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The Usability of DSLR Cameras for Amateur Photographers
- An Empirical Case on Design

Master thesis
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Abstract

Digital cameras have taken over a significant amount of the photography done by amateur and professional photographers in the last decade, and the interest for Digital Single-Lens Reflex (DSLR) cameras is increasing. Many photographers purchasing a DSLR are amateurs, and cameras should be designed in order to suit their level of photography skills. Amateur photographers are studied for this thesis, and they seem to blame them selves when not being able to utilize the camera the way they intend to. Results of this thesis show that users want to take good and artistic photos using the manual settings, and that it is important for them to be in control of the camera and their results during photo shooting. It also shows that such an approach to the camera is complicated and not achieved by the users. The methods used in this thesis reveal several complications in the User Interface (UI) design of a DSLR. Based on these and theory on interaction design, suggestions to several improvements are given in order to make the UI meet the needs and goals of its users, and support their understanding of the camera in a better way.

This thesis stands out with its novel research within the usability field in terms of its engagement with DSLR cameras. It provides insights on amateur photographers' wishes for camera use. It also unveils problems they have with operating a DSLR, and suggestions to improved UI solutions are given. The findings of this thesis can be interesting for the field of interaction design, as devises such as the DSLR seldom are studied. Several of the methods used for this thesis are unusual within interaction design, but have lead to thorough and extensive results, and can therefore be used in future interaction design studies as well.

Keywords: Interaction Design, Digital SLR Cameras, User Interface, Downloading Functionality, Usability Principles.

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Chapter 1

Introduction

1.1 Motivation

I decided early upon writing my thesis in the field of interaction design. Not only does it bring together the interesting fields of informatics and psychology among others, but it is a growing field that is interesting in itself, and customers are now often considering usability when purchasing their products (Saffer, 2009; Shneiderman & Plaisant, 2009; Lo & Helander, 2004). I caught the interest for this field while completing a course on Human Computer Interaction (HCI) at the University of Oslo. The interest grew more after reading Donald Norman's book "The Design of Everyday Things", and I started to notice and get interested in poorly designed artifacts around me. An example is a coffee machine in a canteen of an office building in Oslo. The mapping[1] between its two metal tubes (coffee and tea) and their two buttons is completely wrong, as the most right button controls the most left tube. An employee of the building told me that she usually puts empty cups under each of the two tubes, clicks the button for tea, and brings with her the cup that is filled, leaving the other one behind. Another example is a stove I recently used in the Netherlands, which had two vertical oven-plates and two

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[1]Mapping is a usability principle described in *Section 2.1.5.2* of this thesis.

horizontal buttons controlling them. I had to make up my own rules in order to remember which button controlled which oven-plate.

Many users have similar problems when utilizing their digital products (Dave, 2006). A product of particular interest to me is the Digital Single-Lens Reflex (DSLR) camera, which is a device that a lot of people have a passionate relationship to. Many owners of DSLR cameras, however, have problems understanding and using all the features available to them. I ground this assertion on the demand for beginner courses on digital photography[2], projects I have done earlier, and several conversations with DSLR owners about the problems they have operating it. What I find interesting and want to investigate further is that these photographers seem to like their camera, even though they have problems utilizing it. By knowing more about how users wish to use their camera and how they approach its User Interface (UI), a redesigning process for the UI can start.

1.2 Research Questions

The focus of this thesis is on amateur photographers' relationship to the DSLR[3], as their knowledge on photograpy theory is limited compared to professionals, and they therefore might have problems working their camera. DSLR cameras are made in different price ranges and are intended for different levels of photographers. The cheapest cameras are meant for amateur photographers to buy and use, and are focused on in this study. The UI design of these cameras, however, does not seem to be grounded in an understanding of the amateur photographers, and are therefore not clearly understood by the users. DSLR cameras are similar to analog Single-Lens Reflex (SLR) cameras, but contain much more functionality. A DSLR can hold various buttons, wheels, displays, and menus for organization of its functionality.

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[2]The course syllabus include photo theory, but also a lot about how the different DSLR brands work.

[3]See *Section 1.4* for definition of amateur.

Many of the icons used are similar to icons used on digital compact cameras or other digital devices. There are, however, a number of functions and icons that are unique for DSLRs and might be confusing to the users. In this thesis, knowledge about how users would like to use a DSLR and how they perceive the UI of a DSLR intended for beginners, will be thrown light on. Canon EOS 1000D, a camera designed for beginners (Canon, 2008), will be usability tested. Results from the test will be discussed, and suggestions for improvements of the UI design will be given based on the test results, users' comments, and theory on usability. A case study will be done and several methods will be applied in order to gain the knowledge about users' comprehension of the DSLR's UI design and the users' wishes for use of the DSLR, as well as to get ideas for a better UI design. This will be thrown light on through two questions. The first concerns use and practice, while the other concerns UI design:

1. **How do amateur photographers use a DSLR designed for their level of photography skills, and how do they wish to use a DSLR?**

2. **How can the users' use and wishes be supported in a redesign of the UI of a DSLR?**

The research questions stated above will be answered and also lead to knowledge on the usability of DSLR cameras. Several methods will be employed for this case study in order to answer the questions. Questionnaires will lead to basic information on the users' relationship to their DSLR and their wishes for future use of their camera. Interviews will go deeper into issues touched upon in the questionnaire and will generate further information on users' thoughts about different functionality. Usability tests and brainstorming will add to the knowledge on how users perceive the DSLR and what can be done to improve the UI of a DSLR intended for beginners. The outcome of the methods will lead to an understanding of the users' wishes for camera use, as well as the interaction between them and the DSLR. This

will further lead to a redesign of Canon EOS 1000D' UI, which will be visualized through a prototype made in Flash CS3 with Action Script 3.

1.3   Contribution of this Work

Cameras have existed since the early 1800's and have gone through several revisions in the last two centuries (Mann et al., 1971). One of the most noticeable is the move from analog to digital photography. It is no longer only a photo camera, but a computer with all its capabilities as well. Several studies have been carried out on the use of camera phones, ability to share pictures (Kindberg et al., 2005, 2004; Prøitz, 2007), and also the usability of small screens on portable devices such as mobile phones and Personal Digital Assistant (PDA) (Hakala et al., 2005; Acton et al., 2004; Kristoffersen & Ljungberg, 1999). However, to the best of my knowledge, no literature on the usability of complicated camera devices such as the DSLR exist. This thesis follows up on the lack of research in the area. It stands out as novel with its focus on the DSLR camera's UI design, and with its grounding in users' comprehension and utilization of it. It also throws light on actual problems, such as an issue of wanting many functions but also a user-friendly camera or photography tasks that are complicated to perform for the users. Possible solutions to the design issues appearing are then worked out. The growing number of DSLR cameras possessed by amateur photographers, and the challenges they have operating them proves a neglect when it comes to bringing the users into a design process and understanding their needs, wishes and their ways of seeing and using the camera (IKT-Norge, 2009). As design is forming the use of a device, the use should also be forming the design (Löwgren & Stolterman, 2005). The study done in this thesis takes the approach of understanding the actual users, in order to make a UI design that supports them. Existing usability issues, never discussed before, are found through the work of this thesis. Based on the issues, design

ideas are given in order to improve the UI of a DSLR for amateur photographers. Assumptions about the users are not randomly made, but issues are investigated carefully, through several methods, in order to get trustworthy data to work with and base a conclusion upon. I have written a paper on the study of this thesis, which is submitted to the Human Computer Interaction Symposium (HCIS 2010) of the World Computer Congress in Brisbane, Australia and will be presented in September 2010.

1.4 Terms Defined

Within interaction design, the subject of interest is often referred to as the *User*. This is because the interest lies within the person's use of a device, that is, the interaction between the user and the device (Preece et al., 2002). The term *User* will be used throughout this thesis, as the case study is focusing on interaction design. When carrying out different methods, more suitable words will be used when referring to the users participating. The term *Respondent* will be used for a subject answering the questionnaire, *Interviewee* will be used in reference to the person being interviewed, and *Participant* will be used for users participating in the brainstorming. Though different terms, they are all the same set of users of the product being investigated.

When talking about photography, these users are often divided into two groups based on their experience and knowledge: *Amateurs* and *Experts* (Ferry, 1988; Stewart, 2009; Salovaara et al., 2009). An amateur user of digital SLR cameras is defined in this thesis as a person who is relatively new, physically or mentally[4], to DSLR photography. Since the participants of this thesis were going through a beginner course on digital photography, they are all assumed to be amateurs as opposed to experts. *Intermediates* can be used about photographers in between

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[4]'Physically' means that the user has used the camera for a short period of time, while 'mentally' means that the user feels new and insecure with the camera and its functionality.

beginners and experts (Cooper & Reimann, 2003). In this thesis, intermediates will be a part of the rather broad definition of amateur photographers. There is a great difference in how an expert sees the world of which s/he is working in, and how an amateur, or novice, sees it (Dumas & Redish, 1999). Amateurs will therefore be focused on here as the relationship between them and their DSLRs is of interest for this thesis.

Before entering the research done for this thesis, an overview of the content of each chapter is given.

1.5 Chapter Overview

Chapter 1: Introduction The problems to be addressed, contribution of the work, and definitions of terms used throughout the thesis is presented here.

Chapter 2: Theory Relevant theory about Interaction Design and the DSLR camera is presented in this chapter.

Chapter 3: Literature Review Recent research on camera use and small screens is reviewed. An overview of recent cameras and their functionality is given, and different ideas about camera extensions and improvements are presented.

Chapter 4: Methodology The methodology and ethics of this thesis is described, and the case study and its methods are carefully presented.

Chapter 5: Setting the Stage for the Empirical Study The case study is summarized in this chapter.

Chapter 6: Results Results from each of the methods: *questionnaire*, *interview*, *usability test*, and *brainstorming* are presented.

Chapter 7: Discussion Results from Chapter 6 is discussed, considering theory presented in Chapter 2 and 3 in order to answer the research questions stated in Chapter 1.

Chapter 8: Conclusion Based on Chapter 7, this chapter makes conclusions on the results and answers the research questions given in Chapter 1. A prototype is also made, and described, for visualization of the results. Proposals for additional research is then given.

Chapter 2

Theory

The two main theoretical fields of interest for this thesis are Interaction Design and Digital SLR cameras. From interaction design, concepts and insights, as well as critical principles and connections to the DSLR are given. SLR cameras' basic functionality and the special characteristics of the DSLR is then presented.

2.1 Interaction Design

Interaction Design, HCI, and other close related fields are concerned with building interfaces that help and satisfy their users. Saffer (2009) mentions that small annoying things in peoples' everyday lives are what gradually drive us crazy. An interaction designer's job is to avoid this by improving poorly designed interfaces and by inventing new ones (Saffer, 2009). In an interview with Bergman, Norman says that to make design work as a part of ones everyday life, the technology has to "disappear" and be invisible (Bergman, 2000). He argues that there are two versions of being "invisible", one where the technology really is invisible, and one where the technology is so well designed that it does not feel like a technology, but rather a natural and taken for granted part of the everyday activities (ibid). Löwgren and Stolterman (2005) state that the UI of a product shapes the product in the way it is made use of and understood by the user. Good products are those designed to

suit the goals, life style, and behavior of people (ibid).

> *Interaction design is about shaping digital artifacts. It is about giving structure and form to human environments and activities.* (Löwgren & Stolterman, 2005, p. 171)

Simultaneously, as the design is shaping the way the user behaves, the behavior of a user should shape the design. This implies that old design also is, and should be, shaping new design (ibid). Within interaction design, the designer has to be a researcher to understand the user and the situation they are designing for (Cooper & Reimann, 2003). Norman (2002) mentions that people are good at understanding clues from nature, and that this knowledge should be taken into account while designing products to be used by people.

Interaction designers are often concerned about users' needs (Bergman, 2000). Users' needs are seen apart from the device, and is rather based on the capabilities and characteristics of the users (Preece et al., 2002). A photographer's needs can for instance be to keep memories, develop a hobby, or make art. In order to be able to cover these needs, several user goals, which has a connection to the device, have to be met. Such goals can for instance be to learn about photography, use a lot of functions, get sharp pictures, or take artistic pictures.

2.1.1 History

Interaction Design has existed as an informal discipline for a long time, but it was first spoken of in 1990 and given the name of *Interaction Design* by Bill Moggridge (Saffer, 2009). Marc Retting, designer, educator, and researcher, announce Xerox PARC's design of the Star interface in the 1970s as the first conscious interaction design, a design containing icons in the UI (ibid). Xerox PARC's design was again based on research at the Stanford Research Laboratory and the Massachusetts Institute of Technology (Myers, 1998). Icons were spoken of in 1975 by David

Canfield Smith (ibid). These are important concepts today, and when designing user interfaces, decisions have to be made upon what icons, colors, and shapes to use.

2.1.2 Different Approaches

There are different approaches toward making good interactive UI designs, such as Interaction Design, HCI, Participatory Design (PD) etc. Various approaches differ in their prioritizing and in use of certain methods, but are very similar and overlap a great deal (Saffer, 2009). Although they have strong similarities, there are some discernible differences. HCI is closely related to interaction design, but contain somewhat more quantitative methods related to engineering and computer science (Saffer, 2009). It is a field that focuses on the interaction between a product and its users. HCI tends to center its interest on the users' needs in order to design products that meet these needs. Participatory Design, on the other hand, is a Scandinavian approach that makes sure to involve and empower users through the design process from an early stage (Grønbæk & Trigg, 1999). Users and designers work as equivalent and cooperating participants, however with different positions when it comes to decision making (Muller, 2002; Preece et al., 2002). Different features from these approaches are employed in this study. Usability testing, which is a typical HCI method, is carried out, and through brainstorming, users are involved and empowered in order to compose design and give valuable feedback. Users' statements are taken into consideration throughout the study, and principles from interaction design is employed to substantiate and provide reasons for design choices.

Staffer (2009) mentions four different approaches to design: *User-centered*, *Activity-centered*, *Systems*, and *Genius* Design. The approach of this thesis leans towards user-centered design, which focuses on the users and ground the design and research process in the information gathered (UsabilityProfessionals'Association,

web). Preece et al. (2002) take a user-centered approach for granted in interaction design, and explain that the goal of an interaction designer is to meet the goals of the user.

2.1.3 The Importance of Interaction Design and HCI

Dumas and Redish (1999) state that usability is important to the customers when purchasing a product. They refer to a figure presented in *PC Week*[1] that indicates that the UI is the second most important aspect when purchasing a product, just after reliability. UI was listed as a higher priority than price and performance. Dumas and Redish point out the importance of a good user interface and satisfied costumers for a company to be able to sell products in the future. Myers (1998) states that much of the HCI used in commercial production is developed based on research from universities, while Saffer emphasizes the importance of being innovative when the old design is not good enough.

> *Designing isn't about choosing among multiple options - it's about creating options, finding a "third option" instead of choosing between two undesirable ones* (Saffer, 2009, p. 6).

Most products need a UI solution designed for their case specifically. A design might work for one product at one place, but not for another. Retting says in an interview that interaction design is about the meaning people give to an object (Saffer, 2009). The users' model of how the system can be used and how it works is called a *mental model*, and has to be considered in an early stage of the design process (Preece et al., 2002). Norman (2002) distinguishes between the *mental model* of the user, the *design model*, and the *system image*. The mental model is how the designer thinks of the system, while the system image is how the system really works. It is important to struggle for the user's mental model and the design

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[1]Nr. 1/9/89 p. 81

model to be as similar as possible. When they are, the designer can work toward obtaining a system image that reflects the user's model (Norman, 2002).

2.1.4 Automatization vs. User Control

After conducting a user study on a video editing software, Girgensohn et al. (2001) concluded that automatization always reduce user control, and that this can result in an unwanted outcome. Smith and Mosier (1986) emphasize that intervening processing should be handled automatically by the computer, and that the user does not need to know about it unless an error occurs. Norman (2002) agrees and clarify that a system should hide information irrelevant to the user, and make visible information the user needs to be able to understand and recognize an opportunity or an action on the user interface. Smith and Mosier (1986, web) say that "*As a general principle, however, it is the user who should decide what needs doing and when to do it*". They are of the opinion that if a user is not able to be in control of the interaction with a device, s/he will probably feel frustrated and even threatened by the system, and s/he will accordingly avoid using it. Norman warn that "*There are dangers in simplification: unless we are careful, the automation can harm as well as help*" (Norman, 2002, p. 193). By taking away problems with automatization, new ones arise (Norman 2007).

2.1.5 Goals and Principles

2.1.5.1 Goals

Usability is an important and central concept of HCI (Löwgren & Stolterman, 2005). When designing user interfaces, there are several usability criteria one may strive to obtain. They can be divided into usability goals and user experience goals. Preece et al. (2002) mention six usability goals: *effective to use, efficient to use, safe to use, have good utility, easy to learn*, and *easy to remember how to use*. They also

mention user experience goals, which are meant to make a system more delightful for the user. Examples of the goals are: *motivating*, *supportive of creativity*, and *helpful* (ibid). What goals to set for a design depends on the artifact's nature and the needs of the user. The usability goals and the user experience goals does not say anything about how they can be obtained.

2.1.5.2 Principles

Principles are more specific, but still widely applicable and fundamental goals for the design, and are chosen based on users' goals for their use of the system (Preece et al., 2002; Shneiderman & Plaisant, 2009). These are generalizable abstractions which draw the designers attention to different aspects of the design and are often based on research on how people learn, understand, and work (Dumas & Redish, 1999). The principles mentioned below are important in general (Preece et al., 2002) and also for this spesific study in order to detect problems and make improvements to a design that should motivate, teach, and be easy to learn, understand, and use for amateur photographers.

Visibility calls attention to the importance of making the right functions, and how to use these, visible. By making the right things visible at the right time, the designer helps the user to see and comprehend only what they need for the given task and not the entire structure of the product and its workflow (Pendse, 2008).

Feedback is important so that a user knows what is going on and what to do next. If feedback is not given, the user might think that the job is not done, and try over again. Feedback while the system is processing data is also important for the user not to give up and think that the system is not responding to his or her action. Sound is a form of feedback. The sound of a closing shutter, for instance, tells the user that a photo has been taken. Some form of feedback should be given after every action performed by the user (Shneiderman & Plaisant, 2009). Good

feedback might lead to good visibility (Preece et al., 2002).

Constraints is about restricting the users' action on the interface at a certain time or state (Preece et al., 2002). An example of this is when unable menu choices are shaded in gray so the user can see that clicking them will not lead to anything. A constraint narrows down the options given to the user, and will thereby help him or her focus on their real task (Pendse, 2008).

Mapping refers to the relation between two things. It can be the UI design and it's effects in the world, or the buttons and the screen of a DSLR (Preece et al., 2002; Norman, 2002). An Example of good mapping is the steering wheel of a car, which swings towards the same direction as the wheel is turned (Norman, 2002).

Consistency is fundamental and important in order to not confuse the users of a product (Pendse, 2008). Consistency should be kept throughout all links, menus, colors, icons, fonts etc. (Shneiderman & Plaisant, 2009). A consistent design makes it easier for the user to use, learn, and understand a product (Pendse, 2008).

Affordance is a concept redefined by Donald Norman and refers to "*the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used*" (Norman, 2002, p. 9). The word affordance can be replaced with "is for", and means that the affordance of an object is the strong clues it conveys to the user about how it can and should be used (Norman, 2002). For instance, the DSLR afford holding and its buttons afford pushing.

