Design and evaluation of an image visualisation interface for a life-logging camera

by

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Abstract
The purpose of this thesis is to explore how a web-based image visualisation interface can be
designed to complement an existing product. To achieve this purpose a study was conducted at
Narrative, a small independent developer. Their newly released product, the Narrative-clip, is a small
automatic camera that takes two pictures every minute. The camera is accompanied by cloud
storage functionality and a mobile application which lets the users view their images. Due to the
large amount of pictures taken by the camera, voices have been raised for a web-based system to be
developed to increase the accessibility of the user content. The goal of the study was to identify
requirements, develop a design suggestion for a web-interface and evaluate the interface from a
stakeholder perspective.

The study employed a hybrid design method, drawing on strengths from several recognised and
popular design methods. Interviews were conducted with both users and employees at Narrative to
identify demands and expectations of the system. The information gathered was later concretised in
a design workshop with the goal of producing ideas and solutions to the system. The gathered
material was used in three iterative steps, resulting in a final high-fidelity prototype. Each of the
iterations used usability testing to identify design issues and to motivate improvements on the
system. The conclusion is two-fold: three characteristics important for the final design and two key
aspects for the design mindset. The characteristics found to be central for the web-interface were a
simple design over multiple features, familiarity with the design and a good overview of one’s
uploaded content. Furthermore, the design process mindset was equally important. Identified
aspects of the mindset that were important for the final design were a broad context and follow-up
work.
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1 Introduction
Images and photographs have been an important part of human culture since the days of the first photograph. The technological advancements throughout history have seen a wide arrangement of ways to capture images and in today's society the digital medium dominates. With the introduction of the digital format the ability to capture one's surroundings became easier. Collections of images have moved from the private photo albums to be made available through social networking sites and image hosting services. New innovative solutions provide alternative ways to capture images and in greater quantity than before, but with new possibilities difficulties can arise. This thesis will look into and address some of the issues that can occur for a service focused on capturing and viewing images.

Narrative (earlier Memoto) is a software and hardware developer based in Linköping (Sweden). They have quite recently launched their new product focused on the trend 'life-logging'. The product is called the Narrative-clip and is a wearable automatic camera that takes one picture every 30 seconds to try and document your everyday life so you can relive your memories. Accompanying the camera is a mobile application which lets you browse and share pictures you like. However no computer or web service is available. People from both within and outside the company have expressed opinions for such an interface to be developed.

The work in this thesis is focused towards the design of a web-interface to act as an image visualisation system for the Narrative-clip. This is a unique design situation for the reason that it is partly an existing artefact and partly a proposed item. It partly exists because of the mobile application that is available to the customers, which might act as a form of benchmarking tool for the interface. But it is also an innovative opportunity to expand the Narrative trademark and the relationship to the users.

1.1 The Narrative-clip
The Narrative-clip is a small wearable automatic life-logging camera. Life-logging is a popular trend focused on capturing one’s life through images, to share with others or relive past experiences. The camera got no external buttons, but allows for extra pictures to be taken by tapping on it. The Narrative-clip can store up to 4000 images at a time and the pictures can be automatically uploaded to the Narrative cloud-service by connecting it to a computer. The Narrative-clip service uses a smart algorithm to analyse, group and elevate pictures automatically for the user in the accompanying software, which lets you view and manage the pictures taken.

Today the software is only available on mobile platforms as an application (iOS and Android). Because the mobile application has been the only way to view pictures and the users are familiar with the design, there is a good reason to translate some of the design elements into the web-interface. Figure 1 shows one of the featured views in the product called a moment, which is a collection of pictures from the same area or within a certain timeframe. Each moment also consists of a user selected cover photo that acts as a representation of the whole moment. The figure shows a section of a moment with the large image as the main view and the thumbnails representing additional images in the moment.
1.2 Purpose
The purpose of this thesis is to design a web-interface for the Narrative-clip system. To achieve this purpose, a short evaluation of different design and usability methods will be conducted, to try and ascertain the method most suited for designing an image visualisation system.

The design is conducted through a study, influenced by the chosen design approach. The goal of the study is to identify requirements for the system and to provide Narrative with a design solution for their web-interface that can be used for further development or as inspiration for their own implementation. Moreover, an additional goal is to evaluate the design solution from a stakeholder and user perspective. To help fulfil the purpose of this thesis the following research question is asked:

*How can a web-interface that handles large amounts of images be designed?*

1.3 Delimitation
The method was based on three design disciplines, a more encompassing design method is out of scope. Users were hard to reach due to geographical positions and were complemented with potential users. The number of participants in the usability tests was restricted to six at most to limit the scope of the study. A fully functional product was out of scope for the thesis and a digital prototype was introduced instead. The study will not result in a completed system ready for customers. The prototype does not have the complete functionality of a live system and only showcases a design suggestion. Only one design solution was developed to limit the scope and to present a digital prototype with basic functionality.
2 Background
The background section consists of two parts; a short review of how a large quantity of images can be presented to a user and a theoretical background of design methods that can be used in a development project. The section also briefly introduces the reader to the notion of design, usability and the multifaceted definitions of the words.

2.1 Representation of images
One of the main functions of the web-interface will be of presenting images to the user of the system. As the Narrative-clip takes about two pictures per minute, which approximately adds up to 1700 pictures a day (calculated on a 14 hour day), it is of interest to find the best way to present large amounts of pictures. With the increased popularity of social networking sites and cloud-based hosting services for files, documents and images, the issue of how data should be presented to the user becomes more and more important. This is perhaps most evident in a visual medium such as images due to the various content of each picture and the amount of pictures often presented together.

Presenting numerous images at the same time is in itself not a problem. Issues arise when they should be presented in a specific way or perhaps with a particular purpose. Showcasing all images as small thumbnails provides great overview of a large quantity but at the same time provides little to no appreciation of the picture itself, due to its small size. The same problem exists when presenting larger but fewer images. The user can easily identify and appreciate a single image but have a hard time to get an outline of the whole set of images. Finding a balance between these two issues can be vital to the final user experience. To help address this, some services with similar concepts will be studied to see how they choose to present images. The study will in no way cover all features or views provided by the services and only allows for a narrow analysis of a chosen main view.

2.1.1 Flickr
Flickr is a well known website used for image and video hosting. It provides users with the option of sharing and embedding images on social media and is widely used as a hosting tool by professional photographers.

The Flickr website uses a grid of rows and columns to present the user uploaded pictures in an easy and structured way. The number of images per row varies and each picture differs in size. Every picture got the photographers name clearly visible in the lower left corner without the need of clicking or hovering over the picture. Hovering over the picture displays additional information: a title description of the picture, the possibility of saving it to your favourites, viewing comments or seeing an even further detailed explanation of the image. The latter can also be achieved by directly clicking on the image. The detailed description contains additional information of the picture: number of views, upload date, links to comments, adding to favourites, sharing option, download option (hidden behind ‘more actions’), associated tags and image groups as well as the author’s photostream.

The main display of pictures is a so called never-ending scroll. This function loads new content (pictures) when the vertical scroll list reaches the end of the page, thus eliminating the need of loading a new page for showcasing more pictures.
Flickr presents images in various sizes due to the variations in user-uploaded content. This means that the number of images being shown in a single screen may vary, depending on the images sizes. Though, it is quite clear there is a favour of larger but fewer images to be viewed, probably because of the strong focus of showcasing user content. Thus, Flickr presents images in a more detailed view, while retaining some overview of the larger number of images.

2.1.2 Google Picasa
Picasa is a software application for managing and viewing digital pictures. In addition to the software there is also a website available for the users where they can choose to share images. The program provides many features such as image editing, sharing to social media and face tagging.

