeys, shortcut keys and terms should be used consistently with other applications.

- The main features should be directly available in the main view with only few key presses and such features should not require scrolling or switching to another view.

- Options menu should be ordered according to frequency of usage and logically, so that related items are near each other. Related items should be hidden in submenus to make the options menu shorter. Submenus should not be scrollable and third-level submenus should be avoided. Unavailable items should be completely hidden.

- Typing text should be allowed without forcing the user to do something first. For example, a note creation or searching could start automatically when the user starts typing the keypad. Other shortcuts should also be used to allow more efficient use for advanced users.

- The user should be given feedback of his or her actions within a short period of time. In case of a longer pause, a progress indicator and a possibility to cancel the action are needed.

- The application should prefer selection controls to text entry controls because the error rate resulting from selecting data tends to be lower than from entering data. Text entry should be avoided but if used, it should be made easy by providing reasonable default values or by informing the user about the required format.

- Information should be grouped in a way that supports the user's actions. The most important and relevant information should precede the less-important and less-relevant information.

- The language used should be neutral and the terminology should be familiar to the target users. The amount of text should be kept to minimum but abbreviations should still be avoided, unless they are familiar.

- The background graphics should be less colorful than the foreground. The backlight can be kept active if the screen needs to be monitored for longer times (e.g. when viewing a slideshow).

- The icons used should be simple, distinguishable, and familiar to the user. They should not be used too much and they should not be used to replace essential textual information.

- Colors should be used consistently. They can be used to highlighting and grouping items. Any information should not be provided by colors alone but the same information should be available also without color. The amount of colors used should be limited to 3 – 5. Black, gray and white are the best for providing fine details and blue should be avoided for displaying important information.

- Errors should be prevented and tolerated. Irreversible actions should be avoided and confirmation dialogs should be used to warn users about possibly harmful actions. Error messages should be meaningful, respectful towards the user and in plain language.

- Context sensitive help should be provided everywhere in the application through the options menu. That is, help should concern the task being performed by the user. More detailed help should be provided in the application's website.

3 Current media galleries

The amount of digital media that people have is increasing and so is the amount of different kinds of media galleries available. With new portable devices like smartphones and PDAs it is possible and more common to carry around large amounts of media files. These devices all have some kind of media galleries and whether the media gallery is just a list of files or stylish software with abundant features, the most important thing is that the user is able handle his or her media with it. This chapter takes a look at what kind of products are available on the market. A more detailed summary of media gallery software is available in a special project work that was carried out prior to this Master's thesis (Pahkala 2004).

3.1 Information retrieval

Media gallery software available was mapped by browsing relevant magazines and websites. This was done to get a good view of what are the most appreciated media gallery programs on the market and what features are expected to be in a good media gallery. Issues from (at least) January 2004 to October 2004 of three Finnish (MikroBitti, MikroPC, Tietokone), one British (Personal Computer World) and one American (PC Magazine) information technology magazines were browsed to find articles that dealt with media centers, photo album software or mobile devices.

Since articles and reviews are generally more reliable in magazines than in the Internet, information retrieval focused on magazines. However, important information about mobile phone software that could not be found from magazines was found from the Internet. The leading provider of mobile downloads (Helsingin Sanomat 26.10.2004, MikroBitti 10/2004), www.handango.com, gave information about which photo album products were most popular. These products could also be purchased or downloaded for trial use from the site.

The articles that were found concentrated much on photo albums but reviews and comparisons of media centers were also found. Media centers handle all kinds of media files – pictures, music or other audio and video – whereas photo albums are for managing pictures.

3.2 Media galleries in computers

When plain media players like RealPlayer and Musicmatch are left outside this examination and software that have also photo managing features are studied, there are only few major media centers that control the market. Besides Microsoft's Windows XP Media Center Edition 2004, one media player whose most recent version handles also photos – Windows Media Player 10 – and one popular photo managing software that now handles also audio and video – ACDSee 7 – step up. The usability and the features of Windows XP Media Center Edition 2004 have been praised (e.g. Personal Computer World July/2004, PC Magazine 19/2003). At the same time, the new versions of Windows Media Player and ACDSee are said to have improvements both feature-wise and usability-wise compared to the older versions (e.g. PC Magazine 17/2004, Personal Computer World March/2004).

With the mushrooming of digital photography, the number of digital photo albums seems to have increased immensely lately but according to magazine reviews, there are only a few programs that lead the market. Besides the abovementioned ACDSee 7, Adobe Photoshop Album 2, Jasc Paint Shop Photo Album 5 and Apple iPhoto 4 for Macintosh get the highest ratings. Adobe Photoshop Album 2 has been regarded as the most advanced and the most easy to use photo album software (e.g. MikroBitti 2/2004, Tietokone 11/2004). Jasc Paint Shop Photo Album 5 resembles Adobe Photoshop Album 2 with its looks and features but – according to reviews – it does not quite reach to the same level (Tietokone 11/2004). iPhoto, on the other hand, has conquered the photo album market within Macintosh users with its various features and slick appearance (MikroPC 6/2004).

3.3 Media galleries in mobile devices

Portable media devices like camera phones have become increasingly popular and these devices naturally have some kind of a media gallery. The amount of media that people are able to store in their mobile devices like phones is increasing very rapidly (Sorvari et al 2004). Media gallery may not be the most important part in the mobile device for the manufacturer or the buyer but media galleries develop in line with the whole device and become more sophisticated. For example, Nokia's 6630 camera

phone has a media gallery quite different from the earlier models and it will be introduced and evaluated later in this thesis.

Microsoft has introduced the portable version of its Windows XP Media Center Edition – Portable Media Center software. It runs on a number of mobile devices like Creative Labs Zen and Samsung Yepp YH-120. The software allows you to listen to your music and watch your videos, TV shows and pictures on the move. The user interface of Portable Media Center software is regarded good and pretty intuitive. (PC Magazine 17/2004).

Users do not necessarily have to settle with the device manufacturers' own media gallery software anymore but it is possible – depending on the device – to install third-party media gallery software. Resco Photo Viewer and SplashPhoto are such third-party applications and they are the most downloaded and most highly rated photo album software for Series 60 (www.handango.com). Nokia offers Lifeblog, a multimedia diary that keeps track of captured images and videos as well as sent and received messages. Lifeblog is a PC and mobile phone software combination for a Windows PC and selected Series 60 imaging phones.

3.4 Common and popular features in media galleries

When the features of the top media galleries – both in computers and in mobile devices – were inspected, some trends and consistency in the products could be seen. These common features are presented below. In addition, features that could be found from the products and that were appreciated by magazine reviews are reported. Listing these common and popular features help creating guidelines about what kind of features should be used in future products.

3.4.1 Categorizing and annotating

In many programs, media files can be categorized and annotated in different ways. In Adobe Photoshop Album 2, an unlimited amount of tags can be attached to images and images can be searched and categorized according to these tags (Tietokone 11/2004). In SplashPhoto, images can be categorized in self-defined categories and viewed one category at a time or all categories together. Efficiency is improved if a

batch of items can be selected and categorizing or some other action (e.g. deleting) can be done to the whole group at the same time. Another way to make potentially tedious annotating job more efficient is to auto complete users' typing based on existing categories, like in Apple iTunes. Music files can be categorized by many different attributes, for example in Windows Media Player 10: by artist, song, album, composer, genre, year or rating. Suchlike categories apply for TV series as well. One common attribute among music tracks is nowadays album art or an image of the album where the track was on. Album art can certainly make browsing music files more enjoyable and more efficient at the same time.

Location information has been considered an important metadata type by many PC based image & video management applications in which location is commonly provided as a default categorization criterion, e.g. Adobe Photoshop Album (Sorvari et al 2004). Nokia Lifeblog has a location tag – that is sometimes defined automatically with an accuracy of a country – in addition to name, date and time tags.

A common solution is to gather up a registry file containing the metadata of the media files, e.g. location or categorization information. A more uncommon way is to include the metadata to the file itself. Many image formats support this but not many programs use this possibility. Because programs have different kinds of solutions in this matter, metadata is not easy to transfer between applications. This makes changing programs difficult. (MikroPC 6/2004)

3.4.2 Sorting by any property

Almost all programs allow users to sort files by any attribute they like. For example, SplashPhoto can sort images by name, category, size, resolution, date, note or save location. Files can usually be sorted either ascending or descending. In PC software, the order can usually be changed by clicking the columns, and in smartphone applications, the order can be changed in settings.

3.4.3 Selecting how much details are shown

Personalization of the user interface was regarded as a positive thing in many media gallery reviews. It is, for example, common to let the user select which details of the

files are shown on the screen if any. Details are e.g. name, date, size, resolution, location and category. For example, in Resco Photo Viewer and SplashPhoto, thumbnails can be viewed with or without details or files can be browsed in a list with many details without viewing thumbnails.

3.4.4 Thumbnail previews

In practice, all of the media galleries in computers show thumbnail previews of the images and videos to make the recognition of files easier. Mobile media galleries, on the other hand, are still often lacking thumbnail previews – especially with video clips. For example, Nokia 6630 media gallery shows thumbnail previews of images but not video clips, whereas Nokia Lifeblog shows previews of both images and video clips.

> *"Working with a large amount of pictures would be hopeless without the possibility to view them as thumbnails previews." (Tietokone 11/2004)*

3.4.5 Adjustable size for thumbnails

Another common way of letting the users personalize the user interface is to allow them to adjust the size of thumbnail previews. For example, in Adobe Photoshop Album 2, thumbnails' size can be adjusted steplessly whereas Fotoware Fotostation 4.5 has 15 and Jasc Paint Shop Photo Album 5 has 3 alternative thumbnail sizes (Tietokone 11/2004). In Series 60 applications Resco Photo Viewer and SplashPhoto, the size and thus the amount of thumbnails on the screen can be easily changed with shortcut keys.