2.1.6 HCI and the Digital SLR Camera

> *Most computer users know all too well that opening the shrink-wrap on a new software product augurs several days of frustration and disappointment spent learning the new interface. On the other hand, many experienced users of a program may find themselves continually frustrated because the program always treats them like rank beginners.* (Cooper & Reimann, 2003, p. 33)

Cooper and Reiman see the complication in finding a right balance when designing for both amateurs and experts. It is a crucial task to find a way to design the UI so it can inform the beginner about the camera, while at the same time avoid annoying him or her in the years to come with it. New users must grasp the concepts and scope of the camera quickly or they will abandon it, Cooper and Reimann further says. At the same time there are very few users at the outer edge of either amateur or expert. Most users rather find themselves in the middle, also called an *intermediate* (ibid). Users quickly move from amateur to intermediate, but seldom further to the expert level. Cooper and Reiman state that "*Most users in this middle state would like to learn more about the program but usually don't have the time*" (Cooper & Reimann, 2003, p. 34). Since many DSLR cameras have automatic program settings as well as manual settings, it is possible to use these and not develop further comprehension for the camera and the use of it. Without a lot of time and spirit, understanding the camera and using more of the functions offering user control might take a long time and not be a priority to the amateur photographer. While a beginner needs to learn what the camera does and how to work it, an intermediate needs to be reminded these things without extensive explanations (ibid).

2.2   The Camera

Since the first picture was taken in 1839 (Mann et al., 1971), the camera has gone through some great improvements, both in quality and design. Mann et al. continues that although many changes have been made, the main job for the camera remains the same: getting the right amount of light through the lens and into the camera to produce an image. The SLR camera got its name from the technique that it utilizes, a mirror reflection of the light coming through the lens (ibid). The light is directed onto a focusing screen and a prism system at the top of the camera so the photographer sees the approximate visual field that will be exposed to the film or sensors in the camera (Laytin, 2000).

Before digitalization of the SLR, images was captured onto a film, whereas in the digital cameras there is no film, but a small plate covered with a grid of light sensors (Baron & Peck, 2002). These light sensores are referred to as 'pixels' and captures the light before it is saved to a memory card in a specified format (ibid). Digital SLRs have several advantages compared to analog ones. For instance, the user will be able to see the image and its metadata just after taking it, and memory cards let the user capture several gigabytes of pictures, delete unwanted ones, and use the same memory over again. Both these advantages are mentioned by interviewees in this thesis (*Section 6.2.7, 6.2.8*, and *6.2.9*).

In order to capture photographs with the right amount of light, there are three parameters that can be modified: Shutter speed, aperture, and ISO. Each of these control the amount of light or sensitivity of the image, and if one of them is changed, one or both of the others have to be changed as well to maintain a similar amount of light in the picture. The shutter speed controls the movement in the image, while aperture controls the depth of field, and ISO the quality of the image. These three, together with White Balance (WB) and focus, are described under and are important to understand in order to be in control of ones photographing. This theory is therefor used when designing the usability test of Canon EOS 1000D

(APPENDIX D).

2.2.1   Shutter Speed

Shutter speed is the amount of time the light is let into the camera body. In other words, it is the time that the shutter takes to close up after it has been opened. The longer the shutter speed, the more light is let in to the sensor, and the brighter the picture gets. Shutter speed is measured in seconds. The bigger the denominator in the fraction, the faster the speed (i.e. 1/400 is faster than 1/15). Entire seconds will often be measured like this: 1", 2" etc. (Peterson, 2004). The shutter speed has an effect on how movement will look in your picture. With a slow shutter speed, movement will be dragged out and blurry, while with a short shutter speed, movement will freeze and be captured clear and sharp. Both options can be desirable, but in different situations. The shutter is normally located between the camera's lens and sensor, and is usually made of a number of small, overlapping metallic blades (Mann et al., 1971).

2.2.2   Aperture

The aperture is the size of the opening in the lens. The opening is formed by a series of six overlapping metal blades and determines how much light is being let in to the image sensor. Aperture is measured in 'f-stops', and is often written like this: f/2.8. The 'f' stands for the focal length of the lens, wile the '/' means 'divided by'. The lower the number, the larger aperture size and the more light is let through the lens. For every next full aperture stop down, the amount of light entering the lens is cut in half (Peterson, 2004; Burian, 2004). The aperture controls the depth-of-field, which refers to the amount of the photo that is in focus. The larger the f-stop number is, the greater the area of the image that will be in focus, accordingly, the greater the depth-of-field. A bigger depth-of-field is often used when photographing nature where everything in the image is interesting, while a smaller depth-of-field,

will for instance be used when taking portrait pictures with the background out of focus.

2.2.3 ISO

In traditional photography where film is used, ISO (or ASA) is the indication of how sensitive the film is to light. In digital photography it refers to the sensitivity of the image sensor in the camera. The lower the ISO, the less sensitive the camera is to light, and the better the quality of the image. When the number is high, the image will contain more noise, which is the digital equivalent of film grain (Payne, 2009). In relatively dark circumstances, high ISO might still be the best choice for your image, while in bright daylight, a low ISO will most likely give the best result. ISO is often measured in numbers where each next step is double the previous one (i.e. 100, 200, 400).

2.2.4 The Photographic Triangle

The use of the three parameters mentioned above is called *The Photographic Triangle* (Peterson, 2004). By changing the different parameters, one can have about six different correct exposures, but they will all have a different effect on the picture (ibid). Most digital SLR cameras give you the option of choosing automatic settings and avoid the issue of shutter speed, aperture, and ISO. Automatic settings are often decent, but can fail under unusual situations and give the users little control of their photography. The camera may measure a lot of light in the image to be taken and give you a sky with the perfect amount of light, while the person of interest is much darker than acceptable. What would most likely be more ideal in this situation is an overexposed sky and a visible and well lit person. This is one of the many reasons why the user would often be able to take better and more desirable pictures by setting the Shutter speed, Aperture and ISO manually. By doing so, the user will be able to intentionally manipulate their photographs to get

the effect that they desire.

2.2.5 White Balance

The camera will catch colors differently in different light conditions. There is a great difference between outdoor light and different types of indoor light. The camera provides different choices of WB settings for the user to choose from, including automatic. In order to get the colors completely right, the user might take a picture of a white area and let the camera use this information to define the tones of the other colors as well. The WB should be set every time the light is not captured right by the camera (Johnson, 2005).

2.2.6 Focus

In order to obtain sharpness in an image, the lens has to be focused perfectly. This is done by finding the proper distance between the lens and the image sensor, based on the distance between the lens and the subject of the camera (Rosch, 2003). In digital SLR cameras, focusing can be done either automatically or manually. Autofocus is often more precise and faster than a human being can be. Two focus modes are always offered in DSLR cameras: *single* and *continuous* autofocus (Gerlach & Gerlach, 2009)[2]. *Single* is for use when the motive is still, while *continuous* is used when the motive is moving. Focus points[3] are used for determining the focus area. One or several focal points can be used simultaneously, and what focal point the camera should use can be set manually by the photographer.

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[2]Canon EOS 1000D have one single and two continuous focus settings: '*ONE SHOT*', '*AI FOCUS*', and '*AI SERVO*'.

[3]Focus points are areas of the image that will be focused when camera is set to autofocus.

2.3 Recap

Relevant concepts, history, and basic knowledge from interaction design and the DSLR camera has been reviewed through this chapter. The theory examined is employed during the empirical case study of this thesis. It has been important building blocks for design of the methods used, and further for the discussion and conclusion of the results the methods lead to.

Chapter 3

Literature Review

Some research is already done on the use of cameras, design on small screens, and the possibilities for future cameras. This chapter gives an overview of some research done, as well as an introduction to camera features already on the market. Finding research on the usability of DSLRs, or digital cameras in general, has been futile. The lack of this research makes it difficult to find relevant background information, but nevertheless makes the study of this thesis important to the field of interaction design and to the designers of digital cameras.

3.1 Research on Camera Use

Politiken.dk (Vigild, 2009) published an article on consumer studies done by Nikon on the Danish people's camera use and differences between their age, gender and place of residence. This study is based on answers from 1010 respondants, and unveil a great difference between women and men in their use of the camera. The article reports that men like to be the one emptying the memory card on to the computer and publishing the pictures online, while women take more pictures, buy more cameras, and like to share their pictures more often.

In a similar study on the use of camera phones done by the University of Sussex and Microsoft Research (Sellen et al., 2004), trends toward similarities and differ-

ences in usage between different ages and genders were revealed. The study shows that a lot of the images taken were shared with others, not so much by sending MMS to one another, but mainly by sharing the images on the spot by viewing them on the phone's display. The participants took about 34 pictures and 3 videos each a month. The majority of the images were of people. Youths took more pictures in situations with other people, such as their friends. Men captured significantly more pictures of practical and individual use than women. Sellen et al. (ibid) state that the camera phone is a device often used like a digital camera, but differs from it in the range of activities it supports. The quality of the pictures and the weight of the device are also two main differences between a camera phone and a digital SLR camera.

Salovaara et al. (2009) distinguish between amateurs and professionals, and present a statistical preliminary analysis of their web based survey on camera use and user characteristics. They found that technological knowledge and social construction are important factors according to appropriation. They state that when designing easy appropriable technologies, one should support users' understanding of the device, how it works and what functions it contains. They also found that using the camera as a mirror or a flashlight was more familiar to women than men, while taking photos of maps to use instead of the paper version, or using the camera as a note-taking device was more familiar to men.

3.2 Design on Small Screens

Although I have found no earlier research on the UI design of DSLR cameras, some research have been done on UI design of small screens on portable devices, often mobile phones or PDA. Hakala et al. (2005) see the challenge of presenting a hight amount of information on a display, limited in both pixel and physical size. They state that as the memory capacity increases, the need for better file

management tools increases as well. Different ways of displaying data with file structures has been tested throughout time, and *tree visualization*[1] might be the most common. Other structures such as having an overview and details displayed at the same time, zooming in the screen, or pop-up components are also considered. Acton et al. (2004) want a maximized use of the artifact's screen. They focus on transparency[2], and found that it did not improve the product's efficiency or the frequency of errors done, but that it was still found more attractive and enjoyable among the users. Cockburn and McKenzie (2001) studied the differences between 2D and 3D dimensions on screens, and found that although tasks were preformed better on 2D screens, 3D were preferred. Due to small displays, Hakala et al. (2005) suggested using light and shadows to create a fake 3D look without a need for more pixels and screen space. Users participating in a brainstorming for this thesis will be asked to make a file structure for the DSLR's menu items, but the discussion is not taken any further than that.

3.3 Cameras Today

Todays photo cameras can not only capture pictures, but also shoot HD video, offer photo and video editing, and record metadata as destination captured by GPS etc. Camera producers are constantly coming up with better cameras and newer functionality, some of which are discussed in the remainder of this section.

Projector in Camera As a new functionality, Nikon has implemented a projector in their camera COOLPIX S1000pj (DigitalFoto, 2009a). It can clearly project images directly from the camera and onto a white wall from five to forty inches in diameter (ibid).

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[1]Tree visualization structure is traditionally rooted, directed graphs, with the root node at the top and children nodes below their parent node (Shneiderman, 1992).

[2]Transparancy, or *translucency* is defined as a design where "the user can (to some degree) visibly see through on-screen displayed 'objects' to those beneath them" (Acton et al., 2004).

3D Photo As the first camera offering 3D photography which does not require special glasses, Fujifilm present the *FinePix REAL 3D W1* camera (DigitalFoto, 2009b). The camera has a designed 3D display and additional frames for the pictures can be purchased. Photos taken with this camera can also be printed on special paper by the company.

Face Recognition Face recognition software, such as in Apple's *iPhoto*, is being developed by several companies and institutions. To recognize a person's face and tell it apart from other faces is a complicated task. Hafed and Levine (Hafed & Levine, 2001) reason this in how ones face can have many variations, while the variations between different faces might be rather small. They also state that we have yet to see face recognition software that works perfectly. To recognize an object as being a face, is less problematic. Kodak recently introduced a camera, Kodak EasyShare Z915, which recognizes its motive, that be a face, nature etc., and adjusts it's camera settings based on this information (DigitalFoto, 2009c). Nikon's COOLPIX S1000pj can also recognize faces and has a function called *Skin Softening* which analyze skin tones and adjust them in the picture (DigitalFoto, 2009a).

Screens and Buttons Canon EOS 7D, '*made to be the tool of choice for serious photographers and semi-professionals*' (Canon, 2009b, web), has several new and interesting features. A transparent LCD screen i shown in the viewfinder, on which help is provided. For instance will a gyrometer indicate the position of the camera, and user defined Auto Focus (AF) points can give a greater control and degree of fineness and sensitiveness. Most of the camera's buttons can be user defined, so favorite functionality will be easy accessible (DigitalFoto, 2009d).

3.4 Future Cameras

Kroeker (2009) philosophizes over future cameras and suggest that the next major step in photography might be on how images are captured and processed, while he also points out that usability is a major challenge in this work. Kroeker mentions *Levoy*, who, among other things, works on a project on refocusing pictures after they are taken. This can be changing the focus in a photo from one object to another, or simply repair an out-of-focus picture. Although *The Moment Camera* and photo stitching are mentioned as future cameras, there are already cameras out or in production that partly cover the ideas mentioned in *Section 3.4.1* and *3.4.2*. The complete ideas are still not implemented in any commercial camera, and are therefore discussed here.

3.4.1 The Moment Camera

Microsoft researchers, Choen and Szeliski (2006), present a phenomenon they call *The Moment Camera*. They point out that during 10% of peoples awake time, our eyes are closed due to blinking. Therefore the camera often captures the photographed with closed or half-closed eyes. The main idea of Choen and Szeliski's camera is to capture a picture over time, so the camera can chose a part of that time when no eyes are closed. This can be a great remedy when photographing groups. Different shots can be emerged into one picture to get a group photo where no eyes are closed. Cameras can also notice when someone is smiling, and chose that moment to keep. The camera will gather more data then needed for an image, and automated and user-assisted algorithms will provide the best picture from this data. Choen and Szeliski argue that capturing a picture of a friend while blinking does not capture the moment, since this is not how the person is comprehended in real life. Camera producers have already made functionality based on the same problem to solve. Nikon's COOLPIX s1000pj, for instance, has a setting where the

camera takes a picture first when no one has their eyes closed (DigitalFoto, 2009a). This camera can also recognize smiles.

Choen and Szeliski's *Moment Camera* can capture both bright and dark areas within one image. Although they would like this functionality to be somewhat unremarkable to the user, the system, on the other hand, will be rather different from a regular one. It contains three steps: 1. Finding features in the images and matching them. 2. Locate the best picture to choose. 3. Modify pixel value based on the rest of the image in order to get a smooth and correct exposed photo. During data recording, the camera changes exposure settings and focus points in order to take different photos that kan be worked into one good one.

> Current digital cameras suffer from limited dynamic range: They cannot
> image both very bright areas and dark areas in the same exposure (Cohen
> & Szeliski, 2006, p. 42).

This can change with the moment camera, where two exposures can merge into one image, and get a perfect exposure of both bright and the dark areas[3]. Lischinski et al. (2006) present a tool that, with user input, does about the same thing: it locally adjusts tonal values in an image. Nayar (2006), at Columbia University, describes a technique that, with only one captured image, can grasp more ranges in an image. He argues that digital cameras' usual measurement of 256 levels of brightness is not enough to capture the variations in brightness found in many typically scenes.

The Moment Camera can also capture dynamics with it's several exposures (Cohen & Szeliski, 2006). For instance can a kid swinging across a set of monkey bars be captured at different places through time and several exposures can be printed to one photo, see *Figure 3.1.*

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[3]This is also possible to do in Photoshop with several images of different exposures. The technique is called 'high dynamic range imaging'.

Figure 3.1: Retrieved from *The Moment Camera* (Cohen & Szeliski, 2006).

3.4.2 Photo Stitching

Photo Stitching is a technique aiming at making one image out of several, some what overlapping, images of different parts of a view. The image to become can for instance be a panorama or a photo of high resolution. Brown and Lowe (2003) present a system for merging several captures into one image. They use object recognition techniques to select matching images. The matching spots in different images are placed over each other for the panorama image to become complete. This will automatically happen without user input. The system is robust to camera zoom, illumination etc. Baudisch et al. (2005) at Microsoft Research exhibit a similar system, but point out that their photo stitching system will be implemented in the camera. The adventage of implementing the system in the camera is that the photographer can quickly see what parts of the image are missing, and take new photos right away, without having to come back to the sceen.

3.4.3 Open-Source Camera

People at the Stanford Computer Graphics Laboratory and the Nokia Research Center Palo Alto Laboratory are developing an open-source concept of a camera (Levoy, 2009). The camera accommodates DSLR lenses and sensors and uses an embedded Linux operating system. It can connect to the Internet, and the camera

owner will be able to download functionality of their own interest (ePHOTOzine, 2009).

3.5 Recap

The literature reviewed in this chapter introduced some research on camera use, as well as ideas, and already implemented functionality, for digital cameras. The different functionality is taken further in the empirical study of this thesis in order to investigate what type and how much functionality users want in their DSLRs. The knowledge on people's camera use subsidizes the findings of this thesis, although the case of amateur photographers and the usability of their DSLRs, however, is not studied before.

Chapter 4

Methodology: The Case and the Methods Used

Throughout this chapter, the case study is presented, together with its reigning methodology, ethics and law, and the methods used. Each method is described carefully, and reasons are given for the choice of methods and methodology.

A study on DSLR users, their relationship to the DSLR, and the usability of a DSRL will be conducted for this thesis. The approach of this study contains both qualitative and quantitative research. Qualitative research differs from quantitative in how it goes in depth of a phenomena and gathers information about the meaning people assign to it (Thomas, 2003). The researcher's impressions and reactions to the data will influence the result, and are therefore considered qualitative data sources (Myers, 1997). In quantitative research, conclusions are made upon instances measured in numbers. Silverman (1998) states that qualitative and quantitative research are not polar opposites, and argue that there are no principled grounds to be either one or the other. A combination of the approaches rather, is often preferred (ibid).

The overall methodology of a study can be defined as a general approach to the study of research topics (Silverman, 2005). It provides the reason for using a set of

different methods in the study (Clough & Nutbrown, 2002). A case study is one out of several research methodologies[1], and it draws epistemological attention to the question of what specifically can be learned about a single case (Stake, 2005). It can result in a deep knowledge about the individuals' mindsets toward a device and is often used in the fields of psychology, which is an important part of interaction design (Yin, 2009; Saffer, 2009).

> "[...]the distinctive need for case studies arises out of the desire to understand complex social phenomena." (Yin, 2009, p. 4)

A case study can take one of three different approaches: *intrinsic*, *instrumental* or *collective* (Stake, 1995). With an intrinsic approach, there is usually a case already identified and interesting in itself. The study is undertaken because of an intrinsic interest in, and a desire to better understand, the particular case (ibid). Within an instrumental approach, the specific case usually has to be chosen. The case selected is meant to provide insight into an issue or to draw some sense of generalization. A collective approach is, in general, a set of cases with instrumental approaches (ibid). An instrumental case study is carried out for this thesis in order to grasp an understanding of amateur photographers' relationship to the DSLR, and to make some general assumptions about the UI design of DSLRs. Photographers are recruited from several different beginner courses on digital photography, and are therefor expected to be rather ignorant to digital photography, but with a wish to learn more about the camera and about photography in general. The user interface of Canon EOS 1000D will further be investigated and redesigned based on results from the research. The particular case in an instrumental case study can be chosen for various reasons: it can be the most extreme, less likely, more educational, or the most representable case (Stake, 2005). The choice of case in this thesis relay upon several reasons: The people studied are representable as amateur

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[1]Case study is often referred to as a method, but due to the definitions by Silverman (2005) and Clough & Nutbrown (2002) mentioned over, I herby define it as a methodology.

photographers as they have attended beginner courses on digital photography[2], and bringing them into the case study can be educational since they are people wanting to understand and utilize their camera. The Canon EOS 1000D is chosen as representative for the case study since it is the most popular digital SLR brand in Norway and Europe (BusinessWeek, 2008; ePHOTOzine, 2008). It is also spoken of as very 'user-friendly' and rated 'best in test' in several online tests (Canon, 2009a), which indicates that it is less likely to have a bad UI design. Both observation and communication with users has been done in order to obtain the relevant information about use of cameras. One main reason for using both observation and vocal communication is that people don't always do what they say they do (Blomberg et al., 1993), and both their statements and behavior can be interesting information for the research. Usability testing, which normally is not included in case studies, will be used in this one, seeing that it is a crucial part of interaction design and will help finding areas which have potential for improvements[3]. Based on information gained from usability tests and the other methods, solutions toward an improved UI design of DSLR cameras will be proposed.