The software presents large amounts of pictures in a grid network, comparable to other software services and applications. The system contains more advanced features than only image sharing, for example providing editing tools to enhance photographs. Picasa web album, a web-based part of the system, uses a similar design as the desktop program for managing images, which is also grid based. The web-interface shows pictures in two main views: *highlights* and *all pictures*. The *highlights* are divided into categories based on user input, time and date. The *all pictures* view shows every image in equal size and the only option is to select or click on a photo. Clicking on an image opens up an overlapping larger view of the image, called a lightbox. The lightbox contains options of tagging, sharing, deleting and adding a description. Selecting a picture opens a new menu with the selection of sharing, copy, deleting and downloading the image.

Picasa presents all images in the same size even though resolutions can vary greatly between different images. The service favours medium sized images that allows for a larger quantity to be presented in a single screen while maintaining some detail of a specific image. This creates a greater overview for an individual user in exchange for lesser details of single images.

2.1.3 Imgur
Imgur is one of the most popular image hosting sites of today, partly because of the close association with social networking services. The site offers users to upload local images, from other websites or to create their own content directly at the site.

The start page is divided into two main columns, the larger one containing images while the slightly smaller column shows user comments and simple managing tools. The images are separated in a grid network, each in equal size. Hovering over an image provides a small pop-up window with additional information: a title for the picture, number of likes and number of views. There is also the possibility to like or dislike the picture by pressing an up or down arrow. Pressing an image provides a larger view with an action menu below and a title above the picture. The menu contains sharing options to other social media services, the option to like and dislike, favourite and report an image. Further below the image is a comment section allowing users to leave notes. There is also a possibility to submit a collection of images, an album; images are then presented horizontally with a small description following it. In likeness with Flickr, the Imgur site uses a never-ending scroll to load new pictures for the user.

Imgur uses smaller images of the same size, cropping larger images at the same time. This allows for a great overview of the submitted user content but at the same time forces the user to click on an image to see major details.
2.2 Theoretical background

In this subchapter, a theoretical background for the thesis is presented. The section starts by presenting definitions of what design and usability is, followed by a few of the most popular and well-known design methods, presented with their goals, advantages and disadvantages.

2.2.1 What is design?

Without the knowledge of how to create things, and more importantly, why to create things; working with a project or a product can become meaningless. To help with encouraging these activities, design is usually what most companies turn to for guidance. But what is design and is there a common definition? Historically, design has been seen as the styling of a product, its edges and shapes (Neumeier, 2009). This definition is very limited and is outdated in today’s society. Neumeier (2009, p. 32) defines design as change, based on an old quote by Herbert Simon:

“Everyone designs who devises courses of action aimed at changing existing situations into preferred ones.”

This is only but one definition, Buxton (2007) proposes that there are so many different definitions of design, that trying to identify only one is futile. In comparison, Moggridge (2007) also speaks of the vagueness implicated by design, while Stickdorn & Schneider (2010) describes it more like a process (of designing). For the purpose of this thesis, design will be defined along the lines of Neumeier (2009) and Stickdorn & Schneider (2010); a process of change for betterment.

2.2.2 What is usability?

Usability describes how a user can interact with a product or service in an effective, efficient and satisfactory way (Usability.gov, 2014:1; Reiss, 2012). Working with usability is not limited to only these aspects though. As Moggridge (2007) and Reiss (2012) put it, the system also needs to be useful. The distinction between usable and useful is perhaps the most important aspect. A system can be extremely effective and efficient, but if it does not help the user to achieve his or her goals, then you have a system which no one uses (Reiss, 2012; Lowgren & Stolterman, 2004).

So why care about usability? Reiss (2012) speaks of the many differences in the usability industry and how nothing is black or white. A different design, not necessarily a ‘better’ design, may help improve the customer satisfaction and thereby the profitability of a company (Reiss, 2012; Schlatter, 2013).

2.2.3 Service design

Service design is a rather new interdisciplinary method that combines methods and tools from various design approaches. It is more focused on the process of designing something rather than the actual outcome. It incorporates several aspects not thought of as classical design areas, such as organisational structures and service experiences. (Stickdorn & Schneider, 2010)

Stickdorn & Scheider (2010) presents service design as a dynamic evolving approach that tries to create a way of thinking rather than relying on predetermined definitions to control the work. To help achieve this thought process there are five principles of service design:
User-centred: Knowing the customer [user] is important in all approaches because of their essential involvement with the product or service. Service design tries to attain a genuine understanding of the user that goes beyond that of statistics and analysis of empirical data. To attain this, tools and techniques are used to put the designer in the point of view of the customer, where realisation of their experience can be achieved. (Stickdorn & Schneider, 2010)

Co-creative: A system can affect many different actors, such as management and employees, not just end-users. Excluding any of these from the development process might lead to a lack of information or feedback. Therefore, service design aims to include all these groups as early as possible in the process. Co-creation is continuously advocated throughout the development, prototyping and testing of the product or service. This lets the customer to get involved and create value in the service, possibly resulting in additional customer loyalty. (Stickdorn & Schneider, 2010)

Sequencing: Every service consists of several touchpoints. A touchpoint can be seen as an interaction between a user and the service, or the steps necessary to get in contact with the service. Sequencing is a combination of multiple touchpoints made to create a sense of expectation of the service for the customer. This means that interactions with a service takes place over a period of time, in which the customer can change its perception of the service depending on how fast or slow the progress is. The goal is to find a rhythm that includes all aspects which may affect the customer in order to ensure a continuous progress of the touchpoints. (Stickdorn & Schneider, 2010)

Evidencing: Evidencing is about taking behind the scene events and turn them into headline information; making the intangible tangible. One great example of this is loading time on websites or similar applications. By introducing a loading bar or icon the user can easily follow the progress and consequently will be more patient with the time delay. One significant facet of service evidence is its connection to the touchpoint sequence, which helps to create an understanding of backstage processes. (Stickdorn & Schneider, 2010)

Holistic: The holistic principle is aimed towards keeping a wider context. Holism is the theory that whole entities have a greater value than the sum of its parts. This means that there are numerous characteristics that should be taken into consideration and be reappraised from different points of view to try and capture a bigger picture. (Stickdorn & Schneider, 2010)

The actual process of service design is derived from the five principles. It is an iterative progression of four stages (Stickdorn & Schneider, 2010):

- Exploration
- Creation
- Reflection
- Implementation
Though the process can be seen as linear, the iterations allow you to be agile and adapt to possible mistakes during the course of action, permitting to even start again from the beginning. Stickdorn & Schneider (2010) points out that the four step process is a rough outline and should not be used as an all-inclusive guide for designing. Exemplifying this is that the first step of any process should be of designing the process itself. The designer needs to act in a critical way towards the chosen design process to be able to use them in an effective way (Lowgren & Stolterman, 2004). As mentioned in the five principles, service design tries to capture as broad a perspective as possible, because in the end the development is dependent on the specific context of the particular project (Stickdorn & Schneider, 2010). Below follows a short description of the four stages of service design.

**Exploration:** The exploration stage is used to create an understanding environment of the particular context the project is taking place in. This includes the essential identification of the actual problem to be solved, not just the perceived problem but the underlying root of the difficulties (Stickdorn & Schneider, 2010). As discussed earlier in the chapter, it is equally important to apply various perspectives to get a broad context, as it is to identify the real problem. A limited view will only result in a limited problem description, with the possibility of missing out on critical facts.