> *"Image managing [computer] applications offer beyond exception the possibility to control the size of the thumbnails." (Tietokone 11/2004)*

3.4.6 Slideshow

A common feature for viewing images is a slideshow where images change automatically. In many cases, there are transition effects between the slides. It is often also possible to personalize the slideshow by selecting frame duration and the type of the transition effects (e.g. 'fly from left' or 'blinds'). In Windows XP Media Center

Edition, among others, slideshows can be made more impressive with background music and pan-and-zoom effects which in a way make still images alive (Personal Computer World July/2004).

> *"Using Windows XP Media Center's slideshow option is brilliant. The panning and transition effects are really good and make an otherwise dull slideshow a lot more interesting." (Personal Computer World July/2004)*

Smartphone applications make good use of the small screen by automatically, if wanted, rotating the images so that they fill the screen, i.e. landscape images are rotated 90 degrees to fit into the portrait screen. A useful feature is also forcing the backlight to stay on during the slideshow because the images would be difficult to see without the backlight.

In a study by Rodden and Wood (2003) the slideshow facility was an appreciated feature in photo management software and almost all participants used it.

3.4.7 Rating

Many programs allow users to rate media files, usually on a one-to-five scale. For example ACDSee 7, Apple iPhoto and Windows Media Player 10 have this feature. This way the most or least liked files can be rated and later searched. With the help of ratings, users are instantly able to see how much they appreciate a certain song, movie or image.

In Nokia Lifeblog, files can not be rated but they can be put to favorites so that they remain on the phone even after synchronization and they can always be viewed from the favorites folder.

3.4.8 All media in one application

One obvious trend in PC programs is that all media files are managed in one application. For example, Windows Media Player that previously managed music and video files, enables handling also images in its most recent version. At the same time, ACDSee that was previously just image managing software, enables handling audio

and video files too. The popular music player Apple iPod now has a version that shows images as well – iPod photo.

> *"Windows Media Player 10's library now stores all of your media files, including videos and pictures, which is extremely handy." (PC Magazine 17/2004)*

The media in mobile devices can more and more be managed from one state, i.e. users don't have to take many steps to go from viewing their images to browsing their music tracks. For example, Microsoft's Portable Media Center has shortcuts for 'My pictures', 'My music', 'My video' and 'My TV' in its main menu, whereas Nokia 6630 media gallery has shortcuts for 'Images', 'Videos', 'Tracks' and 'Sound clips'.

New content types such as continuous multimedia streams have become commonplace due to advances in storage, encoding, and networking technologies (Cranor et al 2003). Windows Media Center software puts TV beside images, music and video as one media type and TV viewing will soon be possible and common with mobile devices as well.

3.4.9 Hiding the folder structure

Nowadays, users do not usually have to worry about the folder structure when browsing their media and they don't have to search files from different folders and subfolders. Most media galleries show media files automatically, regardless of their location in the folder structure. The amount of files showed can possibly be restricted by selecting the locations which are shown. For example, in Windows Media Player 10, it is possible to choose to show the contents of your 'My documents' folder but not other users'. In the Series 60 application SplashPhoto, it is possible to view files that are either on the phone's internal memory or on the memory card or both.

3.4.10 Timeline and calendar

One popular way to ease the browsing of a large amount of images and other media files and finding certain items is to present them on a timeline or on a calendar. Adobe Photoshop Album 2 has a calendar view to browse photos by day, week, month or year and a sliding timeline view. PC Magazine (5/2004) regards Adobe's slider as informative, useful and easy to use. Also Jasc Paint Shop Photo Album has a calendar

view in addition to folders, collections and keywords views. Nokia Lifeblog, on the other hand, is completely based on its timeline view in which images, videos and messages are presented in chronological order. In Apple iPhoto 5, those calendar dates that include photos are bolded to separate them from those dates that do not contain any images.

3.4.11 Sharing

In chapter 2.5 it became evident how important sharing of images is to people. Media galleries respond to this need and offer ways to share media both privately and in public. Images can, in most cases, be sent straight from the program to wanted receivers by email and also by MMS or Bluetooth in mobile applications. It is a more common possibility to publish media in the Internet for a selected group of people or the entire world. Nokia Lifeblog makes the so called weblogging easy by letting users store the server settings and making the uploading of images to a Web server semi-automatic. In Jasc Paint Shop Photo Album 5, pictures can be shared by creating web pages of them, so that the page contains thumbnails that are links to the actual images.

3.4.12 Co-operation with mobile and computer software

Since mobile devices have smaller storing capability and simpler input and output mechanisms, it is often easier and more efficient to manage and store media files on a computer rather than on a mobile device. On the other hand, it is good to have an efficient and easy way to enjoy computer's media files on a mobile device and vice versa. Mobile software cannot be designed simply as a copy of their desktop counterpart because while resolution in the mobile devices increases, the display sizes will probably not. So mobile devices' smaller displays and trickier input mechanisms call for a simplified version of the desktop software.

Microsoft's Portable Media Center software works in co-operation with Windows Media Player 10 so that all media files on the computer can be synchronized with a mobile device equipped with compatible software. If wanted, this synchronization can be set automatic every time the device is connected to the PC. Nokia Lifeblog includes both phone and PC software. Items on the phone can be transferred to the PC with the PC software. The transferred items are then, by default, deleted from the

phone. Also SplashPhoto image viewer has desktop software that synchronizes with the mobile device. It has the same features for organizing images as the mobile software, added with the possibility to edit images. Apple iPod's content is almost automatic to manage and update using the iTunes software.

3.4.13 Basic image editing

Many image viewing applications allow basic editing of images but leave more advanced editing to special programs. Basic editing means rotating images between landscape and portrait orientations, cropping images, adjusting the colors of images and possibly adding text to images. Many applications have automatic image correction feature that allows adjusting color, sharpness and brightness with a single click. Computer applications like Jasc Paint Shop Photo Album 5 and ACDSee 7 have abundant image editing features but Resco Photo Viewer proves that simple editing can also be done with a phone. Many imaging phones give the possibility to enhance pictures with fun effects like frames before sending them, for example Siemens SX1's Image Fun application (Tietokone 3/2004).

Video clips can not be edited like images in existing media gallery applications but editing them has to be done in a dedicated video editing application.

3.4.14 Printing

Printing is closely related to media files, mostly images. All the computer media galleries have the possibility to print images from the application. Mobile applications do not currently have this feature but surely it will become a common feature with self-service picture making kiosks becoming more common. For example, Adobe Photoshop Album 2 and Jasc Paint Shop Photo Album 5 have different kinds of printing templates that allow the user print individual greeting cards, calendar and photo albums or just several images on one sheet to reduce the consumption of valuable photo paper.

4 Usability evaluation of focus products

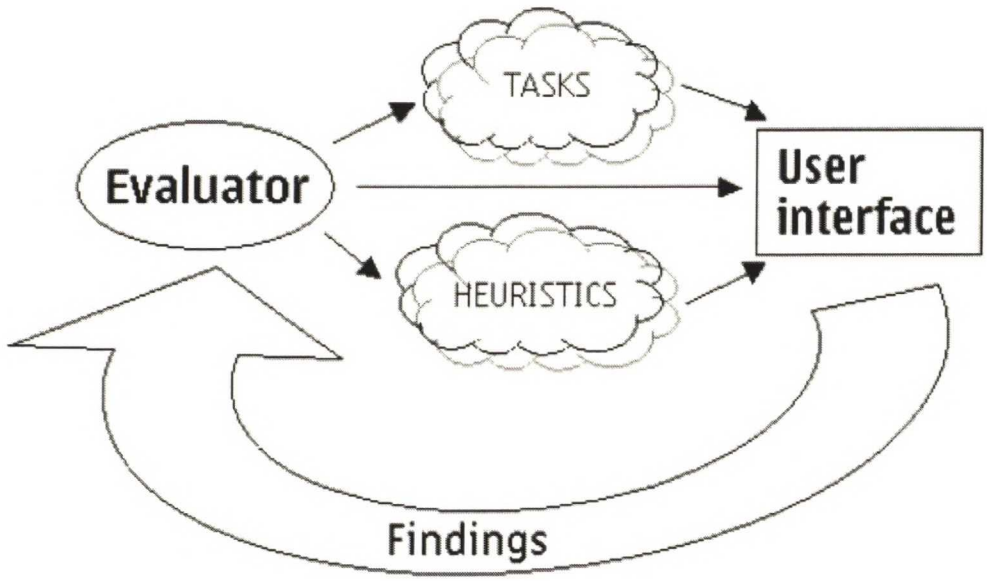
Usability of four interesting media galleries was evaluated using the heuristic evaluation method. In this chapter, the method, the focus products and the results of the heuristic evaluations are presented. The results were used in creating usability guidelines for media galleries in mobile devices.

4.1 Method

The method chosen for this study is heuristic evaluation that was introduced earlier in chapter 2.3.2.1. Influences from the other introduced method, cognitive walkthrough, was also adapted to get more perspective to the evaluations. The heuristic evaluation method – like any other usability evaluation method – works best when more people than one participate. However, in this study the evaluations were done by only one person so this drawback had to be minimized by viewing the products from different perspectives and more than twice, like recommended by Nielsen (1994). Hence the evaluations were carried out in three phases in the following manner:

1. Familiarization
2. Walkthrough based on typical tasks
3. Walkthrough based on the heuristics

At first, the whole user interface of the product was familiarized with by exploring all the different states and trying out all the functions. This was done to get an extensive understanding of the product. Secondly, typical tasks of end-users were performed to see how easy or difficult these tasks are to perform with the product in question. This procedure was carried out like in the cognitive walkthrough method: the analyzer tried to identify with the user's context and tasks to see if the hypothetic user was likely to encounter problems. Finally, each state of the product was inspected by focusing on one heuristic at a time. For example, the consistency – internally within the product and externally with other products – of each user interface element was checked state by state, and the intelligibility of terms and symbols was examined in each state. Picture 3 explains the procedure.