4.1 Paradigm

Research studies will always contain some underlying epistemology, which refers to the theory of knowledge, and how we acquire it. Hirschheim (1992) claims that information systems, fundamentally, are social rather than technical and involves mental phenomena such as thinking, meaning, action etc. He argues further that social sciences need to be interpretive, understanding the mental aspects associated with such social action with information systems. Information about the partici-

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[2]They might not represent the devision of age and gender, but both women and men of several ages are taking part, and they are representable for the case as they are all amateur photographers.

[3]Usability tests are, however, used in some case studies, such as "Rapid Desirability Testing: A Case Study" (Hawley, 2010), "A Usability Test of Web-based User Assistance" (Ellison, 2009), and "Kodak: International usability testing in multiple European countries" (UserFocus, web)

pants' comprehension of DSLR cameras will be gathered in form of oral communication. Their statements, together with their behavior, will further be interpreted by the researcher. The study of this thesis will mainly be done with an underlying interpretive paradigm[4]. The methods employed are concerned about gathering information about the users' thoughts, ideas and comprehension of DSLR cameras, the meaning they assigns to the cameras and their use of them (Myers, 2009).

4.2 The Case Study

This study deals with amateur photographers and their relationship to the DSLR[5]. It focuses on gaining an understanding of the users' reasons for getting a DSLR, their wishes for utilizing the DSLR, and their thoughts about the usability of DSLRs. The way they use the camera, when presented with tasks to carry out on its UI, is also of interest. After gaining knowledge about the users and their relationship to the DSLR, improvements to a UI design are worked out. The improvements are based on users' statements and actions, and on a usability test done for Canon EOS 1000D, which is a camera meant for amateurs to use (Canon, 2008). The improvements are also made to the UI of Canon EOS 1000D, in order to make it work better for its users, the amateur photographers.

4.2.1 Knowledge about the User

In order to design a good UI for a device, knowledge about its user group has to be generated. Users' needs, goals, and ideas will be collected throughout this research[6]. To get some ground data about the users and their camera usage, questionnaire

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[4]Paradigm is a set of background assumptions and a way of thinking about an issue (Thomas, 2005).

[5]The focus of this thesis lay on amateur photographers because experts know a whole lot about photography, photo theory, and how to work their camera, while many amateur photographers have a hard time utilizing their camera. There are many amateurs getting DSLRs, and they should be given a DLSR designed specifically for them, and not for experts.

[6]See *Section 2.1* for definition of 'needs' and 'goals'.

answers are gathered from 115 respondents. Answers from the questionnaire are also shaping further research, and participants for further research are picked out from the answers given based on their age, gender, and the volume of their answers[7]. Interviewees are asked about their present use and about their wishes, thoughts and ideas for future use of a DSLR. How the users wish to use the camera, how much of the user interface they understand and use actively, and how they interact with the camera is of interest for this study. The data gathered will be analyzed and applied in a redesign of Canon EOS 1000D.

4.2.2 Canon EOS 1000D

The Canon EOS 1000D is a camera purchased by many amateur photographers (Canon, 2008). The camera possesses many of the automatic settings found on Canon's compact cameras, such as 'portrait' or 'landscape' etc. These settings are also marked with the same or similar icons as used on compact cameras, which makes them recognizable for many users (*Figure 4.1*). The settings are found on a wheel on top of the camera together with manual program settings[8]. The manual program settings are not marked with symbols, but with the letters 'A-DEP', 'M', 'Av', 'Tv' and 'P'. With 'A-DEP' (depth of field AE mode) and 'P' (Program AE mode), only 'ISO' can be set manually, while shutter speed and aperture are set by the camera. With 'Av' (Aperture Value) aperture and 'ISO' can be set, while shutter speed will be determined by the camera. With 'Tv' (Time Value) the shutter time and 'ISO' can be set while aperture is determined by the camera. With the camera set to 'M' (Metered Manual mode), every component can be set manually. There is a little switch on the lens where automatic or manual focus can be chosen.

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[7]Respondents of different ages and genders, preferable with rich answers to the questionnaires, were picked out.

[8]What is called 'manual (program) settings' in this thesis, contains one manual and several quasi-manual settings where one or more components can be set manually by the user.

Figure 4.1: Canon EOS 1000D. Pictures retrieved from www.lydogbilde.no (Lyd&Bilde, 2008b), and www.jjmehta.com (jjmehta.com, web), respectively.

4.3   Ethics and Law

During data collection, I have followed the Norwegian regulations on collecting and managing personal information entitled: Personopplysningsloven (2000). Pursuant to Section 8 of this law, I have collect data only from those who have given written consent. Prior to getting consent, the participants were informed about the conditions with which the data were to be used, as defined in Section 19. In accordance with Section 11, I only collected data which was relevant to my study, and used it only to the closely defined purpose of this thesis. No sensitive data was collected, and all data was kept confidential.

4.4   Triangulation of Methods within the Case Study

Mixing different methods or data sources, or repeating an investigation on one or several different people, is called *triangulation*, and is done to reinforce the quality of a study by exploring issues from several perspectives (Marschan-Piekkari & Welch, 2004; Mackey & Gass, 2005). Methodical Triangulation[9] is applied in this thesis. It refers to the use of several different research methods or measurements to investigate

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[9]Mackey & Gass refer to the concept as Methodological Triangulation.

a phenomenon (Mackey & Gass, 2005). Getting the same, or a similar, outcome from different methods boost the credibility of a study (ibid). Triangulation of quantitative and qualitative data collection can lead to a validation of quantitative data with the qualitative data (Swanson & Holton, 2005). In order to answer the research questions stated in *Section 1.2*, several methods of quantitative, but mostly qualitative data collection is employed and support each other. The issue of having many functions vs. a user-friendly camera was for instance introduced through the method of questionnaire, and was taken further in interviews and brainstorming, and a usability test unveiled that the user interface was not as user-friendly as users said it was during questionnaires and interviews earlier in the study.

Norman recommends in an interview with Bergman that the users' needs and activities are discovered before designing starts (Bergman, 2000). That is why prototyping is the last method applied for this thesis. Needs, wishes, and requirements for use of a DSLR will be identified and established through the research[10]. Based on this, and direct ideas toward UI design from the users participating, an interactive prototype will be made for visualization of the ideas. The prototype will be a low-fidelity redesign of the UI of Canon's EOS 1000D. It will be made in Adobe Flash, and offer menu and button functionality. It will not, however, possess the feel of a camera due to its presentation on a screen, as opposed to the form of a DSLR camera. The case study in this thesis will contain five main methods: questionnaire, interview, brainstorming, prototyping and usability test.

4.4.1 Questionnaire

A questionnaire is a set of written questions given to a respondent who answers the questions and gives it back. It is most often used in quantitative research and with highly structured closed questions which can be statistically analyzed, but it can also pay off in qualitative research and with open-ended questions (Wickens et al.,

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[10]See *Section 2.1* for definition of 'needs'.

2004). Questionnaires can be used on their own or as a part of a broader study to clarify or to deepen understanding (Preece et al., 2002). They involve a relatively brief engagement with the topic on the part of the respondent. This is why it is used in the early stage of this research to get a brief hold of amateur photographers and their use and thoughts abut DSLR cameras. Through the questionnaire, a relatively large amount of basic information is gathered, which can be utilized to guide and narrow down topics for further work. The questions used can be closed or open-ended (ibid). Whereas closed questions require a precise answer, open-ended ones has no predetermined format or content (ibid). In the questionnaire used for this study, both types will be used. Respondents will always be influenced by their circumstances, and King (1996) mentions that outside events can have a significant impact, but that they cannot always be predicted. The questionnaires used here were given to participants of three different beginner courses in photography, before or while the courses were running. Due to their course attendance, it is assumed that these respondents are interested in learning more about the digital SLR camera, and that their answers might be influenced by the courses' syllabus.

The accuracy of the answers given in a questionnaire may be weaker the longer and more monotonous the questionnaire is (Dornyei, 2003), therefore the questionnaire used here is restricted to fit to one page of size A4. Questions should always be clear and specific, and one should also be aware of acquiescence when designing them. This refers to respondents who just agree to something because of unsureness or ambivalence. No questions that provoke such answers should be included. The so-called *halo effect* (overgeneralization) has also to be taken into consideration when designing questions and evaluating answers (ibid). For instance, a respondent who loves his new camera because it takes sharp pictures might answer that s/he also like other aspects, like the buttons or the menu, even if these aspects are clearly insufficient. Questionnaires work the best when combined with other methods that can boost the credibility of the answers or produce new answers and points

of view (Gillham, 2000). Questionnaire respondents who give relatively extensive answers will be picked out, and a request for further co-operation will be sent to the appurtenant e-mail address.

4.4.2 Interview

To gain a deeper understanding of users' relationship to their DSLR, interviews will be carried out. Interviews within research can be divided into three main groups depending on their amount of flexibility: *structured*, *semi-structured*, and *unstructured* (Fontana & Frey, 2005). Structured interviews have predetermined questions and often options to choose from (Preece et al., 2002). They are always asked in the same way to all participants. Unstructured interviews have no predeterminate questions, but rather topics to be discussed, and the interviewer can form questions as the interview develops. A semi-structured interview is designed to answer preset questions, but also to illuminate valuable comments made by the interviewee on the spot (ibid). The interviewer of a semi-structured interview can guide the interview while it is running and follow up with new questions. Preece et al. (2002) distinguish between closed and open-ended questions in interviews. Open-ended questions will provide deep and personal answers, often not thought of by the interviewer, while closed questions will provide the interviewee with a set of alternatives to choose from. The interviews done for this thesis will be semi-structured and with open-ended questions. The scope of every interview, is to get an understanding of the individual's approach towards the digital SLR camera. It is important that the interviewer makes sure not to express personal opinions, as it will most likely strongly influence the answers given by the interviewee (Fontana & Frey, 2005).

> *Researchers should not privilege any ways of looking at the world or at particular techniques but should instead continue to question, question, and question (Fontana & Frey, 2005, p. 697)*

Remaining relatively neutral while trying to maintain the bonds of trust with the interviewee can be challenging for the interviewer, and it is worth to notice that some influence by the interviewer and the circumstances will always take place. Denzin and Lincon (2005) see the interview as the art of asking questions and listening in a conversation. The interview can be seen as a one-way pseudo-conversation in which the interviewee is to be listened to (ibid). When asking follow-up questions, they should be based on what has been said, and not on ones own personal interest. The interviewer can, however, guide the interview towards a topic of interest for the project. It is important to consider the circumstances of the interview, and to take into consideration the fact that every interview will be influenced by the relationship that arises between interviewer and interviewee, and that this will shape the nature of the knowledge generated (Fontana & Frey, 2005; Preece et al., 2002). Interviews are most commonly done face-to-face, which is also how it will be done in this research. During the interview, notes will be taken and a sound recording will be saved for future reference. The data gathered here boost the answer to questions stated in *Section 1.2*.

4.4.3   Usability Test

To identify specific problems within a system, usability tests[11] are carried out. This is a crucial step in which design issues are exposed on prototypes and existing products (Wickens et al., 2004; Löwgren & Stolterman, 2005). During a usability test, users interact with the system to detect usability problems overlooked or suppressed by the designer. Difficulties and frustrations they express while using the system are recorded to identify problems and opportunities in order to enhance the UI. Performance aspects can also be particularly emphasized, such as time used on a task or types and amount of errors. Acton et al. (2004) distinguish

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[11]What here is called *'usability tests'*, is often referred to as *'user tests'*, which is misleading due to the testing of the system and its usability, and not the user (Saffer, 2009).

between these two types of data, and call it *objective* and *subjective* feedback. The objective feedback is measurable aspects as time of performance, amount of errors etc., while subjective feedback is what the user says and how s/he acts during the test. During the usability test carried out for this thesis, both objective and subjective information will be collected.

Usability tests must be grounded in an understanding of the users and their tasks, and with a consideration of interaction design principles and theories (Preece et al., 2002). What system parts to test and measure is decided by the designer. The decision can be based on for instance different usability goals, users' needs, or often performed tasks. The usability test carried out for this thesis will be based on gathered information about the users, as well as often performed tasks and design solutions looking too complicated. According to Wickens et al. (2004), testing on, and talking to, rather few people can yield a large amount of valuable information. Five to six participants can be enough to provide sufficient information (Nielsen, 2000; Molich, web), and using rather few participants is more profitable than using many (Travis, 2003). Nine users have taken part in the usability test of this thesis in order to throw light on as many usability issues as possible. This is a rather high number according to the prior statement. In order to gain as much information as possible from every user, they will be asked to *think aloud*[12] during the test, so that the designer/researcher can understand what the user is doing and why s/he is doing it. The session will be sound recorded and notes will be taken on what they say and how they act on the camera's UI design, as well as their visual reactions towards the design. The usability test is carried out after each interview in order to identify problems with the existing Canon EOS 1000D.

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[12]'Think Aloud' is a method where the user is asked to say out loud what he or she is thinking, such as expectations of the system and reactions to its behavior.

4.4.4 Brainstorming Session

After the nine interviews and usability tests, a brainstorming session was held. Design tasks and topics to brainstorm was given to the participants based on the information gathered, and a method called "Collaborative Analysis of Requirements and Design" (CARD), developed by Tudor in 1992, was employed as one of the tasks. Using the CARD method, users were given cards containing words from the buttons and menus of the camera, and they were asked to sort them into new structures. Ideas for new task flows can then come into being (Lafrenière et al., 1999). Brainstorming is a method whose aim is to generate as many ideas as possible in a short amount of time (Linton, 2005). The process is a group activity where the participants are given a question or a topic to work on and produce ideas for. Retting states that to get one good idea, many ideas have to see the light of day (Preece et al., 2002). After idea generation, the participants organized their ideas in order to discuss them.

Every participant is asked to contribute freely, but not take any role of leadership in the group. Gallupe et al. (1992) has presented two problems that can occur in brainstorming sessions: *production blocking* and *evaluation apprehension*. The former happens when someone can not express their ideas because someone else is talking, while the latter refers to participants not expressing their ideas due to concern about conflicting opinions (ibid). There are, in general, three rules for brainstorming: *encourage wild ideas*, *don't criticize or question any ideas*, and *add to or develop each others ideas*. The participants of the brainstorming done for this thesis were presented these rules. The best ideas are often based on, or inspired by, earlier ideas from the group, and the participants should therefore encourage each other to follow these rules (Jones, 1992; Löwgren & Stolterman, 2005; Gallupe et al., 1992).

Gallupe et al. (1992) explain that the average of output per person will fall when the group size is increased, as size hampers idea generation. Löwgren and Stolter-

man (2005) claim that the number of participants in a brainstorming group should be between three and seven, while Linton (2005) mentions that eight to twelve is a typical number of participants. For this project nine people were gathered for a brainstorming session. They were divided into groups of three for discussions and idea generation. Having small groups might also prevent the occurrence of production blocking and evaluation apprehension. There were two parts with a break in between, and in the end of each session all three groups got together for discussion of the most important issues and ideas they found. The topics of the session were based on answers gathered through questionnaires, interviews, and usability tests, while the outcome of the session were directly used and taken into consideration during a prototyping session. Dan Saffer express that "*Designers find their solutions through brainstorming, and then, most important, building models [...] to test the solutions*" (Saffer, 2009, p. 6). Idea generation and some design will happen both during analysis of the outcome of each method, during the brainstorming session, and during prototyping afterwards.

4.4.5   Prototyping

Prototypes are tools for communication and are made for testing purposes so that they can be further improved before the final product is developed (Saffer, 2009; Preece et al., 2002). The first thing to consider when prototyping is the user interface. Saffer describes the interface as "*[...] where the invisible functionality of a product is made visible, accessible and usable*" (Saffer, 2009, p. 170). He points out that interaction design is about much more than just the user interface of a product. Before prototyping, a set of requirements and often perform tasks have to be established (Apple, 2009). For this project, these will be established through questionnaires, interviews, usability tests, and a brainstorming session. Design can be divided into two main types: *conceptual* and *physical* design (Preece et al., 2002). With the former, the designer is concerned about the conceptual model of

what the system will do and how it will behave, while with the latter, the concern is on graphical details of the design. Both will be focused on in this thesis, but conceptual design will be prioritized as this project is in an early stage of design.

> *In fact, a prototype can be anything from a paper-based storyboard through*
>
> *to a complex piece of software, and from a cardboard mockup to a molded*
>
> *or pressed piece of metal.* (Preece et al., 2002, p. 241)

As long as a prototype can be interacted with and give the designer feedback, just about anything can be considered a prototype. It should be used in some what realistic circumstances and provide answers as to how it is being used and whether it is optimal or not. Prototypes are mainly made to answer questions and choose between alternatives (Preece et al., 2002). They can, however, be divided into two main categories based on their level of functionality and material credibility: *low-fidelity* and *high-fidelity*. A low-fidelity prototype does not look too much like the final product due to its purpose of encouraging exploration and modification. It is often used in the early stages of the design process and is usually cheap, quick to produce, and of a different material than the final product will be. A high-fidelity prototype should be used in the latter part of a design process, and is more similar to the final product as it has the look and feel of it. The goal of prototyping is to go through enough design opportunities to find a good solution that works the best for the user-base of the product. When the best design is found, a high-fidelity prototype should be made (Preece et al., 2002; Wickens et al., 2004). For this thesis, a prototype is made mainly to visualize ideas for an improved UI design of Canon EOS 1000D. The ideas of improvements will be generated through analysis of data generated through the methods employed. The prototype can further be used as a first prototype in a design process. It can be tested and redesigned in order to result in a final prototype and product. The prototype made for this thesis is of low fidelity, as it is a first prototype made of a new UI design. The thorough study of the users of DSLRs and the design ideas given in this thesis is very valuable for

further design work.

4.4.6 Observation and Note Taking

Observation and note taking are supplementary to interviews, usability tests, and brainstorming. Observation can be done in the field or in laboratories. When done in laboratories, the designer can decide what to observe and arrange activities for this purpose. The same set of activities can be carried out on several subjects of observation, such as it is done during usability tests for this thesis. Both crucial behavior and oral comments are noted during data gathering. Angrosino (2005) states that there are three main ways in which social-scientists have conducted observation-based research: *participant*, *reactive* and *unobtrusive* observation. Using the first type, the observer is immersed in the community studied. With the second type, controlled settings are used and the people being studied are aware of the situation. In the last type, the observed ones do not know that they are being studied. In the research of this thesis the users know they are studied, and so *reactive* observation is employed. It is often difficult for people to imagine and describe how they would feel and act in different situations, which is why observation is used to obtain such information (Wickens et al., 2004; Preece et al., 2002). Sound has also been recorded during the interviews, usability tests, and the brainstorming of this thesis. Observation is carried out together with other methods in order to catch the interactive nuances between the user and the DSLR, and notes are taken in order to remember the observations. Different people might have different comprehensions of the world. They might therefore say things that are not completely correct and complementary, and observation of the users might thus be just as important as talking to them. In one instance, an interviewee found the usability of his camera to be very good, while during the usability test, I observed complications that was in contradiction to his earlier statements. Much can be learned from additional observation.

4.4.7 Data Analysis

After data collection, analysis must be done. Peräkylä (2005) distinguishes between two different types of empirical material in qualitative research: *interviews* and *naturally occurring materials*. While some empirical material can be generated in 'naturally occurring' situations, data collected through questionnaires, interviews, usability tests, etc., is strongly marked by the researcher's ideas and goals for the research. No material for this thesis has been created in natural occurring situations, it is all generated in settings created by the researcher. When analyzing interviews and other generated data, one has to select and contextualize statements that are important to the study.

