

User Experience Design in an Axis Camera Setup Interface

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User Experience Design in an Axis Camera Setup Interface

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Sammanfattning

I en värld där UX-standarden höjs av att använda välutvecklade vardagsprodukter, förväntas det bättre och bättre UX Design av alla produkter inom IT-branschen. Man skulle kunna säga att UX Design inte bara är avgörande för den framtida positionen på övervakningskamerabranschen, utan även ett krav för att möta efterfrågan av att det inte längre endast är experter som installerar kameror. UX Design kan också skapa en ekonomisk vinst eftersom det sänker behovet av support och utbildning samtidigt som det ökar försäljningen genom att stärka varumärket.

Vi har skapat en installationswizard genom flera iterationer. Med en grundlig bakgrundsstudie har vi lärt oss att använda etablerade UX Design-metoder, som till exempel användningstestning. Dessa iterationer har lett till totalt fyra designprototyper där varje steg av wizarden har blivit designad på papper, utvecklats till en mid fidelity Balsamiq Mockups-prototyp och genom processen blivit en välutvecklad och klickbar high fidelity-prototyp. Prototyperna har skapats genom att använda etablerade designregler, de senaste designtrenderna och Axis Communications nya grafiska profil.

Med direkt feedback, minimalistisk design, färre tekniska termer, smarta förslag och automatiska inställningar har vi skapat ett mer effektivt sätt att installera en Axis-kamera som även uppmuntrar användaren att göra ändringar samt utforska inställningarna.

Abstract

In a world where the UX-standard is rising from the use of well-developed everyday products, better UX Design is becoming more and more expected of all products within the IT-industry. It can not only be argued that an investment in UX Design is critical for the future position on the surveillance camera industry, but also required to meet requirements of the non-experts installing the camera. UX Design could be also be an economical profit as it will lower the need of support and education, while also increasing sales through branding.

We have created an installation wizard through several iterations. With a thorough background study we have learned how to use established UX Design methods, like for example usability testing, to the fullest. These iterations have created a total of four design prototypes where every step of the wizard has been designed by paper, evolved to a mid fidelity Balsamiq Mock-ups prototype and through the process become a mature and clickable high fidelity prototype. The prototypes have been made using established design rules, latest design trends and Axis Communications' new graphic identity.

With instant feedback, minimalistic design, less technical terms, smart guessing and automated settings we created a more efficient way to install an Axis camera while also encouraging the user to make changes to and explore settings.

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Glossary

API Application programming interface. Specifies how software components should interact with each other.

Capture frequency To reduce flickering on the video stream, the frame rate used should be a factor of the frequency from the local electric mains. This would mean a user from the US should choose 60 Hz and 20, 30 or 60 FPS. Users from Japan can choose both 50/60 Hz and a suited frame rate while the rest of the world have 50 Hz and should use 12.5, 25 or 50 FPS.

FPS Frames per second, also called *Frame rate*. Higher FPS would mean a smoother image, but demands more bandwidth or storage.

IxD Interaction Design. See section 2.2.1 at page 12.

MVP Minimum Viable Product. The most independent and smallest product that can be released with the intention of receiving feedback from customers and following in that product's steps later on when the bigger products are developed and released.

NTP Network Time Protocol, a network protocol for time synchronization.

PTZ Pan-Tilt-Zoom. Commands/attributes of some cameras.

QA Quality Assurance. Testers working with detecting and preventing errors in the code developers has written.

ROI Return on investment. How much earnings, directly or indirectly you will earn back for making a certain investment.

RWD Responsive Web Design. See section 2.7.3 at page 25.

Swipe A command where you move your finger sideways to get to the next horizontal page or function. Popularized by touchscreens but can also be applied to non-touchscreens with mouse-clicking.

UCD User-Centered Design. Technique where the needs and desires of the user is in focus when developing a product. See section 2.3.

UX User Experience. The satisfaction a user gets when using a particular product. See section 2.1 for definition.

Waterfall development Waterfall development model is a sequential software development process where activities are finished before another can begin. Once an activity is completed, the development proceeds to the next phase and there is no turning back.

Wireframe A skeleton version of an interface to pass the concept of the design to the viewer, stripped from a lot of its final visual design and implemented functions. Often used in an early stage of usability testing before the code has been written. Can be both on paper and digital.

1

Introduction

Axis Communications AB is a network camera manufacturer with its origin in Sweden. Axis is the market leader in network based video surveillance and is a driving force in the transition from analog to digital video surveillance. Axis has around 1600 employees worldwide and the headquarter, based in Lund, hosts around 1000 employees [1].

Axis has had great success with high technology network cameras with great functionality. The surveillance camera industry is growing at a steady pace, introducing new actors trying to capitalize on the market. In order to keep its market leading position, Axis must drive the industry but also be ready to react when a crucial industry change occur. Axis, as an open-minded and innovative company with a well-established business model, should be suited for any type of change. Other industries have shown great improvement in user experience design over the last few years. People are also getting used to that everything they use have a good user experience and is negatively surprised when it's not. This thesis will discuss how User Experience Design (UX Design) could be the next game-changing event for the surveillance industry.

1.1 Background

UX Design has empirically been proven that if done right a company can save money and improve their software product as a result of committing to UX Design [2]. Axis is applying parts of UX Design, mostly from external consultancy. This chapter will mention a few reasons why UX Design is important and why specifically Axis should commit to UX Design.

1.1.1 Circumstances constantly changing

Availability and increased UX standard

Access to high speed internet is getting easier and cheaper while hard drive storage, SD-cards and other components are dropping fast in price. This leads to people who otherwise wouldn't be interested in an expensive surveillance system, like small shop owners or maybe even residential, now are viable customers. Suddenly not only trained users or professionals buys Axis products or use the software, but also people with low technical skill and little or no previous experience

with surveillance cameras. With help from products like mobile phones, tablets and websites, the general standard and demand for UX has increased remarkably since the release of the first iPhone in 2007 [3,4,5]. Without any particular technology, the UX it gave was revolutionary and the mobile phone quickly became a necessity for many. Ever since, competitors have duplicated and evolved the concept, while other industries caught on. As a result, it is common to take for granted that every product has a good usability, and be negatively surprised when it doesn't [6].

1.1.2 Market leader

One of the main goals of Axis is to remain world leader of the surveillance industry [7]. To visualize the effect of what a clear commitment into usability could have on Axis, a comparison could be made to the mobile market and the way Apple with its iPhone quickly conquered the line of business. In only four years Apple went from a market share of 0% to almost 30% [8]. The main difference from competitors was great usability and UX but otherwise nothing exclusive regarding the technical specifications. Since 2007 Apple has released new models of the iPhone where the established brand value has guaranteed them a large part of the cookie for some future. With this in mind, one could say that Axis could benefit from being the first of its industry to create products with good UX and high usability.

Today, none of Axis main competitors has stood out with a high UX standard product as of yet (Henrik Ahlfors, private communication. March 2014). However, as surveillance camera systems are quite complex, it can take a few years to develop one unless a disproportionately amount of resources are suddenly put into it. With such a long development cycle, it cannot be taken for granted that none of the main competitors already started this process. If establishing a good UX Design before any of the competitors do, a huge advantage could be gained. This however goes both ways. If a competitor were to release a product with great UX Design tomorrow, it could take some time for Axis to catch up, which in the long run could prove to be costly.

1.1.3 A new type of customers

As new circumstances are introduced into the market every day forcing companies to adapt or fall behind. Lower prices and better internet connections has created a new customer type that for Axis will keep growing for some time, the "nom-technical user". This user is often representing a small business where compared to large companies one cannot have different persons with expertise on all positions like security and IT. It is more probable that the small business is using the same user to fill these roles, either partly or completely alone. Since the Axis products will expand more and more to this kind of companies, the usability of the products must be improved to fit the users that don't have as much IT experience.

1.1.4 Comparing with other industries

Working with the current interface design (see figure 1.1 or appendix D) one can discover that the graphical appeal seems outdated and it is also repeatedly breaking against fundamental design and usability rules (see chapter 2.7.1 & 2.7.2). The graphical design, which also affects the total UX, is very similar to Windows 98, released 1998 and other interfaces released around that time. A comparison with other software industries is illustrated in figure 1.2.

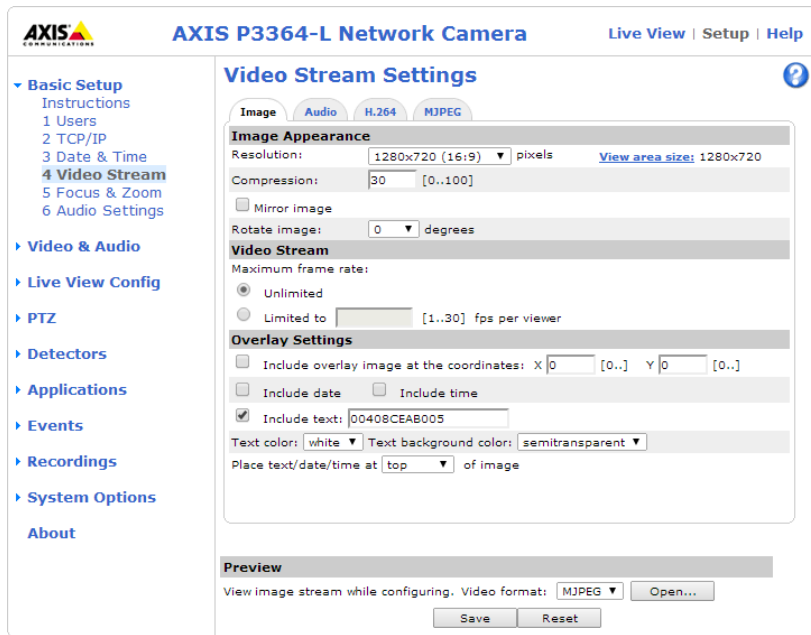


Figure 1.1: Video stream settings in the current interface design in an Axis camera



Figure 1.2: Evolution over time of different software

1.1.5 Technology lifecycle

Donald Norman wrote in his book *The Invisible Computer* [9] that in every industry there will come a time when customers will have their technological needs met and no longer crave to new features or better performance. Aspects like how easy something is to use and how it makes them feel will suddenly have a bigger impact than the technology itself.

Norman further describes the process into a curve with three main steps (see figure 1.3):

- The first step of the curve could be described as the early days of mobile phones. Having the “latest feature” like a camera, color screen, better resolution or simply higher megapixel on the camera dominated the choice between different brands and models.
- The second step is when the technology matures, and the customers expect not only the features that were the new big thing a few models back, but also expect them to work good. This step can be seen as a transition between the previous step and the next step where new technology and features are still requested but it’s still more important that the functions that the product do have is reliable and working good.
- The third step is when most of the customers’ technology needs are met and the customers simply don’t care if you have 20 or 25 megapixel in the camera. What the customer does care about is for example the usability of the product, pride of ownership and how the product makes them feel when using it.

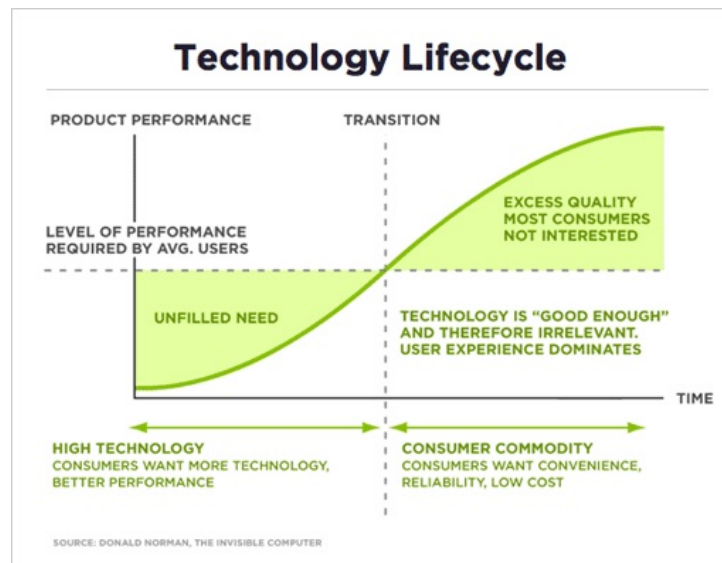


Figure 1.3: Donald Norman’s Technology lifecycle [9]

Axis is approximately at the second step, approaching the third step of the curve. When selling a new camera, an argument like “The camera has 10 more megapixel and double the FPS than previous model” no longer reaches the effect as an argument of “The camera has easily adjustable settings and it installs automatically when connected” does. People have become satisfied with the technical specifications and have a larger need of a “smart” design, easy installation, reliability and the little things that make the product enjoyable to use (Stefan Sandor, private communication. February 2014).

1.1.6 ROI for the end customer

When improving the UX of a product as mentioned in 2.5.3 and 2.5.4 the UX can have great effect on the *return on investment* (ROI). Since almost all of Axis cameras are sold through a third party reseller offering a package price, the increased ROI would not only be valid for Axis themselves but also for the end-customer. These packages can include cameras, installation, software and a service agreement. If an installer can set up a camera in 25% less time than before, the reseller (who is paying the installer) can also offer the end customer a lower price than before, without paying less for the actual camera from Axis. With a lower total price for the end customer, their increased ROI might suddenly have made the difference between buying Axis cameras instead of either choosing a cheaper competitor or not investing in cameras at all.

1.2 Related work

Boström and Delmeby [10] wrote in 2012 a master's thesis where they examined the usability in the current interface design of an Axis camera (see figure 1.1). They made a user research and identified primary users which will be taken into consideration in this master's thesis. Their conclusion about further investigation on how to ease the basic setup of a camera is the foundation of this thesis.

1.3 Purpose

When installing an Axis camera as much as 80% of the installers will only perform simple settings, such as set date and time, rotate the image and then use the default settings in the camera. If installers were to optimize more video settings for their specific needs they could not only save up to 90% of the bandwidth/storage used, but also increase the quality of the video. The current interface design does not invite usage and exploration. The goal will be to give installers more confidence in changing settings without the risk of critical error and having to do it all over again. Today it is simply not worth the risk or time unless you know exactly what you are doing from the beginning (Stefan Sandor, private communication. February 2014). Installers have requested a quick way of setting up the camera, perhaps through an installation wizard. This could solve some of the previous stated issue and does not exist in the current interface design.

A prototype of a camera setup interface will be created through wireframing, usability testing and other established methods. The term camera setup interface will from here on be referred to as *installation wizard* or *wizard*. The prototype should:

- Encourage users to make changes to camera settings, especially complex settings affecting video quality and bandwidth demand.
- Encourage users to explore the available settings and show the effect of them.
- Give users a better user experience when installing an Axis camera.

Axis is applying parts of UX Design at various levels throughout the organization but has not yet implemented a unanimous working method and lack organizational UX maturity. This thesis will investigate different usability evaluation methods and especially those that are recommended

to use early in the software development process. This thesis will also investigate how the parts of UX Design investigated in this thesis UX Design could affect Axis in the current organization structure and what the benefits and disadvantages are.

This could be summarized to the following goals:

- Investigate what UX Design methods and techniques that are appropriate in an early design phase.
- Investigate how applying parts of UX Design could affect Axis.

1.4 Approach

1.4.1 Literature study

A literature study was performed to find relevant theories within the area of UX Design with greater emphasis on usability evaluation methods on which the thesis could be based.

1.4.2 Design process

The parts included in the scope of current interface design were evaluated. The design process was divided into four phases, illustrated in figure 1.4. Three phases with creation, testing and inspection and a fourth and final phase with only creation in form of a high-fidelity prototype. The tool used for wireframing and prototypes was Balsamiq Mockups.

Background study

The scope for an installation wizard was discussed and agreed after a meeting with a camera configuration product manager who was one of the researchers in the underlying user research made in 2011 (Stefan Sandor, "The Axis users", unpublished). As a part of the background study, an observation was carried out of how Axis conducts their usability testing as a reference on how testing is performed on a product in at a later stage of the software development cycle.

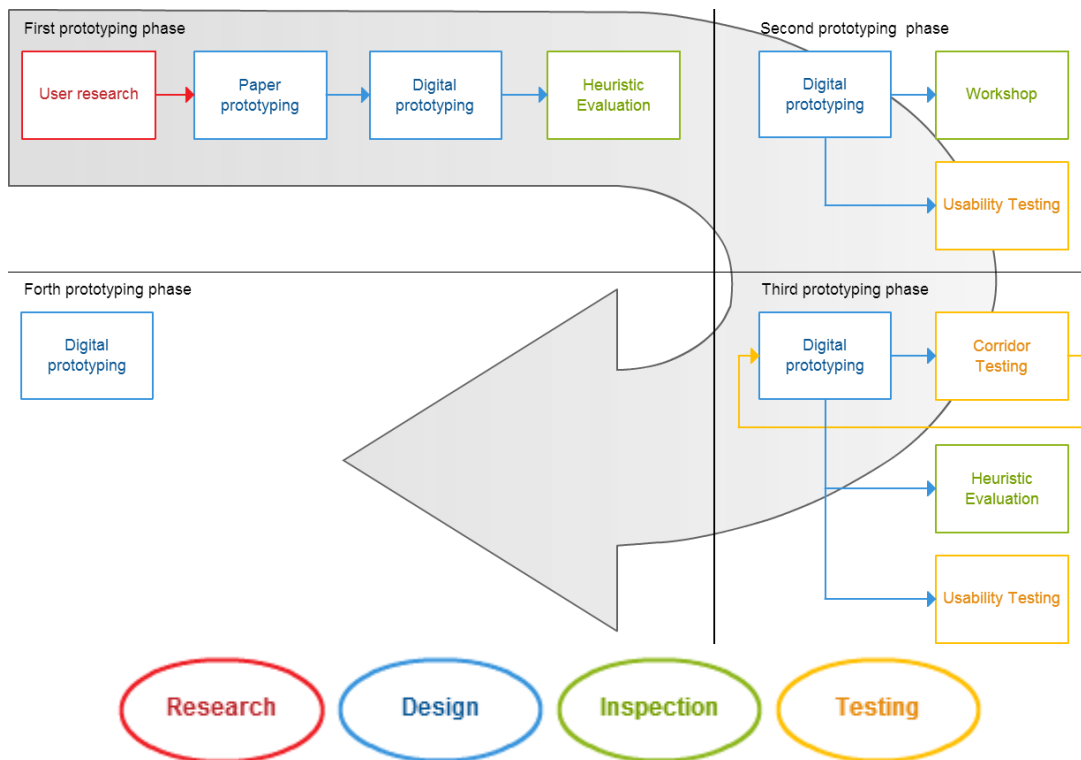


Figure 1.4: The four phases of the design process

2

Theory

2.1 User Experience

User experience (UX) is all about the satisfaction a user gets when using a particular product, system or service. It involves intangible qualities like emotions, behaviors and anticipations and is a consequence of the product's presentation, functionality, system performance and interactive behavior. Other factors can be the user's prior experiences, attitudes, skills and personality [11]. UX goes beyond giving the user what they say they want or providing checklist features and even ease of use. It includes an overall concept involving engineering, graphical design, marketing, industrial design and interface design [12]. When done right, the user will feel satisfied when using the product, and might not even know why.

To reach this, one cannot simply focus on having either a lot of great functions, a great visual design or superb marketing, but need to use all of the factors that together make a good user experience.

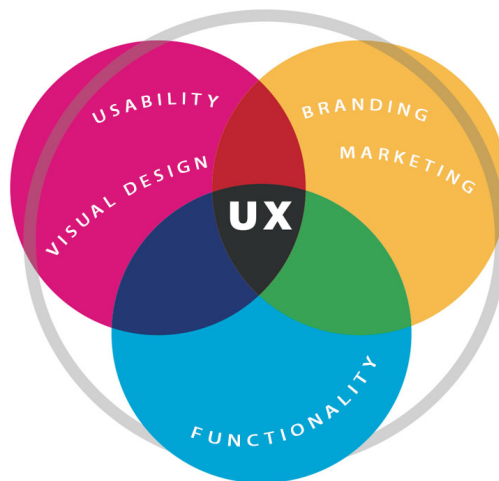


Figure 2.1: Factors affecting User Experience

2.1.1 History of UX

In a sense, UX has always been present. Perfecting design to make something better is in our nature. In modern time, the awareness of a user's satisfaction started to develop in the late 19th and early 20th centuries. Winslow Taylor and Henry Ford both worked towards making humans more efficient, productive and routinized with the help of machines. Ford with his car and Taylor with his industrial thinking. People however, didn't respond positively about this and felt that they were becoming cogs in the machines and dehumanized. Over the following century, even though UX being called various things, a lot of research was put into the field [13].

In 1955, Henry Dreyfuss wrote a book called *Designing for People* [14]. Dreyfuss put the focus back on the user rather than the machine and that everything we design is for the user needs and not a part of the machine. A quote from the book shows something very similar to one of many definitions of UX today.

“When the point of contact between the product and the people becomes a point of friction, then the [designer] has failed. On the other hand, if people are made safer, more comfortable, more eager to purchase, more efficient - or just plain happier - by contact with the product, then the designer has succeeded.” [14]

In combination with the progression of cognitive science, more interest was put into the possibility of enhancing the human and its capacities with the help of computer instead of replacing the user, making it a part of the machine. In the 1970's, a research center at Xerox named PARC designed a graphical user interface that would greatly influence the standard of human-computer interaction, what our computers would look like, and how they still look today (see figure 2.2) [13].