Picture 3. The evaluator went through the user interfaces of the focus products in three phases. Familiarization was done without any specific goals and after that, the user interface was inspected focusing on tasks and the usability heuristics. Findings were recorded as they were revealed.

It is not enough just to go through the product once but to find the maximum amount of usability problems and positive findings as well, the user interface must be examined several times. At each three stages of the evaluations, any findings were documented as soon as they came up.

While usability problems were searched and found, also positive issues were discovered. These positive findings were good design solutions that improved the usability of the products. They were recorded and analyzed so that they could be learned from and made good use of when creating the guidelines. The main idea behind the usability evaluations of the focus products was that by avoiding found usability problems and learning from good solutions future media galleries can be made more usable.

4.1.1 Tasks

The user interfaces of the focus products were evaluated through some basic tasks to see how easy or difficult these tasks were to perform on each product and to find usability problems that way. The tasks were chosen with the help of earlier studies about how users use their digital images (see chapter 2.5), and by simply looking what

were the functions that these products offered. The following tasks were tried provided that it was possible with the product in question.

1. Search a certain photo/video/audio file.
2. Open a photo/video/audio file.
3. View a photo in full screen mode, use zoom.
4. View a slideshow.
5. Change the size of the thumbnails and change the view mode.
6. Rename files.
7. Set an image as a background image.
8. Sort files by different attributes (name, date, size, type etc.).
9. Categorize files.
10. Send files via MMS/e-mail/Bluetooth.
11. Edit photos or videos.
12. Mark files for selection.
13. Delete files.

4.1.2 Heuristics

The heuristic evaluations were finished by evaluating the user interfaces based on heuristic rules so that the whole interface was examined through each heuristic, one at a time. The heuristics that were used in these evaluations were Nielsen's heuristics that were more closely introduced in Table 1.

1. Visibility of system status.
2. Match between system and the real world.
3. User control and freedom.

4. Consistency and standards.
5. Error prevention.
6. Recognition rather than recall.
7. Flexibility and efficiency of use.
8. Aesthetic and minimalist design.
9. Help users recognize, diagnose, and recover from errors.
10. Help and documentation.

4.2 Focus products

Popular and new Series 60 products were chosen to be the focus products that were evaluated in this Master's thesis. The products include two photo albums, one media gallery for all kinds of media files and one multimedia diary for images, videos and messages.

The first two of the focus products, Resco Photo Viewer and SplashPhoto, were installed to Nokia 7610 imaging phone and they were evaluated with that phone. The third product is the default media gallery of Nokia 6630 imaging phone so it was naturally evaluated with that phone, as was Nokia Lifeblog which was installed to Nokia 6630. Both Nokia 7610 and Nokia 6630 have Series 60 platform.

4.2.1 Resco Photo Viewer

Resco Photo Viewer is an image viewing program that can be installed to a mobile device. There are different versions for different devices – pocket PCs, digital cameras and smartphones. The program can be used for previewing, viewing, editing, managing and sending photos that are stored on the device. It was recommended by MikroBitti magazine (10/2004) as being one of the most popular image viewing programs for mobile devices. Resco Photo Viewer for Series 60, the version that was used in this evaluation, has been downloaded over 13 000 times from Handango and it has a rating of 4.5 out of 5 from the users (www.handango.com). A 14-day fully

functional trial version of the software version 4.20.4 was installed to Nokia 7610 to perform the evaluation. More information about Resco Photo Viewer can be found from the website http://www.resco-net.com/symbian/viewer.asp.

4.2.2 SplashPhoto

SplashPhoto is also an image viewing program that can be installed to a mobile device and it too has different versions for different devices. The program can be used for previewing, viewing, managing and sending photos that are stored on the device. Like Resco Photo Viewer, also SplashPhoto was recommended by MikroBitti magazine (10/2004). SplashPhoto for Series 60, the version that was used in this evaluation, has been downloaded over 13 000 times from Handango (SplashPhoto for Palm OS has been downloaded over 179 000 times) and it has a perfect rating of 5 out of 5 from the users (www.handango.com). A 30-day fully functional trial version of the software version 4.21(0) was installed to Nokia 7610 to perform the evaluation. More information about SplashPhoto can be found from the website http://www.splashdata.com/series60/splashphoto/.

4.2.3 Nokia 6630 media gallery

Nokia 6630 smartphone is Nokia's leading imaging phone with 1.3 megapixel camera. The phone's media gallery was chosen as a focus product in this study because it was Nokia's newest media gallery version available, and – although there has not been any thorough comparison between phone manufacturers – Nokia seems to have invested most effort in its phones' media gallery application.

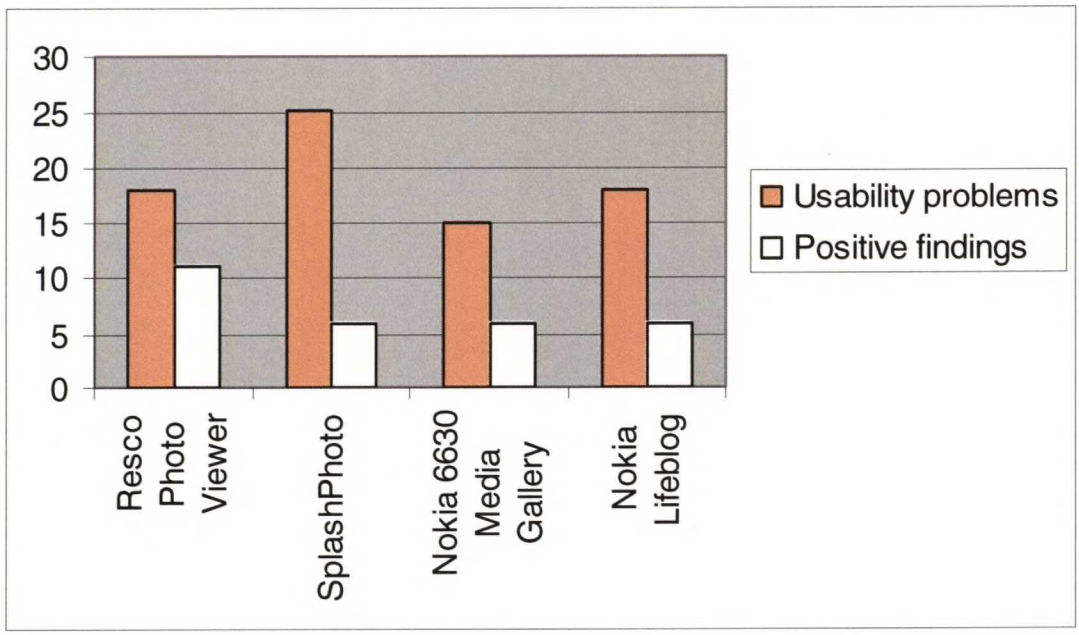
Nokia 6630 media gallery is divided into six parts: images, video clips, tracks, sound clips, links and all files. Tracks refer to mp3 files and sound clips to wav files or other such formats. Images and videos can be viewed and organized in folders. Tracks and sound clips can be listened to and tracks can be collected to track lists. There is a separate Image manager application on the phone for viewing images in a slightly different way. More information about Nokia 6630 imaging smartphone can be found from the website http://www.nokia.com/6630.

4.2.4 Nokia Lifeblog

Nokia Lifeblog is a different kind of concept compared to the other focus products. It is a multimedia diary application for both mobile phone and PC. It automatically stores user's images, videos, messages and text notes and presents them chronologically on a timeline. Images, videos, messages and notes can be viewed, deleted and put to favorites. Files can easily be transferred from phone to PC. The Nokia Lifeblog phone application was evaluated – not the PC application. A fully functional but limited trial version of the software version 1.5 was installed to Nokia 6630 to perform the evaluation. More information about Nokia Lifeblog can be found from the website http://www.nokia.com/lifeblog.

4.3 Results of heuristic evaluations

An average of 19 usability problems and 7 positive findings were recorded during the evaluations. Most problems (25) was found in SplashPhoto and least (15) in Nokia 6630 media gallery. However, the amounts of found problems are not directly comparable because the products had different kinds and different number of features. Still, the quality of the problems is comparable because the focus products are all Series 60 applications handling images and possibly other media files. Picture 4 shows the amounts of usability problems and positive findings for each evaluated product. All the usability problems and positive findings and the heuristics they concern can be found from Appendix A.



Picture 4. The amount of usability problems and positive findings found in the usability evaluations of each four focus products.

4.3.1 Resco Photo Viewer

The overall impression about Resco Photo Viewer after its evaluation was that it has all the basic features for viewing and editing images and it gives users freedom to personalize the use experience with versatile options. Images could be browsed in many ways and watched with slideshows that could also be set up in many ways. The six different browsing views can be seen in Picture 5. Images could be cropped and the colors could be adjusted, and especially the cropping feature seemed quite handy and useful. It was noteworthy that the possibility to make serious errors while cropping was prevented by not allowing the user to save the cropped image on the original image (the edited image had to be saved with a new name). Quite similarly, a picture whose colors had been edited could easily be reset to the original if the changes did not please. Thus the program did well in preventing errors and recovering from them if they were made.