> *Meaning condensation entails an abridgment of the meanings expressed*
> *by the interviewees into shorter formulations.* (Kvale, 2007, p. 106)

To analyze and pick out points of the interview is a crucial task that will lead further research and influence the resulting outcome and solutions. In order to do this, a technique inspired by coding is carried out (Emerson et al., 1995). Different themes in each interview were detected and highlighted in each their color in order to get an overview and grab an understanding of their content. Patterns, differences, and similarities between the interviews were then found. Analysis should start from the beginning of each interview, if not before (Kvale, 2007). When an answer to a question is given, the interviewer should make sure that everything is understood correctly. This makes it easier for the subsequent analysis, and important information will be more evident. All data collected for this thesis was analyzed after it was collected. In this way, results from one method was fed into the next in order to answer the research questions stated in *Section 1.2*. Data was coded and categorized in order to make the results clearer for the researcher before analysis (Peräkylä, 2005; Kvale, 2007).

4.5 Recap

This chapter has presented the methodology and the paradigm of the empirical study. It has also presented the case study and every method used, as well as the ethics and law that is followed throughout the study. The material that was presented explains the implementation of the methods and how the results and conclusions are influenced by the researcher and the methodology and methods used.

Chapter 5

Setting the Stage for the Empirical Study

In the following chapters of this thesis, the gathered empirical material is reviewed, results are shown and the findings are discussed. Before entering the chapters, the stage for the study conducted is set here.

Though a lot of research is already done on the usability of camera phones and other small devises, the research of this thesis stands out with its focus on the usability of DSLR cameras for amateur photographers based on the users' statements and their ability to work a DSLR's UI design. Theory on photography and interaction design is taken into consideration when designing the research of this thesis. The methods of questionnaire, interview, usability test, and brainstorming are together gathering information that leads to a good understanding of the users investigated and the DSLR cameras they use, with a focus on the Canon EOS 1000D.

The case study of this thesis is concerned with amateur photographers' relationship to the DSLR camera. Users' needs are investigated and usability goals and user experience goals are further determined[1]. Their current use and their

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[1]See *Section 2.1* for definition of 'needs' and 'goals'

wishes for future use is investigated. Their ability to operate the user interface of Canon EOS 1000D, a camera designed for beginners and given a lot of credit for being best in test and user-friendly (Canon, 2009a; Lyd&Bilde, 2008a), is tested. Several usability principles are focused on during the discussion of the results from the methods. What types of functions the users want in a DSLR is also explored. The issue of having many possibilities and functions in the cameras vs. having a user-friendly and easy-to-use camera appears, and ideas for a solution benefiting both requests is given. The results from the methods are gathered and analysed in order to answer the research questions stated in *Section 1.2*. Parts of the UI design of Canon EOS 1000D is analyzed and suggestions to improvements are given.

Chapter 6

Results

This chapter presents the results from the material generated through four methods; questionnaire, interview, usability test, and brainstorming. Each method is designed to strengthen discoveries from their prior methods, as well as discover new and interesting areas in order to answer the research questions stated in *Section 1.2*. Results from each method are presented chronological as the methods were carried out, and interesting findings are emphasized and further brought into the discussion in *Chapter 7*.

6.1 Questionnaire

A questionnaire was handed out to people attending courses on digital photography (*APPENDIX A*). Results from the questionnaire are based on answers from 115 respondents from three different beginner courses on digital photography, and the answers given reflect these people and their influence from the courses. There were 2.8 times more women than men among the respondents. This and the devision of age is listed in *Figure 6.1*.

Almost every respondent saw themselves as an amateur rather than an expert. Only two wrote that they were '*a somewhat ok expert*', or '*an amateur on technique, but an expert on composition*'. The duration of possession of a DSLR camera varies

Age	Male	Female
19 - 30	5	35
31 - 40	12	25
41 - 50	5	12
51 - 60	4	7
61 - 70	3	2
SUM	30	85

Figure 6.1: Table showing age and gender of the respondents.

from approximately one week to six or seven years. There was also a variation in active usage of DSLR cameras, from only a few days to a person who has been using a DSLR for as much as nine years. Prior to the DSLR the 115 respondents currently own, 97 respondents had earlier possessed a digital compact camera, 59 an analog compact camera, 49 an analog SLR, and 4 respondents had earlier possessed a digital SLR.

Most of the respondents had cameras made by Canon, while almost 1/3 had a Nikon camera. Olympus, Pentax and Sony were held by respectively 7%, 2%, and 2% of the respondents (*Figure 6.2*). This distribution of camera brands is relatively consistent with the portion of the market in Norway (Østmoen, 2009; Svendsen, 2009).

Possession of Camera types

7% 2% 2%

27%

62%

● Canon   ● Nikon   ● Olympus   ● Pentax   ● Sony
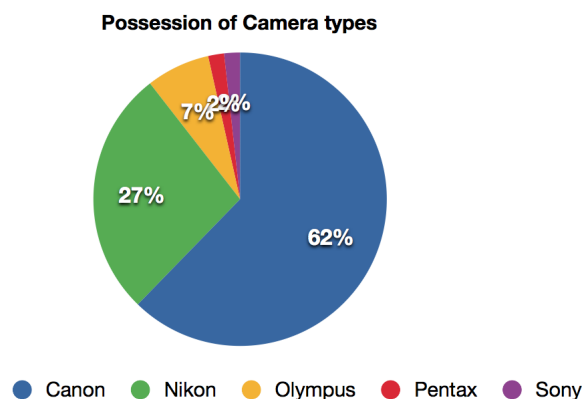
Figure 6.2: Cameras possessed by the respondnats.

6.1.1 Important when Purchasing

The respondents were given nine components and were asked to choose the ones they found important when purchasing a DSLR. *Figure 6.3* shows the results, and points out that brand was particularly important when purchasing. Price, tests, user friendliness, and that the camera was recommended by acquaintances was also important to many, while color was not important to anyone.
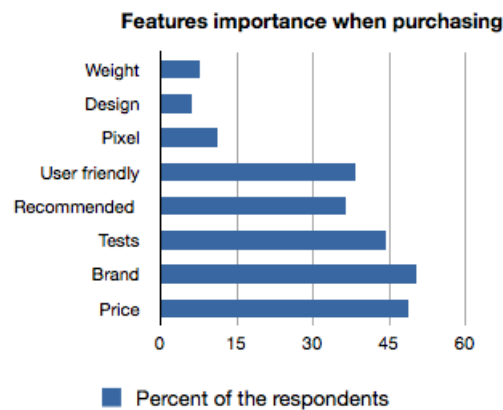
Figure 6.3: Figure showing percentage of respondents choosing each of the features as important when purchasing a DSLR.

Figure 6.3 shows the number of votes combined. Some answers, however, differed based on gender, and this is visualized in *Figure 6.4*. The first two columns show the amount of men and women choosing the different features, while the two second columns show the percentage of the men and the percentage of the women who chose the different features. User friendliness are distinctly more important to women, while brand is substantially more important to men. More women than men would base their purchase partly upon tests seen on TV or on the Internet.

There were some differences between what different age groups found important, but these were negligible. The average age varied from 34 to 40. Amount of pixels was a little more important to the younger costumers, while the weight of the camera was somewhat more important to older people. According to the median age of the respondents, price, brand, and design was a little more important to the

Important features	Male	Female	Male %	Female %
Price	13	43	43	51
Brand	19	39	63	46
Tests	11	40	37	47
Recommended	10	32	33	38
User friendly	8	36	27	42
Pixels	4	9	13	15
Design	5	2	17	20
Color	0	0	0	0
Weight	1	8	3	4

Figure 6.4: Gender based table of features' importance when purchasing camera.

younger, while weight, also here, was somewhat more important to older people. Four respondents answered that they had possessed a DSLR cameras before. For these people, brand was very important when purchasing their new DSLR. Number of pixels were also mentioned by 50% of these four. Other reasons for purchasing, were that it was recommended by the sales man in the store, or that the camera was a gift.

The findings presented here are important in order to get an understanding of what users care about when getting a DSLR. The differences in age and gender are noticed since there are more women than men in the study, and because the average age of the participants is rather high.

6.1.2 Current Use of the Camera and Wishes for Future Use

The questionnaire contained questions about how the respondents used their DSLR camera and how they wished to use their DSLR in the time to come. *Figure 6.5* shows the six type of photos they were given to choose from, and a percentage of votes each type of photo got. The left circle shows, in percentages of the total, what types of photos users already use their DSLR to take, while the right circle shows, in percentages of the total, what types of photos users want to use their DSLR to take. There were more votes given toward the first question on what photos people were already taking than toward what they wanted to use their DSLR to take.

Artistic pictures was, according to the answers given, the only type of photo that more people wanted to take than the amount of people that was already taking it. Every other type was selected more times on the question of what they were using their camera for, than on what they wanted to use their camera for (*Figure 6.6*).

Pictures of family & friends, vacation, and nature are taken most often. These

What kinds of pictures are taken

What kinds of pictures are desired to be taken
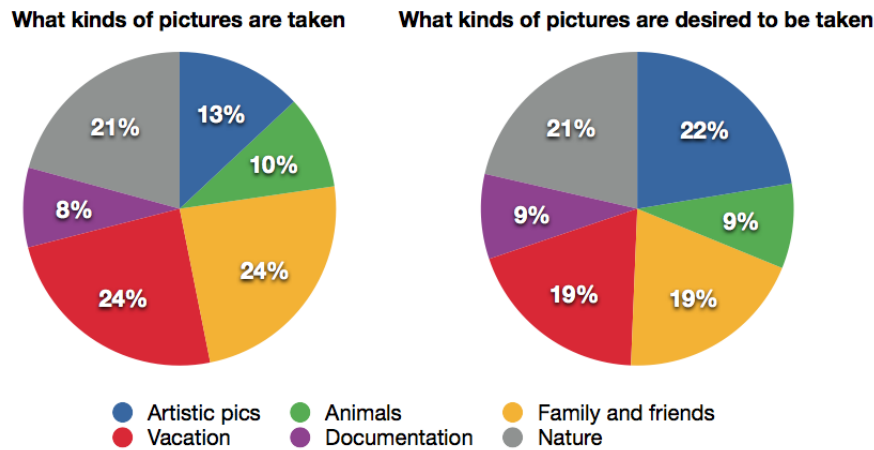
Figure 6.5: The figure hows in percent what the respondents use their camera for (left), and what they want to use it for (right).

Type of photos	Currently taken	Desired to be taken
Artistic pictures	54	69
Animals	40	27
Family & friends	100	60
Vacation	100	59
Documentation	34	27
Nature	86	66

Figure 6.6: The table shows the amount of people selecting each of the types of photos for current and future use.

photo targets are also interesting for future photography. One particular target stands out: artistic pictures. The number of people wanting to use their DSLR to take artistic photos are substantially higher than the amount of people using their cameras for artistic photos today. It is the only type of photo that more people want to take than the amount of people currently taking. When asked how they use

the DSLR differently from their earlier cameras, three main ways were mentioned by several respondents: they take more pictures, they set the camera into manual mode and they experiment more with the camera. Respondents wanted to learn more about the camera, take more and better photos, and they wanted to take photos they could pride their walls with. Artistic and interesting pictures were also mentioned initiatively by several respondents.
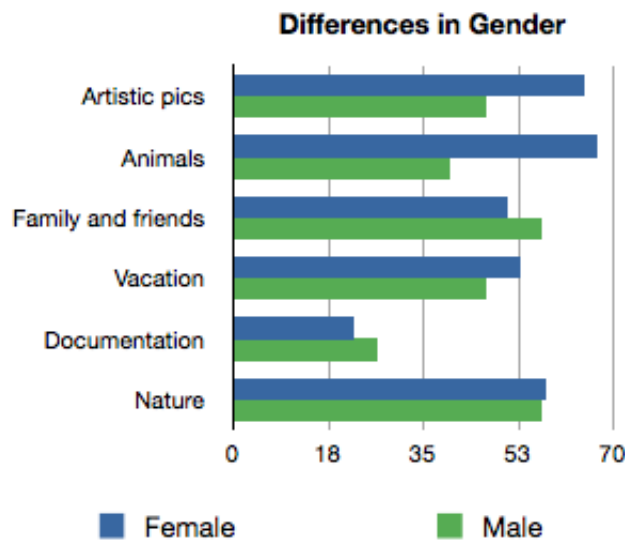
Figure 6.7: Gender based figure of what wishes the respondents have for their camera usage. X-axis: Percentage of respondents choosing the different targets. Y-axis: The different targets.

There are some differences in gender when it comes to types of pictures desired (*Figure 6.7*). The numbers of males taking, and wanting to take, documentary photos is greater than the number of women doing the same. More women than men state that they want to take artistic photos and pictures of animals. When asked how they use the DSLR different from other cameras, several women (and a few men) wrote that they experiment more. There are some moderate differences where more men want to use the camera to photograph family and friends and more women want to photograph vacations.

There are also some differences in age when it comes to wishes for camera use. The average and the median age, however, differs greatly for some of the targets as
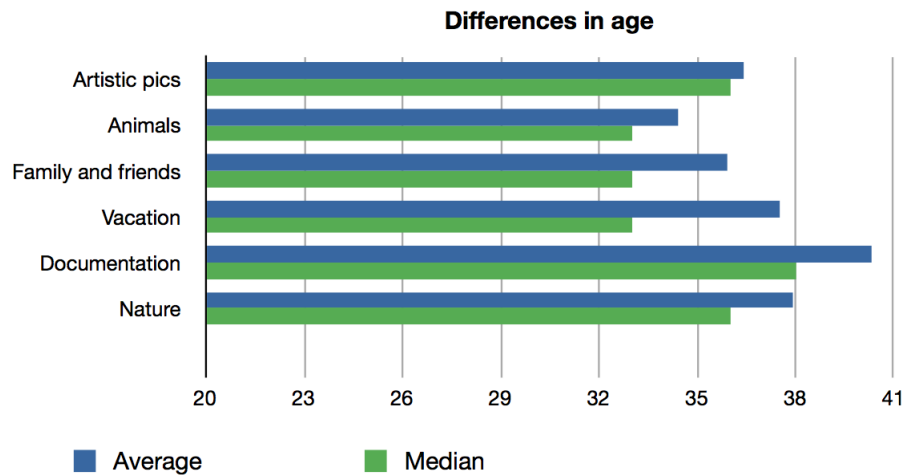
Figure 6.8: Age based figure of what wishes the respondents have for their camera use. X-axis: Age of respondents. Y-axis: Wish for camera use.

seen in *Figure 6.8*. Documentation, nature, and artistic photos are in general more desirable targets by older people than animals are. When it comes to pictures of vacation and family & friends, there are differences between the average and the median age.

6.1.3 Pros and Cons

41% of the 115 respondents used automatic settings more often than they used manual, 30% used mostly manual settings, while 27% used both settings just as much. When asked about the good aspects of their camera, 18 people wrote that it was user-friendly. Easy to use, as well as the opportunities and the quality of image was also mentioned as good aspects by several questionnaire respondents. Many found it easy to take pictures in daylight and to get good focus in the image. Using preset exposure settings (automatic settings) was considered easy and with good results. The auto focus was also bragged about by several. While some respondents mentioned many opportunities as good, others named the camera's complexity as a bad quality.

When asking for aspects they did not like, many answers were referring to

hardware such as the lens or the flash. Requirements for competence, getting the right focus, menus, buttons, user guide, size, and weight were mentioned as bad aspects. One respondent stated "*[It] requires competence in photography in order to know how to get the best pictures.*" (translated from Norwegian). Another respondent reported that he wanted pictures that not always were obtained with the preset exposure settings, and mentioned photographing at night, in movement, fog, and rain as typical complicated conditions. Taking photos in dimmed light and of moving objects was mentioned by many, as well as the challenge of great differences between dimmed and bright light in a motive. To take portraits and do panning[1] were also written by several. The amount of things to know about the camera is considered difficult. One person articulated; "*Everything is hard now. I am a beginner.*" (translated from Norwegian), while another wrote; "*The hard thing to do is to make pictures turn out the way I want them to*" (translated from Norwegian). There are many technical aspects with the camera, and this is said to be complicated by several of the respondents, but at the same time good by others. More answers were given to what was hard or complicated to do, than to what parts of the camera was bad.

6.1.4 Findings taken further into the interviews

Results from the questionnaire revealed that many users found the usability of their camera to be good. This was taken further in the interview, and interviewees have been asked about the usability of their DSLR. Questionnaire respondents mentioned many opportunities and functions as good aspects with their cameras, and the issue of having many functions vs. having a user-friendly UI design has been investigated further during the interviews. What types of functionality users want has been given attention, together with what parts of the UI design they find

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[1]Panning is a technique for capturing movement. The camera is following a moving object in the same speed to get the object clear and the background blurred and dragged out. It gives the impression of speed (Kobré & Brill, 2004).

user-friendly or not. A question toward what particular opportunities the users see with their DSLR was also given during the interview. The results from the questionnaire show that many users wanted to use more manual settings, and this discovery will be followed up in the interview.

6.2 Interview

Nine people, five women and four men, were interviewed based on the results from the questionnaires. Their exact age was not recorded, but ranged from 19 to about 60. All citations from interviewees are translated from Norwegian to English. See *APPENDIX C* for the interview guide, and *APPENDIX F* for an overview of the interviewees' opinions on different functions presented to them in question 4 of the interview guide[2]. Every interview is analyzed individually and the most important features from each of them are presented here[3]. In the beginning of each presentation, a short summary is given.

6.2.1 Interview 1

In this interview we can see that the interviewee wants to learn about photography and take artistic photos, and that she is concerned about 'not cheating'. She finds the camera rather complicated to use, and does not want too many functions in it.

The interviewee got her DSLR because she wanted to take better pictures and learn more about photography than she was able to do with her compact camera. She found the quality of light to be better with a DSLR, saw the ability to take photos in difficult situations (darkness e.g), and expected to be able to take more artistic photos. She had only used manual settings because of her attendance of a photo course, and said that she would continue to use manual settings, except

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[2]The interviews can be given the examiner whenever requested until the end of the project period when the presentation of the project is over.

[3]Not every interview was sound recorded well enough to provide citations.

when taking documentary photos. She was presented some functions for a future camera, and her answers can be seen in *APPENDIX F*. She mentioned that photo stitching might be cheating and that face manipulation definitely is cheating and should rather be done in photo-editing software. Using automatic settings was also cheating to her. She was concerned about too many functions and an exaggerated use of the camera, and said that she did not want to spend too much time learning to use it and that there were many functions she did not need. She did not know what to look for in a menu, due to her absent knowledge of the terminology, and did therefore take a course on it. She mentioned that the menu was complicated and the screen a little too small, and when accidentally clicking a button and entering a menu, she often had problems getting out of it again. She found it more important to understand the most important functions than to have a lot of functions in the camera. Having both a quick and an easy-to-learn camera was important to her. She mentioned that the buttons were too similar and that she often clicked the wrong one. She could also mistake the ISO button for being the release button due to its position. A full list of the things she found easy and hard to understand is listed in *APPENDIX G*.

6.2.2 Interview 2

This interviewee wants to learn about photography and take artistic photos. He finds the DSLR complicated to use, and there are several things that he wants to do in photo-editing software, and not use the DSLR camera for.

The interviewee wanted to develop his knowledge on photography past his compact camera. He expected a DSLR to have better quality of image than a compact camera, and to give more possibilities for such as taking artistic photos and changing lenses. He wished that the usability of his camera (Olympus) was better and mentioned that it was hard to use since he needed a course to learn the photo terminology needed to use it. He found the shutter, photometry, and flash particularly

complicated, and had only used automatic settings, but wanted to use manual after finishing his course. When giving his perspective on the functions presented to him (*APPENDIX F*) he pointed out that there were several things that he did not want the camera to do because he wanted to do them manually in photo-editing software. He wanted to use a lot of time on photography since it was one out of a few things he could do well with his walking disability. He found it more important that a camera was easy and quick to learn, than to have many and quick-to-use functions. He did not want a hybrid camera, and said that he was glad there were no video function in his. He also mentioned that Canon EOS 1000D was better to hold than his Olympus camera, which had a camera house that was too light. He liked the placement of buttons on the Canon camera and could nicely reach them with his thumb.