**Creation:** The next stage in the service design process is the creation phase. As can be understood from the name, this segment is focused on creating concepts and testing out new ideas. Stickdorn & Schneider (2010, p. 130) describes it as: “One of the main features of service design thinking is that this approach is not about avoiding mistakes, but rather about exploring as many as possible mistakes.” It is also in this stage, in combination with the reflective stage, that most of the iterations take place (Stickdorn & Schneider, 2010). This is partly due to the natural aptitude of iterations taking place between ideas and reflections, and partly to the significance of including customers, employees, designers and other contributors in the development process (Stickdorn & Schneider, 2010). It is a mean to achieve the end of co-creation and working from a user-centred perspective.

**Reflection:** If the creation stage handles concepts and imaginings of new ideas, the reflection stage helps to assess and try them out. Prototyping is a common tool for testing but Stickdorn & Schneider (2010) mentions that the surroundings can be equally vital for the experience at hand.

**Implementation:** The last stage, implementation, in the service design process builds a representation of the service, where the management of change is a central aspect (Stickdorn & Schneider, 2010). One of the main cornerstones in service design is the inclusion of different stakeholders during the whole process. Throughout the implementation phase, opinions and ideas from participants become even more vital than before, because of their central role (Stickdorn & Schneider, 2010).

### 2.2.4 Participatory design
Participatory design, also known as cooperative design, is a design method for incorporating as many stakeholders as possible in the development process (Scariot et al., 2012; Bazley et al., 2012; Robertson & Simonsen, 2012; Holmlid, 2009). It is a dynamic approach that borrows from user-centred design (UCD) to take co-creation to a new and more complex level (Manzini & Rizzo, 2011; Scariot et al., 2012). During the participatory process end-users express and define a current problem which they feel needs to be solved. The designers work with the users through a variety of methods to accomplish a solution (Bazley et al., 2012). Similar to both service design and user-centred design, many of the techniques used to gather and analyse data is shared between the principles. Some of
the more common practices include workshops, stories, iterations and prototypes (Muller, 2002). Furthermore, participatory design is also closely tied with interaction design (Holmlid, 2007; Holmlid 2009).

The process of development in participatory design is similar to that of service design, apart from a few differences (Holmlid, 2009). The process is based on an initial exploration phase where problem definition and possible solutions are defined. This is followed by a development stage which evaluates and implements potential results (Robertson & Simonsen, 2012). Even though participatory design is not expressly iterative in nature, iterative processes are actively used during prototyping (Simonsen & Hertzum, 2010; Robertson & Simonsen, 2012).

Scariot et al. (2012) mentions some concerns with participatory design, mainly with the expense of human and financial resources. Acquiring opinions from all the affected stakeholders in a project does not only require time, but consideration must also be made of how communication is conducted and to whom. If meetings with stakeholders or users end up taking more time than producing the actual results, the benefits of participating may be lost (Scariot et al., 2012; Blomberg & Henderson, 1990).

2.2.5 Interaction design
In similarity with other design disciplines and design overall, interaction design have no definite definition. Lowgren (2013, section 1.1) says: “Interaction design is about shaping digital things for people’s use”. This description seems to be one commonly used among interaction designers (Moggridge, 2007). As interaction design is often associated with design of digital artefacts and their use, it is important that they generate reassuring connections (feedback) with the users to show that an interaction has taken place (Moggridge, 2007; Polaine, 2005). This feedback loop is part of what makes good interaction design, according to Moggridge (2007). Other similar aspects include navigability, intuitive interaction, behaviour and quality. Interaction design is closely tied to user-centred design and utilises many of the methods advocated by that field, for example personas (Holmlid, 2007; Patton, 2002). This means that users are an active part in most of the activities during the interaction design process.

Moggridge (2007) argues that the process of interaction design is based on two main principles: understanding people and prototyping. To help create this in-depth understanding it is not enough to only focus on the persons, there must be a larger comprehension of all the factors that can affect the solution. When this has been achieved the power of prototyping can be utilised to full effect (Moggridge, 2007).
3 Method
This section describes and motivates the process choices made for the thesis. The method is based on an integration of tools, techniques, principles and models gained from previously presented design approaches and associated literature.

3.1 Process: a hybrid method
The reader should once again be reminded that the discussed design methods are quite similar and are only used as guidelines. Therefore, there is a possibility that certain elements are already integrated in the different models or used by practitioners. The point of integrating interaction and participatory design with service design is to expand the number of tools and procedures that can be used in a development process, independent of whether it is used for a digital artefact or not. The purpose of this method is to provide a broad context and to eliminate as many design and usability issues as possible.

The method is based on the service design process, with the iterative stages exploration, creation, reflection and implementation. This provides the option of utilising some of the tools and techniques associated with service design, especially during the exploration phase (see preceding chapter). The service design process model is chosen because of the linear overview it provides, coupled with the possibility of adaptation of the process and the principles of service design discussed earlier. The method continues by drawing aspects from both participatory and interaction design. The analytical and experiential attributes of interaction design are employed in a workshop and during the creation and reflection stages where sketching and prototyping is the main activity. The focus on user and stakeholder involvement from participatory design is also integrated in the same stages by usability testing and the workshop relationships, but most prominently during the implementation stage where the users’ feedback is the most valuable. Figure 2 shows the work process.

![Figure 2: Study method.](image)

3.2 Exploration
In accordance with the discussed design methods in the previous chapter the study will start with an exploration phase. This segment is performed as a requirements study including a lot of different stakeholders. The purpose of the requirements study is to get insight into the demands and ideas the stakeholders might have of the interface, which will be used as a basis during the continued design work. The study will also help to understand the technological preferences the stakeholders might have; a good solution for management might not be a good solution for the users (Orlikowski &
The stakeholders are divided into two groups, the first consisting of employees and management at Narrative and the second group is made up of active customers and users of the Narrative-clip.

### 3.2.1 Interviews
To be able to capture a broad perspective a number of interviews were conducted with key members of each of the targeted groups. Traditional face-to-face interviews were performed with the employees at Narrative while the customers [users] were interviewed through email. The interviews were structured to follow the methodologies proposed by Goodwin (2009) and Kvale (2009) because of the model's recognition within the industry. The interviews were semi-structured to allow the respondent to answer freely while specific information could be gathered.

Because of the geographical dispersion of Narrative's customers, traditional methods for gathering data, such as face-to-face interviews, were not applicable. Instead the option of interviews through email was investigated. According to Hunt & McHale (2007) there are several benefits of using email as a method of inquiry, especially time for reflection, cost and range of participants. Hunt & McHale (2007) as well as McCoyd & Schwaber Kerson (2006) also argue that Internet based techniques gives similar findings as traditional methods. Oltmann (2010) and Dimond et al. (2012) presents additional advantages of using email as an interview tool and points out that consideration should be taken of the respondents' context, as to what approach is best suited, instead of focusing on only one model.

Even though there are numerous advantages of email interviews, there are also a few disadvantages. Hunt & McHale (2007) mentions the issue of interviews taking too long, as respondents need more time to answer. Because of this the focus between the parties may be affected and in the end, the quality of the questions and answers (Hunt & McHale, 2007). More disadvantages are that a non-face-to-face interview misses out on nonverbal cues an interviewee might give, thus making it harder to adapt eventual follow-up questions (Hunt & McHale, 2007; Oltmann, 2010). A common source of concern for interviews of all kinds is ethical issues, even more so when they are conducted through email as communication is limited (Hunt & McHale, 2007).