Picture 5. Resco photo viewer's different views: a list with a) large, b) medium or c) small thumbnails and a grid with d) large, e) medium or f) small thumbnails. Users could choose whether they want to see between two and twenty images at a time and in which order the images were presented.

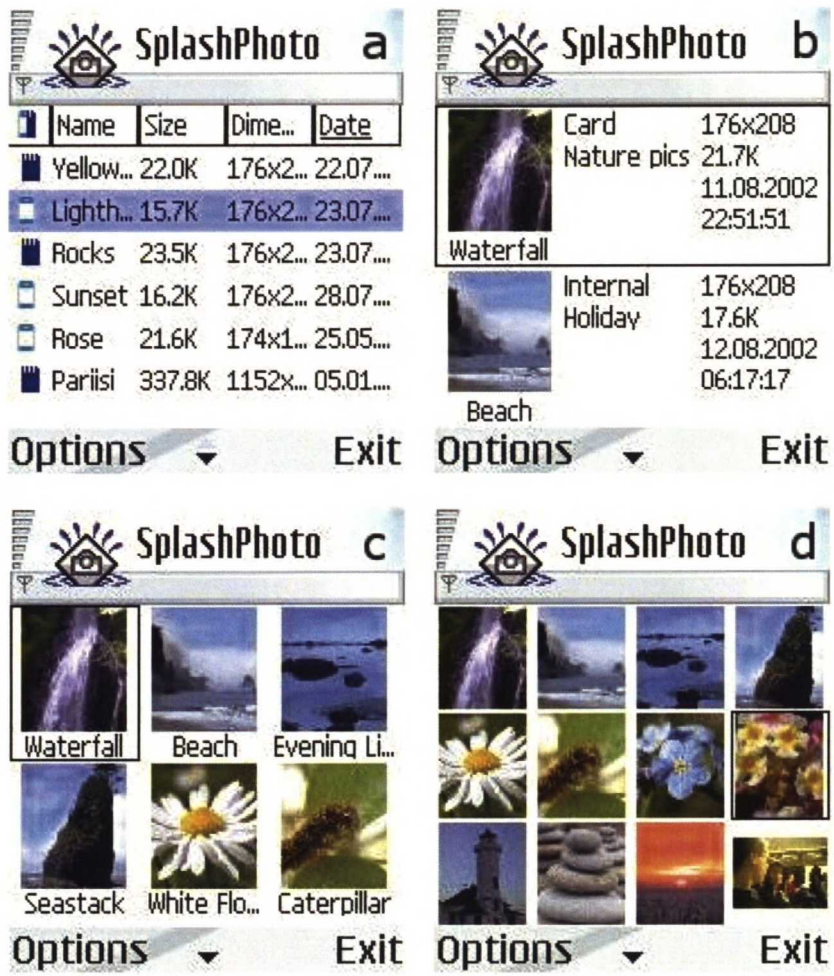
There were no such usability problems in Resco Photo Viewer that would substantially hinder the use but there were problems that potentially cause troubles for novice users and problems that lead to inefficiency. All the found usability problems and positive issues can be found from Appendix A.

In many cases, lack of information from the program to the user caused uncertainty: The program asked for "JPEG quality" of an edited image but did not specify what kind of input could be set. There was also no textual information to explain the color editing icons. Furthermore, softkey labels were not shown when images were opened or colors were adjusted and because of this, the user had to either know or guess what the softkeys did in each state and errors were not prevented enough. Most of all, there was no help function to explain the various functions, settings and shortcuts. There was a good help available on the company's website though. Two problems that

caused unnecessary inefficiency were that images could not be renamed or deleted when they were opened but they had to be closed to do these operations.

4.3.2 SplashPhoto

SplashPhoto was quite similar to Resco Photo Viewer but it was a bit more reduced concerning features and it had more usability problems. SplashPhoto did not have the possibility to edit images but it allowed categorizing images into self-defined categories. Quite similarly to Resco Photo Viewer, images could be browsed in four different views that are presented in Picture 6.



Picture 6. SplashPhoto's different views: a) a list, b) a list with thumbnails and a grid with c) large or d) small thumbnails. Users could choose which details were shown as columns in the list view. In other views than list view, the selected image was not clearly highlighted. This problem was most obvious in d) and when looked on the screen of the device.

There were some major issues that degraded the usability of SplashPhoto: Image opening and closing could be done only by pressing the selection key whereas normally in Series 60 applications opening can alternatively be done through options list and closing by pressing the right softkey. These basic operations should be visible to the user and not only hidden. Now the right softkey was always assigned to 'Exit' and this caused unwanted exiting from the application – especially in situations where the softkey labels were not shown because of a full screen image. Inconsistent use of softkeys and softkey labels is a major reason for usability problems (Series 60 Usability Guidelines 2004, 17). All the found usability problems and positive issues can be found from Appendix A.

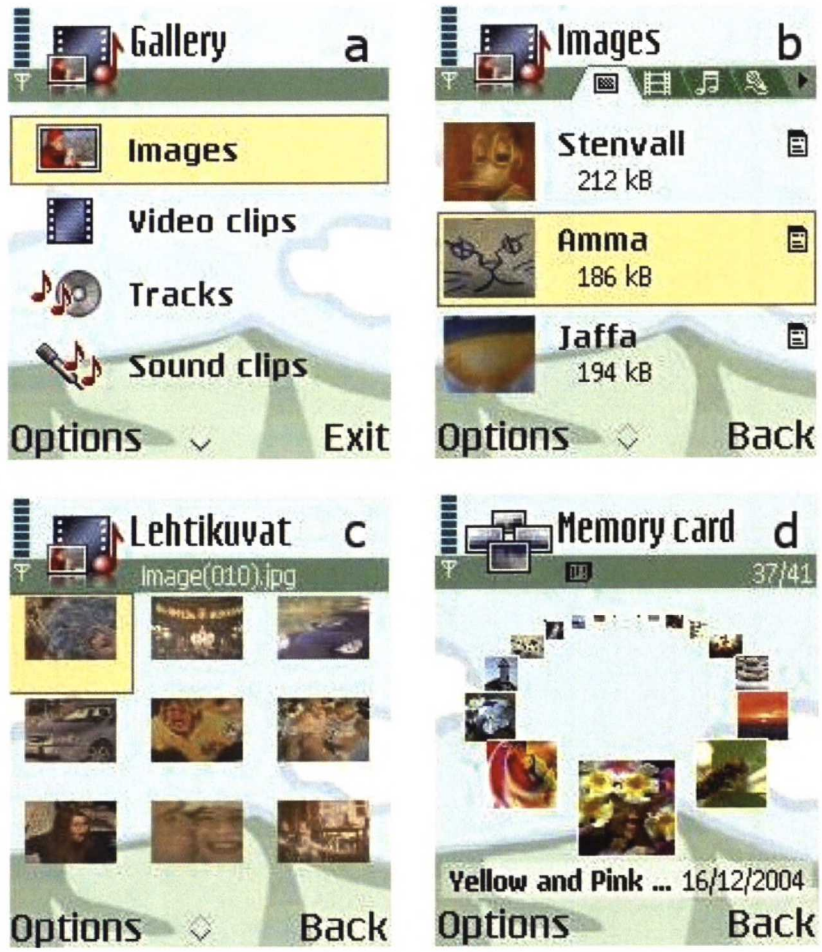
A problem that made managing large amounts of images difficult was the lack of a marking feature. Images could only be categorized, moved or deleted one by one or all visible images at once. This made the options list unnecessarily long because there were options 'Categorize all', 'Move all' and 'Delete all' that the marking feature would have made needless. In addition, these options enabled accidental errors where the user tries to change only one image's status but changes all images' status. For example, categorizing all images to one category – potentially a very damaging operation and hard to recover from – could be easily done because options 'Categorize' and 'Categorize all' were next to each other in the options list and there was no confirmation query.

The zooming of images was poor compared to Resco Photo Viewer's zooming function. Firstly, zooming was limited by the resolution of the image. For example, if the resolution was the same for the image and the display, zooming in or zooming out was impossible – the user was not told any reason but was left wondering why zooming did not work. Secondly, zooming was very slow. Pressing zoom in or zoom out always made the picture disappear for a second.

4.3.3 Nokia 6630 media gallery

Nokia 6630 media gallery is an application for managing images, videos and audio files. It was simplified compared to the two previous focus products because it did not have as rich possibilities for viewing and managing media files. For example, images could not be edited or shown as slideshows. In a separate Image manager application

(Picture 7d) there was an image show option but it was not a real slideshow since the images had to be browsed manually. The browsing views could not be personalized at all, they are shown in Picture 7.



Picture 7. Nokia 6630 media gallery's a) main menu, b) image list, c) folder view and d) the image loop of a separate Image manager application. b) presented the images in a list that was in chronological order whereas c) presented the images in a grid in alphabetical order. The view mode or the order could not be changed.

Nokia 6630 media gallery did not have any major usability problems but there were some flexibility and consistency issues. All the found usability problems and positive issues can be seen in Appendix A. As mentioned earlier, there was no possibility to change how and in which order the files were presented. By default, the files were presented in a chronologically ordered list, three items at a time. However, images that were put to a folder were presented in an alphabetically ordered grid, nine images at a time. Video clips in a folder were nonetheless presented in a list just like outside the folder, probably because there were no preview pictures of the videos. Audio files

could not even be put into folders – which was inconsistent. Moreover, the useful search feature was not accessible in the folders. Mp3 files were presented according to ID3 tags which would have been ok if these tags could have been edited with the phone. Now erroneous tags could not be corrected.