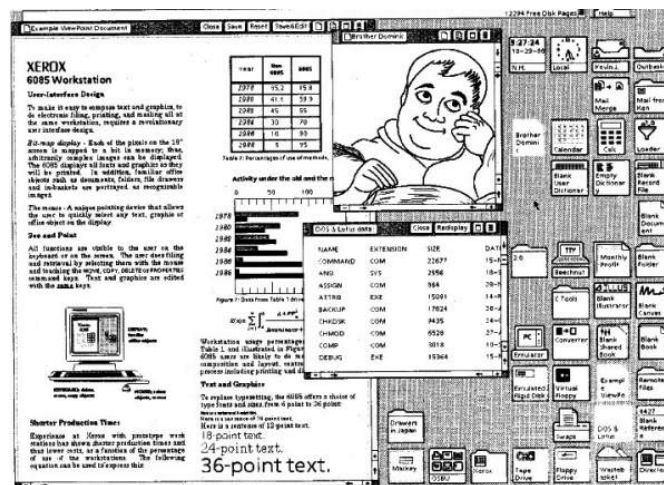


Figure 2.2: The Xerox Star Graphical User Interface [15]

The term “User Experience” was introduced by Donald Norman when he was working at Apple in the early 1990s. Even though parts of today's UX had been around for a long time, people had been using labels like user interface design, human interface and usability more or less accurately. However, Norman thought that the existing terms were too narrow in their definition and wanted to emphasize that the users total experience, the satisfaction or dissatisfaction, was the main priority [13,16]. Recent technology advances have introduced the human-computer interaction to

more people in more aspects of their life, especially the emergence of mobile internet usage. The technology changes rapidly but human behavior, including some characteristics of UX, changes slowly [17].

2.1.2 Usability

A big part of the UX comes from the usability of the product. These terms are often confused with each other. To be more precise one could define UX as the satisfaction a user gets when using a product. Usability on the other hand refers to the extent a user reaches the desired goal of an action in terms of numbers of errors, time efficiency and self-confidence in the goal [18].

Have you ever clicked on the wrong button because the one you intended was right next to it? Wondered if a setting was saved or not? Clicked on several menus before finding the right one or maybe simply didn't see that it was in the other column all along? All of these are just a few examples out of thousands that can occur when the usability is low, and it will, to some extent, create frustration with the user, lowering the total UX.

2.2 User Experience Design

User Experience Design (UX Design) is the discipline to achieve a satisfactory UX. The term is not uncommonly confused as User Interface Design, User-Centered Design or Usability but cannot be narrowed down to a single technique, process or method. UX Design cannot be seen as a discrete step in the software development process or a checklist feature. It is an ongoing effort of understanding the user, responding to their needs in order to evolve the product or system [19].

UX Design is “...the creation and synchronization of the elements that affect users’ experience with a particular company, with the intent of influencing their perceptions and behavior.” [20]

A big misconception is the “U” in UX Design as one can not only focus on the user needs but also need to carry out the business goals. UX Design can be seen as a way to find the sweet spot of achieving business goals and user needs at the same time [19]. Product development can often be a battle of opposite forces between marketers and developers. Marketers realize product opportunities and compiles requirements to developers. These requirements tend to focus on company business goals rather than user desires and needs. Developers seldom lack the input and features to incorporate into the product but lack time and resources to implement them. They have to prioritize what they think is important, which can result in taking on the easiest or the most technically challenging problems. It is here between marketing and development where UX Design tries to balance and prioritize user needs and business objectives [21].

The total experience of a product is the sum of all interaction with it, including software, copy-writing, graphics, layout, flow and physical appearance as some examples. All ingoing parameters must be cohesive. If one part is “state of the art” while another is dreadful, it could negatively affect the total user experience [22, 23].

2.2.1 Interaction Design

Interaction Design (IxD) can be seen as a branch of UX Design which handles the relationship between people and machines. IxD has become an established discipline of its own but, like many other disciplines, fall under the umbrella term UX Design (see figure 2.3). IxD has borrowed practices from other design disciplines but fills the design needs of digital products with dynamic behavior and changing user interfaces [21]. Interaction design has become a research field and been recognized due to several educational programs worldwide. It's a profession not anyone can do but requires knowledge, experience and skill as a more complex understanding of IxD is crucial. Realizing that a function is working badly is not enough as one also needs to understand why it is not working and how it can be improved. Having a combination of IxD and engineering could also be beneficial as it would give an understanding of the underlying technical limitations when designing new solutions.

Typical activities of an interaction designer are to form hypothesis of what could fulfill the intended target, work iteratively around these and deliver prototypes, ranging from low fidelity paper prototypes to high fidelity wireframing [24].

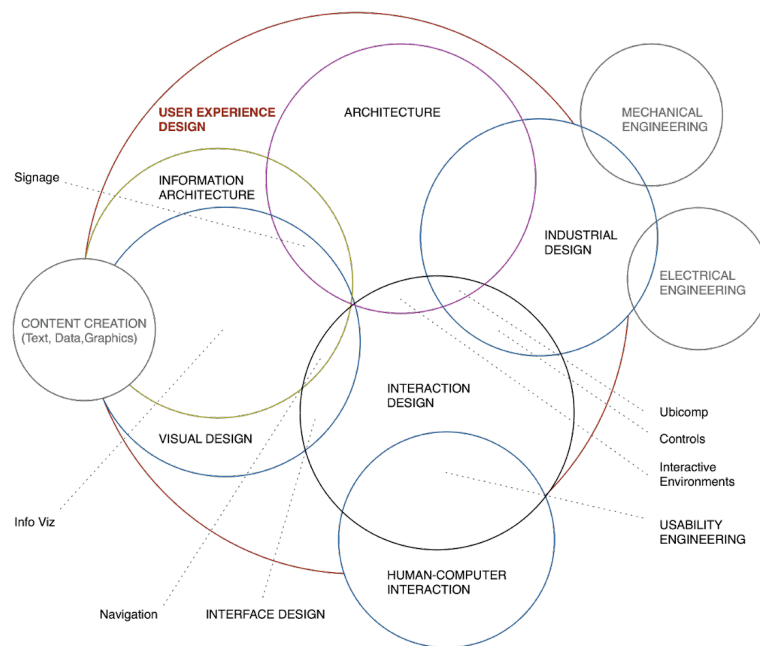


Figure 2.3: The disciplines of User Experience Design [25]

In figure 2.3 different disciplines of UX Design are visualized. Not all companies need a specialist in all disciplines; within a company single persons can handle one or more of these disciplines under various titles, such as interaction designer. But for large companies it is impossible for one to handle them all if a sufficient UX is to be obtained [25].

2.3 User-Centered Design

2.3.1 Definition

The term *User-Centered Design* (UCD) was invented by Donald Norman in 1986 and became widely spread with his book *User-Centered System Design: New Perspectives on Human-Computer Interaction* [26]. Norman emphasized the necessity to investigate the needs and desires of the user and the intended usage of the product. Since then UCD has evolved and now represents the techniques, processes, methods and procedures to design a usable product where the consistent approach is to put the user as primary focus [27]. UCD has become the dominant design approach in UX Design [28].

UCD is described in the standard ISO 9241-210:2010 [11] by six principles:

The design is based on an understanding of users, tasks and environment

Understand the user, what their goals are and in what environment they operate. A good experience of one user might not work for another.

Users are involved in the design and development

This can be achieved by early field studies and focus groups and with usability test on a design suggestion, final design and released products.

The design is driven and refined by a user-centered evaluation

Let experienced usability professionals perform usability testing throughout the design process. As soon as an artifact is ready it is also ready for usability testing.

The process is iterative

Users have difficult to explain what they want, rather than what they don't want. By presenting numerous improved proposals after each iteration the user can refine their wish.

The design addresses the whole UX

Usability is more than making a product easy to use. Things as emotional and perceptual aspects should be taken into consideration.

The design team includes multidisciplinary skills and perspectives

To get a greater exchange and more perspectives covered, the team should contain more than a single disciplinary.

2.3.2 Advantages with User-Centered Design

By involving the users, the product will be designed for its intended purpose in its right context. By having multidisciplinary teams, more creative design solutions can be proposed to problems and design challenges. Letting users discuss on early design proposals can also aid in the understanding of the users' needs and reveal information that otherwise would be hard to obtain [29].

2.3.3 Disadvantages with User-Centered Design

The user research takes time and extends the total development time at a higher cost. Different competences may be required, some who are working within the company but not primarily with

development, such as the marketing and sales departments. The end product may also be too specific and focused on a single group of users that it might not be transferable to other user groups [29].

2.3.4 UX Maturity

In order to practice UX Design, the organization must be mature enough to apply the discipline. There are different models to grade the organization's maturity level. One model is the *Human-Centredness Scale* [30], another is the *Corporate Usability Maturity* [31,32]. Both are based on the organizational attitude, technology and management activities and intend to assist improvement towards usability and UCD. The higher on the scale, the more the organization is applying user-centered ideas and are more likely to produce usable products.

Schaffer wrote in 2004 about *Process for Institutionalizing Usability* [33], another UX maturity model where a central term is UX strategy. When an organization realizes the need for a UX strategy Schaffer urges the need for an executive champion who holds the vision, owns the UX roadmap, organizes resources and overcomes obstacles. Organizational usability training, preferably by a usability consultant is also needed and UCD methods need to be integrated in the development process. A recommendation is to do a showcase project to provide a proof of concept and fine-tune the process.

2.4 Applying User-Centered Design

How to integrate UCD into software development, especially agile methodologies have undergone research during the last couple of years. Both UCD and agile methods focus on customers/users, have iterative nature and continuous testing which makes them suitable to integrate with each other. In most cases the adoption of UCD into agile methods have resulted in improved quality and usability, increased product satisfaction and added value to the process and team [34].

2.4.1 Agile UX

Agile UX can be seen more as an attempt to merge parts of UX Design activities and agile methodologies rather than a method of its own. A user research can either be performed before a project is started or in its initial phase. The result of user research and testing can be instrumental when prioritizing tasks [35]. A common practice is that the UX Design activities are handled before the affected development, which to skeptics can look like a mini-waterfall process, the very thing agile methods is trying to get away from [12]. When implementation is done, usability testing can be undertaken and the outcome can result in new tasks to improve the software [36].

Conflicts could arise when UX Designers and developers work together. Time pressure on developers forces them to sometimes produce things they are not satisfied with. If an elaborated design is presented, time pressure could be reduced. Another area of conflict could be the two groups stepping on each other's toes. This is however not unique for merging agile and UX Design. By working closely together and with good management the risk will decline as the team gets more experienced with the process. There is also the probability that UX Designers lack the knowledge of how hard it is to implement or vice-versa that developers discard UX Design

as unimportant or obvious. By working together, the gap can be bridged and UX Design and implementation should not be seen as separate activities but as chain of tasks with a mutual objective [36].

2.4.2 Lean UX

Lean UX is an expression that comes from the book *Lean UX: Applying Lean Principles to Improve User Experience* [37] written by Jeff Gothelf, published in 2013. It's a fundamental way of thinking when one wants to introduce UX Design into an agile development. The core-values of Lean UX go hand in hand with what defines UCD, with the main difference of having less documentation and replacing it with verbal communication.

One of the goals of Lean UX is to move away from the traditional waterfall and decrease the distance between the different departures in a company. By having all of the components of a project (product management, software engineering, interaction design, visual design, content strategy, marketing and quality assurance [QA]) in one cross-functional team, a lot of documentation that otherwise would have been sent between the departments can be continuously verbally expressed throughout the project instead. It is also important for the team to have a constant communication with the end customer to always stay updated with user requirements. Not having to do a complete background study, the team can start prototyping sooner and both sooner and faster find users to test it on. With this constant communication, not as much documentation is needed since you as a team make the decisions together.

Another goal of Lean UX is that when cross-working in a agile development, everyone needs to have design thinking in mind as people will collaborate across roles and see the design together from a wider overview. This way the team is not relying on "hero designers" to find the perfect solution, but instead together come up with rapid experiential prototypes to quickly learn what ideas work and meet the company goals, and which ones that doesn't. Together, the team is always striving to as quickly as possible release a *minimum viable product* (MVP) to see what's working and later follow in its steps.

2.4.3 Effect Managing

Effect Managing is, just as Lean UX, very close to the core values of UCD. The term was coined by Ingrid Ottersten and Mijo Balic who not only wrote the book *Effect Managing IT* [24], but also founded the UX Design consult company *InUse*, based in Sweden.

Effect Managing has a heavy focus on doing the user research correctly and sufficiently, and then justifying all decisions based on what effects that you would want to achieve and how to achieve these effects. In this way, it is easier to justify the reason for change when speaking to stakeholders.

The user research could include for instance personas, scenarios and business goals. Some of this information might already exist within the company but should be verified and completed with customer contact, as one of the key points of UCD. This could be anything from surveys, interviews, workshops to focus groups. After the user research, concept prototypes will be developed and tested iteratively. After this, implementation and further testing is done until a MVP can be released.

One of the key features with Effect Managing and maybe what makes it unique is its tool to summarize all of the user research, the *Effect Map*. This is a useful tool where it is easy to see what change needs to be made and how to do it. The map can also be used backwards and see why a specific change is being made, as it can be followed back to its root on the map, and see what caused it. Without the *Effect Map* it's easy to miss factors that are important for an efficient and pleasant use.

2.4.4 Aesthetic over usable

When realizing that the design of one's product has become outdated and is in need of an update, it can be tempting to update the visual design without working with the usability. A more aesthetic look can initially give the user a better first impression, resulting in better UX. However, if the interface has fundamental errors breaking usability rules, the appearance can lose its value when the user becomes frustrated with it. This could be for example not finding the way in the navigation or having problems completing the tasks the user is trying to do. The bottom line is that a visual design can give an appearance of better UX, but it's a waste of time and resources if fundamental interaction design isn't taken care of as well [38,39]. For the benefits of a good visual design combined with good UX Design, see *Pleasant visual design* in chapter 7.

2.4.5 Comparison

Agile UX

Strengths

Unify developer and designer in an agile product development – The different departments of the company will work closer together and create a wider understanding for each other's work and the overall goal.

Weaknesses

Time pressure – When working in sprints, time pressure might cause both developers and designers to submit a work they are not done with. At different stages in the design process the developer and the designer have different timescale.

Lean UX

Strengths

Unify developer and designer in an agile product development – The same as in Agile UX, see above.

Time efficient – Can produce a MVP fast as time is saved with verbal communication instead of documentation.

Weaknesses

Requires a big change in the organization – Due to the fact that every department must work together, it can be challenging for a big company to adjust to Lean UX. Even though

one might argue that the Lean UX model is very good, it needs a decision on a high level of management before it can start.

Requires that people are geographically on the same location – As the core people of each project needs to meet and speak to each other often, a distributed organization will find it challenging.

Each person can only have one project – As everything needs to be more or less memorized due to the lack of documentation, people shouldn't be involved in more than one project at the time. This is not specifically a bad thing but makes the team inflexible if a project comes to a temporary pause.

Effect Managing

Strengths

Isolated projects possible – Even though Effect Managing can be applied to the whole company, it doesn't have to. With isolated test projects it's easier to persuade decision makers before making the bigger commitment. Once Effect Managing is being applied to more projects the background study can be made faster as they usually have parts included in each other.

Weaknesses

Comprehensive background study – Especially in larger projects, the background study can be very time consuming. If one has the time for this, the reward can be great. However, if corners are cut, the quality can drop significantly as requirements or user needs might have been inaccurate from the start.

Aesthetic over usable

Strengths

Low commitment – Does not require as much investment as other methods and could give a slightly better satisfactory towards the product.

Weaknesses

Low effect - Even though someone might think the product is modern because of the visual appeal, the total UX when actually using the product has barely changed from before. It might even give a negative effect as the user expected a higher UX.

2.5 Return on investment of UX Design

2.5.1 Introduction

Return on investment (ROI) is a well-established expression to measure the financial success of an investment. An organization normally thinks about ROI in terms of key performance indicators (KPIs) and depending on organization, different KPIs will be important. Saving of user's time, increases in usage and error reduction are examples of different KPIs [40]. When investing, the

goal will always be to gain more than invested. In terms of KPIs, a measurable goal is set and if the goal is exceeded the investment was profitable and a good ROI.

When investing in UX Design, it's not as easy to see the exact effect it brings with it, but it can be measured. The return is spread out on a lot of different parts of the organization and it can be hard to pinpoint the increase in brand value to a specific investment in one of the product's UX. One example is that it can create loyalty and indirect advertising through happy customers while the difference you see in number is the increased sale on newer products. The organization must also have a high enough UX maturity in order to gain positive ROI. This section will point out established facts about ROI of UX Design and when it should be applied.

2.5.2 New products

By focusing on the customers' requirements and UX Design early on in a development process the chance of positive ROI is higher than if it would be applied later in the development lifecycle [41]. How can development of new products save a time and costs by having early focus on UX Design?

More efficient development

Having a clearly stated plan of what the customers want and needs while also focusing on the rest of the UX Design will save both time and costs. Doing this correctly could for example result in not having to add new functions when finding newly detected requirements, while also giving a much more accurate estimate of the total budget needed as there won't be as many surprises delaying the project [41].

A rule of thumb is that correcting an error in the development phase instead of the design phase will cost roughly 10 times more. If the system has been released already, the relative cost would be 100 times more than in the design phase [42].

Reducing maintenance and redesign costs

Established usability evaluation methods can discover most usability errors in the design phase. Correcting these errors right away in the earlier and cheaper phases would be optimal for two reasons:

- Avoid changes to implemented functions (that turn out not meeting the requirements)
- Reducing user frustration as the UX currently might not be meeting the expectations of the user [41].

2.5.3 Existing products

When introducing UX Design to an existing product, one might still need to completely remake it if it's been too long since the design had some work done to it. If this were to be the case, the highest possible ROI would be to focus on keeping the design continuously modern after the remake. For a product to stay modern, it is of most importance that an iterative process where the design is improved is present [37]. As the standard of what's modern is constantly changing,

a product ignoring this fact after the remake will soon be outdated again and eventually in need of another remake. Remaking over and over again is less time-efficient and therefore more expensive, giving a lower ROI, than making small adjustments and constantly fine-tuning the design. If there is no continuous UX Design but instead only remakes, the UX will of course also be worse in between.

Increase user productivity

With good usability, which is a requirement when speaking of good UX, the user will have spent less time finding and using the functions it is looking for compared to if the product had less usability. In situations where an installer or maintenance technician charge by the hour, spending less time on the same tasks can have a great effect on the end customers total cost.

Decrease user support and education

The user will make fewer errors when using the software and will also be less confused and unsure about where to find and how to adjust a setting correctly when the design is good. Directly, this would lead to less need for user support and both less and faster educations of the software. Indirectly, decreasing user errors and making the user to feel in control and understanding the software will lead to less frustration and a better UX for the user [41]. Of course a change to an interface could cause a temporary increase in calls to the support, but if it is changes where the usability is improved, they will decrease over time to a lower level than before.

2.5.4 Sales and brand value

A better UX while using the product will not only make the users feel more satisfied with it, but they are also more likely to recommend it to others, by word or maybe a review. When users finds a product they are feeling comfortable with in terms of “easy to use”, they will be more likely to stay loyal to that brand when buying another product. As a conclusion, UX Design will lead to better brand value. Therefore, and even though it’s hard to measure the exact ROI of it, better UX will indirectly increase product sales, retain current customers, attract more new customers and increase market share [27, 41].

2.6 Usability evaluation methods

2.6.1 Definition

Usability evaluation methods can, according to Nielsen [43], be divided into four categories; automatical (running usability measures through some program), empirical (real user testing), formal (calculate usability on models and formulas) and informal (usability is measured with thumb rules, skills and experience of an evaluator). Automatic evaluation methods for usability and formal methods are either hard to apply or scale to larger, more complex user interfaces. From here on, informal usability evaluation will be called inspection and empirical usability evaluation will be called testing.

2.6.2 Usability inspection methods

Usability inspection is a general term for a range of different methods. They often focus on user interface specifications making them suitable to be performed early in the software development process [44].

Cognitive walkthrough

Cognitive walkthrough is a user interface evaluation method that analyzes the mental processes needed by the user to perform a specific task. A correct sequence or set of sequences are determined in order to achieve the task. An analyst then examines these sequences and at every point assess whether a hypothetical user would be able to select the proper action to continue the sequence [45].

Lewis and Wharton [45] briefly described the method in five key features. The method...

1. *...is not based on user data but the reflections and judgment of an analyst.*
2. *...examines specific user task rather than the whole concept of the interface.*
3. *...analyses the correct sequence of action but does not prove that it will be followed by the user.*
4. *...does not only identify areas of trouble in the user interface but also suggests reasons for the trouble.*
5. *...does not focus on the interface but rather by tracing a likely mental process by a user.*

The method assesses if the interface is designed to support the users intent or works against it and attempts to find areas where users will perform fine and areas where they might struggle. Cognitive walkthrough is not intended to see how well a user recovers if they depart from the correct sequence. If the correct sequence is easily completed the users will with higher probability learn and use this sequence, hence use the product in the intended way.

Heuristic evaluation

Heuristic evaluation was first described by Nielsen and Molich [46] in 1990 and later refined Nielsen [43] in 1994. It normally involves usability experts who review a user interface according to accepted usability principles [27]. The strength in the method is that it does not have to be conducted by usability experts but can also be conducted by software engineers, although the result of inspection can be unreliable [47]. Nielsen stated that usability experts who also had knowledge within the product domain, so called double experts, was the most efficient inspectors [48]. The method is very cost efficient and have been proved valuable in tight time and budget circumstances.

Each evaluator performs the user interface inspection alone. Not until all assigned evaluators are done are they allowed to communicate their findings in order get independent and unbiased evaluations. The evaluation session should take around 1-2 hours in which the evaluator goes through the interface and compare it to a list of usability principle (the heuristics). A complete list of Nielsen's heuristics can be found in appendix A. Other usability findings are also allowed to be brought up in the result. For example could the design rules listed in section 2.7 be used

as guidelines to find other issues. The evaluator's results are collected and compiled into a list of usability issues [49].

Consistency inspection

Consistency inspection has been generally known for a long time but was popularized by Nielsen in 1994 [43]. It is a method where designers assigned to other projects within the company assess whether the interface is designed as their own design. After the inspection a review meeting is conducted where the participants agree on what the overall design should look like and the inspectors should have mandate to make changes in their own design. This method works best when applied early in the development cycle before the effort of extensive changes are too comprehensive [50]. Examples of inspection targets could be terminology, fonts, color schemes or layout. Organizational benefits with this method can highlight consistency across other groups. If you also let product managers and developers perform consistency inspection they could be made aware of consistency issues in the future [43].

2.6.3 Usability testing methods

Usability testing is a process where a representative of the target audience performs an evaluation of the usability on a product. Reasons to perform usability testing could be to ensure that the product is easy to learn, eliminate problems and frustration and to verify and validate that changes made are improving the product. Usability testing does not guarantee that the final product is useful due to its artificial situation, test persons might not fully be representatives of the target users and usability testing might not always be practical to apply. Hence, usability testing should not be the only way of evaluating the product [27].