### 3.2.2 Data analysis
The analysis of the gathered data is based on a qualitative approach encouraged by Goodwin (2009), which focuses on two types of modelling: single-case analysis and cross-case analysis. Single-case analysis focuses on finding behavioural patterns in one source of data material while cross-case analysis is a comparison between multiple sets of data (Goodwin, 2009).

### 3.3 Creation and reflection
The creation stage is mainly made up of sketches created by the designer based on the exploration phase. These sketches might be individual new ideas, ideas generated from collected data or expansions on ideas and suggestions provided by stakeholders. The main thought behind using sketches as a tool is to transform thoughts into tangible information that showcases the relationships of an idea (Baskinger, 2008). To successfully portray these relationships Baskinger (2008) mentions the importance of depicting information in an ordered and structured way, even when only using sketches.
Sketches should also consider a number of ‘good-practice’ principles. Johnson (2010) presents several minimalistic techniques that help to improve the overall design and usability of an artefact. The proposed guidelines by Johnson (2010) also help the designer to evaluate drawbacks and advantages of different solutions. Low-fidelity prototypes can be generated from the sketches which have multiple benefits in terms of cost, ease of creation and ease of testing in comparison to more advanced prototypes (Rettig, 1994). Low-fidelity prototypes are (commonly) paper-based representations of a user interface which are used for iterative design refinements of a proposed solution (Rettig, 1994).

3.3.1 Workshop
A workshop is a gathering of business representatives, developers (designers) and users who come together to find solutions to a design problem (Gaffney, 1999). Conducting a workshop early in a development process does not only generate ideas free from constraints but also helps to provide incentives for organisational management to carry on with the project (Gaffney, 1999). Following suggestions proposed by Gaffney (1999), a workshop should include a clear agenda and scenarios. Scenarios are simple descriptions of how users interact with an artefact. They should be free from technical references or complicated language and be derived from an understanding of the user and the context in which the user interact with the system. Scenarios are used to focus participants in a workshop on design parameters and system requirements. (Gaffney, 2000; Go, 2009)

3.4 Implementation
As mentioned in the introduction, no complete working system will be developed for the purpose of this thesis. The implementation stage will be represented by a more detailed prototype; a high-fidelity prototype. Though, still only a model of the envisioned system, the sample will be more advanced, showing off parts of the desired functionality.

Cagan (2008) specifies several benefits a high-fidelity prototype has over the simpler paper-prototype. Perhaps the most important characteristic being the use of a real representation of the product which further helps evaluate its usability (Cagan, 2008).

3.5 Usability testing
Usability testing is a tool for evaluating a design based on user reactions, needs and expectations (Rettig, 1994). One of the most important aspects of usability testing is that it is a test of a product or service; not an evaluation of the participants in the test (Rettig, 1994; Usability.gov, 2014:2).

The test itself should include a number of task scenarios and metrics to better capture the user’s experience of the product (Rettig, 1994; Usability.gov, 2014:2). Measurements recommended to use include completion rate, error-free rate, frequency and subjective measures (Usability.gov, 2014:3). To help the researcher there are also several moderating techniques that can be employed during a usability test. Some of the most common methods include think aloud and probing. The practices serve to enhance the session goals for the test and therefore they may vary (Usability.gov, 2014:2). For the purpose of this thesis a test protocol was produced that covers a selection of the aspects mentioned, see Appendix B.
3.5.1 Measurements
The usability testing will utilise a number of different measurements to value the feedback the test users provide. This section will briefly introduce the chosen metrics used in the study.

The most basic measurement used in the tests is that of task completion rate. The rate measures if a task scenario has been fully completed or not. To do this there is one important factor, critical errors. For a critical error to occur the task scenario have to result in an incorrect or incomplete outcome. A completion rate of 100% is desired. The other metric used is error-free rate. As the name implies, it measures the percentage of tasks completed without any errors. In addition to critical errors the non-critical error is added. This type of error has no effect on the final output of a task, but rather the task being completed less efficiently. The error-free rate is desired to be about 80%. (Usability.gov, 2014:3)

To get a better understanding of the test participants thoughts and expectations a number of subjective measurements will be used. The first metric is based on the users’ expectations and experiences with the system and the task scenarios. The participants will be asked to rank how difficult they expect each task scenario will be to perform, on an odd numbered scale. After a task has been completed the participants will rank how difficult they experienced the task. To gain further insight on the actual thoughts of the test participants, the tests will end with exit questions. The questions will probe the user in an interview like way of their thoughts and impressions of the system as a whole. (Usability.gov, 2014:3)
4 Results
In this chapter the findings and results from the study is presented together with the suggested solutions. The chapter follows the structure described by the hybrid method; with the stages exploration, creation, reflection and implementation. The final prototype is presented last in the chapter with an evaluation of its performance and fulfilment of requirements.

4.1 Requirements study
This section presents how the interviews were performed and the major findings from the modelling of the answers. The interview answers are used as a basis for system requirements as well as inspiration for the design and style of the web-interface.

As mentioned earlier in this thesis the interviewees were divided in two groups: users and employees at Narrative. Five face-to-face interviews were conducted with employees; the people interviewed were one from management, three developers and one designer. The choice of interviewees was primarily based on differences in point of view of the Narrative-clip and the surrounding context, but also on the partition of jobs in the organisation. As developers are the main asset for Narrative they represent a large stakeholder group with influence over the products. The interviews were performed at Narrative’s premises and took approximately 30 minutes. The answers were first analysed using single-case and later cross-case analysis. The single-case analysis consisted of coding key comments into categories that represented the interview questions. The categories were goals, frustrations, priorities and problems. After the first interview with management some questions were modified because they provided no answers or unsatisfactory information, the revised interview questions can be found in Appendix C. This modification also affected the chosen code-words, where focus was moved from requirements to ideas and suggestions.

The cross-case analysis of the employee’s answers showed interesting variances in most of the categories. One common finding though, was that the current system lacked support for managing large amount of pictures in an effective way and thus, would be an incentive for alternative solutions. When asked why an alternative solution was requested by customers almost all employees answered that the difference in screen size and the new possibilities it can bring was the main factor. One employee said: “It is easier to organise and process large amounts of data through a (desktop) computer”, aiming at the increase of screen size. Another frequent answer was the desire to share pictures, both through other services and through the proposed web-interface itself.

Six interviews were performed through an email inquiry with as many users. A reach-out was made in a user-created social media group about the Narrative-clip to find willing users to interview. The post received responses from six different people that were all included in the study. The chosen users represent a diverse spectrum of Narrative’s customers with several of them living outside of Sweden and Europe. An email was sent out to all interviewees at the same time with the questions attached; see Appendix C for the interview questions. The participants were given one week to answer after which one reminder would be sent if no reply had been received. All answers were received on time and no reminder was sent. All questions were specified as optional and the answers were anonymous to encourage more informative responses and to keep a high response rate. The email interviews were structured to follow guidelines set by Hunt & McHale (2007) and Goodwin (2009) to cover aspects of both traditional interviews and those performed through digital media.
The same procedure mentioned earlier was conducted to model the answers; a single-case and cross-case analysis.

A comparison of the information provided from the two types of interview-styles showed no major difference in the amount of content given from the interviewees. The answers were highly personalised and varied in detail in both groups. The users’ answers were more focused towards viewing, managing and organising pictures; none explicitly conveyed a wish of being able to share the pictures. They also expressed a desire to be able to view all pictures, even the ones normally removed because of bad quality or other factors.

4.1.1 Workshop findings
Prior to the execution of the workshop some preparatory work was made. An agenda introducing the problem to work with and the planned activities for the workshop was written as well as scenarios for the creative part. The agenda can be found in Appendix D and the scenarios in Appendix E. The workshop was held at Narrative’s premises and consisted of nine participants spread throughout the organisation; including management, developers and designers. Also attending the workshop was two potential users. The use of potential users instead of actual users was chosen because of the time constraints connected to the thesis and the difficulty in which to gather real users.