Putting images and video clips into folders in Nokia 6630 media gallery was similar to categorizing images in SplashPhoto. SplashPhoto's term 'categorize' is however more explicit than Nokia 6630 media gallery's term 'move to folder' because files are not actually moved anywhere from their folders. Using the term 'folder' in different meaning in the media gallery than in phone's File manager or Image manager applications can be confusing for the user.

There was one clear advantage in the Nokia 6630 media gallery compared to all other focus products in this study and it was the context sensitive help. Help was always available through the options list and the content of the help depended on the current state of the system. All functions and shortcuts were clearly explained. Another positive finding was the find feature. It found, for example, music tracks whether the search word was the artist's first or last name or the name of the song. It was very good that searching could be started by just typing letters with the keypad and no separate search command was needed.

4.3.4 Nokia Lifeblog

Nokia Lifeblog was very different from all the other focus products. It presented images, videos and messages on a timeline day-by-day. Notes could also be added on the timeline. Hence it was a multimedia diary rather than a media gallery application, or it could be called a media gallery without the possibility to change the order of the items. The personalization possibilities were also otherwise scarce since the view mode could not be modified by e.g. changing the size of the thumbnails – like in Lifeblog's computer software. The two view modes, timeline and favorites, can be seen in Picture 8.

Picture 8. Nokia Lifeblog's a) timeline and b) favorites views. The items added to favorites were not deleted from the phone (or the memory card) when the items were transferred to a PC.

Lifeblog was a quite straightforward program that did not have any major usability problems. There were, besides the poor personalization possibilities, some insufficiency in the program's feedback to the user and some parts worked inconsistently. All the found usability problems and positive findings can be found from Appendix A.

Items could be searched only by date or by browsing the items in chronological order. When the amount of items was small and the time frame was narrow, this worked ok. However, when the amount of items and the time frame grow larger, more efficient searching methods are needed. Maybe the idea is that searching is done mainly on the PC application but since the images and videos have names and possibly location information it would be worthwhile to make good use of this information on the phone as well.

Lifeblog was the only focus product that did not show files automatically after the software was installed or the memory card had been changed. While it had been ideal situation that the uploading of the files was automatic, it was semi-automatic since Lifeblog gave informative messages about how to recover items in above-mentioned situations. When these so called lost items were recovered, the program always asked to plug the phone into the charger before starting data import. However, while power consumption may have been greater than in normal use, data import could be done without plugging the phone into the charger. The message to the user, however,

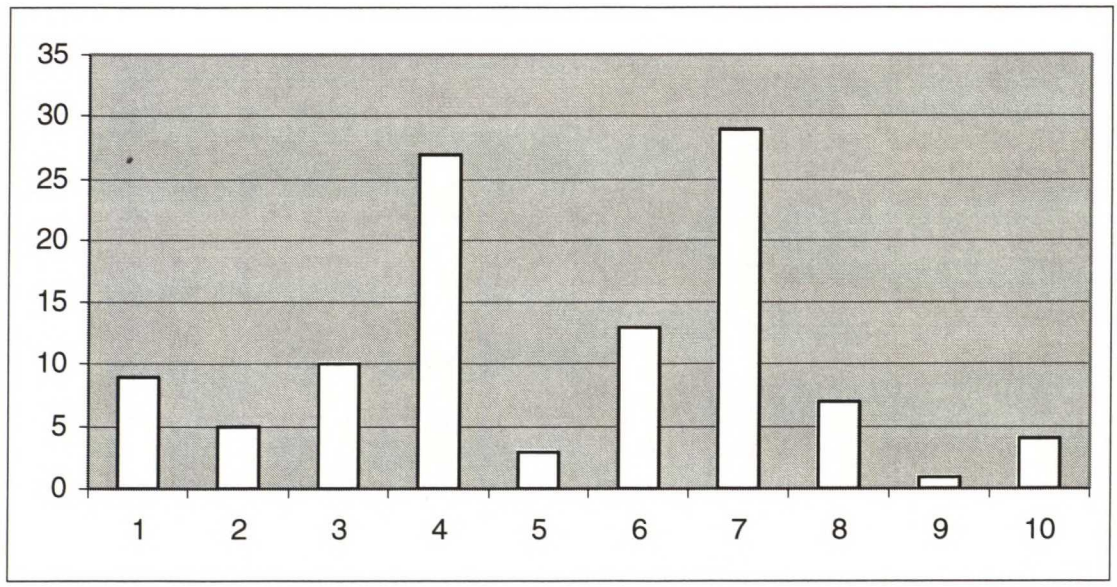
implied that plugging the phone was a necessity and the data import could not be done without the charger, e.g. when on the move. Instead, the message could have told that the operation may require a lot of power in the battery in which case it would be left for the user to decide if he or she still wanted to perform the data import.

The lack of personalization possibilities could also be seen in the settings of Lifeblog; general settings included only one item but it could have included a lot more. For example, the view mode could have been changed as well as rotation and zooming of the full screen view. Additionally, it would have been nice to be able to set the media files and messages to be kept on the phone or deleted during synchronization. Now all the items that were not set as favorites were deleted. This can be confusing to the user as can be noticed from the frequently asked questions of Lifeblog's website. Amazingly, the single setting in the general settings list was favorites size that did not even strike as a relevant setting to the user.

4.4 Conclusions

Overall, the focus products had relatively good usability and hardly any major usability problems but every product had naturally room for improvement. The amounts of problems and positive issues found on each product was shown earlier in Picture 4.

All the found usability problems were categorized under one or several of the Nielsen's heuristics (see Table 1). The most violated heuristics were '7. Flexibility and efficiency of use' and '4. Consistency and standards'. The heuristic '9. Help users recognize, diagnose, and recover from errors' was violated in only one situation, hence the error messages were mostly clear in those rare occasions that errors occurred. The total amount of problems per heuristic can be seen in Picture 9.



Picture 9. The total amount of usability problems in all four focus products per heuristic. The most violated heuristics were '7. Flexibility and efficiency of use' and '4. Consistency and standards'. The ten heuristics are explained in Table 1.

As can be seen from Picture 9 and the tables in Appendix A, the products had various types of problems. Like mentioned, majority of the problems were cosmetic or such that they could be coped with. The errors that violated the heuristic '7. Flexibility and efficiency of use' were often caused by the fact that some operation could not be done in some state or some essential shortcut or function was missing. The errors that violated the heuristic '4. Consistency and standards' were many times those same cases that some operations could be done in some state but not in some other; for example, images could not be renamed or deleted when they were opened, only when they were closed. Other kind of consistency errors were such that the program did not work like a Series 60 application normally does; for example, softkey labels were different than they should have been according to guidelines and common practice.

The help provided to the user was generally speaking poor. As an exception, Nokia 6630 media gallery's help function was excellent for it offered context sensitive instructions in every state. The other focus products did not have any help function but they relied solely on online help that could be found from the products' website or, in Lifeblog's case, a Windows Help file that could be downloaded from the Web.

There were differences between the products in how item details like name, date, location, artist, song, album, etc. could be edited. In Resco Photo Viewer and Nokia 6630 media gallery, details could only be viewed but not edited (except the name of the file). In SplashPhoto and Nokia Lifeblog, on the other hand, editing possibilities were better since details could be edited from the same state that they could be viewed in. It turned out that date information of media files often became distorted, for example when files were transferred. It would be important that the capturing time of images and video clips would stay correct or – if not – it would be possible to edit the time stamps easily and in batches.

All of the focus products hid the folder structure from the user so that files did not have to be browsed by folders but they were shown all together or according to parameters set by the user. Thus the user did not have to know if a certain file was located on the phone memory or the memory card and in which folder it was. This was a positive characteristic for it eased managing media files and prevented losing files in the folder structure.

5 Guidelines

These guidelines should apply to media gallery software in different kind of mobile devices. This study is, however, concentrated on Series 60 applications, so the guidelines may be most valid with Series 60 devices. The guidelines are based on earlier researches, existing products and their usability evaluations that are all explained in the earlier chapters.

These guidelines are meant to be general so they are not all-inclusive and they do not offer any specific details. Instead, they can be used as a reference when developing new media galleries. Technical limitations were not considered since the results of this study are intended to help product development in the future and the current limitations may well be overcome in the near future.

In the 15 guidelines that are listed below, there are mainly special guidelines that apply for media galleries only. Such universal rules that concern not only media gallery application but all applications and the whole user interface of the device (e.g. guidelines for Series 60 platform in chapter 2.6.1) are not listed because those rules can be found from other sources and observing them should be self-evident.

5.1 Navigation

Different media types – images, video clips, music tracks etc. – should be presented in a consistent manner. The browsing views and possibilities to switch between different views should be similar with all media types when applicable. Basic actions like opening, deleting and viewing details should also work similarly in all cases.

Users should not be forced to navigate through folders to get to the media files. Instead, one type of media should be presented in one place regardless of the files' location on the device's memory or a memory card. It is, however, recommended to let the user choose in application settings which folders are shown in the media gallery; this way the user would, for example, see his or her photos without seeing the device's template pictures or see files located on the memory card and not those that are on the device's internal memory.

5.1.1 Different views

There are many ways to present media files on the screen. It is hard to say that some view would be better than other. All views have their advantages and different people like different views. The guideline is that users should be allowed to use the view that they like best in each situation. The view should not have to be the same with different media types, i.e. music tracks could be set to be in a list whereas images could be browsed in a grid. If the files have details like names and locations attached to them, it can be reasonable to browse the files so that these details are shown, for example in a list. If the files, on the other hand, have not been annotated at all – like often is the case with photos – a grid view not showing any details is more suitable. Examples of list view and grid view can be seen in Picture 5a/b/c and Picture 5d/e/f respectively.