Rubin and Chisnell [27] categorize usability testing into four different methodologies; exploratory, assessment, validation (verification) and comparison tests.

Exploratory testing

Exploratory testing is conducted early in the development cycle with the objective to evaluate the preliminary and conceptual design. The test artifact can be paper-prototypes, low-fidelity prototypes or early product proposals. The result may direct the further design process. The test leader has much interaction with the test person in order to fully understand and discuss the thought of the design.

Assessment testing

This could be seen as the most common usability test since it's conducted midway through the product development cycle. The objective is to find deficiencies in the design and measure how efficient the design has been implemented. The test leader takes a more reserved role in order to evaluate how self-explanatory the product is.

Validation testing

Validation testing is performed late in the development cycle on a near release product. The objective is to verify that the usability requirements are met and the usability issues found in earlier testing are removed. The test leader has restricted interaction with the test person for a more realistic scenario where the user normally don't have anyone other to consult.

Comparison testing

This type of testing can be performed throughout the whole development cycle, based on the objective with the test. Comparison test can be used to choose between different early design proposals or compare the product with competitors.

Think aloud

Think aloud is not a method but rather a technique that can be used in usability testing with the intention to capture the thoughts of the participants while performing a specific task [27]. It is effective because the collected data reflects the actual usage rather than the test person's judgment about the products usability [51]. The technique gives instant information about task specific situations that would be hard to remember in an afterward debriefing and reveals early clues of more troubling areas of the product. Disadvantages with the technique are that it's unnatural to continuously express your thoughts and some test participants finds it distractive. To think aloud slows the thought process down and increases the awareness which normally have good effect. However, errors that could occur in an actual workplace might be prevented or minimized due to the increased awareness.

One of the main advantages with applying the think aloud technique is its robustness. Even if you don't apply it according to the proper methodology you can still get reasonably good findings. Another robust factor is that the test can be led by almost anyone and still give adequate result. An experienced test moderator will of course give a better outcome but if none is available it is still better to test than not to test [27]. It's also very convincing towards managers to motivate usability development in a product by showing them a sample of a test session from the current user interface [52].

Corridor testing

Corridor testing is an informal form of usability testing with purpose to quickly get feedback. The name reveals its purpose to go out in the office corridors and grab a person at random and get their opinion on a matter. Corridor testing can be useful in small design changes or when there is no time or need to perform a more formal usability testing [53].

2.6.4 Inspection vs. testing

Both usability inspection and testing can detect and oversee different usability issues; therefore a combination of them both should be conducted to achieve a more usable design [44]. Several studies have been conducted to evaluate which of the methods that is most effective. According to Tan, Liu and Bishu [54] they should not be seen as competitors but rather as complement

to each other. Liljegren [55] for instance found that usability testing had greater effect after a cognitive walkthrough had been conducted.

2.7 Design rules

2.7.1 Norman's design principles

In his book, *The Design of Everyday Thing* [17], Norman lists some useful principles when designing user interfaces:

- **Visibility**

“The more visible functions are, the more likely users will be able to know what to do next. In contrast, when functions are ‘out of sight’, it makes them more difficult to find and know how to use.” [56]

- **Feedback**

“Feedback is about sending back information about what action has been done and what has been accomplished, allowing the person to continue with the activity. Various kinds of feedback are available for interaction design-audio, tactile, verbal, and combinations of these.” [56]

- **Constraints**

“The design concept of constraining refers to determining ways of restricting the kind of user interaction that can take place at a given moment. There are various ways this can be achieved.” [56]

- **Mapping**

“This refers to the relationship between controls and their effects in the world. Nearly all artifacts need some kind of mapping between controls and effects, whether it is a flashlight, car, power plant, or cockpit. An example of a good mapping between control and effect is the up and down arrows used to represent the up and down movement of the cursor, respectively, on a computer keyboard.” [56]

- **Consistency**

“This refers to designing interfaces to have similar operations and use similar elements for achieving similar tasks. In particular, a consistent interface is one that follows rules, such as using the same operation to select all objects. For example, a consistent operation is using the same input action to highlight any graphical object at the interface, such as always clicking the left mouse button. Inconsistent interfaces, on the other hand, allow exceptions to a rule.” [56]

- **Affordance**

“Affordance is a term used to refer to an attribute of an object that allows people to know how to use it. For example, a mouse button invites pushing (in so doing acting clicking) by the way it is physically constrained in its plastic shell. At a very simple level, ‘to afford’ means ‘to give a clue’. When the affordances of a physical object are perceptually obvious it is easy to know how to interact with it.” [56]

2.7.2 Shneiderman's eight golden rules

Ben Shneiderman writes in his book *Designing the User Interface: Strategies for Effective Human-Computer Interaction* [57] about eight rules to be seen as guidelines to a good interaction design and to improve the usability of an interface:

- **Strive for consistency**
“Consistent sequences of actions should be required in similar situations; identical terminology should be used in prompts, menus, and help screens; and consistent commands should be employed throughout.”
- **Enable frequent users to use shortcuts**
“As the frequency of use increases, so do the user's desires to reduce the number of interactions and to increase the pace of interaction. Abbreviations, function keys, hidden commands, and macro facilities are very helpful to an expert user.”
- **Offer informative feedback**
“For every operator action, there should be some system feedback. For frequent and minor actions, the response can be modest, while for infrequent and major actions, the response should be more substantial.”
- **Design dialog to yield closure**
“Sequences of actions should be organized into groups with a beginning, middle, and end. The informative feedback at the completion of a group of actions gives the operators the satisfaction of accomplishment, a sense of relief, the signal to drop contingency plans and options from their minds, and an indication that the way is clear to prepare for the next group of actions.”
- **Offer simple error handling**
“As much as possible, design the system so the user cannot make a serious error. If an error is made, the system should be able to detect the error and offer simple, comprehensible mechanisms for handling the error.”
- **Permit easy reversal of actions**
“This feature relieves anxiety, since the user knows that errors can be undone; it thus encourages exploration of unfamiliar options. The units of reversibility may be a single action, a data entry, or a complete group of actions.”
- **Support internal locus of control**
“Experienced operators strongly desire the sense that they are in charge of the system and that the system responds to their actions. Design the system to make users the initiators of actions rather than the responders.”
- **Reduce short-term memory load**
“The limitation of human information processing in short-term memory requires that displays be kept simple, multiple page displays be consolidated, window-motion frequency be reduced, and sufficient training time be allotted for codes, mnemonics, and sequences of actions.”

2.7.3 Design trends

It is also important to follow the design trends that emerge from other products and applications with time. Some of these are so well accepted by the general public that you soon take them for granted elsewhere as well.

Gestures

A fairly new design trend is the swipe gesture, visualized in figure 2.4, that first showed up on mobile phones, tablets and other touch screen devices but has also made its way to websites all over the world. Other gestures include pinch and spread where two fingers are moved together or apart, normally to zoom in and out.

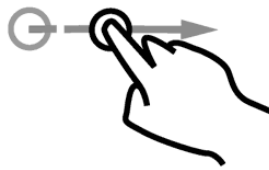


Figure 2.4: Swipe gesture visualized [58]

Responsive web design

Responsive web design (RWD) is a term coined in an article written by Ethan Marcotte in 2010 [59]. The core of RWD is to let websites adapt its appearance to different screen resolutions automatically instead of having separate sites depending on screen size (see figure 2.5). An incentive to use RWD is that only one code base needs to be maintained and devices with odd screen resolutions will need no special treatment. The ability to rotate the device will also be handled smoothly with no need for site reload or odd behavior when applying RWD [60].



Figure 2.5: RWD [61]

A downside to RWD is the total website load time could increase due to all devices included in the download data. A study shows that nearly 50% expects the website to be loaded “faster” or “just as quickly” on a mobile device compared to desktop computer, regardless of mobile

connection rate [62]. Therefore it is of high importance to reduce the time needed to load the website, no matter what device is browsing it.

Less is more - minimalistic design

Another way to improve the UX, on both low and higher screen resolutions, is by using a minimalistic design. This has become more and more common in web design the last few years but also applies to any interface design, especially one that will be used on different devices. The goal of a minimalistic design is to remove everything that is not essential, keeping only the interface's most basic features, stripped of unnecessary and excessive elements, colors, shapes and textures. This way, the interface will have a clear focus point and a calming effect on the user. Google has always been known to design their products from a as minimalistic point of view as possible. Starting with the search engine google.com, and later on the Android platform for mobile phones [63, 64].

To help visualizing, a comparison where you can see the minimalistic design of google.com versus the more function based design of yahoo.com in figure 2.6.

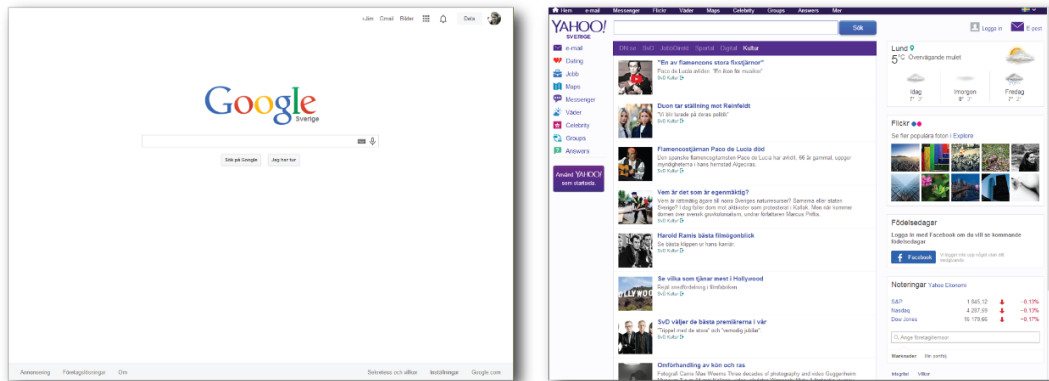


Figure 2.6: Google.com compared to yahoo.com [65, 66]

3

First prototyping phase

3.1 Method



Figure 3.1: Overview of activities in the first prototyping phase

3.1.1 User research

As no external interviewing were to be done, a user research from 2011 (Stefan Sandor, “The Axis users”, unpublished) was studied to compensate this. Boström and Delmeby’s [10] master’s thesis was also studied since they also had performed some user research. To supplement our user research, some internal interviewing was done and will hereby be included in what’s referred to as “user research”.

Personas

Three different personas were created to represent different types of users within the installer segment.

Effect map

An *Effect map*, a key feature in Effect Managing, was created for one user category, namely the *Installer*. The *Effect map* was used to aid the design process and to construct scenarios for usability testing.

3.1.2 Design

Based on the current interface design (seen in appendix D) and the conducted user research, the first design phase started with prototyping on paper followed by transition of most tasks to digital prototyping in the application Balsamiq Mockups.

The new design should be more automated and give (visual) feedback on changes. The design should also work on tablets with responsive design with no vertical scrolling (fixed view area) with as few clicks as possible in every wizard step.

All affected tasks in the current interface design were put on to a wall to get a better overview and find dependencies (seen in figure 3.2). The design process started with paper prototyping with focus on conceptual models of every task.

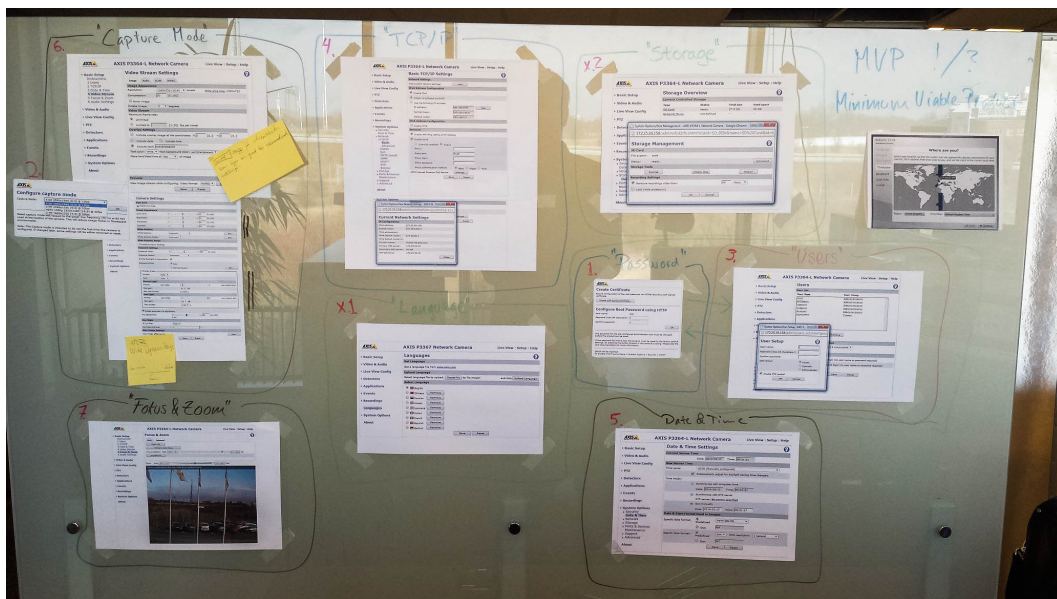


Figure 3.2: Current interface design pinned to a wall

Axis released a new graphic identity during the first quarter of 2014 with new color schemes, in yellow, red, green and warm gray. The design suggestion will try to follow that graphic identity as much as possible to give a realistic view on how Axis could implement and still be true to the new graphic identity.

3.1.3 Heuristic evaluation

Two different usability experts made an evaluation of the initial prototype with main objective to see early interaction issues. One domain expert was shown the prototype in order to identify any design suggestions that would be impossible to implement and that the design was aligned with Axis technical terms.

3.2 Result

3.2.1 User research

The user category *Installer* does not necessarily understand English, knows very little of IP network, video, optics and parameters affecting the image quality.

Personas

Novice installer

The novice installer has low or no knowledge with IP-networks. The installer does not understand English and have mandarin as native language. The installer works for a Closed-circuit television (CCTV) company but have little knowledge of video, camera and optics. The installer is not interested in fine-tuning any settings and the main motivation is to complete the configuration as quickly as possible.

Man-in-the-van

The *Man-in-the-van* user does not only work with cameras but also alarm solutions and performs all wiring, installation and configuration. The *Man-in-the-van* has a background in analog surveillance systems and therefore has medium video knowledge, but not as much knowledge within network based camera surveillance systems.

IP Surveillance expert

The *IP Surveillance expert* is a normally a person responsible for the overall security, including the camera surveillance. He has high knowledge in both IP and video and knows the technical terms used in the surveillance industry.

Effect map

The *Effect map* (see figure 3.3) did only focus on one user type, namely installers. The highest priority was to get language support. The current interface design has support for different languages but involves many steps in a possibly language first making it hard to change. Therefore focus would be to make this process easier.

The installer user requested a quick setup of the camera and that it should be more automated with good default values. In the current interface design many settings are not understood by the installer and therefore not changed. Visual aid could help explaining difficult settings and to provide a live preview would help see what a setting changes in the video stream. Several settings in the current interface design have ranges between 0 and 100, which have no real world mapping.

Another request from the installers is good feedback on settings changes with possibility to undo or revert to the default value. Also quick help close to where the setting is made and double coding it with both a question mark and a text stating *Help*.

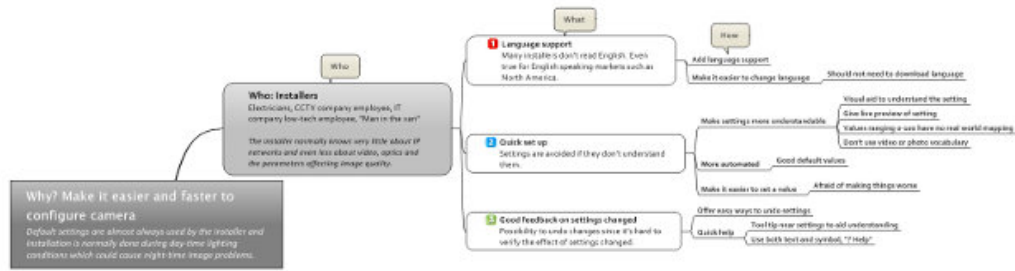


Figure 3.3: Effect map of installer user. A larger version can be found in appendix C

3.2.2 Design

Task sorting

Before the sketching could begin an initial sorting and ranking of tasks was done. During the sketching some dependencies between the tasks was found. *Camera Settings* would not be rightfully applied before the focus was set, which depended on *Capture Mode*. *Language* was set as the first since it would change the language of the whole wizard as well as the rest of the camera’s web interface. Previously *Root Password* was the first that was set, but technically it didn’t have to be first. It was concatenated with the user administration, since *root* is an undeletable “superuser”. *Capture Mode* and *Video Stream* shared the same technical term so they were merged together without the underlying technical aspect taken into consideration.

Audio Settings were not an important task during installation according to the user research and was removed. *TCP/IP* was renamed to *Network* and since *Camera Settings* needed to be distinct from *Video Settings* it was given its own step in the wizard. The evolution of the sorting and ranking can be seen in figure 3.4.

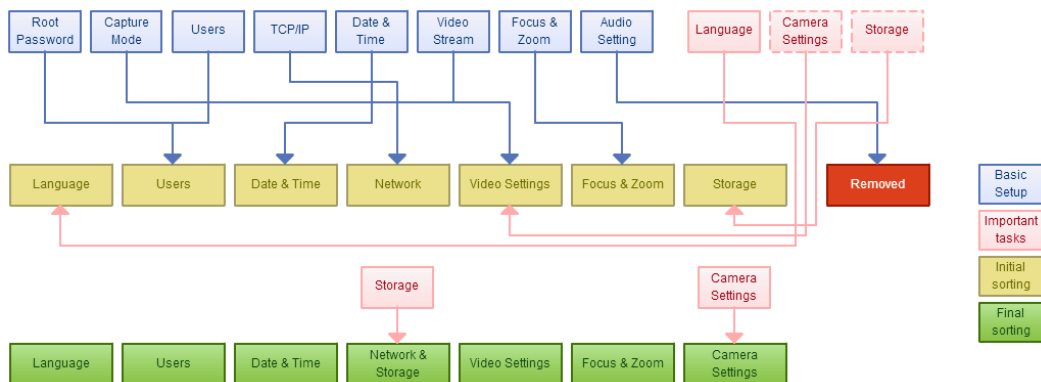


Figure 3.4: History matrix of sorting tasks. Tasks colored in blue are from the current interface design’s “Basic Setup”, the current prioritized tasks.

Wizard

The book *Designing Interfaces* [67] suggests three different wizard types (see figure 3.5); two-panel selector, discrete page step-by-step and step-by-step where all steps are in one page. Normally a wizard offers a *next button* and *previous button* to step between different tasks, but the third type makes that unnecessary. The two-panel selector offers an easy overview and navigation between the different tasks and is normally used in OS installation wizards. The two other types are more used in web wizards. Common for all wizards is to offer good default values to speed up for the users who willingly let the system decide.

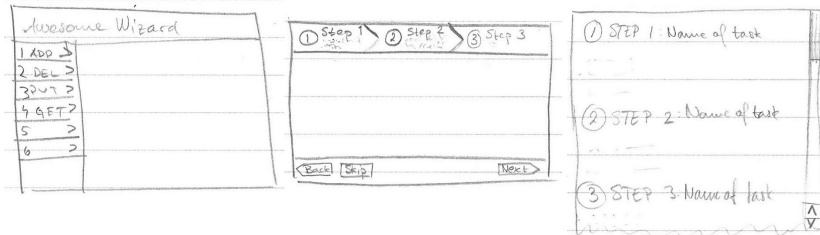


Figure 3.5: Three different types of wizards

The discrete step-by-step was decided to be used since it offers clear overview of all steps, isolates the context from the other steps and is commonly used on the web. In a second iteration in the top horizontal bar, the steps was given the form of arrow to emphasis on the progress each steps implies (see figure 3.6). A similar design is also used in another Axis web project (see figure 3.7).



Figure 3.6: Evolution of the wizard template

Language

In the first iteration, two different design suggestions were produced, both containing the country flag as main attribute. The design should, based on web browser language, computer language or geographical location (*geolocation*), be able to suggest the most likely language as default. The first design orders all flags in a 5x3 matrix where all flags are given the same real estate. The second singles out the three most likely languages with larger flags, but hides some of the

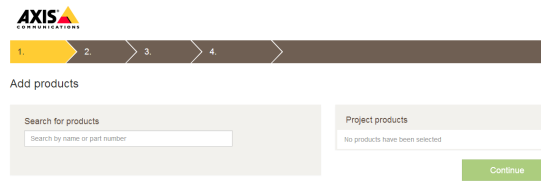


Figure 3.7: A web wizard design used in an Axis project

available flags. Both designs have an upload function as all user won't have direct access to internet and be able to download more languages.