The first activity in the workshop was a short brainstorming action where the participants were asked to write down any issues and design goals that they could associate with the system on small cards. These cards were later sorted into different categories through affinity diagramming, for example some of the headlines used were responsiveness (connected to the user interface) and social sharing, to give an overview of the thoughts of the participants and to help create new ideas for the next activity. After the brainstorming the group was split in half and each sub-group was asked to produce at least one design of an optional view of the product. The groups were then asked to briefly explain their designs to the corresponding group, after which a discussion of the strengths and weaknesses of the different approaches was initiated.

The last activity of the workshop was to generate a common design based on the issues, suggestions and discussions of the previous activities. Due to constraints of time, only one group-design was finished and thus, no common sketch was produced. Instead a deep and creative discussion began, analysing possible solutions further and building on the single design that was produced.

4.1.2 Requirements
From the workshop and the interviews a number of requirements were gathered. The requirements provide an overview of the desired functionality of the final solution, serving as a blueprint to model the prototypes from. As several requirements were mentioned in both the interviews and during the workshop, a mutual list was made containing 15 requirements, see Appendix A.
4.2 Initial design and first iteration
During the design process several sketches and prototypes were developed. This chapter will present the initial ideas that were generated from the workshop and the sketching-work that took place afterwards. The first round of user-testing and the outcomes from that session is also presented.

The first iteration started with creating a lot of sketches to capture the various ideas generated through the workshop or put forth in the interviews. Figure 3 shows one of the sketches produced; a sample created by participants during the workshop. The main idea behind this sketch was to provide a common theme with the current mobile application. The figure shows a collection of moments in a timeline and a navigational menu on the left.

Figure 3: Design suggestion from workshop.

The accumulated sketches generated two design solutions, each with a different focus. The first solution was leaning more towards an idea of a social-media service. Meanwhile, the second solution was more influenced by the wishes of the customers; an interface to view, manage and organise images. The design suggestions were not disjoint; they shared some aspects with each other and the mobile application. The section below will only present the main screens of the two solutions. This due to the fact that at this stage, the solutions had not been tested and validated with users and Narrative, thus, they could be heavily modified or discarded all together. Figure 4 and Figure 5 shows the main screens of the two solutions.
Figure 4: Main screen of design solution one.

The above figure shows an expanded suggestion from the workshop: a navigational menu to the left and a grid of moments in the middle. The moments are accompanied by an action-menu to their right.

Figure 5: Main screen of design solution two.

Figure 5 shows a large grid of a limited number of pictures that are interactive. The images enlarge when the mouse hovers above them.

The first design solution got more in common with the existing design of the mobile application than the second version. This is due to the fact that it is a modified version of a suggestion provided during the workshop, but also because of the different focuses of the two solutions. The second design does contain a moment view, though it has been moved to another screen to better give the opportunity to view a larger selection of pictures. The two solutions were later presented to Narrative with their planned focuses, ideas and accompanying sketches to evaluate if the designs matched their
expectations. The discussion was also used to decide which solution to expand upon and continue with usability testing. A decision was made to develop the second design, seen in Figure 5, based on a short discussion and personal preferences.

The continued design consisted of three core screens: a main view, a moment view and a view of all pictures. The initial idea was to provide alternative representations of the system functions, which were creative and interesting to use. This was later changed in favour of a more simple design. Figure 6 shows the first version of the moment view, where each circle represents a moment with the cover photo centred and dynamic images around it. Most of the designs presented below were later found to be less than optimal, see chapter 4.2.1 (First iteration user testing), and were changed or improved in later designs.

Figure 6: Initial moment view.

The moment view had one sub-screen that gave a detailed view of the images contained in the moment. Figure 7 shows the detailed moment view. The screen illustrates the selected moment as highlighted on a single line and the neighbouring moments following below. All pictures in the moment are supposed to be shown under each section. A small icon in the top right corner shows the cover photo for each moment.
The third and last core screen depicts a view of all pictures available to the user, see Figure 8. Images are displayed over the whole screen and they are presented dynamically in size based on varying factors. When the mouse is hovered over the image a checkbox appears to select the picture. Actions that have been performed on an image are shown in the lower left corner.

Figure 9 illustrates a detailed view of a single picture available through any screen that shows singular images. The screen is presented as a lightbox over the current view and got the option of adding a description and tags to the picture. An action-menu is also present and in affinity to the previous figure the actions performed are shown in the lower left corner.
4.2.1 First iteration user testing
The testing of the paper-prototype was conducted on both potential users and employees at Narrative. The reason for this was to provide insight of the solution’s validity from both perspectives. A usable system which gets discarded by the company is wasted effort and a functional system that does not have any users is a loss of time and revenue. The design solution was tested with six participants in total, three potential users and three employees. The first iteration prototype was made entirely out of paper and basic hand-drawings to really emphasise the possibility of change in the model and also to save time for the author of this thesis. A test protocol including a user introduction, task scenarios, exit questions and measurements was used during the tests, see Appendix B. The protocol was updated with one additional task scenario for the second iteration of user testing, which was not included in the first round of usability testing. This was because of an additional screen being added in the second iteration.

All the test-roles were performed by the researcher during the usability tests. The participants were asked and encouraged to think aloud throughout the sessions to provide insight into their decisions. Results from the sittings were documented and analysed directly afterward each test. This was conducted to identify weaknesses in the design and to improve upon them. The prototype was continuously improved all through the usability tests, to iteratively enhance the design and seek new inputs from the users on the improvements. Table 1 shows the resulting measurements from the performed tests. A completion rate of 100 % was achieved for all the task scenarios, thus providing validity to the ideas and concepts of the design. Though all tasks were completed without critical errors there were still some elements that the participants found confusing.

<table>
<thead>
<tr>
<th>Task scenario</th>
<th>Completion rate</th>
<th>Error-free rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100 %</td>
<td>84 %</td>
</tr>
<tr>
<td>2</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>3</td>
<td>100 %</td>
<td>50 %</td>
</tr>
<tr>
<td>4</td>
<td>100 %</td>
<td>67 %</td>
</tr>
<tr>
<td>5</td>
<td>100 %</td>
<td>84 %</td>
</tr>
</tbody>
</table>
The users found task scenarios 3 and 4 the most troublesome, as can be seen in Table 1. For task scenario 3 the main issues were design related, meanwhile some confusion arose about the meaning of certain icons in task scenario 4. As the design of the prototype was iteratively improved between test sessions it should be noted that most of the non-critical errors performed by the users were experienced during the initial three tests. There was a notable decrease in errors during the latter part of the user tests.

The usability tests also included subjective measures for the users to answer. These measurements showed that the participants, more often than not, experienced the system easier to use than they expected. Task scenario 3 was both expected and experienced to be the most difficult to complete, which the test measurements in Table 1 shows. Additionally, concerns were raised about differences to the current mobile application and the icon-representation of certain features. The participants also provided insights in how they would have liked the interface to function through the think aloud moderating technique and through the exit questions. This information was deemed highly valuable and was used to improve identified weaknesses in the design.

As described previously in the chapter, there were some changes made to the design after certain testing sessions. The most notable modifications were made on the moment view (Figure 6), where the initial design was discarded because of its confusing and complicated nature. Instead a design more in common with the mobile application was produced to decrease the learning curve of the system. The detailed moment view (Figure 7) was changed to only show the selected moment and nothing else.