If media files are presented on a timeline, it should be scrolled horizontally and the latest items should be located on the right. Although horizontal scrolling is usually reprehensible usability-wise, it is more common and natural to use it when a timeline is scrolled. Furthermore, the growing use of wide-screen displays encourages the use of a horizontal timeline. The screen should not always be filled but only items that belong to the same time unit – usually the time unit is one day – should be put on top of each other or to the same column. Items that belong to different time units should be side by side in separate columns. An example of timeline view is presented in Picture 8.

5.2 Annotating

Annotating means attaching details to media files. Typical details vary depending on the type of the file. Image files should have name, date, file size and resolution information; additional details could be location, event, people and a caption where the image could be described freely. Video files should have length information in addition to those mentioned above. Music tracks, on the other hand, should have artist, album, song, track number, year and genre information or those details used in ID3 tags in mp3 files.

Users should be allowed to edit media details as easily as possible. Annotating should be allowed in batches so that a group of files is selected or marked and a tag is applied

to all of them. This way the categorizing of files can be made more efficient. Allowing marking files and editing details in batches eases the managing of large amounts of media files. For example, location or date information of several images or album information of several music tracks could be edited at once. The user should also be offered existing details when he or she annotates files by typing (auto complete) because same details often repeat themselves. To furthermore minimize the amount of typing, users should be allowed to choose from existing categories and the likely alternatives should be presented as default values if possible. For example, location and people can be predicted to be similar as in other media files created in the same period of time. Location can also be assigned automatically using positioning and recognizing people may be tried using automatic face-detection.

Tags should be possible to organize so that they could have sub-tags. For example, 'Paris 2005' tag could be placed under 'Traveling' tag. This way the tags would be similar to folders with subfolders – a concept that is familiar to most users – and the breadth of the file structure could be controlled by adding depth to it.

5.3 Thumbnail previews

There should be a thumbnail preview of images and video clips to help users recognize the items without opening them. Video clips should show the first frame as a preview image. Music tracks should show album art as a thumbnail preview if such was available. Users could be allowed to attach their own images to audio files and those images would replace default icons.

Fast browsing of files should not be hindered with time-consuming loading of thumbnails. The loading of thumbnails can be quickened for example by storing them in cache memory so that they would be ready when needed and they would not have to be created again and again.

5.4 Sorting

Users should be allowed to sort files in a way that is convenient to them. It should be possible to sort files by any detail that is available and in ascending or descending order. In some case browsing for example songs in chronological order is handy, but

in some other case alphabetical order is more appropriate. If different details of items are shown, it would be good if it was graphically indicated by which detail the files are sorted.

5.5 Searching

When the amount of media files grows large, efficient searching methods are needed. Because items have names, date and time information and they can moreover have location and other information, these details should be made good use of in the searching process. Files should be possible to search and browse by date, name, category, keyword etc. Starting the search should be effortless; the search word would be asked after a shortcut key press or the search word could just be written without any preceding command.

5.6 Sending and sharing

The media gallery should support sending and sharing of media files so that users could easily communicate their experiences with others. Sending should be possible straight from the media gallery application using whatever technique available (for example Bluetooth, SMS or email). It would also be an advantage if the media files could easily be shared in public, using for instance a weblog or a public multimedia diary on the Web.

5.7 Basic editing

Basic editing of the media files should be possible within the media gallery application or with the help of other, embedded, applications which can be accessed from the media gallery.

The most important editing features for images are rotating, cropping and adjusting colors and at least rotating should be allowed in the media gallery. With video and sound files, the basic editing include cutting and combining files but these may be such complicated operations that they should be handled by a separate and embedded application.

If a media file is edited, the changes should remain after the file is closed. For example, if an image is rotated to the desired position, that position should remain. There should, however, be an easy way to reset the file back to the original because it is easy to permanently ruin a picture, e.g. with poor color adjusting.

Because images, videos and sound files often grow large in file size, there should be possibility to convert them into smaller sized files to enable sending them with the mobile device. For example, images and videos could be saved with smaller resolution that would make the file size small but still be suitable for small screen use. Users should not be forced to enter any values for the size but it should also be possible to choose a suitable value from a list of some basic values. The user should be told, for example, which file size would be good for MMS sending and which for uploading to the Web.

5.8 Resetting changes

It should always be possible to undo the changes made to a media file and reset the file back to its original state. The risk of making errors while editing media files is relatively large using a mobile device and therefore users must be allowed to easily recover from errors and undo erroneous actions. One possibility is to force users to save the edited file with a new name so that the original file always remains. Another way is to have reset and undo commands in the options menu. Resetting should be confirmed by users so that changes made to a file are not lost accidentally.

5.9 Printing

Printing is nowadays possible with mobile devices thanks to print kiosks and co-operation with photo developers who can send home paper versions of images that they have received in digital format straight from the user of a mobile device. Instead of forcing users to open a separate printing application by themselves, find the item they want to print and submit the order to a printer, they should be allowed to complete the printing task in the media gallery application where they found the item and had the idea of printing it. Media gallery should not allow merely printing of still images but also frames of video clips should be possible to print as well as cover art for home made CDs and DVDs.

5.10 Shortcuts

There should be shortcuts for frequently used actions so that performing these actions does not require going through many steps or key presses. The frequently used actions vary depending on the software but some basic actions that should usually have a shortcut key are zooming, rotating, starting a slideshow, viewing and editing item details, changing the view mode (e.g. size of thumbnails) and opening or deleting an item. All the functions that have shortcuts should also be visible and accessible through menu because it can not be trusted that users are aware of hidden commands.

5.11 Slideshow with effects

The media gallery should have a slideshow feature for presenting images in an impressive fashion. Users should be allowed to modify the order and the duration of the images as well as the type of the transition effect. The backlight of the display should also be possible to force to stay on so that a slideshow could be viewed illuminated and music should be possible to play in the background during a slideshow. Allowing automatic panning and zooming of images would add the extravagance of a slideshow. The slideshow feature can be a powerful feature that makes the media gallery application and the whole device look good for it is likely to come up for example in trade press reviews.

5.12 Synchronizing with computer software

Most users prefer to organize their media on the computer rather than on the mobile device because big screen and big keyboard with a mouse offer more suitable conditions to work with the media files. That's why mobile media gallery software should have consistent computer software as a partner and synchronization between them should be fluent. Consistency means that the logic and terms should be similar. Transferring media files between the computer and the mobile device should be as fluent as possible if not automatic.

The cooperation between computer and mobile software comes more important as the memory capacity of mobile devices grows larger and larger enabling users to store all of their media files on the mobile device. Synchronizing large amount of constantly

changing files calls for powerful and easy-to-use tools. The simplest possible way would be that the files on the mobile device and on the computer would be updated automatically when the devices were connected. The user should be able to decide how the synchronization works to avoid any surprises, for example with file deletions during the synchronization process.

5.13 Context sensitive help

Different functions and settings of the application should be explained in a help function that can be easily accessed from any state of the application. The help function should be context sensitive so that it would open in a part where instructions concerning the prevailing state of the user would be given. Online help is good to have but it should not be the only source of help for the users. Online help should be more thorough and it should be complemented with illustrations that are not suitable for the mobile help function.

5.14 Fun

Even if a media gallery application has the right functions and is easy and fast to use, it may still be unattractive to users. To get the users want to use the application and continue wanting it, the application should be fun to use. Having the right functions and good usability is, however, a necessity and a prerequisite for a fun application. Using graphics and effects creatively and adding surprising and funny features in addition to the anticipated ones are good ways of making the user interface more enjoyable.

5.15 Following standards and style guides

By following relevant standards and style guides it can be in most cases assured that the product is consistent with other products. This kind of consistency makes it more likely that the product works as the user presumes it to work because the user probably has some kind of mental model that is founded on earlier experiences with other products. In many cases, the Finnish proverb "An old means is better than a bagful of new" holds true. In other words, a very good reason is needed to differ from the standards and customary policies.

Concerning Series 60, for example, Series 60 UI Style Guide (2003) gives the basic rules and context for creating applications for Series 60. Series 60 Usability Guidelines (2004), on the other hand, give a lot of recommendations which help to ensure good usability. With the help of these kinds of documents, it is easier to build a user-friendly application. On the other hand, if these guidelines are ignored, usability problems are likely to arise.

6 Conclusions

In this Master's thesis, guidelines for media galleries in mobile devices were created based on earlier research on the subject, existing media gallery applications and usability evaluations done on selected focus products. The guidelines include essential features as well as usability issues that should be considered when creating new media galleries. This final chapter deliberates how well the study managed to reach its goals, how reliable are the results and how they should be used in the future.

6.1 Research questions

In chapter 1, the following research questions were presented to concretize the goals of the study:

- What features should a media gallery in a mobile device have?
- How to achieve good usability in a media gallery?
    - What are the most common usability problems in current media galleries?

The answers to the first research question could be found by examining existing products and their reviews. The recommended features are presented in the guidelines in chapter 5 and are explained also in the earlier chapters.

Answers to the second question can also be seen from the guidelines in chapter 5. These usability guidelines were achieved by inspecting previous guidelines and analyzing usability problems found in current products. However, good usability can not be achieved simply by applying guidelines but naturally the principles of user-centered design must be followed in every state of the product development (see chapter 2.2). The sub-question about the most common usability problems was answered only partially since the results summarized in chapter 4.4 concern the focus products and Series 60 applications and they should not be generalized to other media galleries.