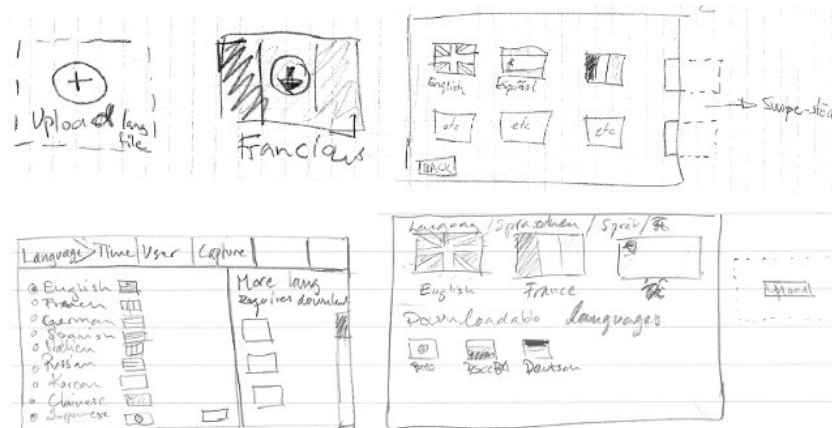


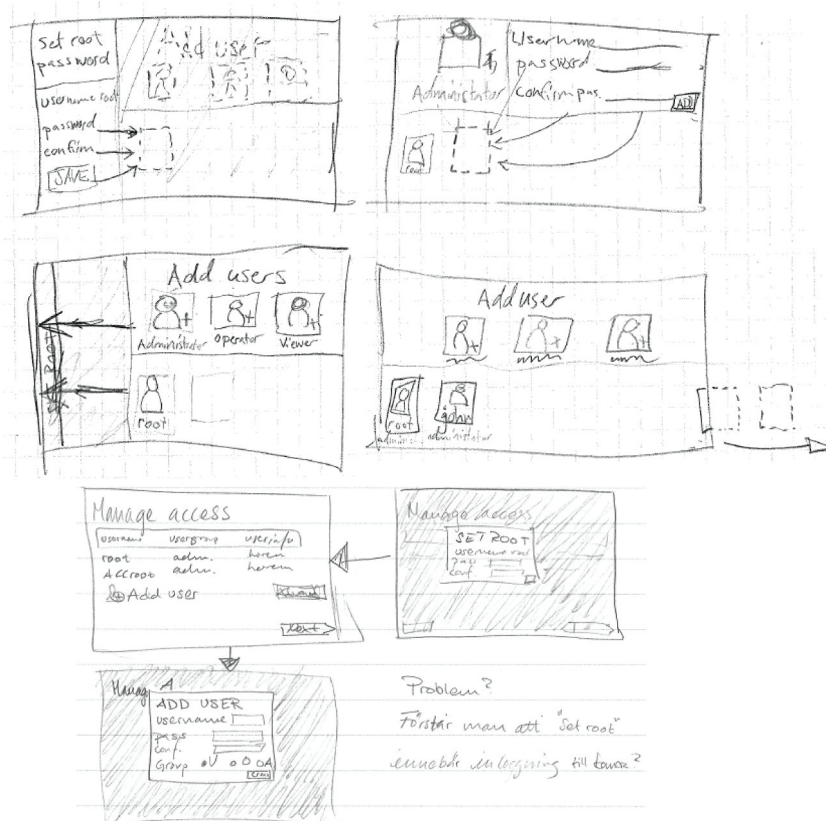
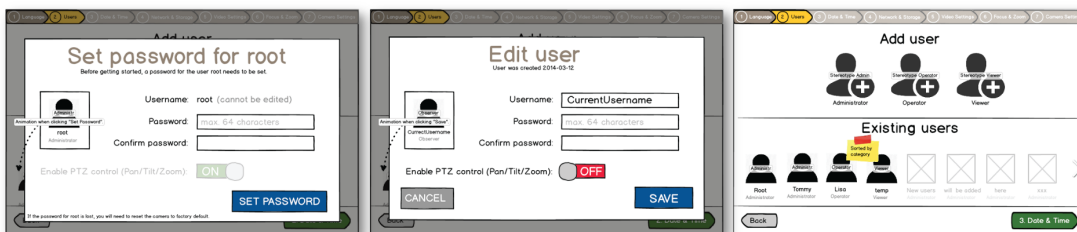
Figure 3.8: Paper mockups of *Language*



Figure 3.9: Digital mockups of *Language*

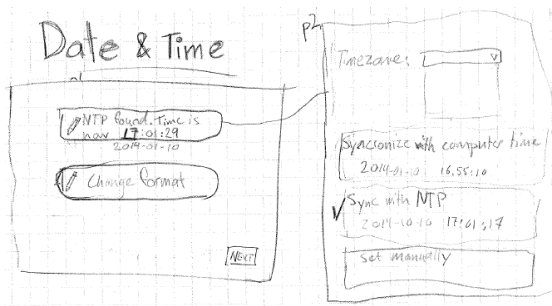
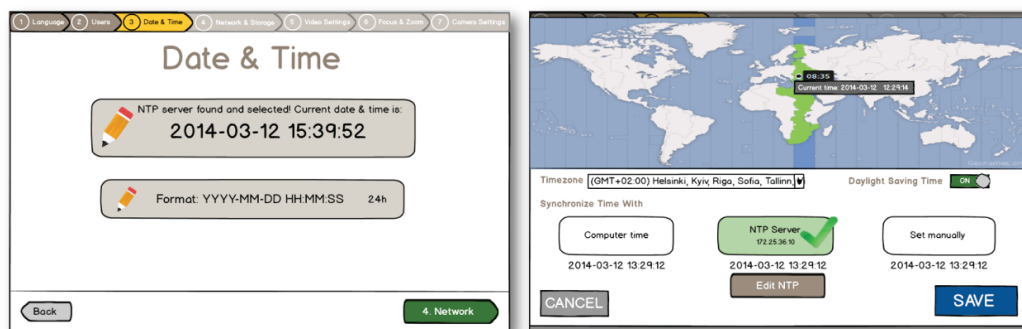
Users

The two tasks *Root Password* and *Users* were merged into one. When the password for the *root* is set, the user appears in the user list with an animation. When adding more users, a similar popup appears where user information is entered. The three different user types; *administrator*, *operator* and *viewer* were all given an icon to create that type of user.

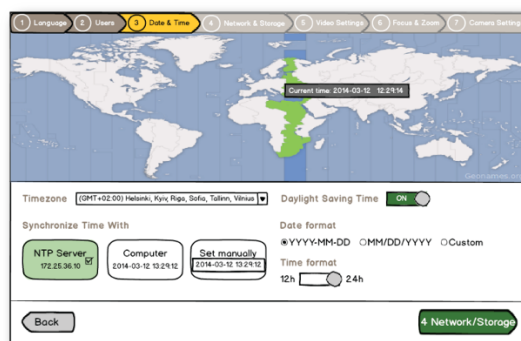
Figure 3.10: Paper mockups of *Root Password* and *Users*Figure 3.11: Digital mockups of *Root Password* and *Users*

Date & Time

The first paper prototype was built on the idea that the date, time and format should be chosen automatically based on information taken from the user's browser and operating system. If a time server (NTP server) was to be found on the network, it would be selected automatically as well. Even though it might not be 100% correct (e.g. an American user on a Swedish computer), an option to change both date, time and format would be essential. Two buttons on the first page with a popup page with more settings was made.

Figure 3.12: Paper mockup of *Date & Time*Figure 3.13: Digital mockups of *Date & Time*

An attempt of putting all of the settings on one page right away (see figure 3.14) was discarded as the interface became too cluttered. As the system should in most cases suggest the correct date, time and format only a simplified question of confirmation is required with the possibility to edit if needed even though being unlikely.

Figure 3.14: Discarded design suggestion of *Date & Time*

Network & Storage

The term *TCP/IP* was questioned if it was too advanced for a basic user. Replacing it with the term *Network* was decided. When setting the *TCP/IP Settings* today, most users will choose to obtain the IP address automatically through DHCP. Important to note is that users that are unsure of what network settings to use are likely to use the suggested option, which resulted in the DHCP option to be preselected and having the text *Recommended*.

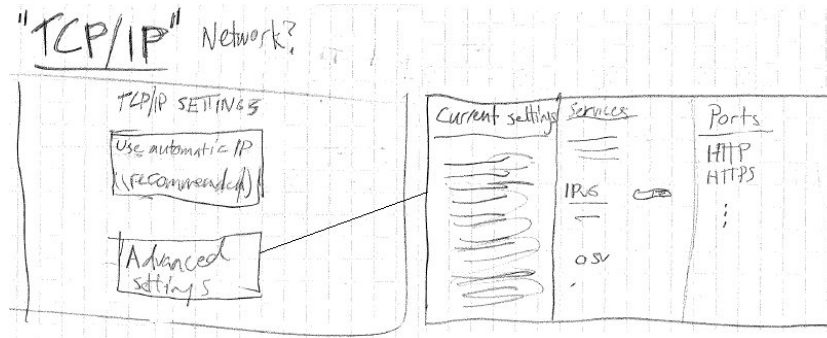


Figure 3.15: Paper mockup of *Network*

When trying to minimize the number of steps in the wizard the *Network* step was merged with *Storage*. *Storage* is meant as a quick confirmation if a SD-card is present and the ability to manage network shares. Further settings of these two would belong on their respective popup pages that would appear when clicking the icons or button below them.

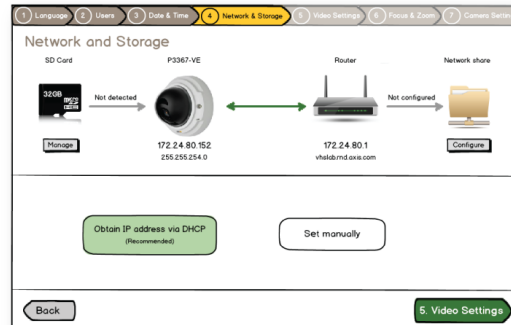


Figure 3.16: Digital mockups of *Network*

Video Settings

Putting both *Video Settings* and *Capture Mode* on the same step was suggested due to them working a lot together and can to some extent be automated. To reduce flickering, capture frequency should be set at a frame rate where it's being a multiple of the frequency of the local electric mains. The frequency is 60 Hz in the Americas, both 50 and 60 Hz in Japan while 50 Hz in the rest of the world. This would mean that if you have 50 Hz you need to choose a FPS at 50, 25,

12.5 and so on. Naturally, once the location of the camera has been set, only these frame rates can be chosen. The location can be set with two different solutions. One is to set it manually (see world map to the right in figure 3.17), while the best probably is to use the information gathered from browser, operating system, language or *geolocation* to make an intelligent guess of where the camera is located.

Once the frequency is determined the user is ready to arrive at the settings page (see left picture in figure 3.17). Two sliders were created on the bottom to adjust the resolution and aspect ratio on the top one, and setting the priorities of *Low Bandwidth Usage* or *High FPS* at the lower one. The result is visualized in the video demo in the top half, while indicators to the right can give the user a hint of the relative difference one could expect by adjusting the sliders. The main reason for this is to encourage the user to experiment and learn what factors affect the final result.

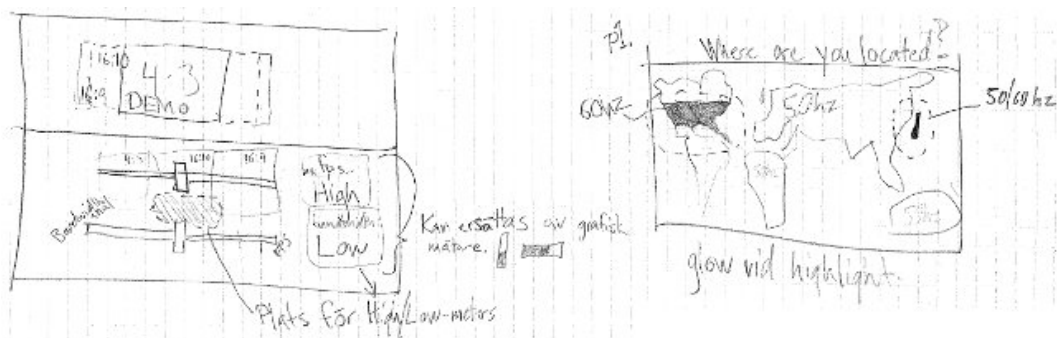


Figure 3.17: Paper mockup of *Video Settings & Capture Mode/Frequency*

Focus & Zoom

To be able to set the focus good, the main feature of the *Focus & Zoom* is to have a live feed from the camera and the possibility to make it full screen. Rotate and mirror image was previously located on the *Video Settings* task but as no live feed is given before the *Focus & Zoom* they were moved here.

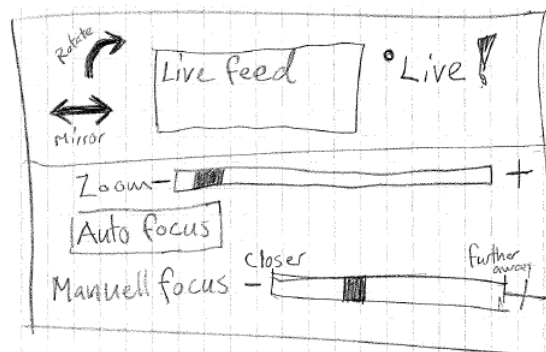


Figure 3.18: Paper mockup of *Focus & Zoom*

Camera Settings

As most of the current users do not change any of the color-related camera settings, the mere introduction of a live feed next to the settings could greatly improve this. The values that can be chosen should also be within reason and not be able to give a distorted picture where one cannot see anything. Currently, values are chosen from what the techniques can offer, but should instead be focused on what the user needs or might want.

One slide was created for scenario-based hint to the system of the whereabouts of the camera (see middle picture in figure 3.19). If the camera knows it's going to record in an indoor/outdoor location and at day/night condition, it should be able to select better default values resulting in better image quality and less waste of bandwidth. The exact values handling the image quality, such as white balance, shutter and gain will not be presented but be embedded into the preset scenario.

An option to install an overlay, e.g. a company logo or timestamp, will give instant feedback on the live feed. This will avoid unintentional errors where you have to make changes over and over again. A design suggestion of this can be seen to the right in figure 3.19.

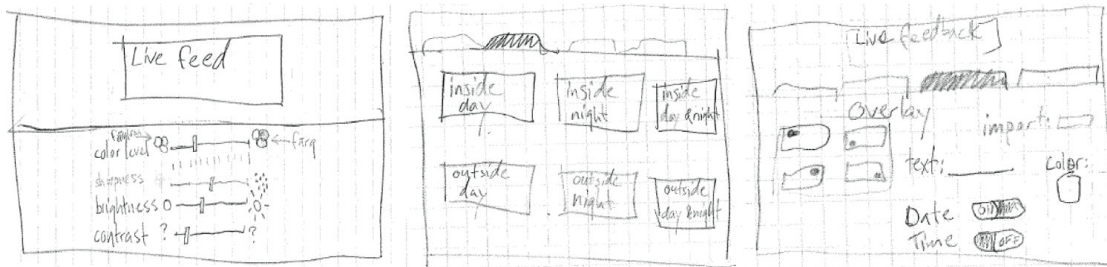


Figure 3.19: Paper mockup of *Camera Settings*

3.2.3 Heuristic evaluation

During on the heuristic evaluation the following improvements were suggested:

- Remove unnecessary information so it doesn't take any focus or real estate. Specifically the PTZ-option when the root password is set and IP-information in the *Network* task.
- The default values should be easy to choose and if changes are needed a more advanced level is acceptable.
- Time and format were given almost the same focus. Let the important things take more focus, either by color, position or size.
- Keep things with similar actions consistent in naming and position.
- Let the user know when the camera is showing live stream, perhaps by making the stream full screen or a text saying *Live*.
- Try to avoid using a popup-window in another popup-window. Can take too many steps to get back.

- Use small icons to show what the information is. A calendar icon and a clock icon can be used to separate the date and time information from each other.
- Offer information editing where the information is shown, so called inline editing.
- Separate *Aspect ratio* from *Resolution*.
- It might not be a good idea to concatenate *Network* and *Storage* since *Network* is an important setting in surveillance industry and *Storage* might steal focus.

3.3 Result analysis

3.3.1 Heuristic evaluation

Start

The need of an alternative wizard was realized. A shorter version than the standard wizard could be better for those who wish to e.g. rotate the image and set the rest of the settings with a Video Management System (*VMS*). This thesis will not explore further into what such a wizard would include.

Language

Including all available languages in the camera would remove the need of internet access to download additional files.

Date & Time

Less focus should be put on time format change as the wizard should guess the correct format. Showing icons ahead of the date and time respectively will make the numbers less cluttered and easier to read.

Users

The greyed out PTZ-option could be removed when the user always has access to the PTZ. This could be both *root* and *administrators*. Removing the greyed out slider would lead to a more minimalistic design and as the help text is already stating that they have access to everything, the user would still get the same information.

Video Settings

The aspect ratio should be extracted from the resolution slider to its own step. Having both resolution and aspect ratio on the same slider is harder to understand. When the slider is pulled to the right, it can still change to a lower resolution due to entering a new aspect ratio. Normally you would always want a higher value, in this case resolution, when pulling the slider to the right.

4

Second prototyping phase

4.1 Method

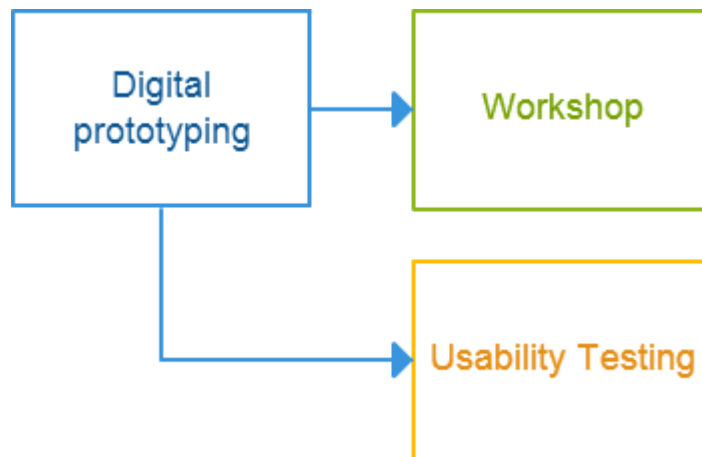


Figure 4.1: Overview of activities in the second prototyping phase

4.1.1 Design

Based on the result analysis in the first prototyping phase (see section 3.3) a new design iteration was performed. The main focus was to complete the transition from paper prototypes to digital prototypes using Balsamiq Mockups of all tasks.

4.1.2 Workshop

To assist the prototype design process a workshop was held with eight other master's thesis students at Axis as participants. The following methods were used during the workshop: card sorting, paper prototyping and design review in group.

Card sorting

The ingoing wizard tasks were written on ten paper cards. The participants were divided into four groups of two and each group was asked to order the task cards and if possible chunk similar tasks. They were also allowed to discard tasks they didn't feel should be in the installation wizard. After five minutes each group's results were discussed in the entire group and they had to motivate their order of tasks. When done with this, the participants were instructed to resort the task cards with the constraint that the total sum of tasks should be seven or less and no task could be discarded.

Paper prototyping

The participants were instructed to each design a suggested solution to the following wizard tasks; *Language, Date & Time, Focus & Zoom* and *Camera Settings*. They were given the constraints that their solution should fit into a tablet, but should also work on a desktop computer without a touch screen. During the prototyping the participants were shown the current interface design and which parts of it that needed to be covered. Afterwards, the different designs was discussed and evaluated by the whole group.

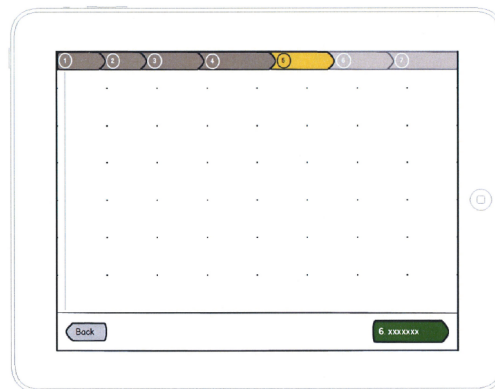


Figure 4.2: Template given to the workshop participants

Design review

As the workshop participants had spread knowledge with different skills and background a focus group scenario was made. The participants were shown the *Second prototype* and were given the chance to comment the suggestions in a brainstorming manner.

4.1.3 Usability testing

After the *Second prototype* was finished a minor usability testing session was conducted with two participants. Both participants qualified into *Novice installer* persona with low technical and video knowledge. The main focus was to confirm concerns and issues found during the workshop and heuristic evaluation. The usability testing was conducted to identify difficult terms and areas but also to validate the design.

Language

A Russian version of the *Start* page was produced in order to simulate how a non-English speaking person would feel and act when first encountering the English web interface, before being able to change language. Two different design suggestion of *Language* was tested on the participants to investigate advantages and disadvantages with them both.

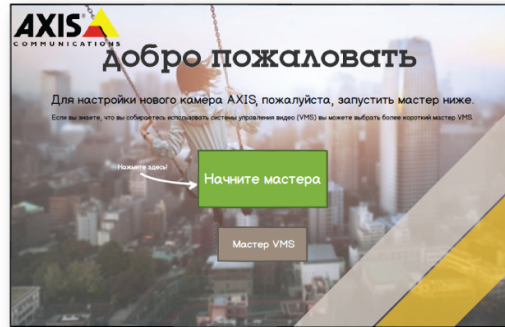


Figure 4.3: Russian version of *Start* page

4.2 Result

4.2.1 Design

Start

Even though the rest of the prototype still is low or mid-fidelity, a start page with high fidelity design was created as it gives a modern feel and encourages running the wizard. Many different colors of the *Start Wizard* button were tried but a green color was chosen since green states a correct action and was aligned with Axis graphic identity.

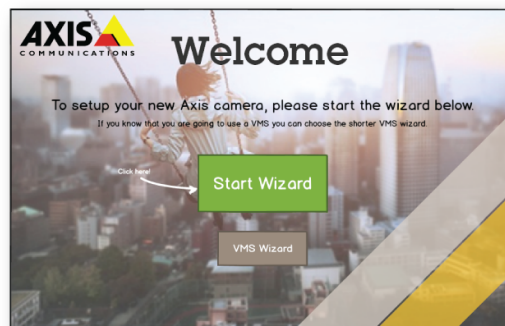


Figure 4.4: Design suggestion of *Start* page

Language

No changes were made to *Language* during this phase. Please see figure 3.9 for screenshots from previous phase. For results from the usability testing, see section 4.2.3 at page 48.

Users

Actual stereotypical pictures were added in the second prototype. The option to delete a user was added to the *Edit user* popup that appear when clicking on an existing user. The *Edit* icon (yellow pen) will be displayed when hovering over the user.