The initial all pictures view (Figure 8) was discarded altogether in favour of an updated version of the main screen (Figure 5) which became the new all pictures view. A hovering feature was added so users can favourite or tag a picture directly. The detailed picture view (Figure 9) got minor updates, removal of the lightbox and repositioning of the menu-bar. A common theme for most of the screens in the revised design is the inclusion of a utility menu, which allows for easy access to basic operations, like sharing and downloading pictures. A completely new screen was also added, a calendar view; based on sketches and suggestions from some of the test users. This view will be presented and tested in the next chapter.

4.3 Improved design and second iteration
This section presents the refined design from the previous iteration, and the second round of usability testing. The key frames of the solution will be shown with their corresponding requirements to give the reader an overview of the fulfilsments of the system. The frames were created using Balsamiq Mockups, a wireframing software (Balsamiq, 2014).
**Figure 10: All pictures view.**

**Figure 10:**

- **Requirement 1:** Several images and rows can be selected for download
- **Requirement 8:** Images can be selected and deleted through the action menu
- **Requirement 11:** The view allows the user to browse all available images
- **Requirement 14:** Images can be selected as favourites

**Figure 11: Detailed picture view.**
Figure 11:

- Requirement 3: The enlarged view allows the user to see the images in greater detail
- Requirement 4: A short description and tags can be added to the image through the side-bar
- Requirement 5: Images can be selected and shared through the action menu

Figure 12: Moment view.

Figure 12:

- Requirement 1, 6, 9: A whole moment can be selected to be downloaded, shared or deleted
- Requirement 3: The view provides familiarity with the mobile application

Figure 13: Detailed moment view.
Figure 13:

- Requirement 1, 5: Moment images can be selected to be downloaded or shared

- Requirement 13: All images associated with a moment and can be manually selected and removed through the action menu

Figure 14: Add picture to moment view.

Figure 14:

- Requirement 12: Images can be added or moved to one or several moments, or placed in an entirely new moment
- **Requirement 3**: The calendar view provides an overview of the images during a longer time period.

- **Requirement 15**: The view allows the user to quickly identify when images have been taken.

4.3.1 Second iteration user testing

The second round of user testing introduced an additional task scenario to test the calendar design, which was not present in the first design. The testing was conducted with five participants, four potential users and one developer from Narrative. The prototype was made out of digital sketches presented in the previous chapter and composed in a Portable Document Format (PDF), with semi-interactive abilities. The interactions contained clickable links to major screens meanwhile functions available on multiple views were manually navigated or described. The results are shown in Table 2, and once again the maximum completion rate was achieved for all the task scenarios. It should be noted that due to the low number of test participants the percentages decrease greatly even though only one or a few errors occurred.

<table>
<thead>
<tr>
<th>Task scenario</th>
<th>Completion rate</th>
<th>Error-free rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>2</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>3</td>
<td>100 %</td>
<td>80 %</td>
</tr>
<tr>
<td>4</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>5</td>
<td>100 %</td>
<td>60 %</td>
</tr>
<tr>
<td>6</td>
<td>100 %</td>
<td>100 %</td>
</tr>
</tbody>
</table>
The issues experienced in task scenarios 3 and 5 were related to the appearance of the “more options” icon; they did not understand what type of functionality the icon provided. The subjective measurements showed a clear improvement in both expected and experienced ease of use by all test participants in comparison to the first round of usability testing, with task scenario 3 still being regarded as the most difficult to complete. The participants found the new calendar view to be both practical and ease to use, providing a more extensive view of pictures over time.

The major redesign for the final prototype consisted of the removal of the more options icon. Instead it was replaced with additional icons on the action menu to point directly to the functions. Minor changes included a more unison design for the whole system, reusing utility from similar screens. The detailed picture view (Figure 11) got a more intuitive design for the description function and the view acts like a lightbox instead of a separate page.

4.4 The Narrative image visualisation interface (iVi)

The high-fidelity prototype was created using the Axure RP wireframe software (Axure, 2014), allowing similar experience and interactions as to a website coded by using HTML, CSS and JavaScript. All screens of the Narrative iVi is presented below, though, most interactions are not visible (the reader is referred to the actual prototype to get the full experience).

Figure 16: Narrative iVi startscreen, the all pictures view
Figure 17: Detailed picture view as a lightbox

Figure 18: Moment view
Figure 19: Detailed moment

Figure 20: Add to moment view as a lightbox
Figure 21: Calendar view

Figure 22: Detailed calendar
4.4.1 Narrative iVi usability testing
The testing was conducted with five potential users, which had not previously tested the design. The high-fidelity prototype was introduced as a complete website with interactions for all major and most minor functionality. Results from the test sessions are presented in Table 3.

Table 3: High-fidelity prototype test results

<table>
<thead>
<tr>
<th>Task scenario</th>
<th>Completion rate</th>
<th>Error-free rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>2</td>
<td>100 %</td>
<td>80 %</td>
</tr>
<tr>
<td>3</td>
<td>100 %</td>
<td>80 %</td>
</tr>
<tr>
<td>4</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>5</td>
<td>100 %</td>
<td>80 %</td>
</tr>
<tr>
<td>6</td>
<td>100 %</td>
<td>80 %</td>
</tr>
</tbody>
</table>

All task scenarios were completed without any critical errors and slightly higher non-critical errors. The increase of non-critical errors can be attributed to the familiarity issue with a new product. All measurements were clearly above the recommended levels (discussed in chapter 3.5), which this session is the first and only test session to achieve, providing validity to the changes made. Difficulties related to the recognition of icons were limited in comparison to previous prototype testing, though users needed extra time to identify the purpose of each icon. Some confusion arose between the moment view and the detailed calendar view because of their familiarity. Suggested improvements proposed by the users included a clearer indication of which view was active and a larger differentiation in size between the moments. The expected and experienced ease of use were for most of the tasks quite equal, with task scenario 3 still being considered the most difficult one for both measurements.
5 Discussion

This section will discuss the impacts of the study results, in particular advantages and disadvantages with major design decisions and the motivation behind them. The section will also include a critical review of the chosen method in comparison to common design methods to consider possible differences in results. A motivation for the hybrid method will also be discussed.

The study was performed during three iterations leading up to the final prototype. During these iterations a number of major and minor decisions concerning the design were made. Starting from the beginning in phase one with the requirements study and the initial sketches a lot of the future work was decided here. The interviews were performed with both users of the Narrative-clip and employees at the company. As can be expected this yielded a quite diverse range of answers regarding their preferences for the web-interface. This was a planned part of the hybrid method, in which to create sundry requirements for the system. The differences in expectations between users and employees became even more apparent after the workshop and the produced design suggestions. The sketches produced before the workshop had a different focus than the ones created by the participants of the workshop. The choice of focus, and in essence the goal of the system to be designed, became the first major tradeoff. On one side the focal point was on the ability to share images internally and externally between users meanwhile the other suggestion was more focused towards the representation and managing of pictures. As described in chapter 4.2, it was the latter focus that was chosen to be further developed.

5.1 Design tradeoffs

An advantage to the sharing design would be its popularity and recognition with current social media, creating a similar service to already existing ones. This is also the main disadvantage for creating a design focused on sharing pictures, there are several well known and immensely popular systems that already provide that type of service. Instead, with a design focused on visualisation and managing of images the system can be used as a user tool with the option of sharing. This would help to fulfil the goal of the Narrative-clip, to relive your memories. It can be argued that the mobile application already accomplishes this functionality, but due to the high amount of pictures the current system handles there is a need for a web-based system that supports the same role.