6.2 The course of the research

6.2.1 Background research

Earlier research on the same field was examined thoroughly using scientific articles from past years. They offered lot of material to base the study on. Recent articles gave the latest information and results which is important when dealing with a new and changing domain. The research about management of media files concerned computer applications, so consideration had to be used when the output of these articles was examined from the perspective of mobile devices; some of the issues that were valid with computers and office environment were discarded since they did not fit to mobile devices and the mobile context.

The best existing media gallery applications were traced mainly by examining trade press reviews. Those applications were then examined by trying them out and checking their features directly from the manufacturers. Reviews of five recognized information technology magazines were used to get a reliable and extensive insight into the media gallery software market. It must be remembered that magazines do not represent the absolute truth but the views presented in them are often just opinions of single editors. Hence, it is not said that the majority of users like some feature if an editor in some magazine has praised it. Any of the resulting guidelines was not, however, based on just one finding or article but they are all derived from many sources. The magazines and thus also the products that came up were all western – due to practicality. Asian reviews and products could have offered more ideas and different kind of solutions and their absence certainly decreases the scope of the study and the results.

6.2.2 Usability evaluation

Usability of four focus products was evaluated using the heuristic evaluation method. One could argue that the results of the usability evaluation are only one man's opinion since no other experts or users participated in the evaluation process. The lack of evaluators unquestionably undermines the results of the evaluation since more usability problems would have been found if e.g. three experts were used. Nevertheless, the one-man-evaluation served this study well and finding more

problems using a few more evaluators would probably have not made a difference in the guidelines.

It was useful to inspect the products three times and from different perspectives. Most of the issues came up already in the familiarization phase; probably because the evaluator had prior experience on usability evaluations. Still, problems and positive issues were found in each three phases with each four products. It was also worthwhile to return to the earlier evaluated products after each evaluation to see if the findings of this particular product apply for the other products as well and vice versa. The evaluation of the products was not completed after the half-a-day evaluation sessions but all of the focus products were actually used a longer period and findings were registered afterwards as well.

Some other usability evaluation method could have been more productive than the heuristic evaluation method that was used. For example, group discussions or test sessions with novice users would doubtless have brought up different kind of thoughts and ideas. This time, however, it was considered that the benefits of such methods were not as great as the resources they would have demanded.

6.3 Applying the guidelines

The guidelines presented in chapter 5 are applicable most of all when the concept of a new media gallery application is defined as they provide aid in deciding which features should be included. The guidelines apply for media galleries in mobile devices but they can certainly provide some ideas for computer media galleries as well since the matters in most cases are not restricted to mobile devices but they are more general. The guidelines can naturally be used also partially without implementing all of the recommended features.

6.4 Suggestions for future work

During this study, it appeared to be difficult to move media files between applications and between devices without losing files' metadata or without it becoming distorted. The reason for this is that applications often have their own metadata system that applies only in that application. Standardization of metadata is needed so that media

could be moved more easily and important information about files would be preserved. It should be defined, what metadata would each media type have and how this metadata would be stored and moved with media files.

Closely relating to this study, it would be worthwhile to examine the features and usability of media players to expand these guidelines to concern also mobile media players. There are massive amounts of portable media players on the market and it would be interesting to see which are the best solutions and what kind of features would be appreciated the most.

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A Appendices

A.1 Results of heuristic evaluations

Resco Photo Viewer 4.20.4 for Series 60

#	Usability problem	Heuristics concerned
1.	Delete confirmation asks "Delete 1 image (s)?" where "(s)" is confusingly on a different line.	2. Match between system and the real world
2.	When an image was cropped, the program asked for "JPEG quality" of the new image. A default value of 90 was given but the scale of acceptable values were not told. The scale could only be solved by trying different values.	5. Error prevention 6. Recognition rather than recall
3.	The icons that were used to adjusting picture colors were not explained, e.g. with tool tips. Different colored circles may not be easy to differentiate when they only differ by color.	2. Match between system and the real world 8. Aesthetic and minimalist design 10. Help and documentation
4.	Pictures were always opened in full screen mode where softkey labels are not shown. Because of that, options and back command were hidden and difficult to find for a novice user.	3. User control and freedom 6. Recognition rather than recall
5.	There was no help function. For example, the meanings of the various settings were not explained.	10. Help and documentation
6.	After the colors of a picture had been adjusted or a picture had been rotated (and saved), the thumbnail preview of the picture still showed a thumbnail of the original picture.	1. Visibility of system status
7.	A list view with small thumbnails did not show preview pictures like all the other views but showed just icons that tell the file type.	4. Consistency and standards 6. Recognition rather than recall

8.	A list view with small thumbnails showed one detail of the pictures and that was file size rather than date which would be more interesting for the user.	8. Aesthetic and minimalist design
9.	When folders were browsed in the folder view, the right softkey was "Exit" while it is "Back" in the phone in a similar situation. This causes unintended exiting from the program.	4. Consistency and standards
10.	An image could not be renamed when it was opened for viewing.	4. Consistency and standards 7. Flexibility and efficiency of use
11.	An image could not be deleted when it is opened for viewing.	4. Consistency and standards 7. Flexibility and efficiency of use
12.	When cropping, the selection key label "Begin/Finish/Move rectangle" disappeared as soon as the pointer was moved and the user was left with no instructions of what to do.	1. Visibility of system status 6. Recognition rather than recall
13.	There was no visible way to save or cancel image color adjusting or image cropping because the softkey labels were not shown. Exiting from the state was difficult for a novice user and it was too easy to cancel the editing accidentally.	3. User control and freedom 6. Recognition rather than recall
14.	The menu items that had a submenu were marked with arrows except for "Icon Size" that had a (sub-)submenu. Series 60 UI Style Guide does not allow a submenu to have another submenu.	4. Consistency and standards 6. Recognition rather than recall
15.	Images could not be set as a background image.	7. Flexibility and efficiency of use
16.	When an image was cropped and an erroneous name was given to the image (name included a special character), a note said 'Save failed' but it was a positive note (with a green check mark) that usually confirms a successful operation. A new name was not asked but the cropping was cancelled.	9. Help users recognize, diagnose, and recover from errors

16.	Zooming required an extra step and turning the zoom on. Fit/fill zooming could, however, be done without turning the zoom on.	7. Flexibility and efficiency of use
17.	Zooming and panning keys were different from those recommended by Series 60 Developer Platform and normally used.	4. Consistency and standards
18.	When some files were already marked, pressing the selection key opened the file highlighted albeit Series 60 UI Style Guide says selection key should open a pop-up menu (including mark/unmark).	4. Consistency and standards 7. Flexibility and efficiency of use
#	**Positive finding**	**Heuristics concerned**
1.	The program had lots of shortcuts: changing thumbnail size and view mode, starting a slideshow, changing slideshow settings, seeing image details, marking images and zooming. All these could be done with shortcut keys without entering options menu. The 'mark/unmark all' function had a shortcut key, which was useful when dealing with lots of images.	7. Flexibility and efficiency of use
2.	Slideshow settings and options were versatile: transition effect, slide duration etc. could be changed.	7. Flexibility and efficiency of use
3.	The original colors could be returned easily despite the image had been saved with modified colors.	3. User control and freedom
4.	There was a clock icon to suggest that thumbnails were being generated.	1. Visibility of system status
5.	When thumbnails were generated for the first time, the program saved them so that they appeared faster the next times. Thumbnails could also be deleted if wanted.	7. Flexibility and efficiency of use
6.	All images were by default shown regardless of the folder they were in, which eased the browsing of pictures. If wanted, only those pictures in the phone memory, in memory card or in a certain folder could be viewed.	7. Flexibility and efficiency of use

7.	It was not allowed to key in unsuitable values for picture size or quality when cropping.	5. Error prevention
8.	There was an Internet link to a good online help.	10. Help and documentation
9.	Backlight could be forced to stay on during a slideshow.	7. Flexibility and efficiency of use
10.	Zooming and panning was fast and smooth and it was not restricted by the resolution of the image.	7. Flexibility and efficiency of use
11.	Images could be cropped manually freehanded or to a certain size and the operation was quite straightforward.	7. Flexibility and efficiency of use

SplashPhoto version 4.21(0) for Series 60

#	**Usability problem**	**Heuristics concerned**
1.	Pressing the right softkey when viewing pictures in normal view mode, zoom mode or slideshow caused exiting the program. This lead to unwanted exits. Normally in a Series 60 phone right softkey closes the picture but not the whole application.	3. User control and freedom 4. Consistency and standards
2.	You could get from the picture viewing mode to the main grid only by pressing the selection key and there was no hint to help find this out. Even the options list did not have this option.	3. User control and freedom 6. Recognition rather than recall
3.	Pictures were always shown in full screen mode where softkey labels were not shown. Because of that, options were hidden and difficult to find for a novice user.	3. User control and freedom 6. Recognition rather than recall
4.	The program opened in picture viewing mode if it had been exited from that mode. This caused surprises because the program did not open in the main grid like you would expect.	3. User control and freedom 4. Consistency and standards

5.	Phone memory icon that indicated the storage location of the image did not resemble a phone or anything else for that matter.	2. Match between system and the real world
6.	Images could not be marked at all. Images could only be categorized, moved, deleted one by one or all at once and sent one at a time. This made managing large amounts of images very tedious process. Normally marking is possible in Series 60 applications with the edit key.	7. Flexibility and efficiency of use
7.	The options list was unnecessarily long because there were options: 'Categorize all', 'Move all' and 'Delete all'. These could be removed if marking was made possible.	8. Aesthetic and minimalist design
8.	There was no shortcut key for starting a slideshow.	7. Flexibility and efficiency of use
9.	There was an unnecessary title (in normal font) in the delete confirmation query which lead to bad sentences like "Delete all Delete all images...?".	2. Match between system and the real world 8. Aesthetic and minimalist design
10.	Moving all images between the memory card and phone's internal memory took a long time; there was no progress indicator and the operation could not be cancelled.	1. Visibility of system status 3. User control and freedom
11.	Options "Categorize/Move/Delete all" in the options list could lead to accidental major changes which would be hard to recover from. For example, a well done categorization would be easy to ruin by categorizing all images to the same category. Possibility to mark items would help.	5. Error prevention
12.	There was no help function. For example, the meanings of the various settings were not explained.	10. Help and documentation
13.	In other views than list view, the selected image was not clearly highlighted.	1. Visibility of system status