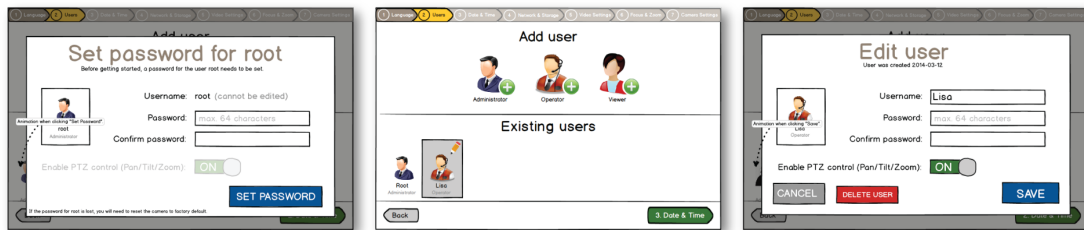


Figure 4.5: Design suggestion of *Users*

Date & Time

This design has applies the “Is this correct? Yes!”-thinking where most users are expected to quickly read what they need (date, time, format, source) and continue to the next step without having to confirm anything on the *Edit* page. The current date and time (including the format) was therefore been redesigned to have icons, increased font size and more contrast to make the user focus on it right away. To avoid entering the *Edit* page to confirm the source, it has been kept in a notification box at the bottom of the page.

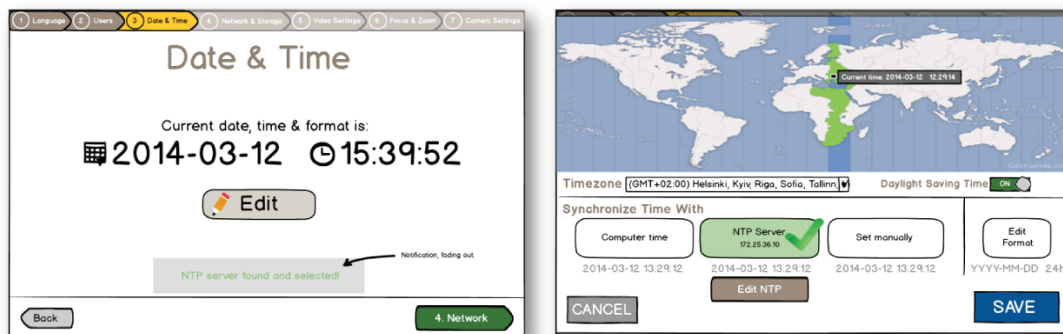


Figure 4.6: Design suggestion of *Date & Time*

Network & Storage

The *SD Card* and *Network share* icons were faded out when not detected to not have the same importance as the network information. A pen icon on the *Custom TCP/IP Settings* button has also been added to hint that you can customize the settings and also to fulfill the continuity of other *Edit* functions in the wizard.

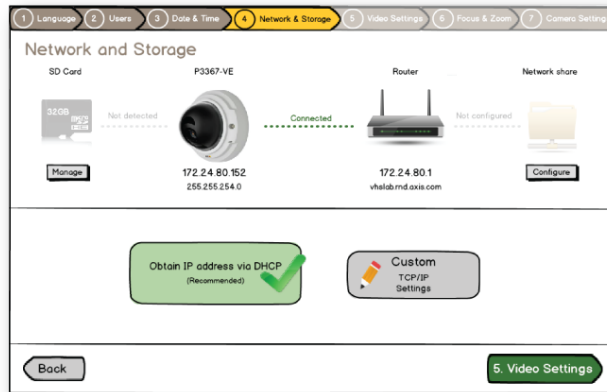


Figure 4.7: Design suggestion of *Network & Storage*

Video Settings

When the *Capture frequency* (50/60 Hz) is automatically detected by the wizard the user will arrive right away on the *Video Settings* step (see to the right in figure 4.8). If this would not be the case, the user can click a part of the world and press *Set*.

Video compression has been included in the lower slider where a value closer to *High FPS* will choose a low compression as heavy camera system load might lower the maximum possible FPS.

The video demo visible on the top of the page is also clickable to change the aspect ratio.

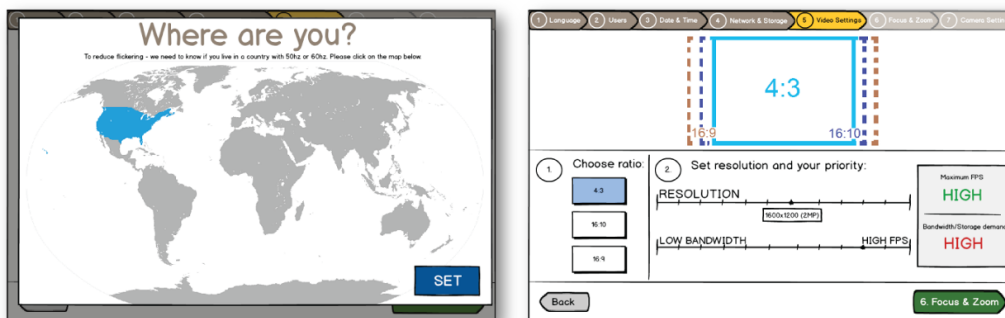


Figure 4.8: Design suggestion of *Video Settings & Capture Mode/Frequency*

Focus & Zoom

Two different design suggestions with great similarity were produced. Both had the live video stream covering the whole canvas area with basically the same functionality placed on top of the video stream.

The first suggestion (see figure 4.9) has an influence of Google Maps (see figure 4.10) with an expandable menu over the live stream. The main concept is to let advanced settings appear as an addition to the more basic settings.

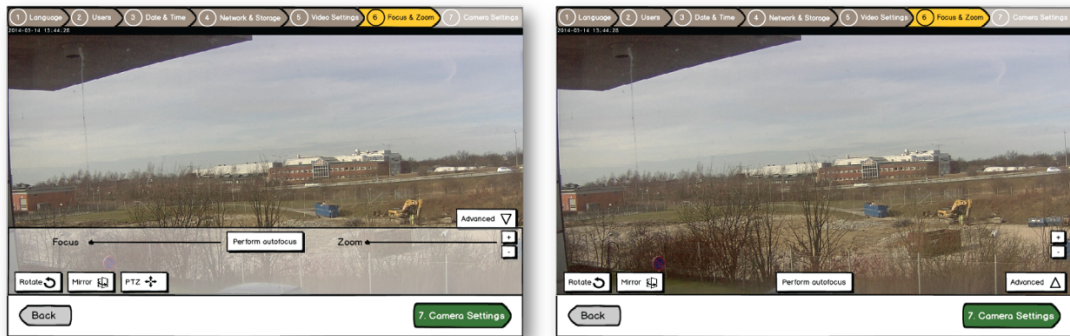


Figure 4.9: First design suggestion of *Focus & Zoom*

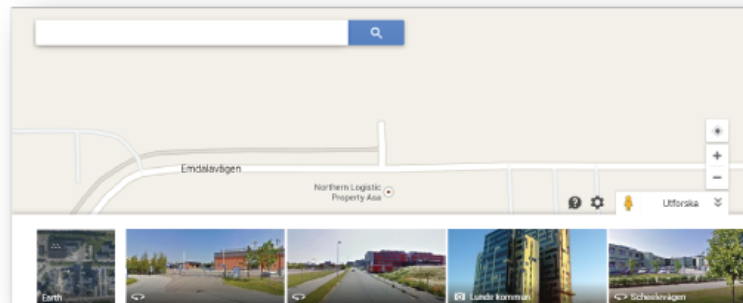
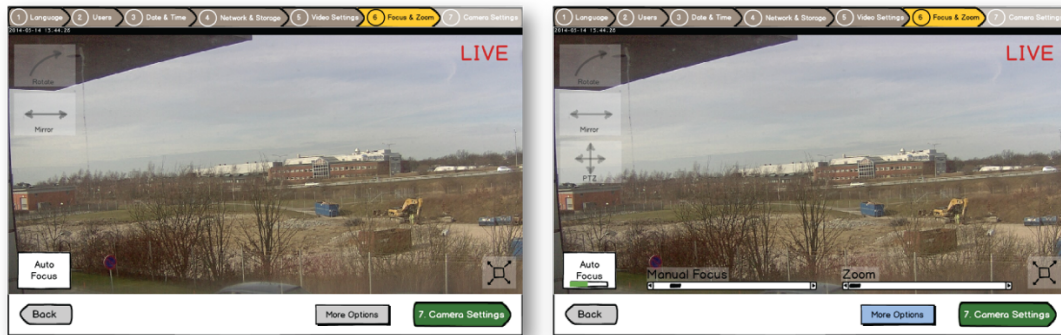


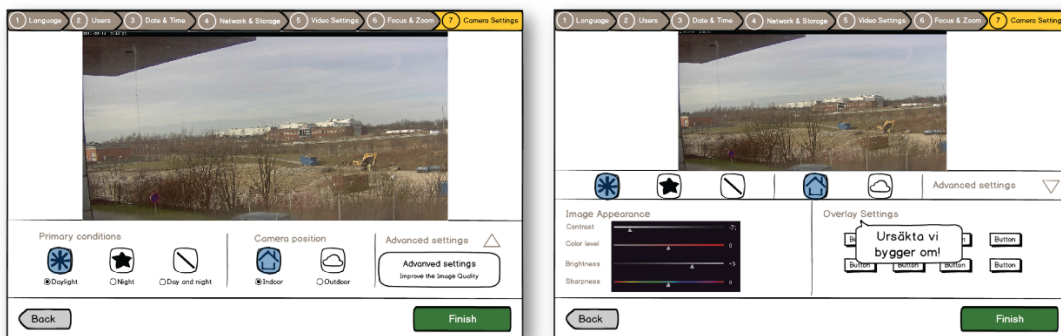
Figure 4.10: Comparison with Google Maps [68]

The second suggestion (see figure 4.11) offered a *Full Screen* button in order to see even better whether the focus is correctly adjusted. The same actions should be visible in the full screen mode. The buttons have opacity so the objects behind still are visible. When the button is hovered, the opacity will decline to make it more affordable. A red text stating *Live* is put in the upper right corner to even more emphasize that is the camera's video stream that is presented. Since the automatically adjust focus function takes roughly 10 seconds to perform, a progress bar is placed on the *Autofocus* button when clicked.

Figure 4.11: Second design suggestion of *Focus & Zoom*

Camera Settings

Image appearance controls are located under an advanced setting. Their sliders should aid in the understanding of what each of the control change. The tab featured in the first prototype was not designed. Instead an advanced menu was added where optional information was placed.

Figure 4.12: Second design suggestion of *Camera Settings*

4.2.2 Workshop

Card sorting

Some participants struggled with the task name *TCP/IP* and did not understand what it could contain. After reorder, all groups agreed that *Language* should be placed first and that it could be combined with *Date & Time*. All groups placed *Capture Mode*, *Video Stream*, *Focus & Zoom* and *Camera Settings* after each other and also grouped together *Users* and *Root Password*. *Storage* was tricky for the participants to understand. One group placed it before video capturing so the capturing could be stored, three groups placed it afterward so the capture could be saved onto the storage. *TCP/IP* didn't seem to have a natural position in the task flow since all groups ordered it differently. The result of the card sorting can be seen in figure 4.13 and 4.14.

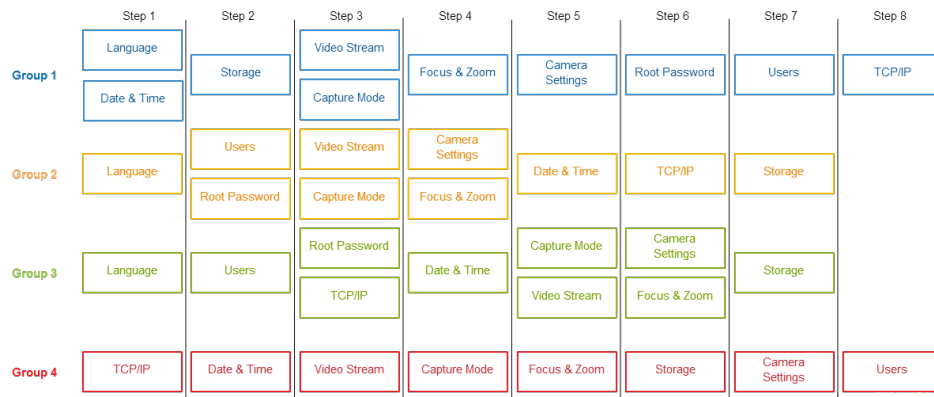


Figure 4.13: The first iteration of card sorting

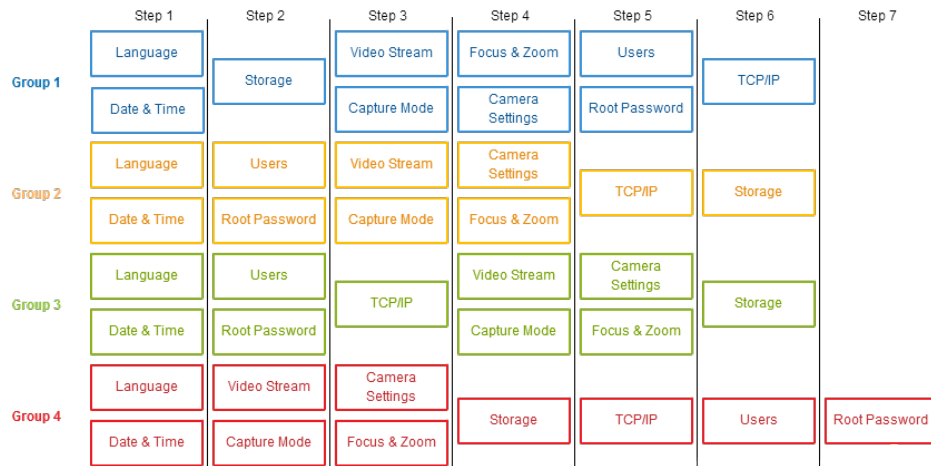


Figure 4.14: Tasks order after second iteration

Paper prototyping

The following designs were found valid and interesting from the paper prototyping:

- Place the zoom slider vertically instead.
- The ability to rotate 180 degrees right away. Could be compared to the first prototype that only lets you rotate 90 degrees at the time.
- Being able to stabilize the picture horizontally was discussed. This would generally mean rotating the image a low number of degrees until not tilting.
- Also being able to tilt the image a custom degree (usually a low one) to stabilize the feed to a horizontal line.
- If the screen is a touchscreen, gestures like pinch, spread, swipe and tap could be used to represent different actions, such as zoom, focus and PTZ.

- If *Language* and *Date & Time* were to be merged, a drop down menu for the *Language* would probably be needed for everything to fit on the page.
- In *Camera Settings*, an interactive menu either on the right or the bottom could be used. This menu would hide when not hovered and also act like a tab menu. When clicking each tab, that specific tab's settings would display within the menu bar. Main categories on the menu could be *Presets*, *Appearance* (color settings) and *Overlay*.
- In *Focus & Zoom*, being able to click the image where the focus should be was noted. This could be mapped with taking photographs with a cellphone.

Design review

The following opinions were raised during the group review:

- The participants didn't know the abbreviation VMS stood for Video Management System and suggested to expand it at least once in the start page.
- Offer a search function for languages if the solution to hide is applied or the number of available languages exceeds a certain number.
- Remove unnecessary information where root password is set.
- The icon when adding a user could imply that a personal avatar can be uploaded.
- The notification of the time source could be shown permanent with the ability to close it to reduce the risk of missing the provided information. The source information could be given in the current time text.
- Time zone is only relevant when NTP time is used. Otherwise time zone will not be relevant and should not steal focus.
- Alter the text from *On/Off* in write protection of SD Card to *Lock*.
- *DHCP* felt like a too technical term. *Automatically assign IP-address* could be a better expression.
- An IP-address is already assigned to the camera, why change it? Perhaps move it to the last step.
- The location should be handled elsewhere than *Video Settings* since the information doesn't make sense being located there. Perhaps in language.
- The term *Maximum FPS* was hard to understand.
- Large buttons felt better if tablet view should be taken in consideration. Smaller buttons might be acceptable on desktop.
- In *Focus & Zoom*, the *PTZ* button should always be visible since you bought a PTZ camera for a reason.
- The mirror button should be led up if activated. The installer and camera might not be at the same place when the wizard is taken and might not be able to tell if the image is already mirrored or not.
- *Presets* would be a good collection name for camera condition and position.

4.2.3 Usability testing

Start

- Even though the test was given with Russian as pre-selected language, the test users had good confidence in starting the wizard and eventually edit the language due to the larger button and also its green color.
- Many felt like the smaller, grey button was some more advanced option and didn't feel comfortable clicking it.

Language

- The idea of seeing all the languages instead of scrolling was encouraged.
- Both participants looked after their native language among the flags, but didn't find it and wanted to use English as second choice.
- If the system would make a qualified guess a combination of the two designs would be good where the most likely languages would be in focus, but all others should still be visible.

Users

- The participants had trouble with understanding the meaning of *root*. They wanted to be able to edit the username and did not understand the task of setting a *Root Password*.
- The participants felt like the icon was an avatar, used in many other places on the Internet, where a profile image can be uploaded and used.
- The participants initially wanted to right click to get the option to delete a user but later found the edit icon. Since no other option was available, deletion of users was believed to be hidden under that icon. If a tablet was to be used, long press on the user would make the menu appear or just tap on the user.

Date & Time

- *NTP* was hard to understand what it did.
- The world map shown to aid time zone did not make any sense in the other options, *Computer time* and *Set manually*.
- The icons and text for the current date and time felt like plain information and not editable. It would be an idea to allow editing there but their first move to alter the time would be clicking the Edit button.

Network & Storage

- Both users put initial focus on the top half of the page, thus giving the perhaps more important *TCP/IP settings* less attention.

- Even though the participants didn't understand the *TCP/IP Settings (Obtain IP address via DHCP)* they had no problem trusting it as it was pre-selected, green and had the text *Recommended*.
- The grayed out SD-card icon signaled that there were no SD-card in the camera. The text *Not detected* was secondary information.
- Both participants did not fully understand the meaning of the step but felt satisfied with the text *Recommended*.
- They did not fully understand the function *Network Share*, but thought it was a way to share the live-feed rather than a storage for video data.

Video Settings

- *Ratio* and *Resolution* was easy to adjust. Resolution was also more commonly known than other terms within the task.
- The term *FPS* was hard to understand.
- The bigger picture of *Maximum FPS* and *Priority* affecting each other was hard to grasp.
- When trying to reduce *Bandwidth/Storage* demand the sliders where experimented with, resulting in a reduced *Bandwidth/Storage* demand. This was done even when not understanding the *Maximum FPS* concept. The colors in the indication aided in the decision making what settings to use.

Focus & Zoom

- When trying to zoom both participants looked unsuccessfully for the term *Zoom*. When not finding it, they both took a guess that the *Full screen* icon was *Zoom*. Due to the larger image, they were given false feedback of zoom.
- The test users didn't want to click *More Options* as they understood it as being some sort of "advanced mode". Not even when not finding what they were looking for did they pressed *More Options*.
- The *Mirror* function was not understood.
- The users thought that the *Rotate* function was a *PTZ* function where the camera was rotating around its own axis.

Camera Settings

- The participants did not understand the underlying reason of the presets but still used them in hoping that the image quality would improve.
- They did not anticipate what would be hidden under the Advanced menu.

4.3 Result analysis

4.3.1 Workshop

Card sorting

The card sorting was performed with four groups simultaneously and the result was discussed after the first iteration. The individual groups were biased by each other's result and the second iteration gave very little new information.

It was clear that the participants thought that *Language* and *Date & Time* could be combined as they are not very complex. This would reduce the total number of tasks which either allows another task to be separated into two independent tasks or shorten the wizard with one step. The latter could result in the wizard appearing shorter and faster to complete. Using the title *Network* instead of *TCP/IP* confirmed to be a correct move as it's easier to understand.

Paper prototyping

The participants didn't have a full system knowledge which was both good and bad. They didn't have any technical limitations but their prototypes could also be hard to implement in an Axis camera.

When combining *Language* and *Date & Time*, a drop down menu with the languages should be preferred as it would save a lot of space.

The ability to rotate the image a custom number of degrees to stabilize the horizon seems excess and should not be included in the wizard. A scenario where the camera is mounted on a wall or a roof where either is tilting seems like a rare scenario.

Gestures are a viable suggestion if a touchscreen is used. Which gestures would represent which action will not be investigated further in this master's thesis since it could easily expand into a whole subject of research.

Design review

Generally too technical language is used in the wizard. The texts need to be explained or rewritten. When choosing *root* password unnecessary information should be hidden. For example the *PTZ* which cannot be turned off anyway.

4.3.2 Usability testing

The usability testing was only conducted with two participants but still felt credible. The participants were good representatives for novice users. The usability testing was rather a confirmation of concerns than finding new issues, although some new issues was found.

Despite an unfamiliar language in the start page both participants basically understood the meaning with the start page and what the green button would do.

Scrolling will be avoided on the *Language* page to give a better overview of what languages are available. When setting up the *root* user, more information must be given or explained with different words.

The world map when adjusting time settings is, even though a neat feature, more confusing than practical. Since the time zone is only a factor when using NTP-server, it should be removed.

Everything around *FPS* and *Bandwidth demand* on the page *Video Settings* needs to be made easier.

There is no need for hidden options on the *Focus Zoom* page as they neither are advanced nor taking up a lot of space. *Rotate* function needs a better icon and text. To give a better clue of what's hiding under the *Advanced tab* on *Camera Settings* all headlines should always be displayed.

5

Third prototyping phase

5.1 Method

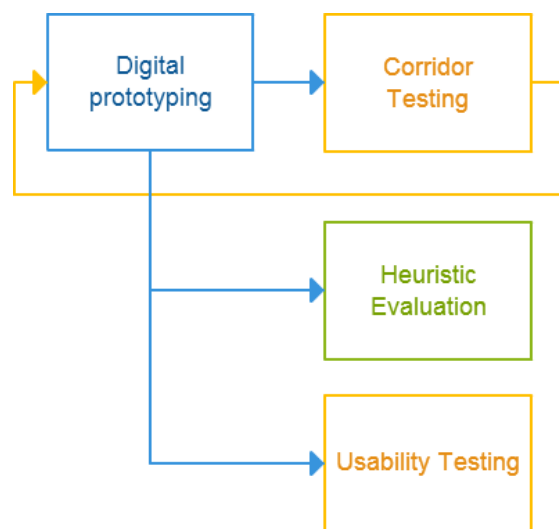


Figure 5.1: Overview of activities in the third prototyping phase

5.1.1 Design

Beginning this phase design decisions were made based on the summary of the workshop and the usability testing made so far. A few key points are the merging of the *Language* and *Date & Time* tasks moving objects to make the user's focus start at a specific object and creating more help texts and help boxes.