6.2.3 Interview 3

The interviewee says that the camera was hard to use in the beginning. He first says that he wants a lot of functionality in his camera, but later on he mentions that he does not want too much functionality after all.

The interviewee got his DSLR in order to take nice pictures and get to know a contemporary camera. He expected the camera to have a lot of functions, and said that he wanted all kinds of information. He found automatic settings easy to use, while measuring light and focus were hard. He wanted to use more manual settings than he was currently using, and mentioned that he did not want too many functions in the camera (see *APPENDIX F* for functions he liked and not). He pointed out that he would like to send photos from the camera and to an e-mail address and that he would like to have a projector in the camera. He had not used every function in the camera, and would probably never use bracketing, he said. He wanted to spend as much time as needed to learn how to use his camera, and added that it was hard to use it in the beginning and that the screen was too small.

Having whether a lot of functions, or less but easy-to-understand functions were equally important to him. It was, however, more important to be able to learn the functions quickly than for the functions to be quick to use. He wished for a CD with instructions, and to get more information through the Internet and the salespeople.

6.2.4   Interview 4

This interviewee wants a lot of possibilities. He finds his DSLR user-friendly, and sees himself as the only limitation when it comes to what possibilities he has with it. There are several things he wants to do in photo-editing software, and not with his camera.

The interviewee got his camera because he wanted more possibilities than his older analog SLR gave him. He wanted a more modern camera and the ability to digitally edit photos. He expected the DSLR to be just as robust and user-friendly as his analog SLR, and found his DSLR to be user-friendly, and the automatic settings easy to understand. He wanted to make the most out of his camera and therefore used manual settings, but pointed out that knowledge on photo theory was required for that. When presented some possible functionality (*APPENDIX F*), he refused several functions because he wanted to do the tasks in photo-editing software instead. He did neither want his camera to recognize the photographer and tag photos with it, but saw the utilitarian value of this function for companies and in accordance to copyright. He wanted information about blurry pictures to be given together with other information about an image (ex. shadows, burned-up ranges etc.). About the possibilities of his camera he said: "*The restrictions lay with me. [...] The possibilities are many*". He did not use the video function of his camera and said that he did not want his DSLR to be a hybrid camera. He thought it was more important that functions were easy to understand than to have a lot of functions, but that it was more important that the functions were quick

to use than easy to learn. He added that picture quality was more important than a lot of functions. Some icons or words, such as 'Disp', were not intuitive to him (*APPENDIX G*). The menu of Canon EOS D7, which is similar to the menu of Canon EOS 1000D, was, however, easy to understand. He noticed that the camera could be hard to use for left-handed users.

6.2.5 Interview 5

The interviewee wants to learn about photography and be creative with it. She wants a lot of options, but too many options makes her confused. She mentions that she would like to download functionality, and that she did not read the manual.

Photography was a hobby for the interviewee who saw limitations in her compact camera and therefore got a DSLR. She liked technology, and wanted and expected the DSLR to let her learn more about photography, be creative, have many options, and play with light. She found the usability of her camera (Canon EOS 450D) to be good, but said that having a lot of options made her confused and that she did not know where to start. She thought the automatic settings were easy, and used them when there was not enough time to adjust the settings manually. After getting some possible functions presented to her (*APPENDIX F*), she mentioned that it would be nice to download software of own interest to the camera. She did not read the manual, and thought it was more important to understand basic functionality than to have a lot of functions in the camera. She also found it more important that functions were easy to learn than quick to use, since she found learning inspiring. She added that it was fun to have a lot of possibilities. She thought the manual was too standardized and wanted additional tips and examples of results. The screen was too small to analyze pictures, and she liked icons better than acronyms in a UI design.

6.2.6 Interview 6

She wants the camera to give her possibilities and to be easy to use. She finds her camera user-friendly, but says that it is impossible to learn how to use the camera by one self. She would like a possibility to choose what kind of functions the camera has.

The interviewee's compact camera did not give her enough challenge, so she got a DSLR to take better pictures and to learn about functions and techniques. She expected the DSLR to take nice pictures, be easy to use, and give her more possibilities than a compact camera would, and said: "*[...] Everyone said that the pictures get better [with a DSLR than with a compact camera]. Even with those automatic settings, the quality gets better*". She did not find it hard to learn to use her camera (Canon EOS 450D), and found its usability OK, but would like it to have more buttons. She thought changing between shutter speed and aperture in 'M' mode was awkward, and used mostly the semi-manual settings 'Tv' and 'Av', and wanted to use automatic settings in stressed situations that required good results. She would like the camera to tell her when a photo is blurry, and found it annoying when the auto focus denied to release the shutter when it was out of focus. She liked that she could create speed in her photos and take pan shots. "*I actually see endless amounts of possibilities, but I think a lot also is very hard to do*", she said. When asked how much time she was willing to spend learning to use her camera, she answered: "*If it was **willing** I would have used five hours a week, but in reality it will not be that much, because I do not have that much time*". She said that she learned how to use the camera during her digital photography course, and added "*I think manuals are so boring, so I do not read them, and to understand it [the camera] by yourself is not possible*". She would rather have few and easy-to-understand functions, than a lot of functions and said: "*I would not want a lot of functions just for the sake of having it, because I would probably not have used them*". She found both quick-to-use and easy-to-understand functions important.

She would not necessarily use every function in the camera, and added: "*One could have produced ones own camera, and chosen the functions one wanted, that would have been fun*". She would also like to have an educational video containing an interactive course.

6.2.7 Interview 7

This interviewee finds the DSLR complicated to use, but sees her self as the only limitation. She does not understand shutter speed and aperture, and forgets how to use them quickly. She does not want to use the most complicated functions yet.

The interviewee used an analog SLR before she got a digital one. She did not find the DSLR as easy to use as she was told it was. She saw similarities between the analog SLR and the DSLR, but mentioned that the DSLR had many additional possibilities, such as changing ISO, WB, and the possibility to see and delete images directly. She found the DSLR more complicated to use than the analog SLR.

> "*It is more complicated than the manual SLR. [...] You have so many options. If you are going to use only automatic settings, there is no reason to have a SLR.*"

She was only using manual settings, and found the automatic settings to be cheating. Later on she mentioned, however, that people should not feel defeated when using automatic settings. She said that there were no limitations for how one can use the camera and added: "*It is only me as a photographer who sets the limitations. [...] If I manage to utilize all the possibilities of the camera, then that's more than enough!*". She could remember how to use the shutter speed and the aperture, but did not understand it, so she forgot about it quickly, she said. She would not play around with the camera every day and did not feel like doing things she did not manage to do. She mentioned that she was afraid of clicking buttons, and would not try and use the most complicated stuff yet. It was more important

to understand the basic functions of the camera than to have a lot of functions, and she also found it more important that functions were easy to learn then quick to use, but mentioned that both were important. She added that she was not very good with icons, and never used the film function or 'live view'. She was concerned about keeping the screen clean, and said that her nose touched it when using the viewfinder. It is not as robust as a manual camera when it comes to rain etc., she said.

6.2.8   Interview 8

The interviewee finds his camera user-friendly, and wants to have many functions and possibilities. He thinks the DSLR is easy to learn, but changes this opinion after completing the usability test.

The earlier analog SLR user got his DSLR when he recently decided to pick up photography. He expected the camera to produce photos of good quality, and to capture an image as soon as the shutter button was clicked. He liked the possibility to change lenses, and found his DSLR camera to be very user-friendly. "*I think it is very easy to take pictures with it, and the camera gives you a lot of possibilities*" he said. He used mostly automatic settings but wanted to use manual more in the future. He wanted to take pictures of nature and animals, and thought the DSLR was good equipment for this. The advantage of being able to take many photos and choose the best ones was important to him. He wanted to spend some time learning how to use the manual settings. There were many things on his camera that he had not used yet, but he wanted a lot of possibilities and thought the camera would be easy to use if he just spent more time on it (after the usability test, he said that it was not so easy after all). Having many functions were more important to him than having few and easy-to-understand functions, and it was more important that the camera was quick to use than easy to learn.

6.2.9 Interview 9

The interviewee does not find it easy to learn how to use a DSLR camera, but says that Canon's cameras are easier to use for beginners than Nikon's. She sees the advantage of using manual settings, and blame her self for the things she is not able to do with her camera. She wants many functions, but do not want to use the camera for photo-editing.

The interviewee had "always" used her parents' SLR cameras, and got her own Nikon D90 recently. She had used both Nikon and Canon, and found Canon cameras to be better designed for beginners, while Nikon cameras had more functionality. "*I think Canon often is better [than Nikon] for first time users when it comes to understanding what the different functions give you and also the general layout of the menu*", she said. She expected a DSLR to have a lot of functionality, but also to be user-friendly. She said that learning to use her camera was not very easy and added that she learned it during a course and not from the manual or the camera it self. She mentioned that it was complicated to make her own menu for the camera and that she wished she could see the histogram of a photo also before it was taken to get the meta data, but that she liked her camera in general. She used automatic settings for about a year and a half in the beginning, but was now only using manual. "*As soon as you learn those functions [manual settings], you understand that you get more out of the photos by setting the camera your self*". She saw the many possibilities of her camera and added:

> "*I have understood, the more I read, that as soon as you have a semi professional camera, the limitations lay with you, only*".

She said that she worked on photography every day, and that she always used her computer for editing, never her camera. She thought having a lot of functions was more important then having functions that were easy to understand, and found it more important that a camera was quick to use than easy to learn.

6.2.10 Findings taken further into the brainstorming

Some tendencies and topics of interest are taken further from the interviews and into brainstorming and design. An example is the issue of people wanting many functions and possibilities, but at the same time are concerned about having a user-friendly camera that is not filled up with too many functions. An idea of downloading functionality to the camera was mentioned and is taken further as a possible solution to the problem. Many interviewees saw their knowledge as the problematic issue, and not the UI of the DSLR, and they wanted to learn more about manual photography in order to take better and more artistic photos. This is described further in *Section 6.4*.

6.3 Usability Testing

After every interview, a short usability test of the Canon EOS 1000D was performed. Six out of nine interviewees possessed a Canon camera. These Canon cameras are quite similar to Canon EOS 1000D in their UI design. The interviewees, referred to as *users*[4] in this section, were given four tasks:

1. Take a photo with long shutter speed

2. Take a photo of me where I am in focus while the background is out of focus

3. Set the white balance to suit this room, using a white sheet of paper

4. Set the camera to only use the right focus point

Questionnaire answers unveil that many users want to use more manual settings, and task one and two stated above will therefore be given. Users also want to take good and artistic photos and be in control of their camera, and in order to do that they should be able to perform all four tasks stated above. The questionnaire

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[4]The involved ones in a usability testing are refered to as "users" (see *Section 1.4*).

respondents find the usability of their cameras to be good, and I will therefore test the usability of Canon EOS 1000D, a DSLR found to be user-friendly (Lyd&Bilde, 2008a). As mention in *Section 4.4.3*, the usability test is grounded in the understanding of users and their usage and wishes for future use of the camera. Task 3 was also chosen because I found it unnecessary complicated to perform, and wanted to get my assumptions confirmed or disproved. The usability test was carried out after each interview and as described in *Section 4.4.3*, and the users were asked to think aloud[5]. See *APPENDIX H* for a quick overview of the outcome of the usability test. All citations are translated from Norwegian, and the results from four tasks are presented as separate summaries.

6.3.1   Task 1: Shutter Speed

Owing to the fact that all of the nine users had gone through a course on photography, they knew what a long shutter speed was. Two out of the users, however, did not know how to change the speed of the shutter with the wheel[6]. The seven others had no problems with this, although one of the users thought he had to use the menu to carry out this task and another one had to squint to see the details on the camera. Four of the users set the camera to the setting 'M'. Two of these managed the task without any problems. One of the two others kept the setting on automatic first and looked for information on the screen and in the viewer. After some time she figured out that she had to change it, she set it to 'M' and finished the task. The other one thought that she already set the camera to 'M', because she did not see the right marker, but the camera was rather set to an automatic setting, so she could not change the shutter speed. She looked at the screen and tried the wheel for changing the speed of the shutter, but did not succeed until I told her what she had done wrong.

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[5]See *Section 4.4.3* for explanation of the 'Think aloud' technique.
[6]One of them had Canon, the other had Olympus.

Five of the users used the setting Time Value (Tv). One of these said that she knew it was 'Tv' or Aperture Value (Av) and that she always set the camera to either one of them and checked the display to find out if it was the right setting or not[7]. If not, then she knew that it was the other one. Another user set the camera to 'Av' first, looked at the screen, and then changed it to 'Tv'. She turned the wheel in front of the camera to change the shutter speed, and added "*I wouldn't have known that if I hadn't taken a course on photography*". The third user who set the camera to 'Tv' did this right away, but said that she did not remember if this was right. She looked at the display, saw it was the right setting, and used the wheel to adjust the speed of the shutter. The fourth one spent some time before she looked at the display and decided that she needed to set the camera to 'Tv'. The last one using 'Tv' said that he thought it was 'P' or 'Tv'. The camera was off and he could not find out which one to use. I told him that he could turn the camera on and use the screen. He did, and easily found out that he wanted to use 'Tv'.

6.3.2   Task 2: Deapth of Field - Aperture

One of the users set the camera to the automatic setting of portrait after some thinking, and said that she chose the easy alternative. Another user said that since it was 'Tv' in the first task, it was 'Av' now. Five users in total set the camera to 'Av' and completed this task without any problems. One of them was asked to try the same with the camera set to 'M'. He then tried the 'AF' (right arrow) button and had a hard time getting out of the AF menu. He did not find the right button to press. Four of the nine users had this very problem. They had the camera set to 'M', and neither one of them found the right button to use. They tried different things and spent some time on it, but could not figure it out. One of the users pointed at the aperture value on the display and said that he did not know how to

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[7]She sees this from the display that shows a fraction to the right, and f + a number to the left.

get there. When I told him what button to use, he clicked it a few times before he understood that he had to hold it down to be able to set the aperture with the wheel. He told me that he could not understand the icon of this button. One of the other two tried the 'AF' (right arrow) button first, then other things for a while and said that the arrow buttons normally are used for this. He did not manage the task before I told him what button to push. The last user told me that he thought the 'Av' button was for locking the aperture and therefor did not try it.

6.3.3   Task 3: White Balance

Only one out of nine users managed to carry out this task. Six of the users went more or less directly to the WB button. Two of these chose 'White fluorescent light' in the WB menu. One of them said "*I do not know if it will be perfect*", wile the other one said that he did not know how to do it manually. Two chose 'tungsten light' in the WB menu. One of them first tried to turn the lens towards the white sheet and click the button marked with WB. When he then got the WB menu he said that he chose the automatic WB setting for indoor light. Three of the users considered 'custom' and two of these also considered 'auto'. One of them tried the 'custom' icon and took a photo. Then she did the same with the 'tungsten light' selected and looked at the two pictures to compare them. "*Is it perfect? No. Absolutely not!*" she said surprised. Another user, who also set the camera to custom, looked into the viewer and took a photo. "*It does not give any information in the viewer about whether it is the white balance it sets, so I do not know if that is what it does or not*". She thought that she had done the right thing but said that if it did not work then she would have look in the menu. I asked her to do so, and she found 'Custom WB' in the main menu. She took a photo and went into the menu again to set the WB with the photo she took. She manages the task (the WB choice was already set to custom). The third of the users choosing 'custom' gave up and said that she thought it was unnecessary to set the WB manually. Only

two users considered using the menu and only one of them managed the task. Two of the users tried to maneuver in the WB menu with the wheel[8], but quickly knew to use the arrows when the wheel did not work.

Eight of the nine users did not manage to carry out the task, so I showed them how to do it, and asked for their opinion. Three of the users used the word "*complicated*". One of them said that she got confused and another responded "*No, I think it is very complicated. I do not understand it*". Three of the users mentioned that there were too many steps. "*That is much back and forth*" one said, and added that it should be possible to do it an easier way. Another agreed that it should be easier and added that it was probably a couple of keyclicks too much. Another responded with "*That was clumsy*" and thought it was too many steps. She added that it was easier with her compact camera[9] where you set it to 'custom' and take a picture of a white sheet, and that is enough. Two of the users blamed them selves. One of them said "*I need to read more*", while the other one said that it was a good function but that it was hard when he did not know how to do it, but easy if he did.

6.3.4 Task 4: Focus Points

None of the nine users the camera was tested on could set the focus point on their first try. One of them said "*I have to find focus in the menu*". Four users thought they had to use the menu, and they spent some time looking through it before they gave up and I had to tell them that they would find it on a button. A user looked through the viewer and turned the lens back and forth. After some time I told him to look for a button and he chose the one next to the correct one (the one with a star icon). Another user tried the 'AF' button and said that it stood for 'auto focus' but that he did not know where to change the focus points. Another user

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[8]This wheel was used for changing the stutter speed and aperture value in task one and two.
[9]She is here referring to a Panasonic Lumix camera.

said "*oh, off course*" and clicked the button for metering mode (up arrow) when I told her to use a button. She tried a little more before she found the right button. Yet another tried the button for metering mode and the display button plus some others before he gave up, and I had to tell him which button to use.

After clicking the focus point button and maneuvering with the arrows, seven out of nine users tried the 'SET' button to select their focus point. One of these users said "*if I find something I want, then I always click SET*", while another tried the arrows and the 'SET' button over and over again until she gave up. Yet another said that he did not understand what happened when the focus point automatically was set back to the middle and that he thought that he was doing the logical thing. A girl said "*I am unsure now, cause I would think that I should click SET after I chose that picture. But... Maybe it happens by it self. Apparently it did*". Five of the users pointed out that a SET button often is used to choose or confirm a choice and one person compared it to the ENTER button on the computer. Eight of the nine users had no problem using the arrows to maneuver to the right focus point. The one that had a problem with that wanted to use the wheel on the front of the camera, but was then only able to move the choice of point up, and down and not to the side.

6.4 Brainstorming Session

Some tendencies were found from the results of the nine interviews and usability tests conducted, and were taken further in the brainstorming session. Many interviewees wanted a lot of possibilities, which was often seen as the equivalent to many functions. At the same time, many interviewees mentioned that they did not want too many functions in their camera since it would make it more complicated. The idea of downloading functionality and building ones own camera was mentioned by two interviewees, and was also taken up during the brainstorming. 70% of the

interviewees found it more important to have few, basic, and user-friendly functions in their cameras than to have a lot of functions. 55% of the interviewees found it more important that the functions of their camera was easy to learn than quick to use. Thus, during the brainstorming, the participants were asked to design a menu structure and to remove the functions they found unnecessary or did not understand. Several interviewees said that the usability of their camera was good, and that their knowledge and abilities was their only limitation. They wanted to learn more about their camera, take artistic photos, and use manual settings more. The brainstorming followed up the matter of supporting artistic photography and ways to make aperture and shutter speed easier to understand and use.

Nine people, three men and six women, were gathered for a brainstorming session on digital SLR cameras. Only seven of the questionnaire respondents had time and wanted to participate, so two additional hobby photographers I know were also attending. There were two reasons for bringing in my acquaintances: 1) I had problems filling up the nine spots for the brainstorming, and 2) it brought younger people to the group which mainly consisted of participants of older age. The nine participants were divided into three groups. The brainstorming session took 2.5 hours and all participants were acting eager and interested, and were taking part in discussions. The session was divided into two parts separated by a break containing drinks, sweets, presentations, and discussions. All citations are translated from Norwegian.

6.4.1   Part One of the Brainstorming

During the first part of the brainstorming, each group were given forty eight notes containing all words from the menu and the buttons of Canon EOS 1000D. They were asked to sort them into a good menu structure, and make icons for each category they made. The groups were also asked to decide upon what functions to put on buttons, what functions to delete from the camera, and to put aside the functions

they did not understand. They were further asked to write down the functions they would want in a future camera, and to think about ideas for supporting the act of taking artistic pictures[10]. In the following we enter the brainstorming session, and follow the participants through my summary of the session.