14.	There was no shortcut for zooming mode but zooming required going to the options list.	7. Flexibility and efficiency of use
15.	Zooming was slow and discrete (not continuous). Pressing zoom in or zoom out made the picture disappear for a second.	7. Flexibility and efficiency of use
16.	Image could not be opened from the options list but only by pressing the selection key. The function should be visible and not only hidden.	6. Recognition rather than recall
17.	Image could not be set as a background image.	7. Flexibility and efficiency of use
18.	Zoom mode looked exactly like normal viewing mode i.e. there was no zoom indicator whatsoever. (Zoom and normal mode had different options and shortcuts.)	1. Visibility of system status
19.	The position of the highlighted image changed when the image was opened and closed. It always ended up being on the bottom row.	4. Consistency and standards
20.	When the view was changed from an empty view (no images showing) to a view with images, none of the images were highlighted while Series 60 UI Style Guide says one item should always be highlighted. The pointer had to be moved to highlight some image.	4. Consistency and standards
21.	Resolution was called "Res" in details view and "Dimensions" in list view and preferences.	4. Consistency and standards
22.	Zooming was limited by the resolution of the image. For example, if the resolution was the same for the image and the display, both zooming in and zooming out was impossible.	7. Flexibility and efficiency of use
23.	In preferences, 6 out of 9 items were for showing/hiding columns (details) in the list view. By moving these 6 items to a selection list under one separate item, the preferences view could be made clearer.	8. Aesthetic and minimalist design

24.	Zooming required an extra step and going to a particular zoom mode.	7. Flexibility and efficiency of use
25.	Zooming and panning keys were different from those recommended by Series 60 Developer Platform and normally used.	4. Consistency and standards

#	**Positive finding**	**Heuristics concerned**
1.	Image name, category, location (internal/card), privacy and note could be changed from the details view.	7. Flexibility and efficiency of use
2.	The view mode could be changed with shortcut keys.	7. Flexibility and efficiency of use
3.	Backlight could be forced to stay on during a slideshow.	7. Flexibility and efficiency of use
4.	There was a link to the company's Internet site where good operating instructions for the program could be found.	10. Help and documentation
5.	In list view, the details to be shown as columns could be chosen.	7. Flexibility and efficiency of use
6.	All images were by default shown regardless of the folder they were in, which eased the browsing of pictures. If wanted, only those pictures in the phone memory, in memory card or in a certain category could be viewed.	7. Flexibility and efficiency of use

Nokia 6630 media gallery

#	**Usability problem**	**Heuristics concerned**
1.	Media files could be viewed in only one way where 3 thumbnails were shown at a time with name and size or artist name.	7. Flexibility and efficiency of use

2.	Images could not be moved to a folder when they were opened but only in the list view.	4. Consistency and standards 7. Flexibility and efficiency of use
3.	Images or videos could not be moved to a new folder with one operation but a new folder had to be created first. Markings were deleted when a new folder was created.	4. Consistency and standards 7. Flexibility and efficiency of use
4.	Tracks and sound clips could not be organized in folders like images and videos.	4. Consistency and standards
5.	The order of images changed illogically when images were renamed or moved to folders.	4. Consistency and standards
6.	Files could not be sorted in different orders, e.g. by name or date.	7. Flexibility and efficiency of use
7.	Images in folders were presented in a different way and in different order than outside folders and in a different way than videos in folders. The view or the order could not be changed.	4. Consistency and standards 7. Flexibility and efficiency of use
8.	Images and videos in folders were in alphabetical order while files outside folders were in chronological order.	4. Consistency and standards
9.	If a folder was opened through the find feature, only that folder was shown in the image or video list after the search was canceled. All the images or videos could be shown again only by restarting the Gallery application or by doing a new (empty) search.	1. Visibility of system status 3. User control and freedom
10.	Mp3 files were presented according to ID3 tags, not file names. However, these tags could not be edited with the phone.	3. User control and freedom 7. Flexibility and efficiency of use
11.	Sound clips (.wav) could be set as ringing tone through the options list but tracks (.mp3) could not. Both formats are, however, suitable for ringing tones.	4. Consistency and standards 7. Flexibility and efficiency of use

12.	Images or videos could not be searched in folders like they could be searched outside folders.	4. Consistency and standards 7. Flexibility and efficiency of use
13.	The folders created in Gallery application were not shown in Image manager application that used different folder structure.	4. Consistency and standards
14.	There was no preview image shown of the video clips.	6. Recognition rather than recall
15.	Folders could not be marked. They had to be deleted one by one.	7. Flexibility and efficiency of use
#	**Positive finding**	**Heuristics concerned**
1.	Context sensitive help (different help in different states) was always available through the options list.	10. Help and documentation
2.	A file could be searched fast by just starting to type the name of the file.	7. Flexibility and efficiency of use
3.	The find feature found music tracks whether the search word was the artist's first or last name or the name of the song.	6. Recognition rather than recall
4.	There were hidden shortcuts for full screen mode and for zooming and rotating an image. Shortcuts were explained in help.	7. Flexibility and efficiency of use 10. Help and documentation
5.	In some cases, pressing the joystick opened a mini-menu with most used commands.	7. Flexibility and efficiency of use
6.	Images were by default shown all regardless of the folder they were in, which eased the browsing of pictures. Images in both the phone's memory and the memory card were shown at the same time.	7. Flexibility and efficiency of use

Nokia Lifeblog version 1.5

#	Usability problem	Heuristics concerned
1.	General settings had only one item: Favorites size. There is no need to hide just one item under settings. There should be more settings or with only one item, the depth of the menu should be lowered.	6. Recognition rather than recall 8. Aesthetic and minimalist design
2.	Size of favorites was a text entry field. It was not told (in that state) what were accepted entries and what unit of measurement the desired number was. The default value was "6144" without any unit.	5. Error prevention 6. Recognition rather than recall
3.	The program always asked to plug the phone into the charger before starting data import. The reason for this was not clear because data import succeeded without plugging the phone and the battery did not go empty.	2. Match between system and the real world 3. User control and freedom
4.	There was no help function in the phone software. For example, the shortcuts were not explained.	10. Help and documentation
5.	'Set as wallpaper' function did not give any feedback and the user was left to uncertainty about the success of the action.	1. Visibility of system status
6.	In timeline view, pressing "*" created a new note. In item view, it opened item details. Same shortcut key should perform similar actions.	4. Consistency and standards
7.	If an image was opened from the default item view to full screen mode, it was automatically rotated to fit the screen and it could be zoomed but not rotated. But if the image was first zoomed and then opened to full screen mode, it was not auto-rotated and it could be both zoomed and rotated.	4. Consistency and standards 7. Flexibility and efficiency of use
8.	In item details view, there were arrows pointing left and right. Normally these arrows indicate that items can be browsed by pressing left and right but in this state browsing was not possible. These arrows should not be shown when the corresponding keys are inactive. On the	7. Flexibility and efficiency of use 8. Aesthetic and minimalist design

	other hand, browsing item details could be allowed.	
9.	Images and videos could be browsed in item view with both vertical and horizontal joystick keys. However, messages and notes could only be browsed with left and right keys while up and down keys were inactive.	4. Consistency and standards
10.	Zooming was limited by the resolution of the image. For example, if the resolution was the same for the image and the display, zooming in or zooming out was impossible.	7. Flexibility and efficiency of use
11.	Files could be viewed in only one way where 6 thumbnails were shown at a time.	7. Flexibility and efficiency of use
12.	Item details could not be viewed unless it was opened for viewing.	4. Consistency and standards 7. Flexibility and efficiency of use
13.	When some files were already marked, pressing selection key opened the file highlighted albeit Series 60 UI Style Guide says selection key should open a pop-up menu (including mark/unmark).	4. Consistency and standards 7. Flexibility and efficiency of use
14.	Adding a file to favorites did not give any feedback and it was not shown which files on the timeline had been added to favorites.	1. Visibility of system status
15.	Message details did not show if the message was sent or received. Timeline icon told this if the user knew the meaning of the icon.	6. Recognition rather than recall
16.	Item details did not either include file size of items, resolution of images and videos or length of videos.	1. Visibility of system status
17.	Items could not be searched in any other way than by going to a certain date. File names, locations or texts could not be used in searching.	7. Flexibility and efficiency of use
18.	The program could not show files automatically but they had to be imported to the program after installing	7. Flexibility and efficiency of use

	the program or inserting a memory card.	
#	**Positive finding**	**Heuristics concerned**
1.	If an item not yet transferred to PC was tried to delete, a confirmation query informed about this.	5. Error prevention
2.	Images could be marked and transferred in batches.	7. Flexibility and efficiency of use
3.	Item details could be edited simply from the 'view details' state.	7. Flexibility and efficiency of use
4.	There were shortcuts for zooming, rotating, item details, go to date and create note.	7. Flexibility and efficiency of use
5.	Adding several large sized files to favorites was very fast.	7. Flexibility and efficiency of use
6.	There was a good help function on the PC software.	10. Help and documentation