When creating the third prototype emphasis was put on consistency and making the design even more minimalistic. *Consistency* in terms of color, size and position of buttons and titles.

Minimalistic in terms of removing any non-essential text or function, putting more focus on the actual important ones.

5.1.2 Inspection methods

Heuristic evaluation

A formal heuristic evaluation was done according to Nielsen's ten heuristics, found in appendix A. Instructions and result sheet was sent out to a number of reviewers as well as performed by the authors.

Expert review

A expert review, seen as a form of heuristic evaluation, was also done with two global sales engineers with worldwide user knowledge.

5.1.3 Usability testing

A more structured usability testing session was carried out with a formal test plan and stated research questions. The test plan can be found in appendix B. Five participants, a number recommended by Nielsen [69], was recruited where one acted as a test pilot.

Participants characteristics

Four questions were asked to the participants before the test started:

1. Rank your general computer experience
2. Rank your general camera/video knowledge
3. Rank your knowledge of Axis cameras
4. What is your main subject at Axis?

Post-session questions

The following questions were asked to the participants after they completed the test:

1. Did any of the steps feel too advanced?
2. Was the wizard too long?
3. Would you want to be able to change more settings than presented?

5.2 Result

5.2.1 Design

General

A higher visual appearance was added to titles and separators, inline with the Axis graphic identity. A more consistent design was applied where similar components were positioned the same.

Language & Time

Language and *Date & Time* was merged. Since it should suggest good default values on both *Language* and *Date & Time* the most important was shown.

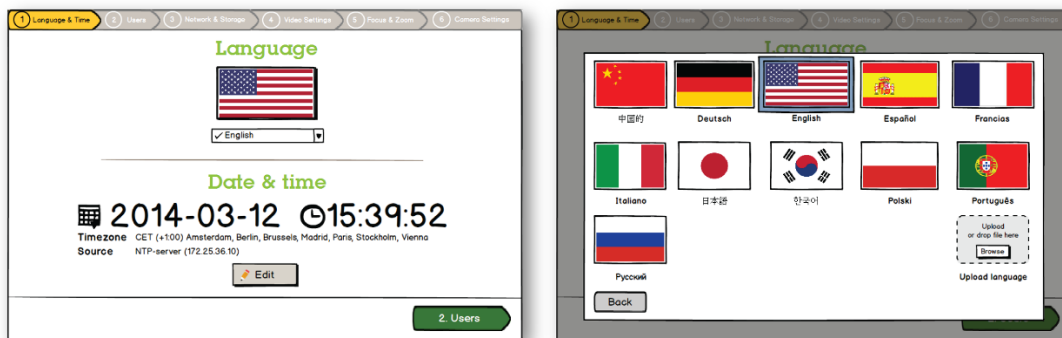


Figure 5.2: The merged design of *Language* and *Date & Time*

The world map for choosing time zone was removed since it only affected the time if a time server (NTP server) was present.

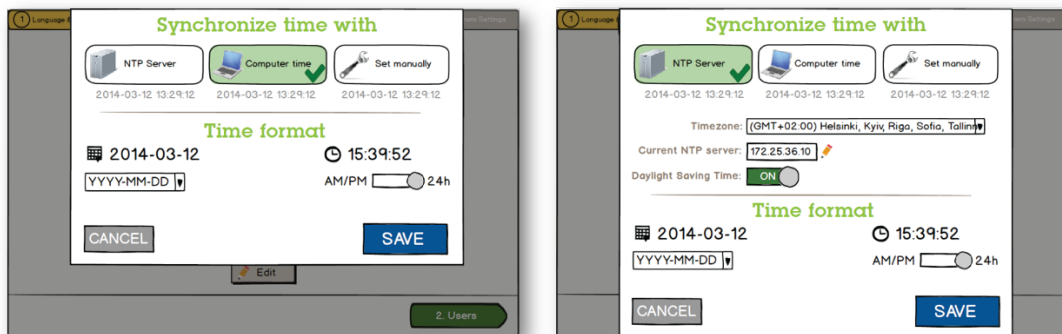


Figure 5.3: Edit time

Users

The heading title *Set root password* was changed to *Set master password* (see figure 5.4) to remove the usage of Unix superuser which was perceived as too technical. The previous help text is now hidden under a help symbol which will appear on hover or press. Since *root* always is allowed to control *PTZ* the text and control regarding *PTZ* was removed.



Figure 5.4: Design suggestion of *Root Password*

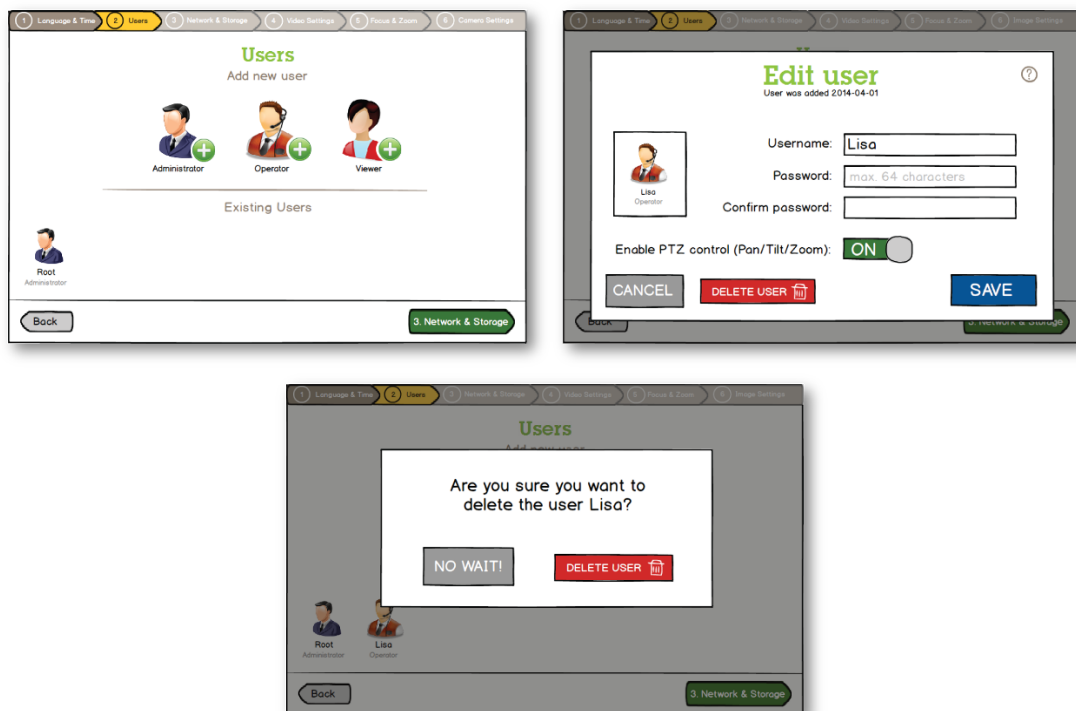


Figure 5.5: Design suggestion of *Users* with new visual look

Network & Storage

TCP/IP-settings have been moved from the bottom of the page to the top to make the user focus on it faster. The terms used on the buttons has been simplified to make a low-tech user understand them easier. Both lower buttons were renamed *Manage* to avoid confusion.

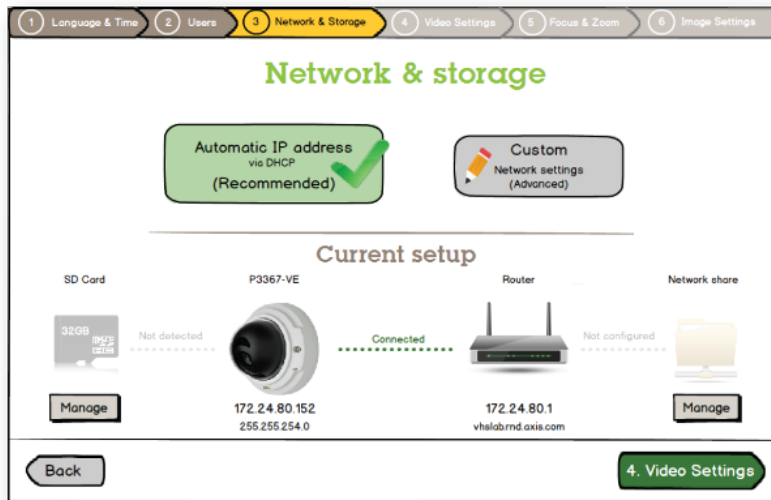


Figure 5.6: Design suggestion of *Date & Time*

Video Settings

An additional slider was added controlling the compression of the video stream as it has too big of an impact on the bandwidth demand to be automated through the other sliders. Predefined settings influenced from *Stream profiles* found in the current interface design were added as suggestions when the users are not sure what they want.

As space would be an issue on the lower half of the screen, the aspect ratio settings as radio buttons and picture preview was moved to the top of the page while other settings were kept at the bottom.

The concept of *Maximum possible FPS*, previously located in the big box to the right, was removed completely as the impact on the others settings didn't affect as much as anticipated.

Values and recommended values were added to each slider to both give better feedback and give the user a sense of what values are reasonable. Values that have absurd negative results, for example as an extremely high compression or resolutions below 300x300 pixels has no possibility to be chosen as these would give a useless image for any users.

Compression can in the current interface design have a value from 0 to 100 where 0 is no compressing at all and 100 the maximum. After testing what bandwidth demand and image quality the scale gives, the new scale restricts the user to the values 10-70 where they also have been renamed to *No noise*, *Tiny noise*, *Low noise* and *Some noise* to increase the mapping to reality instead of the vague numbers.

The *Video Settings* page is still quite complex for an average user. Therefore a clickable question mark icon has been added to a few of the difficult terms.

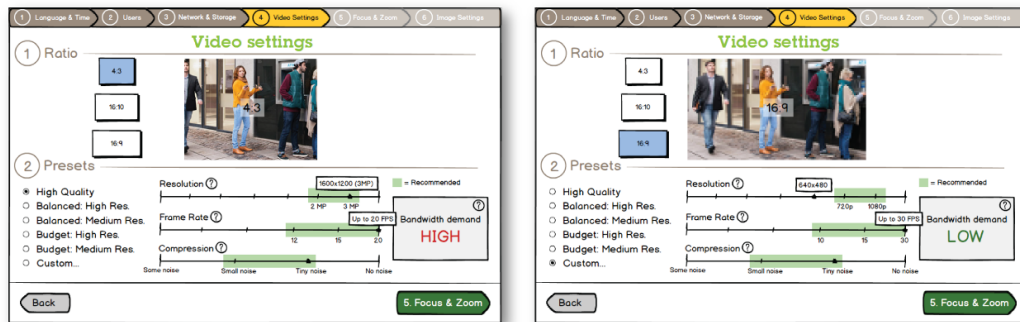


Figure 5.7: Design suggestion of *Video Settings*

Focus & Zoom

All functions are shown instead of hiding some functionality, such as *Zoom*. The function *Mirror* was removed and *Rotate* and *PTZ* control were given larger focus. A more discrete *Live* symbol in the upper right corner was added.

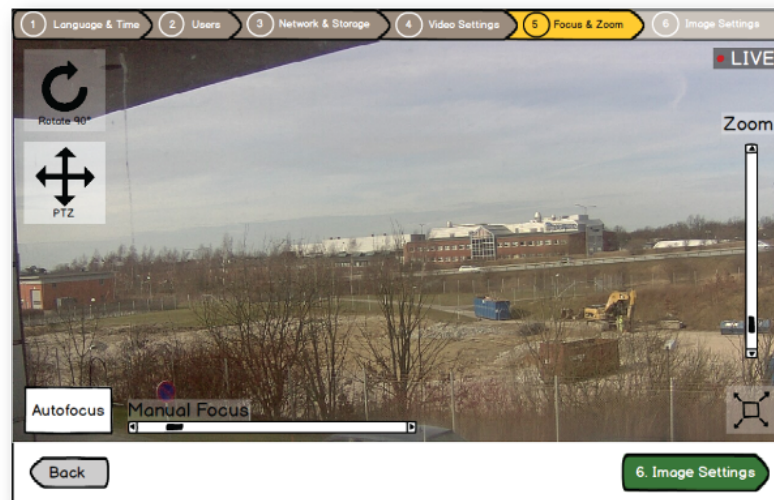


Figure 5.8: Design suggestion of *Focus & Zoom* with all functionality always visible

Camera Settings

During the design phase a corridor testing (see section 2.6.3) was conducted regarding proper naming of the step and how to describe the cameras condition. The outcome of corridor testing

was discussed with a technical writer resulting in that the task *Camera Settings* was renamed to *Image Settings*. The previous sub categories *Primary conditions/Camera position*, *Image Appearance* and *Overlay Settings* was renamed to *Scene*, *Colors* and *Overlay* as be easier to predict and quicker to read.

A tab menu system was introduced instead of hiding some functionality under advanced settings to give a better hint of what functions are possible without forcing the user to use them. When clicking *Close* or at the live video stream in the background, the tab *Scene* will collapse (see figure 5.9 to the right) and the user can choose to either open another tab or finish the wizard with the green *Finish* button.

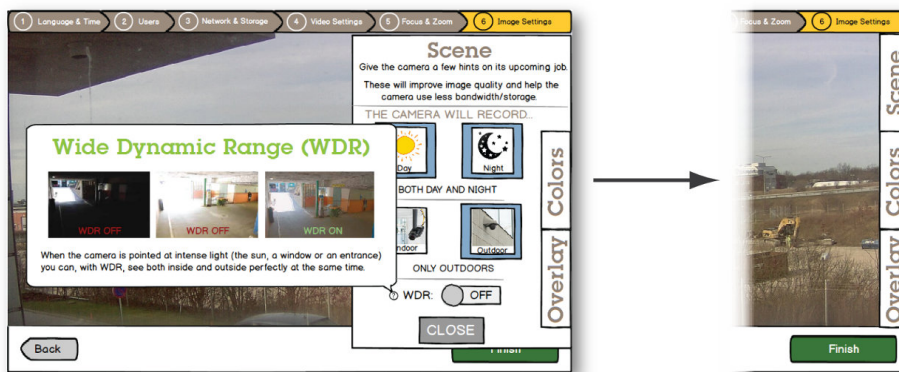


Figure 5.9: Left: Design suggestion of *Image Settings* with *Scene* tab expanded. Right: All tabs collapsed

5.2.2 Usability testing

Participants characteristics

	Test pilot	Test 1	Test 2	Test 3	Test4
Comp. experience	N/A	4	3	4	5
Camera/video	N/A	4	3	3	3
Axis cameras	N/A	3	1	2	2
Main subject	N/A	Image proc.	Data storage	Data storage	Image proc.

Start

All users had problems understanding what VMS was. They also all agreed on that they would click the green *Start Wizard* button anyway. Almost all would do this with a fairly high confidence.

Language & Time

All users used the drop down-menu to access languages. Even though the text *NTP-server* is displayed on the front page, all users confirmed via *Edit* button that it was in fact the so called *time server*. No user knew exactly what a NTP-server was, but came pretty close when thinking for a while and then guessing.

Users

All but one understood the meaning of *root*. The last one thought the page was a login-box rather than a *Set password* box. No user had problems with either PTZ or deleting the user named Lisa.

Network & Storage

Most users acknowledged that DHCP settings were activated from the start but did not really see the connection to the other settings on the lower part of the page. All agreed to that nothing was alarming, but was unsure about whether or not a storage device must be connected.

Video Settings

A lot of the concepts were well understood; *Ratio*, *Presets*, *Resolution*, *Frame rate*, *Recommended* (green) and *Bandwidth demand*. *Compression* was however a bit hard to understand and some didn't realize that the slider was inverted or why. Some users did not focus on the *Bandwidth demand* as much as hoped. All of the users felt free to change settings without risking to undo previous work as they felt the ease to reverse any step with the available presets.

Focus & Zoom

Some of the participants initially used the manual focus instead of autofocus. None found it strange that the image only rotated 90 degrees at the time. They also thought that the PTZ button was confusing and could be removed.

Image Settings

Some of the users did not understand the blue gloria as a sign of being selected and initially clicked the text below the pictures instead (*Both day and night*). However, all users understood the toggle idea as soon as they clicked on one of the pictures. Even though none of the users knew what *Wide Dynamic Range* (WDR) was, some guessed correctly what it could be, while others understood the use of it after reading the help section. All the users found the help icon. When wanting to improve the brightness in the picture, some users did not understand the tabs to the right and two out of five started with clicked *Overlay*, thinking it was some kind of filter.

Post-session questions

None of the participants thought the wizard was too long and could not come up with anything that they missed in the wizard. All answered that there was no task they considered too advanced, even for a more novice user than themselves.

5.2.3 Heuristic evaluation

The number in parenthesis refers to the group in Nielsen's ten heuristics found in appendix A.

Start

- On first occurrence write out *Video Management System* instead of the abbreviation VMS. (#2)

Language & Time

- No help is offered. (#10)
- Computer time could be included in system time. (#8)

Users

- No help is offered. (#10)
- PTZ control could be unnecessary in a wizard. (#8)

Network & Storage

- No help is offered. (#10)

Video Settings

- Ratio should be renamed to Aspect ratio in order to use the correct term. (#2)
- There is no reset button or information of default values. (#3)

5.2.4 Expert review

Users

For most users no additional users will be added except from root. Many VMS users the root users or creates its own users. The ability to control the PTZ should still be offered since it could be useful for some users.

Network & Storage

Fixed IP address are used more often in larger systems. For minor setups with fewer cameras DHCP is still a valid option. The lower part of *Network & Storage* might not be essential and could be removed.

Video Settings

A customer that bought a high resolution camera will probably want to use the full resolution the camera is capable of. If a lower frame rate is set on the video stream there will be no way to increase it during recording.

The expert was not sure if compression scale should be called *noise* or *blur* and suggested a tech writer had a say in the matter. Generally a very pleasant and intuitive *Video Settings* page. Requested a dynamic *Bandwidth demand* indicator that would show a live update of what the current settings generate in bandwidth demand.

Focus & Zoom

Not including the task *Enable iris* found in the current interface design was pointed out as a vulnerability. It is used when targets might become unfocused at night since the camera mechanically does not open iris completely before auto-focusing.

The expert requested the function of *Set focus area/point* to be able to easier set where the focus should be.

Image Settings

A suggestion to increase what different image settings would do to the camera could be to take snapshots with different settings and let the user choose which they would prefer. This feature originated from how the first camera produced in 1996 set its image settings.

5.3 Result analysis

The result analysis is based on usability testing, heuristic evaluation and expert review.

Start

A better explanation of VMS is required as it is confusing too many of the users. A worst-case scenario would be an actual VMS user not understanding the term and therefore choosing the wrong option.

Language & Time

Even though the *Computer time* could be merged into *Set manually* it feels like a small issue and will not be dealt with further.

Users

Some help would be good to determine the difference between the different user types.

Video Settings

As the five presets acted as a fail-safe when experimenting with the sliders, the users felt no hold backs trying out different presets or custom settings.

During the test an issue regarding the aspect ratio was found. None of the participants found it, perhaps due to how the task was given. The test participants were asked to choose the widest picture format where the aspect ratio of 16 to 9 would have satisfied that question. But technically all aspect ratios are of the same width but cropped vertically. The design should not give a false representation of the reality (see figure 5.10). This proves that usability testing could give more than intended. The title *Ratio* could also be renamed to *Aspect ratio* if it's possible without making the design too cluttered.



Figure 5.10: False representation of aspect ratio where the video is cropped horizontally

Compression was probably misunderstood quite a lot due to poor labeling and the inadequate help box. Having the slider inverted (compared to the other sliders) could also be a factor, but it was believe not to have a large impact. The compression label is measured in *noise*, while a more correct term could be *blur*. Blur would technically reduce noise, thus enhancing the confusion.

Regarding the *Bandwidth demand* indicator getting as much attention as intended, either moving it closer to the *Presets* or introducing some kind of visual effect would help. The latter is hard to perform in a high-fidelity prototype.

Suggestion was made to include the current *Bandwidth limit* where the camera would automatically for example lower the frame rate to fulfill the limit during peaks.

Focus & Zoom

All users completed the task of rotating very quickly and with ease. At the moment most of the users saw the *Manual Focus* slider before noticing the *Autofocus* button. As *Autofocus* is more important, this could be corrected with either a bigger or colored button. A secondary option would be to change the position of the button.

Image Settings

The reason why the participants didn't understand the blue gloria when the button was marked, was probably due to the prototype not having as high visual design and effect as a final product.

Post-session questions

The question asked after the test session was over didn't give much information. Too little effort was put into what actually could be important to ask at the end of a usability test session. Especially the question regarding if any setting was missed was poorly constructed. To be able to answer that a high system knowledge would be required, which the participant was recruited on not to have.

6

Fourth prototyping phase

6.1 Method



Figure 6.1: Overview of activities in the fourth prototyping phase

6.1.1 Design

For the fourth prototype, the focus was put on implementing changes based on the usability testing and expert reviews that were made on the third prototype. As this is the last prototype before an implementation would start (which this master's thesis will *not* cover), a lot of effort has been spent on making the prototype more high-fidelity as in a design closer to a final product with better visual design.

6.2 Result

6.2.1 Design

General

All steps has had their visual design significantly improved with a less sketchy look on fonts and graphics while also put into a real web browser window (see figure 6.2).

Start

As many users didn't understand the term *VMS*, it has been written out to Video Management System. The logo was changed to white text to have better contrast to the background image.