The transition between the first and second iteration saw a lot of changes to the design, as detailed in the first user testing chapter 4.2.1. The initial prototype was more based on a creative flow and an idea, rather than identified requirements, which evidently did not work out as expected. The choice of exchanging the ‘alternative’ design for a more simplistic and practical design came naturally, not only did the results from the user testing point at flaws in the design but it was also a part of the evolution of the design process for the author of this thesis. The benefits gained from making this alteration were mainly user experience related but it also added to the less is more mindset. A major addition to the design in iteration two was the calendar view. The interview data gathered in the requirements study showed a demand for an easy way to overview the (users’) pictures in the system. With the ideas from iteration one not completely fulfilling that need, the calendar view was added and got great response from the user testing. Even though the screen provides a good overview for a long timeframe, it can also be seen as an extra layer to the system that receives no real use, due to other screens providing similar functionality. To be sure of the impact the calendar view provides, the use of live testing with several users is probably needed but is out of scope for this thesis.
The work for the third iteration and the final prototype did not contain many design changes. The most notable one concerned the action menu and the configuration of icons. As briefly discussed in the results for the iteration testing, the icons were one source of error during the testing and cause of confusion. The icon representing the ‘more options’ choice was removed in favour of several additional symbols on the menu that was previously hidden under that selection. The advantage of having one icon for each menu function is the ease of access and minimisation of confusion for the user. A problem arises when there are too many icons for the user to effectively categorise, causing structural problems and uncertainty. The line where this happens is affected by many variables and should be judged from case to case. In the context of the Narrative iVi, the functionality estimated to be used widely by users is represented on the action menu.

5.2 Motivating the hybrid method
This section consists of comparisons between the design methods discussed in chapter 2.2. Similarities are based on published literature about strengths, weaknesses and special attributes of each of the methods. The comparisons will help to motivate which process is most suited for the development of the Narrative-clip web interface.

First, it should be noted that all three of the chosen design techniques are quite similar in their processes and aspects. Keeping in mind that service design is not mainly used for (digital) product development, but rather services, which might include digital artefacts. There are valuable experiences to be gained by integrating it in a software process (Lytras & Sicilia, 2009). The methods are all related to user-centred design (will not be discussed in depth) in some form, thus building on the same ground of involving and understanding the user in a design process. Even though this is the case, they have some distinctive differences. Edeholt & Lowgren (2003) presents a framework for understanding relationships between different design disciplines. Their work is mainly focused on correlations involving interaction and industrial design through the presented framework, but they also introduce a reviewed notion of disciplinary integration (originally by Eric Jantsch). Most interesting for this thesis is the interdisciplinary work which requires direct cooperation from all involved methods to achieve the desired outcome (Edeholt & Lowgren, 2003). The framework itself presented by Edeholt & Lowgren (2003) will not be discussed in any wider context, but rather the actual findings, drawn from the article.

Holmlid (2007) expand the framework introduced by Edeholt & Lowgren (2003), including new variables as well as incorporating service design in the relationships. Measurements related to the framework by Edeholt & Lowgren (2003) are highlighted with italics. The reader is referred to the paper in question for full details and definitions. Some key findings in Holmlid’s (2007) paper that are deemed interesting for the purpose of this thesis is presented below:

- Service design processes are highly explorative and somewhat analytical; meanwhile interaction design processes are not significantly explorative and highly analytical.
- Service design materials are highly tangible and highly virtual; meanwhile interaction design materials are not significantly tangible and highly virtual.
- Service design aesthetics are somewhat experiential, highly visual and highly active; meanwhile interaction design aesthetics are not significantly visual, highly experiential and not significantly active.
As mentioned before, these are only some of the relationships found by Holmlid (2007). However, they represent a number of the strengths and weaknesses of the methods in a clear way. Considering the findings there is a possibility for creating an interdisciplinary method that tries to address the weaknesses of only using one design method. Holmlid (2007) mentions that interaction design and service design could be part of such a method, taking into account their similarities and focus. Service design is highly explorative, as can be understood by studying the design process presented by Stickdorn & Schneider (2010) where the exploration phase is meant to create an understanding of the stakeholders. Meanwhile, interaction design is not significantly explorative, meaning that users are not studied in the same extent as in service design and are instead used as testers for prototypes. In contrast, service design is somewhat experiential meanwhile interaction design is highly experiential. This means that interaction design is more focused on how a proposed or existing artefact is perceived rather than how it looks (Edeholt & Lowgren, 2003).

Applying Edeholt & Lowgren’s (2003) framework on participatory design is outside the scope of this thesis, therefore other sources needs to be considered to show relationships between service, interaction and participatory design. Holmlid (2009) says that participatory design does not pay enough attention to the customer experience as a whole; meaning what exceeds the regular user experience, such as brand feel. As participatory design is primarily focused on digital artefacts the surrounding context can be perceived as narrow; users and designers are the main participants involved in the development process. Service design on the other hand can help to expand the perspective by cooperation through many channels and actors (Holmlid, 2009). Associated with this observation is the focus of co-creation of value for the end product in service design (Lytras & Sicilia, 2009; Holmlid, 2009). Focusing on value, which is a common practice in participatory design (Kensing & Blomberg, 1998), goes beyond the necessity of only producing "tools for workers", as Holmlid (2009) puts it. This means that artefacts created through this process adds real value for a user and is not seen as an additional basic tool.

When considering the issues and concerns that have been discussed about the different design approaches, it becomes quite clear that none of the before mentioned methods are adequate enough to cover all the aspects required in the design of the Narrative-clip web-interface. Consequently, an interdisciplinary method that draws on the strengths of all the design disciplines is needed.

5.3 Result validity

The study for this thesis was based on a hybrid method, combining elements from participatory, interaction and service design. The goal of the method is to gather the strengths of each design discipline in turn, to create an encompassing technique for design and usability projects. Because of the utilisation of several different methods and the guideline like essence they inhabit there are multiple issues to discuss. These issues can possibly affect the validity and reliability of the study results, and thus, the final outcome. Runesson & Höst (2008) speaks about the legitimacy of a study’s results, how they should not be affected by subjective influences. Their notion of validity and reliability (result dependency on specific researchers) will be loosely discussed in this chapter.

The first factor for discussion is the use of the three design disciplines. Each of the methods got its own strengths and weaknesses as have been mentioned several times in this thesis. Though, the reader might ask if the same research elements could be used with only one of the methods, and still
achieve the same results. This is of course a possibility, the design disciplines are expressed as guidelines rather than a complete method. This allows a researcher to adapt to the problem at hand. Considering the limitations of this thesis and the extensive use of participatory, interaction and service design, there is no sure way of knowing if the same results could be achieved with only one method. That being said, the author of this report believes that the general form of the design disciplines, by their own, does not contain all of the techniques necessary to complete a similar study. For example, only using participatory design or interaction design would probably result in some stakeholder groups not being included in research, testing or follow-up. This would lead to a loss of valuable data and possibly expert opinions, potentially leading to a less than optimal result.

Turning the focus towards the method of the study there are a few possible weak points in its execution. The first issue is related to the user interviews, which were conducted through an email inquiry. Though no differences were found in the collected data between the face-to-face interviews and the ones conducted through email, additional work should try and perform personal interviews with users to ensure a comprehensive collection of data. As discussed in a previous chapter there is a possibility that some information is not captured due to the loss of direct interaction. The second issue in the study concerns the usability testing. The testing was conducted with potential users instead of real users, which had no or little experience with the Narrative-clip. This might have affected the results negatively, which should be taken into consideration when analysing the results. Another issue was the number of participants for each usability test, which was quite low. Testing on a higher number of users would have been beneficial, to be able to acquire more data on the functionality of the interface and thus, a more reliable result. Providing a larger sample of user participants could detect limitations in the current design which a small sample cannot. Even though the tests were performed with few participants the total number of tests conducted throughout the study should provide a reliable result for the complete design.
6 Conclusion

This thesis elicited requirements and provided a design suggestion for an image visualisation interface focused on life-logging. Several evaluations were performed to validate the features of the design. The study indicates a number of important characteristics to consider for the overall design of the interface.