6.4.1.1 Groupe One

Group one made a list of functionality that they found important and wish to find in a future camera (*APPENDIX J*). Some of the matters listed were: a touch screen, explanation of different menu settings, remote control for taking pictures, and taking the picture first when people's teeth are exposed (smiling) or when their eyes are open. Due to their idea of a touch screen, an alphabetic file structure with a search engine were suggested, and no icons were made for the menu. They did, however, draw icons for 6 functions they wanted to have on buttons (see *APPENDIX K* for list of functions). All icons, except the flash, which was drawn as a lamp, was given the same design as it already has on Canon EOS 1000D. A participant from group two mentioned that with this file structure, a language option should be the first thing displayed on the screen in order to know what to search for. As an aid for taking artistic pictures, the group suggested a function they had seen before, where the camera was to focus on one color in the motive, and everything but that color would be gray scale in the photo. Other participants eagerly intervened and were interested in this artistic function. Group one rounded off with an idea of a flash on each side of the camera in order to reduce the occurrence of red eyes.

6.4.1.2 Groupe Two

Group two divided the functions into four groups.

> "*We wanted to sort them into rather few groups, because if you have to*

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[10]See *APPENDIX I, Part 1,* for the tasks given, and *APPENDIX K* for an overview of the functions the groups wanted on buttons, did not understand, or wanted to take out.

> *look through seven different groups to find what you are looking for, it*
>
> *gets very bothersome.*" (Member of group two)

Their four groups were: 'Basic Adjustments' (for the camera), 'Picture Planning', 'After Treatment', and a fourth undefined group with special functionality such as 'RGB' and 'Sensor Cleaning'. "*It does not matter if there is many alternatives within a group, as long as you can find out where to look*" a member of the group said. I showed all participants the menu of Canon EOS 1000D, which have few groups across several pages and no need for scrolling (see *Figure 6.9*). They were asked whether they liked this type of menu better, or a menu with each group displayed once and with a scrolling option. Two participants exclaimed that they wanted the scrolling version, and one of them added that she never noticed that the same group were displayed several times. Another user liked the present design better, and argued that it was better to see everything on one site, so one can decide to look further without having to scroll first. A participant from group one asked group two if they considered having a function several places, so the user would not have to look so hard to find it. The group answered that they considered it, but decided not to. "*We said NO! Do not need to put it several places*", one of them said and added that not even functions on buttons would be placed in the menu. Icons for buttons were drawn similar to the ones already used on Canon

Figure 6.9: Menu of Canon EOS 1000D. Photo retrieved from www.cameralabs.com.

EOS 1000D, and the group explained that they wanted to keep words and icons that already were acknowledged. They added that ISO was very standardized,

while white balance was not, and articulated that an icon containing a cloud and a sun would be a more intuitive icon for the white balance. They made an icon for aperture ('Av') looking like the aperture opening. All nine participants were then asked whether they in general liked words or icons better. Three participants immediately answered "*Words!*", and one of them added "*How many times don't you look at an icon and think: What do they mean there?*". A participant mentioned that some icons are well know, but that making icons for everything would be a lot of mess. Another participant pointed out that it is easy to write ISO because it is a short word, while spelling out words like 'garbage can' would be more difficult. She also mentioned that one gets used to new icons after using them for a while. Two other participants agreed, and one added:

> "*I think that if you click on that icon [points at the camera] you'll see what it does and then you'll remember that the next time [...] It might be better to just have an icon and hope that it gradually will be universal*".

Many participants were contributing to this discussion, and one suggested a button for getting information as a solution to the problem. Other participants found this exiting and articulated eagerly: "*Oh, quick button! What is this?*" or "*Question mark!*".

6.4.1.3 Groupe Three

Group three divided the menu options into three groups: 'Camera Settings', 'Picture Settings', and 'Picture Viewing'. 'Camera Settings' contained all functions that had to do with base settings of the camera, 'Picture Settings' was for functions that were to be done before taking a picture, and 'Picture Viewing' was for after a picture was taken. Icons were drawn for each group (*Figure 6.10*). The menu did not contain functions they put on buttons. "*When you first have it as a quick button, there is no need to have it in the menu as well*" a participant said. The group wanted, among other functions, to take 'Erase image' out of the menu. The
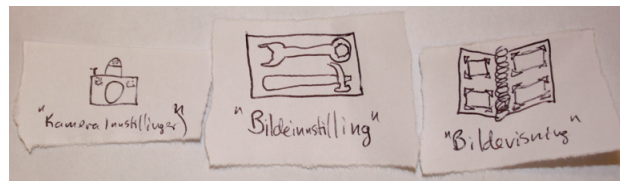
Figure 6.10: Menu icons made by group three.

reason for this was that they only wanted the button marked with a garbage can, "*I was thinking that when you click on the garbage can, you'll get a new question about whether you want to delete one or all.*". Other people agreed to this design idea. The group wanted to spell out 'ISO' and 'AF/MF', and make icons for the rest of the buttons. A person from group one said that she would like the first picture on the display to be an interface for designing ones own menu and adjust the camera to ones own use. A man from group two answered that this was already possible with 'My Menu settings', and they agreed that it was possible, but not easy enough. One of the participants wondered what 'Ordering' meant and got surprised when he found out that I had not made up some of the words to confuse them.

6.4.2 Part Two of the Brainstorming

In the second part of the brainstorming session, the participants were asked to discuss the ideas of a help button, and the option of downloading functions to their camera. They were also asked to give their opinion on 'Av' and 'Tv', and to draw a camera focusing on its shape, design, and icons for buttons (*APPENDIX I, Part 2*).

6.4.2.1 Groupe One

To the idea of a help button, group one said "*Yes. That is a good idea, and we were thinking about the same thing!*", and "*Help button, yes please!*". Many participants were eager about this button, and the icons 'i' and '?' were suggested for it.

The group further explained that they understood the meaning of 'Av' and 'Tv' because of their course on digital photography, but pointed out that they did not find the acronyms intuitive. They proposed a Norwegian substitute, and added that an information button would also help. They did not understand what the 'F' (focal ratio) in front of the aperture value meant, and they found the scale of the aperture confusing. They knew, however, that there were some logic behind it that was important to know about.

> "*When you put it [the camera] on manual, you'll have to know something about how those functions are in proportion to each other. [...] You have to have an idea about what aperture and shutter speed are, and how they play together.*" (Member of group three)

A member of group one added that she wanted her camera to use the same terminology as an expert's camera, and that she saw it as an advantage to be forced to learn how the aperture worked. The group liked the way shutter speed was displayed on the camera. On question about downloading additional functionality to a basic camera, they answered "*We think it is a very good idea to build it out ourself*". They mentioned that the functions that would come with the camera should be on buttons, while downloaded functionality should be in the menu. The group drew a camera similar to a canon camera, but with a touch screen, no automatic settings, and only external flash. As a final statement, a participant said that she wished the camera was more silent. The sound of the shutter closing can be load, and ideas such as muffler or soundproof case were suggested for a more quiet camera.

6.4.2.2 Group Two

Group two agreed that a help button would be good, and jumped to the issue concerning 'Tv' and 'Av':

> "*We find Tv and Av very hard to deal with, we are not able to keep track of it. [...] I figure it out by setting the camera to Tv and see whether I*

> *then can adjust the shutter or the aperture on the screen. [...] I don't
> even care to try and look at the wheel.*" (Member of group two)

Another participant said that she managed to learn what 'Tv' was because she
could find a Norwegian replacement for the meaning of the acronym: *'Tidsverdi'*.
She never bothered to care abut what 'Av' meant. I asked if it would be easier to
understand something else than 'Av' and 'Tv', and one of the members of group
two instantly said:

> "*Yes. We discussed that as well. We were thinking about Norwegian,
> but that is very local. BUT, on the cameras of the future you'll turn a
> wheel and see it on a LCD screen, and then it can be in any language
> you want. It can say 'lukker', 'blender', or something. Or one can make
> symbols.*"

The group found the appearance of the shutter number on the screen rather con-
fusing, and said:

> "*We get really annoyed when we look at the transition between fractions
> of a second and whole seconds, because it says 1/4, then the next value
> is 0, and then an inch character and 3. It should have been written 0.3
> s, which is 0.3 seconds.*"

The group were asked if it would be easier if the 'F' they see on the screen also was
the icon replacing 'Av'. "*Yes, it might. I would not have been more confused.*" one
of them said and seamed positive. "*One can recognize it*" another added. The group
found the idea of downloading additional functionality interesting, and articulated
that they wish for an option of buying an upgrade in the store and get it installed
there. The group wanted cameras for left-handed users as well, and that was their
design idea. They pointed out that they would like a design where the thumb were
more used. A participant from another group said that she found it hard to use
the two fingers together as needed for changing aperture in 'M' mode.

6.4.2.3 Group Three

Due to earlier discussions on the information button, group three had no more comments than: "*Very good idea*". One of the group members was used to, and liked the letters 'Tv' and 'Av', while the other two did not find it intuitive, and they drew two symbols that could replace the letters (see *Figure 6.11*). A participant of the group said that the numbers of the shutter speed and the aperture were confusing, but that she did not know how to do it better. Another member of the group said that it had to be that way because of the numbers' physical explanation. About downloading additional functionality one of the groupmembers said:

> "*We think it is a very good idea to not have all this nonsense that one don't understand and don't need. And than rather gradually upgrade it as one learns how to use the camera. Then it gets better I think.*"

A group member mentioned that she would like buttons with colors, since they would be easier to distinguish. Another member said that he wanted a wheel and a joy stick to replace the arrows on the back of the camera, and added that this design would make the thumb more useful. A participant from another group agreed. After discussing other cameras' design, a member of group one said "*One can wonder why they make the cheaper cameras a little more complicated than the professional ones, because it is not more expensive to make it less complicated.*".

After the brainstorming was completed, I got an e-mail from one of the participants of group three, containing an issue he forgot about, but wanted to communicate:

> "*It should be possible to have a modus where the light is measured in the focus point! If you have your focus point outside of the centrum, it way too often measures the wrong light source, since the light measurer mostly is center focused.*" (e-mail from participant)
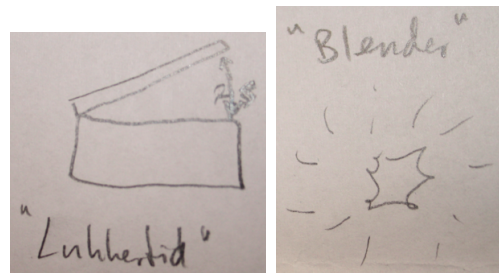
Figure 6.11: Icons made for shutter speed and aperture, respectively.

6.5 Recap

In this chapter, results from the methods questionnaire, interview, usability test, and brainstorming were presented. What I see from these results is that many users want to use the manual settings of their camera, they want to take artistic photos, and they would also like to have more control over their camera. Users also want a lot of functionality in their DSLR, and a user-friendly interface. As Norman (2002) states, having many functions and a user-friendly camera are in contrast with each other as many features make a device more complicated to use. The users blame themselves when they are not able to figure out how to use their camera and think that the usability of the camera, in general, is good. Several design issues were found based on the camera use of the users, and results presented in this chapter will be discussed in order to gain an understanding of the users in order to improve the UI of the DSLR.

Chapter 7

Discussion

Several methods have been employed in order to increase the reliability of this study. Every method used supports one another and leads to new and interesting information about users' relationship to their DSLR, their wishes for usage, and the interaction between them and the camera. Through questionnaires and interviews I found that the users saw their DSLR as very user-friendly. It was said to be '*easy to use*', '*user-friendly*', '*very good*', and '*easily understood*'[1]. The interesting thing about these statements is that the users had decided to take a course on digital photography, that thought them about photo theory and also how to use the DSLR, prior to saying it was user-friendly. In this chapter, I will discuss the results from the empirical study. It is important to notice that the issues discussed form the basis for an improved UI design of the camera, which is presented in *Section 8.1*. The design will prompt further learning, easier use, more user control, comprehension, etc.

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[1]See *Section 6.2.3, 6.2.4, 6.2.6*, and *6.2.8*.

7.1   Desired Utilization of The Camera

The users studied for this thesis were self declared amateurs[2] and wanted to obtain more knowledge about their DSLR to be more in control of their photographic results. In order to be in control of the results of photography, manual settings should be used. One of the users interviewed stated that: "*As soon as you learn those functions, you understand that you get a lot more out of the pictures by setting adjustments yourself*" (*Section 6.2.9*). Eight out of nine interviewees wanted to use manual settings more than they were already doing[3]. Some even wanted to use manual settings exclusively, and wished for the automatic settings to be removed from the camera. Using manual settings will give the user greater control over the results of his or her photos.

Most of the interviewees got their DSLR based on a desire to step up from the camera they were currently using. Six out of nine interviewees mentioned that they had a compact camera before they got their DSLR[4]. They saw the limitations that it had, and wanted to develop their skills to learn more about photography using a DSLR. A user said that she wanted to be more creative and experiment more, while another explained that the compact camera didn't give her enough of a challenge[5]. Being 'supportive of creativity' and also 'helpful' and 'offering photographic challenges' are therefore important goals for the user experience of the camera. A DSLR designed for amateur photographers should offer ways to learn and develop their photography skills. It should not be assumed that the user already knows how the camera works and how they obtain the results they want. A similar point is made by Green and Eklundh (2003) who have conducted research

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[2]99% of the questionnaire respondents saw them selves as amateurs (*Section 6.1*). See *Section 1.4* for this thesis' definition of 'amateur'.

[3]The last interviewee wanted to use manual when she had good time, but automatic when she did not.

[4]One of these interviewees had an analog compact camera, while the five others seemed to have digital ones. The interviewees were not asked whether they possessed a compact camera, so whether the three remaining interviewees had used compact cameras or not is not known.

[5]*Section 6.2.5* and *6.2.6*, respectively.

on speech interfaces. They say:

> *One of the key issues for the usability of speech interfaces is that the*
> *barrier for first-time use must be as low as possible, preferably as low as*
> *to afford first-time success.* (Green & Eklundh, 2003, p. 644)

Although Green and Eklundh talk about speech interfaces, the statement still applies for interfaces of DSLR cameras. Users do not need to become high level photographers the first time they use a DSLR, but getting a hint of success will most likely motivate and inspire them to further develop their photography skills. 'Motivate' and 'inspire' are user experience goals for the DSLR [6]. In order to develop their skills in photography, it is important that they experience success using manual settings and not only the automatic. If they can only get good enough results using automatic settings, they might stagnate and never develop from automatic to the manual settings that gives them a greater user control.

Using manual settings, however, proved to be complicated for many of the users. One interviewee said that she spent a year and a half before she figured out how to set her camera manually, and articulated that one needs to know a lot of photo terminology in order to be able to do so (*Section 6.2.9*). Users can easily stick to the automatic settings, due to their simplicity and relatively good results, but in order to take really good photos and to be in control of the results manual settings should be employed, as they give the user the power to form the outcome by setting the shutter speed, aperture, ISO etc. Due to the users' wish of being in control and using the manual settings, changes should be made to the UI design in order to support this. As mentioned in *Section 2.1.4*, for the users to start using manual settings, the settings have to be rather easy to learn and understand[7], so the users can see the advantages and grasp an interest quickly, otherwise they might stop using them (Smith & Mosier, 1986). Suggestions for improvements of the UI

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[6]See *Section 2.1.5.1* for user experience goals.

[7]'Easy to learn' and 'easy to understand' are therefore usability goals for the UI design.

design are described in *Section 8.1*.

7.1.1 Artistic Photos

I found that many of the users in this study had a need to keep memories[8], make art, or master their hobby. They wanted to take pictures of family and friends, vacations, and nature, but most of all, they wanted to develop into taking artistic photographs. Artistic photos stood out as a type of picture that many users were currently not taking, but wanted to use their DSLR to take (*Section 6.1.2*). Answers from questionnaires reflected a desire to take artistic photos that are good enough to pride their walls. During brainstorming, the groups were asked how a DSLR could better support the act of taking artistic photos. It was optional to answer, and group one suggested a function that would produce grayscale photos, but keep one color visible throughout the image. As mentioned in *Section 3.4.2*, Brown and Lowe (2003) present a function called '*Photo Stitching*', which can be used for stitching together pictures in order to make panorama images etc. The thought of capturing and visualizing other aspects than light such as sound, smell, or emotion has been studied at the *Future Applications Lab* in Göteborg, Sweden, and their artistic phenomena of a camera is called '*Context Photography*' (Ljungblad et al., 2004). Criticism toward such a camera has aimed at the lack of user control. The camera was too effortless and did not support personal expressions, it was said. As mentioned in *Section 2.1.4*, user control should be supported, as the users might desist from using the camera if they do not feel that they are in control and are getting the results that they want (Smith & Mosier, 1986). Retaining user control is very important to users, who several times mentioned that they wanted to learn more about photography and master the art of using the camera. Learning to understand and use the parameters such as shutter speed, aperture and ISO will give the skills needed for taking artistic photos while staying in control of the camera

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[8]See *Section 2.1.2* for definition of 'need'.

and its outcome. Visualizing movement using long shutter speed, for instance, is one way of obtaining an artistic effect in an image. Choen and Szeliski (2006) have also presented ways to visualize movement by printing a moving subject to an image several times throughout an exposure. This is an artistic function of *The Moment Camera* that many users would like to have in their camera, while some rejected this due to a wish of using photo-editing software to achieve the same effect.

7.2 Functions

When users were presented with different functionality, there was a great deviation between what functions they did and did not want in their cameras. This can be seen from the table presented in *APPENDIX F*. Many users, however, were skeptical of using functions offering editing capabilities, as they would rather do this in photo editing software. The table shows a low interest for face recognition and manipulation of skin tones, which is one indication of low interest for photo editing. Having a projector in the camera or getting warned about pictures which are out of focus, however, were two functions many users would like to have in their camera. The latter idea was invented by me while designing the interview guide. Interviewees were interested in the idea and came up with solutions about how to implement it in the camera. One such idea was to place it together with information on burned out areas and shadows. A common feature between the users was that they wanted and expected the DSLR to give them many options and possibilities[9], which implicate many functions. Norman (2007) articulates that users want a lot of features and that this is decisive at the time of purchase. Norman continues saying that "*Yes, we want simplicity, but we don't want to give up any of those cool features*" (Norman, 2007, p. 41). This corresponds with some of the answers from the interview in the present study. Thus, users want a user-friendly

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[9]See *Section 6.2.2, 6.2.3, 6.2.4, 6.2.6, 6.2.7*, and *6.2.9*.

camera, but they do not want to miss out on anything when purchasing a DSLR, and therefore often chose the product with more functions[10]. After being presented with a great number of possible functions, the interviewees were more and more concerned about the usability of their camera. Several mentioned that they already had problems understanding their DSLR and that it contained functions they had never used and probably never would use. Interviewees were asked whether it was more important for them to understand the most important functions in their camera, or to have a camera with a lot of functions, and most of them answered that they found it more important to understand and learn the most important functions[11]. "*I would not want a lot of functions just for the sake of having it, because I would probably not have used them*" (*Section 6.2.6*) an interviewee said, while another mentioned that there were a lot of functions in the camera that she did not need. Although having many options can be confusing to amateur photographers, many users want cameras that give them just that: many options, functions and possibilities. For some users, this was a part of the reason for getting a DSLR in the first place. However, the more features there are in a device, the more complicated the UI design gets (Norman, 2002). One solution to the dilemma of many functions vs. a user-friendly camera, is to let users gradually build their own camera by downloading additional functionality.

7.2.1   Downloading Functionality

By employing this solution, a basic and easy-to-use DSLR with few, but important, functions can be offered the users, and additional functionality of the users' own interest can be downloaded whenever they wish to do so. As mentioned in *Section 3.4.3*, an open-source camera with the option of downloading functionality is already worked on at the Stanford Computer Graphics Laboratory and the Nokia

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[10]In addition is price and brand important when purchasing a DSLR (*Section 6.1.1*).

[11]Notice that this opinion is given after they already have purchased a camera and worked with it for some time.