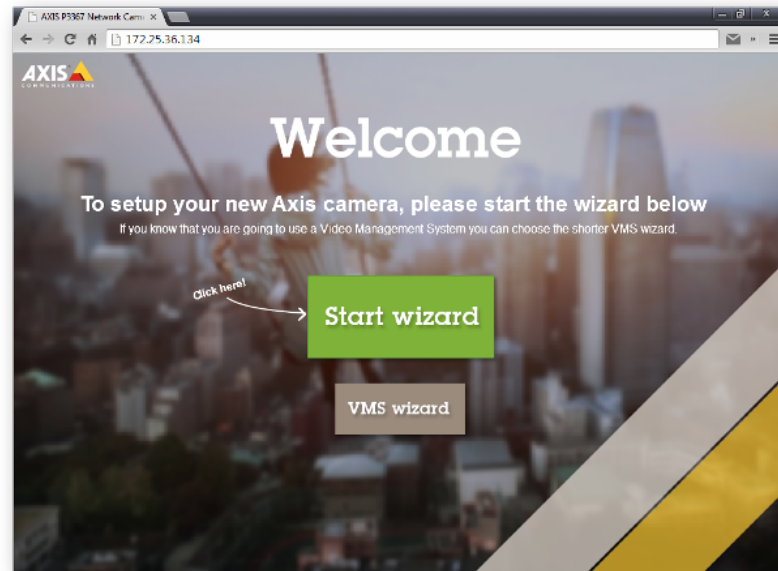


Figure 6.2: Proposed design of Welcome page

Language & Time

For an easier concept of what a *NTP server* is, it has been renamed to *Time Server (NTP)* and has a new icon.

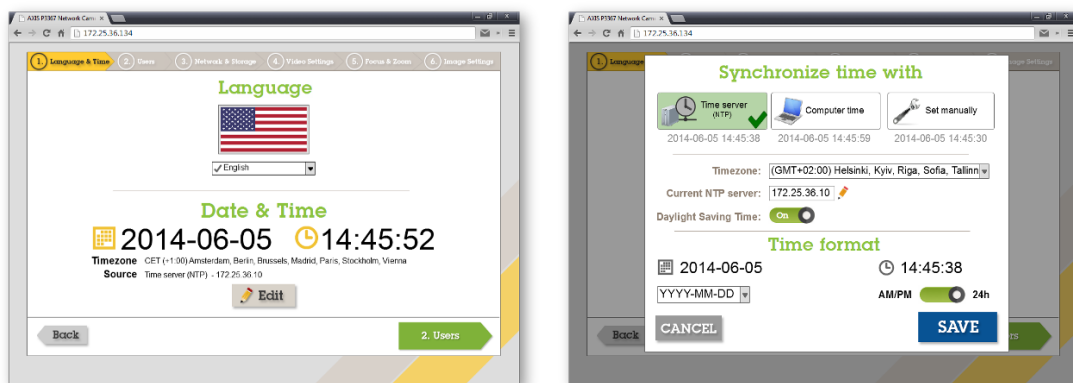


Figure 6.3: Proposed design of *Language & Time* where *NTP* is renamed to *Time Server*

Users

A help page has been added to the overview page for a quicker explanation of what the user types have different from each other.

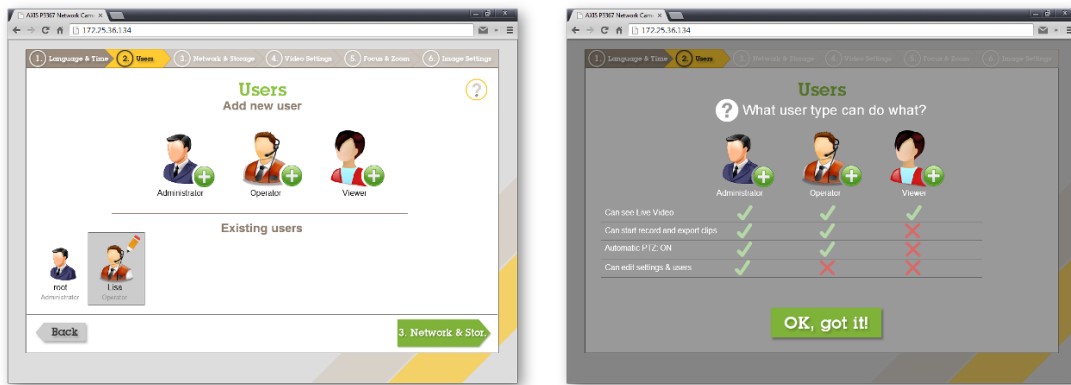


Figure 6.4: Users help page

Network & Storage

The buttons *Automatic IP address* and *Custom* was changed to the same size to give them the same focus. *Automatic IP address* still has a recommended disclaimer since a novice user most likely will use this option. The *Current setup* was also made smaller in height since the importance of this step is to set correct IP settings.

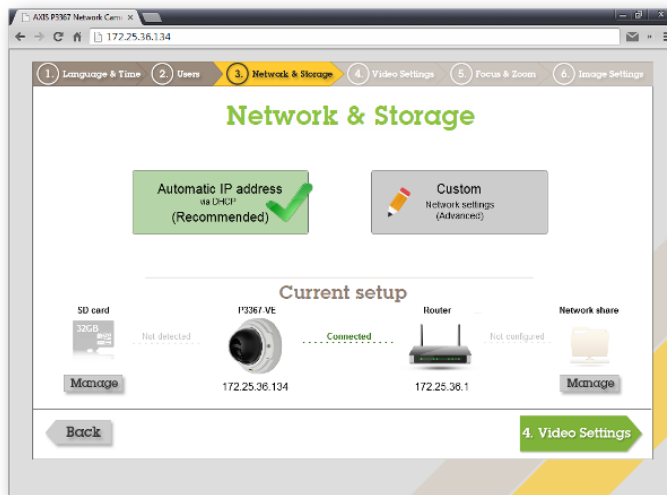


Figure 6.5: Proposed design of *Network & Storage*

Video Settings

Ratio has been renamed to *Aspect ratio* for clarification. The preview image has been edited to corrected show the way different ratios crop the image on Axis cameras.

As some users didn't use the *Bandwidth demand* help as much as anticipated, a small text has been added to it, showing a rough estimation of how much bandwidth will be used.

The scale for *Compression* has been remade to both give a more accurate explanation of the actual effect of compression using the term *blur* instead of *noise*. The word *Some* has also been replaced with *Moderate* to give a more logical slider in terms of what way to pull it to increase compression.

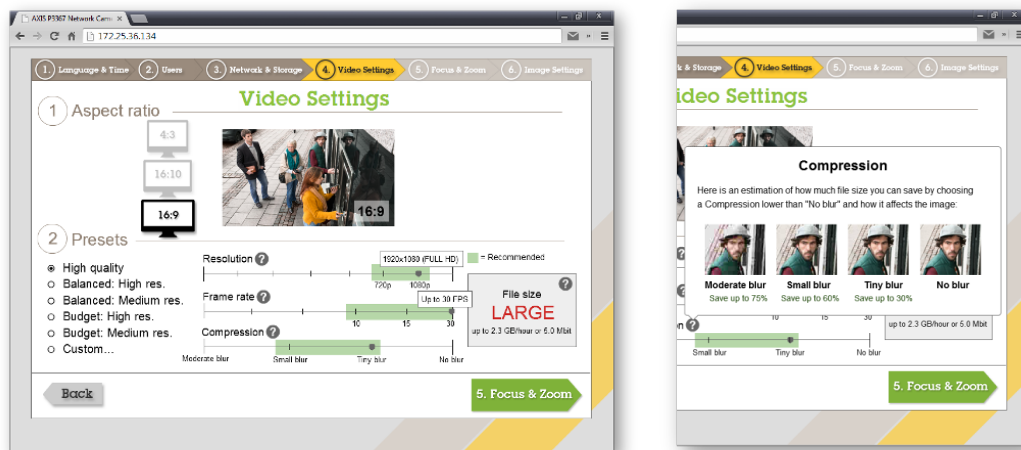


Figure 6.6: Left: Proposed design of *Video settings*. Right: Help dialog of *Compression*

The help page for *Compression* (see to the right in figure 6.6) has been remade with less text and no graph but instead a set of images showing what effect the different compressions would have on the image. To justify how bandwidth a user will use with the different compression-steps, a “Save up to”-text has been added to the help page, mapped to everyday grocery shopping where a typical user can related to that saving for example 50% or more would be quite a lot.

Focus & Zoom

Manual focus is now hidden until an autofocus has been performed to increase the usage of the autofocus function. Visual attention has been given to the *Autofocus* button by giving it a green color instead of the previous white. A Set focus point function has also been added as a second step when using the *Autofocus* button in order to avoid loss of focus during low light conditions.

Image Settings

As some users initially misunderstood the tabs for *Scene*, *Colors* and *Overlay* a higher visual detail was put into these. Transforming the square buttons to actual tab-looking buttons made

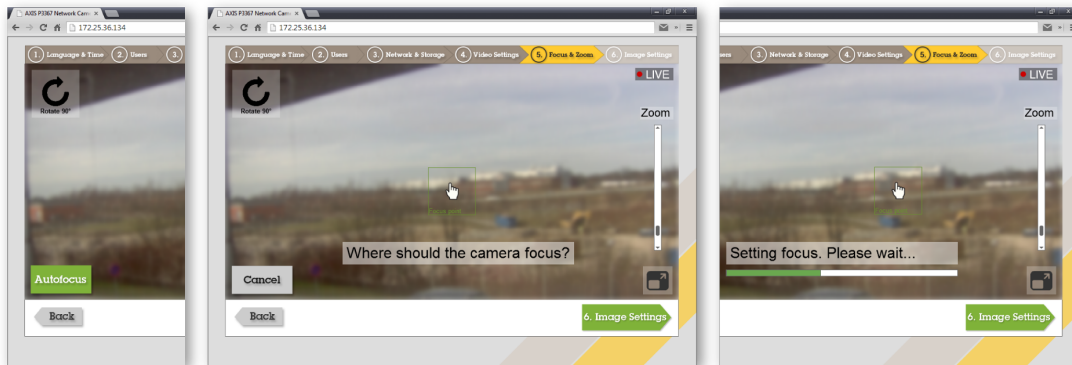


Figure 6.7: Proposed design of *Focus & Zoom* with sequence of setting focus

it clear that the buttons need to be on the left of the big box to make sense instead of previously right. When entering a specific tab all text has been removed from the empty space where the title (for example *Scene*) is in collapsed mode.

The tabs and box were hiding the actual live stream and so the stream was minimized to fit the available space to the left of the tabs.



Figure 6.8: Proposed design of *Image Settings*

7

Discussion

7.1 UX Design at Axis

7.1.1 User-Centered Design models

Generally any of the mentioned methods in section 2.4 except *Aesthetic over Usable* would be viable in order to reach a high level of UX Design at a company. Agile UX has a focus on deciding *how* to build things right while Lean UX and Effect Managing decide *what* the right thing is to build. Lean UX is probably the most efficient method but also requires a complete dedication which can be hard to achieve in a very large company. An almost as good or even as good method judging from style of preferences would be the Effect Managing that can be applied gradually. Agile UX and Effect Managing could be merged into the existing organization at Axis without any comprehensive reorganization but with relevant strengthening in competence. Both could initially be applied in smaller scale and later be scaled up to cover the entire software development organization.

7.1.2 UX maturity

Axis has good conditions to achieve a high UX maturity. Employees are encouraged to be open and innovative which is a good foundation to reach a higher UX maturity in order to incorporate UCD. Some teams have been handed resources and mandate to apply UCD and have been trained by usability consultant aligned with Schaffers UX strategy model. These teams could act as showcase projects towards the organization as a whole. The obstacles lie with the organization where today Axis lacks a UX champion at the high level of management. As long as this state stands, UX Design will not be prioritized on the organizational agenda.

7.1.3 Background study

Doing a thorough background study will have many advantages. Having a better idea who the real user is will let you create a product with functions closer to what the user *really* wants instead of what they are believed to want. It might sound similar but the difference could be

avoiding expensive changes in a later development phase, perhaps even after the product has been released. These changes are often not as good as they could be if they were addressed earlier. Late changes can often get the feeling of being tacked in somewhere where they don't belong as a result of it being too expensive to do all over. When making early changes, everything can be taken into account before going into the implementation phase.

It can always be argued how much one should spend on the background study. Of course doing none whatsoever is rarely an option, but should one for example interview five, 50 or 500 users? We believe this varies a lot depending on the complexity of the product and how many different user types it has. Interviewing 20-30 users will usually give a price-worthy feedback of the most common user types. This is, however, a whole research subject on its own where we can't draw any definite conclusions.

As we have not been able to do a complete background study in this master's thesis we've based our decisions on internal interviews and previous work done by others on Axis. With more time, we would definitely put more effort into this matter. Since we couldn't make the background study as comprehensive as we would want, there is a valid risk that some changes would had been made at a later stage, resulting in less effective development.

7.2 Design

7.2.1 Feedback & instant feedback

A major flaw in the current interface design is the lack of feedback. Not experiencing what difference the change in a setting made will severely discourage the user to make any changes. In the proposed design, three main attributes have been focused on to fix this. Instead of having to click *Save* after every setting all adjustments show feedback as they are saved right away. Not having to open another window to see the actual change has also been resolved as for example any page including image settings has got a live feed next to it, updating and automatically saving with every adjust on the setting. Too much text can be overwhelming where as a visual feedback could both replace a lot of the text and make it feel less cluttered. Having a visual feedback can also explain or replace difficult and technical terms, more about this below.

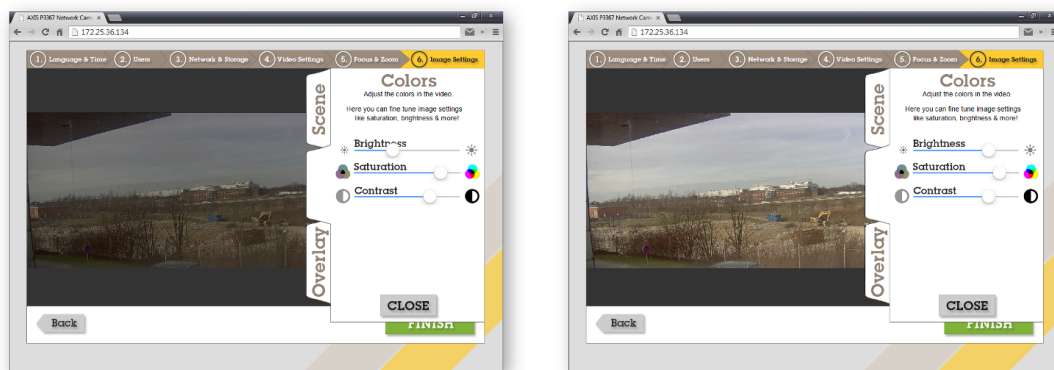


Figure 7.1: Instant feedback when changing brightness

7.2.2 Technical terms

For a novice user installing an Axis camera, there are some terms that are too technical, e.g. *TCP/IP*. The user research showed that installers normally have low IP-knowledge. *TCP/IP* is perhaps well known in the surveillance industry but not in rest of the world. It's a typical case where the developer assumes that the intended user have the same knowledge as himself. Other hard to understand terms are *NTP*, *DHCP*, *root* and *Wide Dynamic Range*. If the term isn't explained further where it's mentioned, the user will not change it. By visualizing the term or rewrite them into simpler, more understandable terms, the problem can be bridged. *TCP/IP* could be called *Network*, *NTP* could be described as *Time server*, *DHCP* as *Automatically assign IP-address* and make it a recommended setting.

7.2.3 Minimalistic design

A lot of users feel overwhelmed with the amount of presented settings in the current interface design. Showing all possible setting that a camera can have, will make a novice user feel that they are way over their head and will not know where to look nor what to edit. Minimalistic design will present only the most crucial settings for the user. An example of minimalistic design can be found in figure 2.6 at page 26. As in the proposed design, settings that are not required to install the camera for most users are not presented in the wizard. These can still be found after the wizard if the advanced user requests them.

The settings presented in the proposed design might still be reduced even more, but it would need a more comprehensive background study. This would determine more precisely who the user is and what settings they feel is critical.

7.2.4 More efficient and less steps

Foreign users who does not understand English will, in the current interface design, have a hard time going through nine clicks in English menus before being able to change to another language. In the proposed design the users need to click once before having a big flag presented with all available languages with flags if clicked or below in a drop down-menu. Since the start page has a clearly color-coded path, even if not understanding a word of the text, the user will click the correct button (*Start Wizard*) as seen during the usability testing with the *Second prototype* (see chapter 4).

A lot of the tasks have been combined to reduce the number of steps the user needs to go through, but also to group up similar settings. *Language* and *Date & Time* was paired up as they are very easy to understand and will give the user confidence of progress. *Root password* and *Users* was paired up as *root* is an already existing user. It was first believed that the *Root password* had to be set before anything else could be made but as it turned out a temporary root password is already present. As long as this password is changed somewhere during the wizard, this won't be a problem.

With an apparent theme on each page, the users will have an easier time figuring out what needs to be done and how. This combined with the reduced number of steps lets the user to be more efficient and save time when installing an Axis camera.

7.2.5 Smart guessing and automated settings

A lot of the settings made in the current interface design could be replaced with automated settings using guesses based on information available at the user's computer. Using information like location from *Geo IP*, data from the operating system or data from the browser could give suggestions of what language, time, time format and capture frequency the user prefers. This could be called "smart" guessing where the proposed design would sometimes remove an option completely and otherwise suggest the most likely option right away.

7.2.6 Pleasant visual design

An old system is usually less user friendly than a new one. With this in mind, a modern look will make the user feel that the interaction with the seemingly new system will be more pleasant than it would with the old system. It is of great importance that the system lives up to this feeling and deliver a good user experience once the user starts using it. A lot can be gained by a positive first impression. For example when showing Axis products in demonstration purposes, a pleasant visual design will encourage new customers to try out the product. If new customers can be tempted to use it from its visual appeal, and especially not be discouraged by an old interface design, more customers will come in contact with the system and learn what a great product it is.

7.2.7 Video Settings

Video settings was definitely the toughest task to design due to its complex nature. In the current interface design most users did not change the settings, mostly because of the page being too complex and thus not understanding it and also not being aware of the consequences of leaving everything on the maximum values. Not fully understanding the page resulted in the user not knowing what settings to change to get a balanced bandwidth demand from their needs while still a decent video quality. Another confusing part has been settings video settings but still having to choose a *Stream profile* later on, both critical to the bandwidth demand of the video stream. The proposed design has had its main focus on addressing all of these issues.

The proposed design have grouped up and separated the different resolutions based on their ratio. Distinct and instant feedback will give the user a clear idea of how the different ratios will look. When trying to find a suitable resolution, frame rate and compression resets will work as "safe settings", especially for a novice user, where the sliders will work as a feedback together with the bandwidth demand indicator. An advanced user can experiment by pulling the slider with the presets to fall back on if not satisfied. Even though it couldn't be visualized with the prototypes, an idea is that the image preview shown on the top of the Video Settings-page could be a short video demo where settings from the sliders below would be reflected. For example if choosing a very low FPS, the video would stutter to simulate how this would look. This could severely help a user not to overdo settings and save otherwise unnecessary spent bandwidth.

The sliders have restricted values to deny the user from choosing inappropriate settings that will be ineffective for either the image quality or wasting an amount of unnecessary bandwidth. For example compression has been restricted to have a minimum value of 10 and maximum value of 70. The sliders have also received recommended values that, as the usability testing showed, users will try to stay within to keep a balanced image quality. If the users have specific

needs and knows what they are doing regarding for example FPS, they can still go outside the recommended values and see how the bandwidth would be affected through the *Bandwidth demand* indicator.

The scale of *Compression* was hard to simplify for the novice user. It is safe to say that this specific setting was the most time consuming and remade setting during the whole prototyping phase. Since the scale of *Compression* is backwards where a high value would result in a lower bandwidth demand and vice versa, the decision was early on made to make the slider backwards as well since the other two sliders would imply that the further to the right you pull it, the more bandwidth will be used. This in combination with the scale changing from numbers to the somewhat incorrect term “noise” still lead to some confusion. The disorder in the image caused by *Compression* could even be argued to cancel out noise, as in small pixels showing up on random places in the stream. Finally, the *Compression* was described in a scale of *Blur*, from *No blur* to *Moderate blur*, inspired by Adobe Photoshop’s saving of JPEG-files (see figure 7.2). This along with a help function describing the effect it would have on the image would hopefully make the phenomenon of *Compression* as easy as it could be to understand.

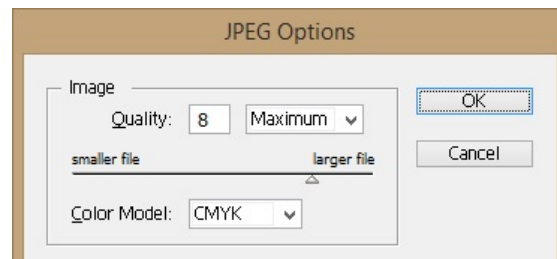


Figure 7.2: Saving a JPEG in Adobe Photoshop

As for of the *Bandwidth demand* indicator box, it started out with including another indicator named *Maximum FPS* since it was believed that some settings would lower the highest possible FPS output. This turned out to have a minimal effect as the hypothesis was tested out and was deleted from the following prototypes.

7.2.8 Focus & Zoom

The ability to rotate with live feedback and more natural steps when setting focus has been seen as a major improvement of the page. Autofocus will get you very close to the correct focus since you will set the focus point in the same step. If not satisfied, the manual focus will appear after autofocusing, combined with the ability to maximize the stream and confirm or manually set the focus in full screen mode.

7.2.9 Image Settings

Even though no such technology is developed as of today, a scenario where the user tells the camera in what environment it will record could help the camera to choose better default settings for that specific environment. This could include advanced options like white balance, shutter and gain which most of the users leave as they are since they are simply too advanced. The concept of WDR was explained through a help box with both a short text and images. A

scenario where the camera will record both indoors and outdoors would also automatically turn on WDR with the option of disabling it.

In the prototyping phase some users had problems understanding that the tabs to the right were actually tabs. In the *Fourth prototype* this has been corrected by implementing a higher visual design where a genuine tab-look will clarify any confusion (see figure 6.8 at page 69).

7.2.10 On/Off sliders

In the proposed design several On/Off sliders can be found. These however vary in color depending on what the normal state of that function would be. For example, when adding a new user of the type *Operator* one can choose to disable or enable *PTZ*. In this case *On* would be green and *Off* would be red since most operators probably would want PTZ enabled. When looking at the WDR function on the *Image Settings*, most cases would have WDR turned off. Therefore the *On* is green but *Off* had been made grey since there is no need to alarming the user.



Figure 7.3: Sliders when OFF state (with red color) should be alarming



Figure 7.4: Sliders when OFF state (with brown color) should be non-alarming

7.2.11 Limitations

Neglected areas

Due to time limitations, there were several areas of UX Design we could not cover with this thesis. To visualize these limitations, see figure 7.5.