The first characteristic is the representation of images, how they are shown to the user. The design process for the Narrative iVi showed that simplicity is preferable to a lot of functionality. This is perhaps a general design philosophy, but even more so when presenting large quantities of data. Guidance can often be found at competitors or similar products and services that can be adapted to suit ones goals. The second important characteristic of the interface is familiarity with the design and the company trademark. Providing the user with a familiar environment not only decreases the learning curve for the application but also creates a uniform experience for the user. The third and last characteristic that is important for the interface is overview. The Narrative-clip produces large amounts of pictures each day and finding a specific image or moment can be difficult. Providing several overview options allows the user to more effectively find the desired data.

There are also two key aspects to the design mindset to consider for a conclusion of this thesis. The first one is that a broad context is an important part of a stakeholder centred development. By limiting the view to only one perspective the work process might take on a completely different focus than what was initially planned. There are always variables that cannot be anticipated and narrowing down the initial perspective would likely increase the number of variables that can change. Thus, altering the final outcome from the planned one. Stakeholders may also be disappointed in the final product if they have had no influence in its design and development. The second and last aspect connects the design characteristics with the design mindset. Follow-up and iterative usability testing was perhaps the most important component for the improvement of the design suggestion and the final result. The feedback from the users and the employees not only showed what elements worked and which elements did not, but also provided support or incentive for change of the general design. This creates direct response to how images or functionality can be represented, allowing for adaptation in a following phase.

To conclude the chapter this paragraph will briefly present possible future research elements:

- A more encompassing usability study of the high-fidelity prototype with real end-users would validate the design decisions made.
- Development of a live web-interface and collection of additional information on usage patterns for the site.
- Look for opportunities to further develop the interface into other business segments, such as social media or hosting services.
References


Appendix A: Requirements

1. Should be able to download one or more images
2. Should be easy to use
3. Should be several different views of images
4. Should be able to add notes and tags to images
5. Should be able to share images publically
6. Should be able to share moments publically
7. Should be able to search for images with different criteria
8. Should be able to delete images
9. Should be able to delete moments
10. Should be able to sort images with different criteria
11. Should be able to show all images, including otherwise removed data
12. Should be able to manually add images to moments
13. Should be able to manually delete images from moments
14. Should be able to select images as favourites
15. Should be able to see when and where an image has been taken
Appendix B: Usability test protocol

Introduction for test participants:

Hello and welcome! You will conduct a user test on a basic prototype for the web-interface of the Narrative-clip. Your responsibilities as a participant will be to attempt to complete a set of representative task scenarios presented to you, in as an efficient and timely a manner as possible, and to provide feedback regarding the usability and acceptability of the user interface. Please provide honest opinions regarding the usability of the application. Remember, you are evaluating the website/service; we are not evaluating you or what you do. So please, do not be hesitant, and if you have any questions feel free to ask.

Task scenarios:

1. You are browsing through the Narrative-clip web-interface and notice several new pictures you are really fond of and would like to favourite them for later reference

2. You are doing a project for the city council and have an upcoming presentation. You remember a moment with pictures that would be perfect for that purpose. Download three pictures from a moment to your computer to use in your presentation

3. During a long trade fair the Narrative-clip grouped all pictures into one moment even though you moved around a lot. You would like to move one picture to another moment that better represents its context

4. You are a regular user of the Narrative-clip and thus get many pictures. It gets hard to remember the surrounding context of the pictures and therefore you would like to add a description and tags to a picture

5. You are visiting your grandparents after your latest vacation and want to show them all your favourite pictures

6. You have used the Narrative-clip since its release and remember a picture taken in October last year that you would like to share to your friends

Exit questions:

- What is your overall impression of the service?
- Is there anything that you feel is missing?
- Do you have any other final comments or questions?
Appendix C: Interview questions

Narrative:

1. What is your profession at Narrative?

2. Do you use the Narrative-clip and the mobile application (personally/work)?

3. What advantages do you see with the mobile application?

4. What disadvantages do you see with the mobile application?

5. Why do you believe an additional solution is requested to complement the mobile application?

6. What type of functionality and ideas would you personally like to see in the web-interface?

7. Do you identify any problems or benefits a web-based solution can bring in comparison to the mobile application (e.g. functionality, design, performance)

8. Do you have any final thoughts or questions?

Users:

1. How often do you use the Narrative-clip and the mobile application?

2. What do like about the mobile application? (e.g. Interface, functionality, performance)

3. What do dislike about the mobile application? (e.g. Interface, functionality, performance)

4. Would you like another organising tool besides the mobile application? If yes, what type of tool?
   a. Why do you want another tool?

5. What type of functionality would you like to see in a possible web-interface for the Narrative-clip?

6. Do you use any similar competitive services? If yes, which ones?

7. Is there anything you would like to add?
Appendix D: Agenda for design workshop

Planned time 1-2 hours.

**Introduction (5min):** Introduce the problem. Handling large amount of pictures on the mobile application is ineffective (due to screen size) and there are no current tools to speed up the process.

**Objectives and issues (10min):** Ask participants to individually write down issues with the current system and their desired goals with the new system.

Sort issues into categories to identify the most pressing problems of the system. Document the goals.

**Scenarios (20min):** Divide the group into two equal parts with diverse participants (i.e. users and employees mixed). Present the scenarios to both groups and ask them to produce possible solutions in accordance with the scenarios, identified issues and goals.

**Combining solutions (15min):** Each group shortly presents the ideas behind their solutions. Discuss and criticize the proposed solutions and work together to find one combined solution.

**Closing workshop (10min):** Summarize solutions and findings and check if every issue and goal has been addressed.
Appendix E: Scenarios for design workshop

**Scenario 1:**

It’s the end of the week-long vacation and Lisa has used her Narrative-clip every day to document the family trip. She plugs in the clip into her computer to upload the last pictures and realises that there are now several thousand pictures to view. She signs in to the Narrative web-interface to quickly get an overview of the pictures taken during the week. As there are so many pictures Lisa decides to only look at the best ones so she can share them with her friends and family.

**Scenario 2:**

Johan has used the Narrative-clip since its first release and is a regular user; he likes to wear it both privately and to work. Johan works as a business representative and likes to connect pictures with meetings and formal parties he attends to build greater customer relationships. This afternoon he received a phone call from an old customer 6 months back, who wants to initiate a new contract. Johan cannot quite remember the experience he had with the customer and decides to check the pictures associated with the meeting. As he enters the Narrative web-interface he searches for the specific pictures using different filters and finds out where he was and how the reception went.

**Scenario 3:**

Betty is nostalgic and likes to view pictures of her grand-children growing up. Through the Narrative web-interface she selects her favourite images to show and marks them with comments, so she can get a continuous timeline of her grand-children.

**Scenario 4:**

Karl is an adventurer and travels all over the country doing different activities. He uses the Narrative-clip to capture beautiful scenes and to document his travels and the places he has visited. When planning a new trip he uses the map function of the Narrative web-interface to get an overview of the places he has visited and the connected pictures, to get a feel for where he should travel next.
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