Research Center Palo Alto Laboratory, and might be interesting to take a closer look at if the project of this thesis is to be worked on further. Ways of organizing and displaying information in the menu of the camera was discussed during brainstorming, but their ideas are not considered further as a downloading solution will demand a different type of menu structure than the ones mentioned by the brainstorming groups. Beelders et al. (2008) have found that when users are familiar with a user interface, they are able to adapt to a slightly modified version of that interface. This indicates that a basic camera with a downloading option will be a user-friendly choice. An interviewee said that she would always yearn for the newest and best camera (*Section 6.2.9*). By giving her the option of downloading functionality, she will know that she can always download the newest functions[12]. Since different users want different functions, downloading additional functionality of the user's own interest is a possible solution. As mentioned in *Section 2.1.6*, Cooper and Reimann (2003) state that new products often take time and are hard to learn, and after gaining some experience with them it is frustrating that they still treat the user as a rank beginner. Downloading functionality to a basic camera will make it less frustrating for beginners due to a simple UI base, and after gaining more experience, users can upgrade their camera to suit their experience level and requirements. This will lead to a better utility[13], as the user gets the functionality that s/he wants.

7.2.2 Additional Functionality

The amount of functions to download can be endless and can support different requirements. Taking pictures in the dark or of moving objects were considered hard to do by several of the questionnaire respondents. Choen and Szeliski (2006)

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[12]The quality of the lens and the camera house, on the other hand, will stay the same. The same goes for hardware features, such as a projector or flash on two sides of the camera (proposed during the brainstorming).

[13]Utility is a usability goal mentioned in *Section 2.1.5.1*.

present what they call *The Moment Camera*, which offers a way to capture the dynamics of moving objects in a picture. The camera will also handle scenes with both dark and bright areas by merging two different exposures into one image[14]. Some respondents found portrait pictures hard to take. Choen and Szeliski suggest that *The Moment Camera* records a picture over time, and automatically chooses the moment in time when no eyes of the subjects are closed. Functionality has been developed that releases the shutter when eyes are open (Nikon CoolpixS550), and methods that recognize faces and soften skin have been implemented. This type of functionality can help when taking portrait pictures, but will simultaneously take user control away from the photographer. A respondent mentioned that he did not always get the photographic results he was looking for. Understanding the procedure of photography is crucial in order to understand the camera and stay in control of ones results. As Girgensohn et al. (2001), Smith and Mosier (1986), and Norman (2002) mention[15], too much automatization takes away some important user control, and the user should make the important decisions during photography.

7.3   Reflections upon Usability

Many users are concerned about the usability of their DSLR, and want a camera they can understand, learn from, and take good photos with. Dumas and Redish (1999) state that usability is important to customers when purchasing a product, and refer to a figure presented in *PC Week* (*Section 2.1.3*). It indicates that the UI is the second most important aspect of a product when purchasing, just after reliability. As seen in *Section 6.1.1*, 38% of this thesis' questionnaire respondents selected user friendliness as important when purchasing a DSLR. 50% of the re-

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[14]It's still important to notice that dark areas needs to be captured with a relatively big aperture opening (low number), a long shutter speed, or high ISO to get enough light through the lens (see *Section 2.2*).

[15]*Section 2.1.4*.

spondents selected brand as important when purchasing[16]. Reasons for this can be the quality of the different brands, but also that the respondents found it easier to use and understand one brand than others due to existing knowledge of the camera brand and its familiar UI design. As Beelders et al. (2008) articulate, it is easier to adapt to a slightly changed UI than to an unfamiliar one. Although users seem to consider usability when purchasing, one has to be aware that users often want the products that seem to give them the most possibilities (Norman, 2007). The interviewees were asked whether it was more important to have a camera that was easy to learn or quick to use, and both alternatives were found crucial. An argument for having an easy-to-learn camera was that it is motivating to learn, so having a camera that is quick to learn will inspire to further usage and growth of knowledge.

Throughout the study of this thesis, it has been shown that users blame them selves when not being able to utilize their DSLR. "*It is only me as a photographer who sets the limitations*" an interviewee said, while another related "*I actually see endless amounts of possibilities, but I think a lot also is very hard to do*" [17]. When they do not know how to work their camera, they blame themselves, and not the UI[18]. Some users had used their DSLR for as many as up to seven years, but still saw the need for a beginner course on digital photography. This indicates that the design of their DSLR does not inspire or help users utilize their camera. Smith and Mosier (1986) argue that a user will avoid using a system if s/he can not be in control of the interaction with it. Based on such statements made, improvements to the UI design of Canon EOS 1000D is proposed in *Section 7.5*, and further described and visualized in *Section 8.1*.

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[16]Note that several selections were possible per respondent, but not everyone selected anything at all.

[17]*Section 6.2.7* and *6.2.6*

[18]Other researchers have reached the same conclusion and say that users often blame them selves when not being able to complete a UI task (Newell et al., 2006; Jacko & Sears, 2003).

7.4 Differences in Age and Gender

In accordance with prior research presented in *Section 3.1*, the results from questionnaires for this thesis found that there are some differences in age and gender when it comes to camera use and wishes for future use of the camera . User friendliness was noticed as important when purchasing by a larger number of women than men. Sellen et al. (2004) mention a study indicating that youth take more pictures of their friends than older people do. As seen in *Section 6.1.2*, there is a slightly lower average age for those wanting to take photos of family and friends than most of the other options given to them. The study mentioned by Sellen et al. found that men capture more photos of practical usage than women do. This is reflected in the present study, where more men than women wanted to take documentary photos. One male questionnaire respondent wrote that he took photos of things that he had to remember. Taking artistic photos is desirable by more women than men. In accordance to earlier studies presented in *Section 3.1*, this indicates that men are more functionally directed, while women are more artistically directed when photographing. The differences presented here are, however, not dramatic, but can influence the study knowing that there were 2.8 times more women than men and an average age of 36 among the questionnaire respondents. There were also more women than men, and the users were mostly over 30 years, participating in interviews, usability tests and brainstorming[19].

7.5 Improving a User Interface

It was articulated in an interview that the UI of Canon's DSLR cameras is better for first time users than Nikon's UI is. Still many complications were found on the UI of Canon EOS 1000D during interviews, usability testing, and brainstorming.

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[19]There were, however, some users under 30 and of both gender participating in every method used.

Research done for this thesis shows that parts of this UI appears confusing to many users, and that several users do not like to read manuals. I will suggest improvements for redesign of a UI in the remaining of this chapter.

7.5.1 Icons vs. Text

Making good and descriptive icons is complicated, and a discussion on whether icons or acronyms should be used for the camera's UI design was taken up during the brainstorming. Each group was asked to decide what functions to keep on buttons and to draw icons for them[20]. Group two wanted to keep all acronyms and icons that were well acknowledged, but also to make an icon to replace 'WB'. Group three wanted to keep 'ISO' and 'AF/MF', but wanted to make icons for the rest of the buttons. Three participants mentioned that they often did not understand icons and therefore liked words much better. Other participants disagreed, and said that many words were too long to spell out and that an acronym would not always be understood. They pointed out that there are good icons, such as the garbage can, and that new icons could be just as good and standardized with time. Research is done on the usability of icons vs. descriptive text, and both alternatives are found to be just as affective (Beelders et al., 2008; Benbasat et al., 1993). An information button was suggested as a solution to the issue of icons vs. text.

7.5.2 Information Button

Before this suggestion, an information button was already thought of. The idea was raised from the fact that users participating in the usability test had problems understanding icons and how to carry out different tasks, and that interviewees expressed that they did not read manuals, but would rather find out about their camera by using it. During the brainstorming, members of each group were asked to comment on the idea of having an information button on the camera. Many users

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[20]see *APPENDIX K* for a list of the functions chosen by each group.

got eager and agreed with statements such as "*Yes, that's a good idea!*", "*Help button, yes please!*", or "*Very good idea!*"[21]. An interviewee said that she took a course on digital photography to learn the terminology she needed, and added that it was hard to look up things in the manual when she did not know what terms to look for. Providing an information button marked with 'info', 'i','?', or 'help' will support users in getting to know the camera while using it. A usability goal for the UI design of a DSLR is for it to be easy to learn, and a help button can support this. The user manual is not always available when a problem or question occurs during photography, but the camera always is. Having a help button providing information, and perhaps also examples of use, should be motivating for the users during photo shoots. Photography examples can also be supportive of creativity, which together with 'being motivating' are important goals for the user experience of the camera due to the users' wishes for utilization. Two interviewees mentioned that they would like interactive courses[22], which is something the information button, to some extent, should cover. It will assist the users when learning how to use the camera. The design idea, generated from this empirical study, is to let the button be activated simply by clicking it while being in any mode. This click makes information about the mode pop up on the display and notify the user about its usage. The button can be helpful for the users in the very beginning, especially the first time they use a new function. It should not bother the users later on since the information is only provided when the button is pressed, and they can choose not to have the information displayed when it is not necessary. As mentioned in *Section 2.1.6*, this is crucial for the users not to be annoyed by the information offered them (Cooper & Reimann, 2003).

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[21]Nikon have already applied a help button to some of their cameras. This button does not, however, cover all the information that should be given in order for the users to learn from it. For instance, on the Nikon D90, a help button gives information about what the automatic settings are, but not what manual settings are or how to use them.

[22]*Section 6.2.3* and *6.2.6*.

7.5.3 Aperture and Shutter Speed

Results from the usability test strongly indicates that even basic tasks, like changing the aperture, was problematic to several users. An interviewee said that she never understood shutter speed and aperture, and therefore quickly forgot how to use them. None of the users of the usability test who tried to change aperture with the camera set to 'M' managed to do this fundamental task. They understood that they had to move the cursor from the shutter speed number to the aperture number displayed on the screen, but not that they had to use the button marked 'Av' to do so (See *Figure 4.1*). They also were not able to associate the letters 'Av' with aperture. They did, however, recognize both the aperture and the shutter speed values on the display. One of my suggestions is therefore to change 'Av' to 'F', *'f'* or *'f*-stop', as this is used on the display. Using the same letter/s throughout the UI design will make it easier for the user to make a connection between components belonging together. It will give much more consistency and better mapping, which are important principles within interaction design[23]. Several interviewees and brainstorming members mentioned that the icons for manual settings were incomprehensible and not intuitive[24]. During the brainstorming session, ideas for other icons were given. While one brainstorming group would like a norwegian substitute to 'Av' and 'Tv' displayed on a LCD screen, another group drew icons to replace the acronyms (*Figure 6.11*). 'Tv' was confusing to many users. A member of group two said that the way it is displayed today, she figures out what setting to use by choosing either one ('Av' or 'Tv') on the wheel, and see from the display whether it is the right setting to use or not. The word 'TIME' could be a better solution than 'Tv', as it nicely describes the shutter speed and might be better perceived by the users. By changing 'Av' and 'Tv' to for instance 'F' and 'TIME', the visualization of the two choices will not be as equal as before. Another solution to the issue of

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[23]See *Section 2.1.5.2* for usability principles.
[24]See *APPENDIX G* for icons the interviewees understood and not.

the 'Av' button is to reorganize the buttons, and make it possible to use the arrows to maneuver the screen. At least two of the four users trying to set the aperture while being in 'M' mode tried to use the 'AF' (right arrow) button to do so. This indicates that using the arrows to maneuver the cursor on the screen is intuitive to the users, and the design should therefore support this action. When maneuvering the screen, arrows afford being used[25]. This solution is integrated in the prototype shown in *Section 8.1*, as all functionality is taken away from the arrows and they are only used for maneuvering the screen.

7.5.4 Consistency

During the usability test, users were asked to change the focus point of activation. Seven out of the nine users clicked the 'SET' button after maneuvering to the right focus point. They thought this would confirm their choice, while it was instead setting the focus point to the center. None of the users managed to do this task on their first try and several struggled with it for quite some time. Since the 'SET' button is used for choosing and confirming in other modes, it should be used for this purpose when setting the focus point as well. Consistency in the UI design is crucial for the user to understand and remember how to use the camera. Five users compared the 'SET' button to the 'ENTER' button on a computer, which is used for choosing and confirming as well. This type of button is rather standardized and affords being used for the act of choosing or confirming.

7.5.5 Utilization of the Screen

I found throughout this study that the screen of a DSLR is heavily relied upon by its users. We are surrounded by screens providing us with information in our everyday lives, and this might be part of the reason why users turn to the screen for information. Many users were looking for information on the screen during the usability

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[25]See *Section 2.1.5.2* for definition of affordance.

test, and this tells us that the screen affords giving relevant information. The users used the screen to find out whether their choice of settings were correct (*Section 6.3.1*). Knowing this, it will be wise to consider the screen when (re)designing a DSLR. To avoid confusion, the UI design of the screen has to be clear, descriptive, and support principles like visibility, consistence, and feedback among others. When clicking a button and entering its menu on Canon EOS 1000D's UI design, the only way to get back out is to choose between the alternatives given in the menu. This has proven to be confusing for users, and one interviewee mentioned that she never knew how to get out of a menu when accidentally accessing it (*Section 6.2.1*). One participant was afraid of clicking buttons, while another had a hard time getting out of the AF menu after accessing it. This could easily be avoided by making it possible to click the same button over again to get out of the menu it accessed. Since the users accessed the menu through a quick button on one of the arrows, a second click on the same button moves the cursor in the menu according to the arrow's direction. This is one good reason to take functionality away from the arrows, and free the arrows, so they can be used for maneuvering only.

7.5.6   One Step Operation

Although most of the users in the usability test understood that they had to use the WB button to set the white balance, they had problems understanding all options given to them when entering the WB menu. Many did not understand that 'custom' would let them set their own WB. Even when the users knew to use 'custom', they had problems understanding how to carry out the task. A user complained that there was no information given when setting the WB and that this made her very insecure. To accomplish the task, three separate steps have to be carried out without getting any feedback or constraints to ease the task: 1) Clicking the WB button and choosing 'custom' in the WB menu, 2) Taking a picture of a white area, and 3) Accessing the main menu, finding 'custom WB', and

choosing the picture just taken as the one to set the WB with. This task should be redesigned in order to let the user feel like it is done in one operation, and not three separate ones. As mentiones in *Section 2.1.5.2*, users should not have to remember several steps throughout an operation, but rather be given constraints and feedback to guide them towards the right action. The WB function should be placed either in the menu or on a button, but not both. When choosing 'custom', the user should be asked to take a picture of a white area, and if the camera has a 'live view mode'[26], this could turn on to signify that the user needs to take a picture. When the picture is taken, the message "White balance is set according to picture taken" should be given on the display. This feedback is important for the user to feel safe, know the state of the camera, and also see the result of his or her actions. The solution will not change the UI design drastically, but remove step 3, accessing the main menu, and make the task more coherent. When a choice, like 'custom', is highlighted, a short text for that choice appears. This text could have been longer and more descriptive. A suggestion to text for 'custom' is given in the visualization of the prototype in *Section 8.1*.

7.6   Recap

Results from the empirical study were discussed in this chapter. Tendencies were found toward users' thoughts about the usability of the DSLR and how they wished to use the DSLR. Results from the usability test of Canon EOS 100D were also discussed. Suggestions to improvements of a DSLR were presented and given reasons for. The findings are concluded upon and visualized in *Chapter 8*.

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[26]'Live view mode' is when the the motive in the viewer shows up on the screen like it does on compact camera. Though Canon EOS 1000D does not have a 'live view mode', several other SLRs do.

Chapter 8

Conclusion

I began this thesis by raising the following research questions: 1) "*How do amateur photographers use a DSLR designed for their level of photography skills, and how do they wish to use a DSLR?*" and 2) "*How can the users' use and wishes be supported in a redesign of the UI of a DSLR?*". These research questions have been discussed based on the extensive empirical material that was gathered for this thesis using questionnaire, interview, usability test, and brainstorming. Questionnaires were handed out at several beginner courses in digital photography in order to reach the right user group. Answers were gathered from 115 amateur photographers, who were setting the ground for further research. Users' wishes for use of a DSLR were carefully gathered and investigated. Findings, such as their wish to use manual settings and take artistic photographs or have a user-friendly camera with many functions, were taken further into an investigation of the UI design of DSLRs and the interaction between the user and the camera. Improvements to the UI of the Canon EOS 1000D were suggested based on the results of the study. Usability goals, and user experience goals that were found for the DSLR, such as having good utility or being helpful and motivating etc., were also considered when designing, and usability principles mentioned in *Section 2.1.5.2* influenced and substantiated the design.

Learn and Develop Skills

In the discussion of this thesis I have showed that the users got their DSLR because they wanted to take better photos than they were currently taking. They wanted to take more artistic photos, learn more about digital photography, and develop their skills with the camera. The users wanted to start using more manual, and less automatic, settings. Using manual settings is not only a requirement from the users, but is also essential for them in order to be able to take artistic pictures and for learning and developing skills within photography and the DSLR camera.

As mentioned in *Section 7.5.2*, a help button will support a development of the photographer's skills. It will provide information about what a button or a mode is, how to use it, and what the result of using it might be. The button can provide help at any time, as opposed to the camera's manual, which is often out of reach during photography. The photographer does not need to know photo terminology to look up information, as opposed to when looking for information in a manual. S/he can browse the camera and use the help button to get information about the current mode. The button will be helpful and support learnability.

Functionality vs. Usability

Another important issue emerging from this study was that many users wanted a lot of functionality in their camera, but that the type of functionality could vary a great deal. Several users had DSLRs with functions they never used, which is considered rather bad utility[1]. In addition to many functions, the users were also interested in having a user-friendly camera and this was pointed out several times. The more functionality in the DSLR, the more complex the UI gets (Norman, 2002). A user-friendly DSLR is crucial for the users in order to learn and develop and be able to take the artistic pictures that they want to take.

A solution to the issue of a lot of functionality vs. usability is to provide the

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[1]Having good utility is a usability goal for the DSLR and is mentioned in *Section 2.1.5.1*.

users with a camera containing basic functionality and with an option to download additional functionality at any time. The solution will improve the utility of the camera as the users will be able to download functions of their own interest and do not need to worry about functions they do not want. The users would be able to learn the few and important functions of their camera such as shutter speed, aperture, ISO etc., and they would rather upgrade the camera when they feel ready for it. This will provide the users with an option of a comfortable and gradual learning curve. The solution will also assure users that they get access to a lot of functionality, which is important for many users. A photographer's requirements might change over time, and downloading and deleting functions might therefore be a good solution for photographers who want to update their camera along with their skills and interests[2].

The Knowledge Leading to a Redesign of Canon EOS 1000D's UI

I have learned from this study that amateur photographers wish to use manual settings and take artistic photographs. I find it interesting that the users seem to blame themselves when not being able to utilize their camera. They saw their own lack of knowledge as the problem, while the camera was seen as user-friendly and infallible[3]. I think the idea of a help button and an option of downloading additional functionality to a base camera will support usability problems that occurred during this research. Improvements of the UI of Canon EOS 1000D are explained in the following section of this conclusion, and a prototype is made to visualize it. The design is made in accordance with several important usability principles and is made based on the users' thoughts, ideas, and behavior.

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[2]New camera houses and lenses might still be purchased over time in order to get a better camera.

[3]After working together with the users for some time, they started to focus more upon the problems they had with the camera and were able to point out camera's limitations.

8.1 Prototype and its UI Design

A prototype was implemented in order to visualize the UI changes that were discussed earlier in *Chapter 7*. Not many drastic changes were made to the UI and the prototype is not fully functional, but is based on the main topics discussed throughout this thesis and the results from the tasks given during the usability test. The prototype can be further used in additional research, be usability tested, analyzed, and then redesigned. See *Figure 8.1 - 8.3* for still images of the prototype. The prototype can be found on this address:

http://folk.uio.no/ierekaa/Prototype/Prototype.html

The functionality that is changed and applied to the prototype is:

- **AF button**: One can set the type of auto focus and the focus point using the same button. The SET button is used for selecting.

- **WB button**: The WB can be set manually by choosing custom and SET. The task is more coherent than before. When asked to take a picture, SET has to be clicked because the shutter button is out of reach on this prototype[4].

- **'Disp'**: Is not changed, but can be clicked on and off.

- **Help button**: Can be used for getting information about 'M' mode, 'AF' mode, and about 'custom' in 'WB' mode.

Since the remaining buttons stay the same, they are not given any functionality in the prototype. Due to the downloading option, the menu will be changed, but its design is not considered in this thesis and therefore not included in the prototype. Salovaara et al. (2009) state that the designer should support the user's comprehension of a device and how it works. Some users tried to use the arrows to maneuver on the screen, and several had problems getting out of a menu they had

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[4]In the real version the shutter button would be used for this, but the image the prototype is made from makes this impossible here.

accessed with one of the arrow buttons. When trying to click the button again to get back out, they were only maneuvering in the menu and had to make a choice to get back out. This indicates that arrows afford being used to maneuver the screen and that when a quick button to a function is clicked and its menu is entered, the button affords being clicked again to exit the function. As mentioned in *Section 2.1*, Norman (2002) says that social conventions that people understand by nature should be implemented in the design of a product. Using the arrows for maneuvering only will support this and will also support the users' mental model of the arrows. They will no longer be used as quick buttons to different functionality, but will be used for maneuvering the screen only. It will provide better mapping between the buttons and the screen, and be more consistent as the arrows are always used for the same thing: maneuvering. The maneuvering functionality is not fully added to the prototype, but the arrows can be used to maneuver between the shutter speed and the aperture values as well as the different options in the 'AF' and 'WB' menus. The 'Av' button is removed because one click on the left arrow will give the same result. The star button (*) is also removed. All this button did was to make shutter speed visible in 'Av' mode and aperture visible in 'Tv' mode. The reason for taking it out on this prototype is that these values should always be visible in order to boost the learnability of the DSLR by helping the user learn the relationship between shutter speed and aperture by seeing one component change in relation to another[5]. Two new buttons were made. The first button is placed down to the left for 'WB' and is given the functionality that was originally placed on the left arrow. Its functionality can be reached with two keyclicks on the arrows with the prototype's UI design and might therefore not be necessary, but is still given a button because the issue of whether to give it a quick button or not was not carefully studied and therefore it will not be changed. The other button is a 'help button', which was carefully discussed in this thesis. The button is marked with a

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[5]The values should rather be made gray to indicate that they can not be changed. Making unchangeable variables gray is a standard in computer programs.

question-mark and will give information about any mode on the camera (*Section 7.5.2*). The button will most likely be helpful, motivating, and supportive of creativity as it will help users learn and understand their DSLR. The 'SET' button was an issue during the usability test. In this prototype it works the same way for every function and is therefore more consistent and support the users' mental model better than the old design. It sets and confirms a choice, also when selecting focus point. Custom-setting WB was proved to be difficult, and an improved design is applied to the prototype. When choosing 'custom' in the 'WB' menu, a message saying "Take a picture of a white area to set the white balance correctly" appears on the screen. When the photo is taken, the WB is automatically set, and a message saying "White balance is set according to picture taken" will appear on the screen in order to give feedback to the user. By applying feedback, setting the WB manually will be a much more coherent task and the user will know at any given moment what the camera is doing as well as what s/he has to do. The change is made on the prototype, but since the shutter button can not be seen on the prototype, the SET button has to be clicked instead. Autofocus and focus points are now put on the same button because they both deal with automatic focus. Some users tried the 'AF' button when they were asked to change the focus point during the usability test, which indicates that users associate these two with each other and that the users' mental model shows that they belong together.

8.2   Interesting for the Field of Interaction Design

The empirical case study I have conducted for this thesis has a novel approach toward the usability of DSLRs based on amateur photographers' wishes for the camera and ways of handling it. As a result of this study I have come across several design issues that, to the best of my knowledge, have not been addressed in the past. The users' thoughts on functionality and their mental model of the

Figure 8.1: An image of the prototype.

Figure 8.2: The AF menu and the WB menu of the prototype, respectively.

Figure 8.3: Help messages for manual mode (M) and custom WB, respectively. When there is more information than what can fit to one page (left), an arrow appears under the message, and the arrow buttons on the camera can be used to maneuver between the different sections of the message.

arrows and the problems that occurred with Canon EOS 1000D's current design are examples of this. More and more people are purchasing DSLR cameras. It is therefore important to investigate the usability of these devices. Some of the methods, or combination of methods, used for this thesis are not normally used within interaction design. They did, however, lead to a thorough understanding of the users. With this understanding some relatively large modifications, such as downloading functionality to the camera, were suggested. My research procedure might therefore be worthy of imitation by other usability researchers in order to find the bigger issues of a design. A great number of users studied for this thesis found their DSLR to be very user-friendly. However, when given photography tasks to perform, several problems occurred. Even basic tasks, such as setting the aperture or the WB, were found to be complicated. This is an interesting paradox that strengthens the statement given by several researchers such as Blomberg et al.(1993), Preece et al.(2002), and Wickens et al.(2004) and *4.4.6*, saying that what people say and what they do may not always be the same. Observing users in addition to talking to them will therefore strengthen the results of a study.

8.3   Additional Research

This study was conducted over a period of eight months, but due to the time limit, there were some areas that could not be covered to the fullest extent. A prototype for visualization was implemented, which can further be tested and redesigned in order to improve the UI. Nikon has a UI where the opening of the shutter is visualized with an interactive drawing of the shutter blades (Steve'sDigicams, 2010), while Sony has now released a compact camera with the typical features of compact cameras, but with the possibility to change the lens (Moynihan, 2010). During a design process, several prototypes should be implemented in order to try out different designs (Preece et al., 2002). If the project of this thesis could be

taken further, different prototypes, with different file structures and designs, would be made and tested. Several design proposals were given by the participants of the brainstorming session, and some of these can be implemented in additional prototypes. One idea is to give the DSLR fewer buttons and a bigger screen, or no buttons and only a big touch screen. This idea arose from the brainstorming sessions, users' utilization of the screen during usability testing, and their comments toward a screen that was too small. Some of the ideas that came up during the study was unfortunately not prioritized in this design process due to the time limit such as file structure, comments on icons vs. text, and different types of functionality. If considering a touch screen, an investigation on buttons vs. direct manipulation on the screen should also be carried out. After finishing this thesis, I see that some of the research done, such as investigating differences in age and gender, were not so necessary. If I was to continue this research, I would like to follow some users around while they are using their camera in order to observe them in real scenarios and ask them questions about their actions and wishes for the camera as they carry out their photographic endeavors.

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APPENDICES

Appendix A

Questionnaire

Spørreskjema i forbindelse med forskning på brukergrensesnitt:

Det kan alltid settes flere kryss om det er flere alternativer som passer.

1. Fødselsår:

2. Kjønn (ring rundt):   Kvinne   Mann

3. E-post (er frivilling, vil kun benyttes til forespørsel om videre samarbeid): _____

4) Hvilket digitalt speilrefleks kamera (SLR) har du (merke og modell)? : _____

5) Hva spilte inn på valget av kameraet? (sett kryss og svar på annet):

Pris		Tester på internett/TV		Brukervennlighet		Design		Vekt	
Merke		Anbefalt av bekjente		Antall piksel		Farge			

Annet som spilte inn:

6) Hvor lenge har du hatt et digitalt speilrefleks kamera?: _____

7) Hvor lenge har du brukt et digitalt speilrefleks kamera aktivt?: _____

8) Har du før ditt nåværende Digitale SLR kamera hatt ett eller flere av disse (Hvis ja, sett kryss):

Digitalt kompaktkamera		Analogt kompaktkamera		Annet	
Digitalt speilrefleks kamera		Analogt speilrefleks kamera			

9) Bruker du SLR kameraet ditt på andre måter enn tidligere kamera? Hvis ja, hvilke?:

10) Hva bruker du kameraet til?:

1. Kunstneriske bilder		4. Ta feriebilder	
2. Bilder av dyr		5. Dokumentasjon	
3. Fotografere familie og venner		6. Naturbilder	

Beskriv med egne ord hvordan kameraet brukes:

11) På hvilken måte ønsker du å utnytte kameraet ditt? (benytt tall fra skjemaet over): _____
   Annet (gjerne mer utfyllende):

12) Benytter du mest ferdigprogrammerte fotoinnstillingsvalg (eks: ikon av blomst eller ansikt) eller manuelle innstillinger av f.eks. blenderåpning, lukkertid og ISO?:

Programmerte innstillinger (ikon)		Manuelle og halvmanuelle		Begge deler like mye	

13) Hvilke gode og dårlige egenskaper ved ditt kamera legger du vekt på?:
Gode:

Dårlige:

14) Hva synes du er ekstra lett å få til når du fotograferer med ditt kamera?:

15) Hva synes du er heller vanskelig med ditt kamera og hvilke type bilder er det vanskelig å ta?:

16) Vil du betegne deg selv som ekspert- eller amatørfotograf?:

Appendix B

Information Letter - Questionnaire

Dette spørreskjemaet er en del av datainnsamling i forbindelse med en masteroppgave i Digitale Medier ved institutt for informatikk, Universitetet i Oslo. Oppgaven omhandler digitale SLR kamera og interaksjonsdesign. I tillegg til spørreskjemaet skal jeg senere holde intervjuer, workshop og observasjon av interaksjon med et digitalt SLR kamera (brukbarhetstesting). Det kan bli gjort lydopptak av intervjuer. Du kan få tilbud om å være med på intervju, workshop eller brukbarhetstesting om du fyller inn e-post adresse i spørreskjemaet. E-post adressene skal ikke brukes til noe annet enn dette og holdes konfidensielle. Alt av materiale vil oppbevares og behandles konfidensielt. Jeg, Ingrid Elise L. Rekaa, og mine veiledere Jo Herstad og Sisse Finken, er de eneste som har tilgang til dataene som samles inn. Hele prosjektet skal være avsluttet 1. juni 2010, og alt av lydopptak og e-post adresser slettes da. Et samtykke til deltakelse kan til en hver tid trekkes tilbake så lenge studien pågår. Prosjekt og datainnsamling er meldt til Personvernombudet for forskning, Norsk samfunnsvitenskapelig datatjeneste AS.

Det er frivillig å delta. Hvis du ikke ønsker å delta eller senere ønsker å trekke deg, vil ikke dette få innvirkning på ditt forhold til kursholder.

Mvh

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Appendix C

Interview Guide

Intervjuguide

1.1. Hvorfor kjøpte du et DSLR kamera?
1.2. Hva forventer du av et DSLR kamera?

2.1. Hva synes du om brukervennligheten til ditt kamera? Hvorfor?
2.2. Hva er lett og hva er vanskelig å få til innen fotografering med ditt kamera?

3.1. Bruker du manuelle eller automatiske innstillinger? Hvorfor? Hvordan?
3.2. Ønsker du å bruke manuelle eller automatiske innstillinger i tiden som kommer? Hvorfor? Hvordan?

4. Diskutere disse ideene, også i forhold til brukerkontroll:
- Persongjenkjenning av fotograf
- Photo Stitching
- Fange bevegelse av flere tider i ett og samme bilde
- Ansiktsgjenkjenning og automatisk utglatting av hud ol.
- Få tilsendt forslag om fotokonkurranser som passer bildet som er tatt
- Et kamera som sier ifra dersom et tatt bilde er uskarpt
- Projektor i kameraet
- 3D fotografering

5.1. Hvilke muligheter ser du ved ditt kamera?
5.2. Hvor mye tid er du villig til å nedlegg for å lære deg å bruke de funksjonene kameraet tilbyr?
5.3. Er det funksjoner du skulle ønske du hadde, men som du ikke har?
5.4. Er det funksjoner du aldri bruker?
5.5. Hvordan synes du det er å forstå den funksjonaliteten som er i kameraet?
5.6. Er det viktigst for deg at kameraet gir mange muligheter og funksjoner, eller at det er lett å forstå de viktigste funksjonene?

6.1. Hvordan er det å lære seg å bruke kameraet?
6.2. Når du ser på kameraet, er det noe du kan fortelle meg hva er bare fordi det ligner på ting du vet fra før eller ser andre steder i dagliglivet? (I forhold til mapping)
6.3. Når du ser på kameraet, hva ser det ut som de ulike delene av kamerat skal brukes til? (I forhold til affordance)
6.4. Er det viktigst for deg at kameraet er lett å lære eller at det er raskt å bruke når du først har lært deg det?

7. Er det noe jeg ikke har spurt om som du synes er viktig å få frem?

Appendix D

Usability Test - Canon EOS 1000D

Brukbarhetstest av Canon EOS 1000D

Oppgaver:

1. Ta et bilde med lang lukkertid

2. Ta et portrettbilde av meg, der jeg er i fokus, mens bakgrunnen er ute av fokus

3. Still hvitbalansen til å passe dette rommet. (Får tildelt et hvitt ark)

4. Still kameraet til å kun benytte det høyre fokuspunktet

Appendix E

Information Letter - Interivew and Usability Test

Dette intervjuet og brukbarhetstestingen av Canon EOS 1000D er en del av datainnsamlingen i forbindelse med en masteroppgave i Digitale Medier ved institutt for informatikk, Universitetet i Oslo. Oppgaven omhandler digitale SLR kamera og interaksjonsdesign. Det blir tatt lydopptak og notater av intervjuet. Alt av materiale vil oppbevares og behandles konfidensielt. Jeg, Ingrid Elise Løvlund Rekaa, og mine veiledere Sisse Finken og Jo Herstad, er de eneste som har tilgang til dataene som samles inn. Hele prosjektet skal være avsluttet 1. juni og alt av e-postadresser og lydopptak slettes da. Et samtykke til deltakelse kan til en hver tid trekkes tilbake så lenge studien pågår. Prosjekt og datainnsamling er meldt til Personvernombudet for forskning, Norsk samfunnsvitenskapelig datatjeneste AS.

Det er frivillig å delta.

Mvh

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Appendix F

Overview of Question 4 in Interview

	Interview 1	Interview 2	Interview 3	Interview 4	Interview 5	Interview 6	Interview 7	Interview 8	Interview 9
Recognition of photographer	YES	YES	OK	NO	YES	NO	OK	NO	OK
Photo stitching	YES	NO	YES	NO	NO	YES	YES	YES	YES
Catch movement from different times	OK	YES	YES	NO	NO	YES	OK	YES	OK
Face recognition and manipulation	NO	NO	YES	OK	YES	NO	NO	NO	NO
Get photo contest info	NO	NO	YES	NO	YES	OK	OK	NO	YES
Message when picture is out of focus	YES	YES	NO	YES	YES	YES	NO	YES	YES
Projector in camera	YES	YES	YES	NO	YES	NO	YES	OK	YES
3D photography	NO	OK	OK	YES	NO	NO	NO	NO	NO

Appendix G

Overview of Question 6 in Interview

	Interview 1	Interview 2	Interview 3	Interview 4	Interview 5	Interview 6	Interview 7	Interview 8	Interview 9
Easy-to-understand things	arrows, play, garbage can, magnifier, menu button, flash, place for battery and memory card, cable in and out lets, on/off button, automatic functions	ISO, turn the wheels, on/off, icons for automatic settings, garbage can, play, self timer, WB, exposure button, menu button, display, magnifier	magnifier, the icons of the automatic settings, M, menu button, display, arrows, info button, garbage can		arrows, automatic settings, other icons that is used on compact cameras	garbage can, play, WB, the icons of the automatic settings		icons of the automatic settings, menu button, garbage can, arrows,	on/off, ISO, icons for automatic settings,
Not easy to understand	disp button, everything that is not mentioned over	the letters for manual settings		Disp	the letters of the manual settings	Av+-, *, Disp, M, Av, Tv, P		the letters of the manual settings	the letters of the manual settings
Can easily see how to use it	display for seeing pictures, viewfinder, flash holder, where to hold, click buttons, turn wheel	AF/MF, flash				click buttons, turn wheels, hold. Can forget to use the viewfinder			everything

Appendix H

Table from Usability Test

Nr	Camera	Task 1		Task 2		Task 3						Task 4			
		Setting	*Success*	*Setting*	*Success*	*Menu*	*WB*	*Other button*	*Custom*	*Other setting*	*Success*	*Menu*	*Focus button*	*SET*	*Success*
1	Canon	Tv	Yes	Automatic	OK		x			x	*No*		x	x	*No*
2	Olympus	M	No	M	No		x	x			*No*			x	*No*
3	Nikon	M	Yes	M	No		x			x	*No*	x			*No*
4	Canon	M	Yes	M	No		x	x	x		*No*		x	x	*No*
5	Canon	Tv/Av	Yes	Av	Yes		x	x			*No*		x	x	*No*
6	Canon	Tv/Av	Yes	Av	Yes		x	x	x		*No*		x	x	*Yes. Not first time*
7	Canon	Tv	Yes	Av	Yes		x	x			*No*	x		x	*No*
8	Canon	Tv	Yes	Av	Yes	x					*No*	x			*No*
9	Nikon	Automatic	Yes	Av	Yes	x	x		x		*Yes*	x	x	x	*Yes. Not first time*

Appendix I

Brainstorming Session

Brainstorming guide

I will wish the participants welcome, inform them about the activities, and let them know why and how I will use the collected material.

Part 1 (40 minutes)

Question 1: Mention important functions that should be in every camera. What functions do you wish to have in a future camera?

Task 1: You are given all the functions of Canon EOS 1000D on notes. You are to group these and make a file structure for the camera. Then make simple icons describing each group. Decide what functions you want to put on buttons (easily available). Functions you do not know what is are to be noted, and if you find unnecessary functions, tear them in two and put them aside.

Task 2: Draw icons for the functions you decided to put on buttons. If you cannot decide upon a good icon, you are welcome to draw several.

Additional question: How can a camera support the act of taking artistic pictures?

Break containing buns, tea, coffee, soda pop, and sweets + presentations and discussions of results (20 minutes)

Part 2 (40 minutes)

Question 1: What do you think of a help button on the camera that can tell you what a mode or a button is and does?

Question 2: How do you understand the letters 'Tv' and 'Av'? Should this be replaced by something else? In such case, what? How do you understand the numbers for shutter speed and aperture on the screen? Should this be replaced by something else?

Question 3: What do you think about the idea of buying a simple, but good camera, with few functions, and with the opportunity to download additional functions later on?

Task 1: Draw one or several interfaces for the camera the way you would like it to be (shape and buttons). You will get some pictures for generatig ideas.

Presentations and discussions of results (20 minutes)

Appendix J

Question 1 by Group 1 - Functions

Functions

- Autofocus
- Flash
- Light measure
- Face recognition
- Precise cut
- Zoom
- Put together two halves of faces in one image
- That the picture is shown on the screen after it is taken
- Screen
- Viewer
- White Balance
- Compensation for too much light in a picture in proportion to the main motive/subject (ex. a person in front of a window)
- Short time between every picture taken.
- Picture programs (macro, portrait, landscape)
- Taking the picture first when people's teeth are exposed (smiling) or when their eyes are open.
- Film
- Delete function
- Regret delete function
- Zoom in a picture taken
- Remote control for taking pictures (they would like there to be a function on their mobile phone for this, so an extra devise is not needed)
- Take pictures over each other and with different luminous intensity with one click.
- Scrolling (all functions alphabetically on the first page)
- Explanation for different menu settings.
- Touch screen. Click a letter (ex. "b") and all the functions starting with that letter will turn up.
- Flash on each side.

Appendix K

Function Overview

	Group 1	Group 2	Group 3
Wanted on buttons	* AF point selection * ISO * Flash * Delete images * Play * Magnifier	* AF point selection * Garbage can * Play * Magnifier * Flash * WB * ISO * AF/MF	* ISO * Flash * AF/MF * Magnifier * Garbage can * Play
Not understood	* Drive mode * Color space	* Firmware Ver. * Custom Functions * Auto play * Print order * Transfer order * Screen color * Drive mode * LCD off/on btn	* Dust Delete Data * Transfer order * Drive mode * Firmware Ver.
Not wanted in camera	* Beep * Firmware Ver. * Print order * Transfer order		* Live View function settings * Screen color * LCD off/on btn * File numbering * Print order * Erase images