To summarize these areas, here are a few of the things we chose not to put any deeper focus on:

- Technical restrictions - Limitations within the current APIs was taken into consideration but not limited ourselves. Design suggestions made are to be interpreted as what *should be possible* rather than *what is possible* today.
- Branding and marketing - How should the new interface be put on to the market.
- The idea was to design, not implement. No investigation on how to technically solve some design suggestion has been done.

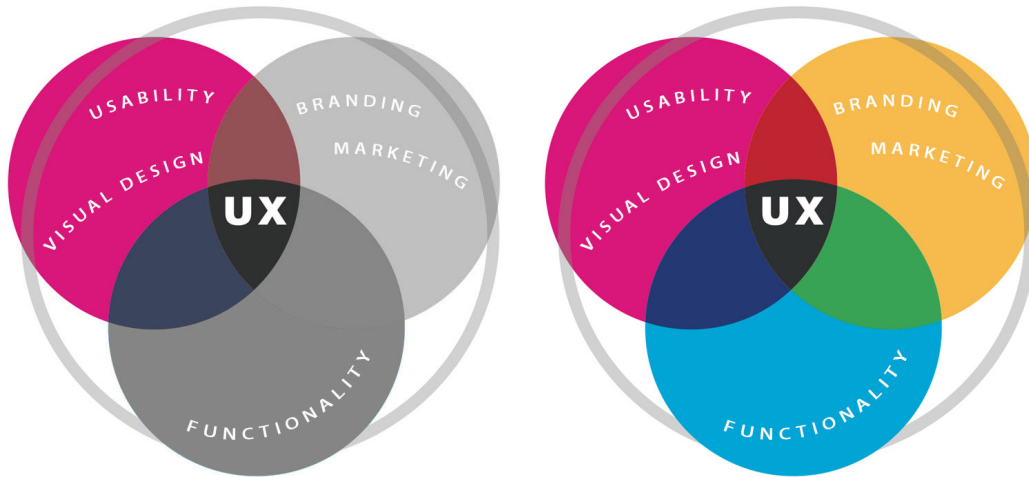


Figure 7.5: Greyed out neglected areas (left) compared to the figure 2.1 (right)

Limitations within our focus

- No user study was conducted and the thesis was based on secondary information and a three year old user study. The information from the user study might not be valid today.
- During the design process focus was mainly on the interaction and visual design of UX Design which are within our field of competence.
- Due to corporate limitations only Axis employees participated in usability testing. In order to get as novice users as possible, other master's thesis students at Axis were recruited as test participants.

7.3 Testing and inspection

7.3.1 Usability testing

Usability testing was performed on both the *Second* and *Third prototype*. The result of usability testing on the *Second* prototype was more of a confirming character where only a few new issues were found. This could be due to the workshop being arranged previous to the usability testing and that only minor changes was made between the *First* and *Second prototype*. The theory, stated in section 2.6.4 that both inspection and testing should be performed on an artifact in order to find as many issues as possible, was thus strengthened. If inspection is performed before the testing, the testing could confirm which of the inspection findings that are an issue to the user.

The usability testing of the *Third prototype* was more formal and a mixture of exploratory and assessment testing, which can be read about in section 2.6.3. The test protocol was prepared based on different scenarios that we found important. Since the test participant will have easier to express their opinion of something they experience, the outcome of the usability test will more likely surround the scenarios than other parts if the prototype. For instance, the task list

in the test protocol didn't contain any scenario regarding the change of time format. The test participants didn't by themselves express any potential issues regarding this area, probably due to that they didn't have to reflect over it. Therefore it is of importance to put some effort into the task list and scenario creation before conducting the test to get as much out of it as possible. A thorough background study could be helpful in order to prioritize which tasks are important and create scenarios based upon those tasks.

Early design testing

The different prototypes were created with a browser in the background to give as authentic feel as possible. The intent was that during the usability tests the participants should forget the fact that they were using a PDF file and imagine the web browser scenery in order to get the participants to act as if it were a working product. One negative aspect of this could be the confusion when an action, normal for web browsing, does not work or that the test participant expects more from the system due to its authentic appearance.

When designing prototypes with Balsamiq Mockups, animations and visual feedback are limited. The time and effort needed in order to achieve these cannot be justified in early phases and should not be invested in until the implementation phase. It is of importance during usability testing to know which areas that should have more feedback in order to analyze the result properly. Test results regarding areas with lacking animations and visual feedback should be evaluated regarding how probable the issue would appear if it was a final product.

When making early design testing you'll generally want to test the conceptual design and find fundamental problems. If one gives the prototype too good of a visual design early on, testing can become harder. During the workshop design review we noticed that the participants focused more on details and less on the conceptual design due to the *Second prototype* having a too detailed visual design.

Performing usability testing on the final proposed design would probably had given little new information as all design decisions were based on either an inspection or testing, and nothing new was added. If anything should have been conducted it could have been a minor informal inspection by a usability expert to get a second opinion before releasing the design for implementation. After implementing the wizard in actual code, usability testing in form of assessment testing should be resumed as the implemented version might differ from the proposed design.

Bonus effect

Usability testing can bring some additional positive effects. If performed on an actual product or system, i.e. not a fidelity prototype, it could be seen as a part of the overall verification. A test participant might use the system in another way than intended or have another preferred ways of interacting with the systems in general which had not been thought of.

One important thing is the pilot testing before the actual usability test is conducted. The pilot test participant can be a person not necessarily with the desired user background. The purpose is not the outcome but to verify the usability test. The test outcome can be included in the overall result but the fact that the test pilot isn't the intended user should be taken into consideration. It's also good for the test leader to know where or which areas that could have either bugs or usability issues in order to get the most out of the real usability test session. We used a test pilot

which gave us improvements to the test protocol resulting in a more uniform usability testing of the other test participants.

Corridor testing

When designing the *Third prototype*, corridor testing, a quick form of usability testing, was tried out. For minor decisions on a limited scale it can give instant feedback on a design suggestion in order to make a more informed decision. It can also be useful when in need of a fresh set of eyes to both confirm hunches and discover major faults. Corridor testing should not be used when there are a lot of factors to a design that the asked person do not have the knowledge about. One part we used corridor testing on was when trying to name the page *Image Settings* and its functions. Some terms we had not thought about came up and were used in the final prototype while another term was confirmed to be good and gave us confidence in using it.

7.3.2 Usability inspection

Heuristic evaluation

We performed two different heuristic evaluations. One less structured on the *First prototype* and another one on the *Third prototype* where we followed the *Nielsen's 10 usability heuristics* as evaluation guidelines. Generally the first evaluation gave more than the second. This could be due to that the amount of usability issues was greater early in the design process but also that the evaluators didn't have any limits or checklist to narrow them down. Furthermore, some of Nielsen's heuristics were not applicable in our high-fidelity prototype:

- Visibility of system status (#1)
- Flexibility and efficiency of use (#7)
- Help users recognize, diagnose, and recover from errors (#9)

We also found a contradiction in two of the usability heuristics, *Match between system and the real world* (#2) and *Consistency and standards* (#4). These two could conflict each other if the standards have no real world connection, especially in the security industry where some terms and standards are very established and should not be renamed completely. In our design we overcame these contradictions regarding technical terms by adding both the standard and a more user friendly term, i.e. *Time server* and *NTP*, *Automatic IP address* and *DHCP*.

In order to get as much out of a heuristic evaluation as possible the evaluators should have some previous experience with UX Design. If no usability experts are available, checklist formats like Nielsen's could work as a substitute. The outcome will however be limited depending on which heuristic evaluation model is used. Evaluation methods like Nielsen's should not be performed on a high-fidelity prototype. Instead a less structured method where different areas and aspects can be included should be used.

We think that evaluators should be aware of the ten usability heuristics in Nielsen's model but not be limited to it, or the ten rules it includes.

Consistency inspection

One form of inspection we didn't try was consistency inspection. Despite no formal usage of the method, inspiration has been taken from another company product with similar features. Consistency inspection could be a method to actively share good solutions within the company, avoiding reinvent of the wheel. It would also increase the user experience if an Axis design would be recognized in all software. If the company graphic identity would be similarly incorporated into all software a large step towards consistency has been taken. But the graphic identity says very little of exactly how to implement specific technical elements which some, but not all, software have in common. If for instance *Live view* would look similar in all of Axis products the users would soon know which company it came from consciously or not. Consistency inspection could be a method to use in order to learn and adapt to better solutions between different teams.

8

Conclusion

In regards of the goal of this master's thesis we have created a wizard and came to the following conclusions:

Encourage users to make changes to camera settings, especially complex settings affecting video quality and bandwidth demand

With for example instant feedback, minimalistic design and less technical terms we have, through our usability testing, confirmed that most test participants felt no holdback when making changes to the camera settings.

Encourage users to explore the available settings and showing the effect of them

Always having a way out, as in putting settings back to their original value, has together with instant feedback been the key when encouraging users to try out settings and see what comes out of it. Making steps extremely easy can make the user feel curious and explore all different combinations in a very short time, before moving on. Again, judging from usability testing, we feel that we've accomplished this.

Give users a better user experience when installing an Axis camera

In the proposed design, users do not find the wizard frustrating, being complicated nor taking a lot of time. As user experience is a complex rating, it is not possible to create a quantitative result without actually implementing the changes and test with a lot larger group. However, when letting people try out our wizard, users has seemed genuinely happy and satisfied with how easy and fast the wizard is.

Investigate what UX Design methods and techniques are appropriate in an early design phase

We think a combination where usability inspection is followed by a usability test is most suited when testing on early design prototypes. The usability inspection should be performed by a couple of persons with knowledge of UX Design in a rather informal manner where the inspectors use their skills and previous knowledge evaluation the design. The usability testing should have a thorough test plan which states the purpose. An exploratory testing with *think aloud* technique is preferred in order to get the most out of the usability test in early design prototypes.

Investigate how applying UX Design would affect Axis

Even though we, with our rather specific master's thesis, did not have a total overview of all

the branches of Axis we believe that we've found several ways UX Design would positively affect Axis. Most important aspects that would be affected from what we've learned are ROI and the ability to stay as number one on the continuously evolving surveillance camera industry. Having a UX Designer present in all projects early on instead of late would save development costs. The result of UX Design would lower support costs and education need, improve branding and generate more sales (see section 2.5). UX Design could not only be required to keep the market share Axis currently has but might also help gaining an even bigger one.

9

Future work

9.1 Background study

A thorough background study and user research should be undertaken to investigate which tasks that are important for what users. The user research from 2011 is a good start but does not investigate which settings that is important or actually used. There could also be regional and local differences between installers which make the background study even more difficult.

9.2 Implement installation wizard

An installation wizard for Axis cameras could solve some of the problems installers have today, which the current interface design does not solve. An installation wizard should contain as few steps as possible and still fulfill the users need. Other products within Axis could perhaps also benefit from having an installation wizard when setting up the product for the first time. We believe that some of our proposed design suggestions could be of use when designing an installation wizard. We also think that some of the concepts we shown could be useful in the current interface design, especially the concept of help dialogs.

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A

10 Usability Heuristics for User Interface Design

Jakob Nielsen wrote in 1995 a list of “heuristics” and described it as “the ten most general principles for interaction design” [70]:

1. **Visibility of system status**

The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

2. **Match between system and the real world**

The system should speak the users’ language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

3. **User control and freedom**

Users often choose system functions by mistake and will need a clearly marked “emergency exit” to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

4. **Consistency and standards**

Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

5. **Error prevention**

Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

6. **Recognition rather than recall**

Minimize the user’s memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

7. **Flexibility and efficiency of use**

Accelerators - unseen by the novice user - may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

8. **Aesthetic and minimalist design**

Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

9. **Help users recognize, diagnose, and recover from errors**

Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

10. **Help and documentation**

Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

B

Test plan – Third prototype

Purpose, goal and objective

Usability testing is done at the end of design phase three to verify that earlier issues are removed and no longer are valid. Some research has been done on the *Video Settings* task and quite extensive changes have been made. This part is the main focus of the usability test and assessed to be the hardest to understand.

Research questions

Start

- Will the user click on the correct button without too much hesitation?

Language & Time

- Can *Language* and *Time* be merged?

Users

- Will users understand the concept of the user *root*?
- Will users find the *Delete* button on the operator Lisa?

Video settings

- Will *Presets* keep the user from changing settings manually?
- Will users find the *Live demo* and will it serve as feedback?
- Will users understand the terms *Resolution*, *Frame rate*, *Compression* and *Bandwidth demand* - if not, will they use the help?

- Will users understand the scale of *Compression*?
- Will users see the connection between *Bandwidth demand* and the different sliders?

Focus & Zoom

- Will users find the rotate function and successfully rotate the image?
- Will users use the *Autofocus* button?
- Will they use the *Full screen* mode?
- Will users find the *Zoom* function?

Image settings

- Will users understand how to select and deselect?
- Will users understand why at least one option on each row needs to be selected?
- Will users understand why *WDR* is automatically activated on the *Both indoors and outdoors* option and what *WDR* means?
- Will users understand the tab system and how to finish the wizard?

Participants characteristics

Four participants plus one test pilot user will be used. As many participants should have low or no knowledge with cameras and optics.

Novice

Low IP knowledge.

IT background

Knowledge of technical terms within IT.

Method

Introduction (5 minutes)

- Take background information of the participant
- Explain test setup
- Explain think aloud technique

Tasks (30 minutes)

A fictive camera has been installed and now requires configuration. The participants will be shown the initial startup screen.

Post-session debriefing (10 minutes)

Follow up on problems found during the test session.

Task list

Start screen

1. Start camera installation wizard.

Language & Time

1. Verify what languages are available.
2. Verify that time is received automatically from a time server.

Users

1. Who or what is the user root? Why is it shown directly?
2. Add an operator named Lisa with rights to move and control the camera.
3. Remove the user Lisa again.

Network & Storage

1. Verify that the IP-address is set automatically using DHCP.

Video settings

1. Choose the widest ratio available.
2. Describe the different terms on the page.
3. Explain the different presets and what differ them. Feel free to click them!
4. Find a setting with low Compression and a low Bandwidth demand. How can this be arranged?

Focus & Zoom

1. Rotate image correctly, set focus and zoom so no roof is seen in the video stream.

Image settings

1. Set scenery to around-the-clock and outdoors only.
2. Explain why the WDR is activated when both indoors and outdoors are activated.
3. Explain what WDR is.
4. Set the scenario to outdoors with WDR activated.
5. Change the brightness of the picture.
6. End the wizard.

Test environment, equipment and logistics

The test will be conducted in Axis usability testing lab with one test moderator and at least one observer. The participants will use a Windows 8 computer with Adobe Reader XI installed. A screen capture program will record the on-screen activity.

Data to be collected

Pre-session questions

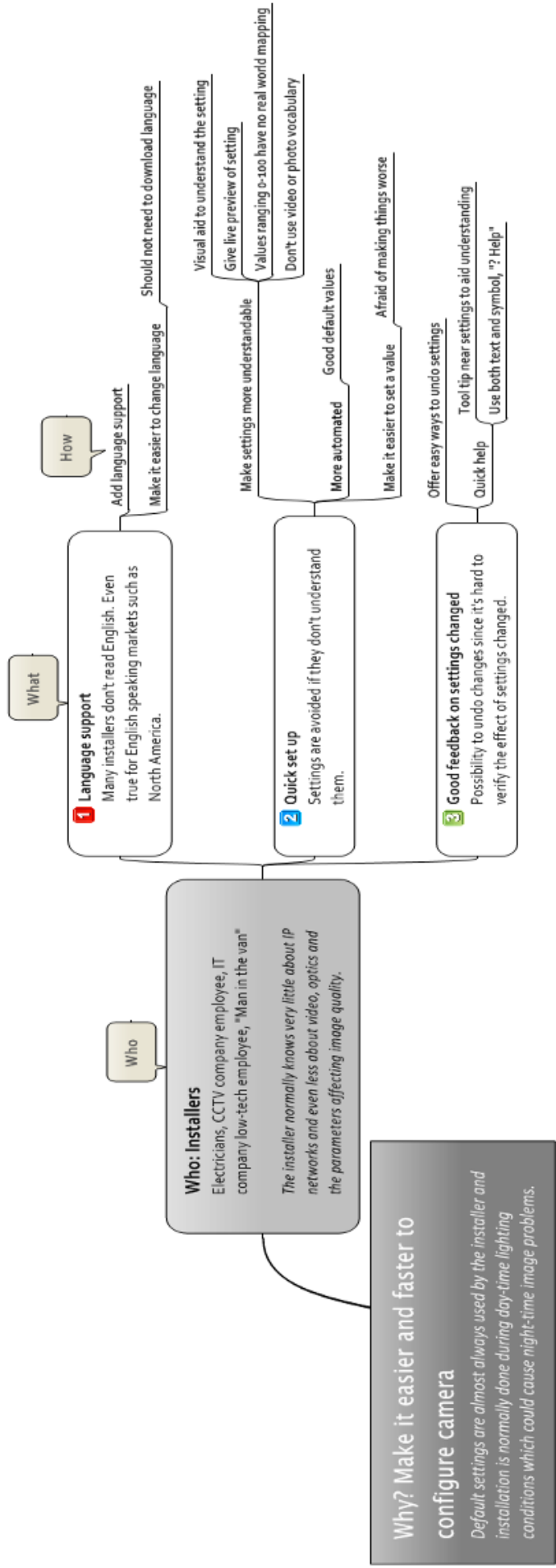
- Rank your computer experience.
- Rank your camera/video knowledge.
- Rank your Axis cameras knowledge.
- What is your main subject at Axis?

Post-session question

- Did any of the steps feel too advanced?
- Was the wizard too long?
- Would you want to be able to change more settings than presented?

C

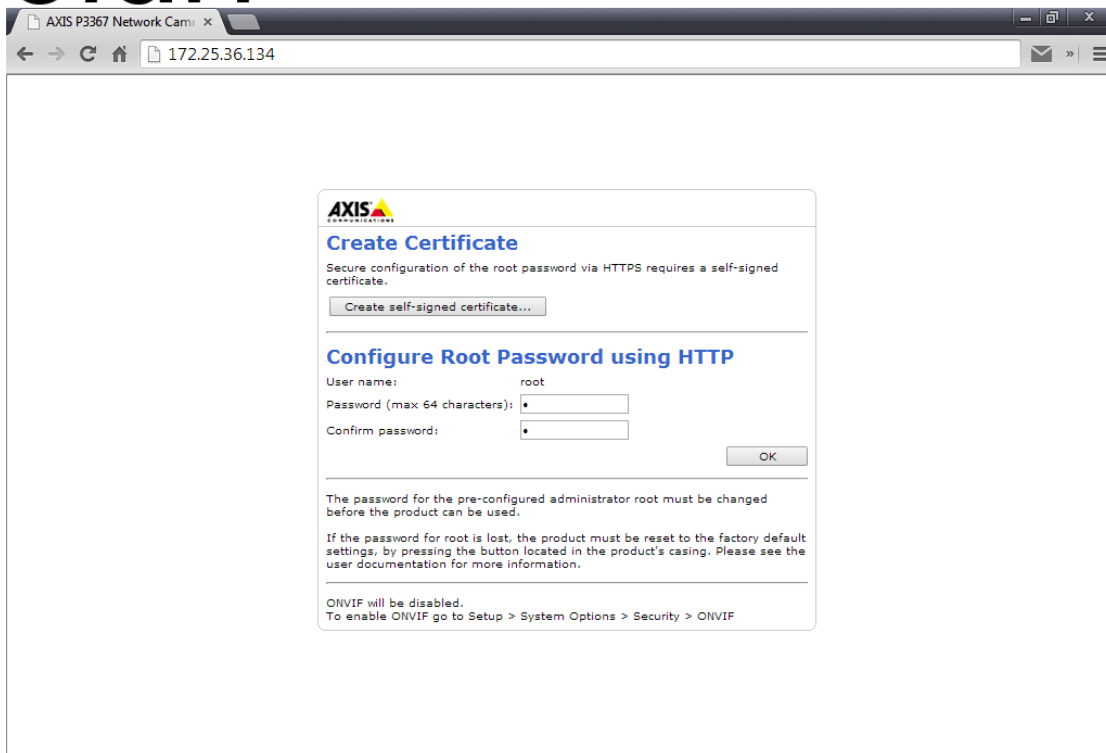
Effect Map



D

Current Interface Design

Start



Date & Time Settings

AXIS COMMUNICATIONS **AXIS P3364-L Network Camera** [Live View](#) | [Setup](#) | [Help](#)

- Basic Setup
- Video & Audio
- Live View Config
- PTZ
- Detectors
- Applications
- Events
- Recordings
- System Options
 - Security
 - Date & Time**
 - Network
 - Storage
 - Ports & Devices
 - Maintenance
 - Support
 - Advanced
- About

Date & Time Settings

Current Server Time
Date: 2014-02-17 Time: 08:51:21

New Server Time
Time zone: UTC0 (Manually configured)
 Automatically adjust for daylight saving time changes.

Time mode:
 Synchronize with computer time
Date: 2014-02-17 Time: 09:51:21
 Synchronize with NTP server
NTP server: [No server specified](#)
 Set manually
Date: 2014-02-17 Time: 08:51:17

Date & Time Format Used in Images
Specify date format:
 Predefined: YYYY-MM-DD
 Own: %F
Specify time format:
 Predefined: 24h With resolution: 1 second
 Own: %T

Users

The screenshot shows the web interface for an AXIS P3364-L Network Camera. The main page is titled 'Users' and contains a 'User List' table. A 'User Setup' dialog box is overlaid on the page, allowing for the configuration of a new user.

User List

User Name	User Group
root	Administrator
ACCAdmin	Administrator
camroot	Administrator
jimpers	Administrator
stuser	Administrator
stsvviewer	Viewer

User Setup

User name:

Password (max 64 characters.):

Confirm password:

User group:

- Viewer
- Operator
- Administrator

Enable PTZ control

OK Cancel

TCP/IP (Network) Settings

AXIS COMMUNICATIONS **AXIS P3364-L Network Camera** [Live View](#) | [Setup](#) | [Help](#)

Basic TCP/IP Settings ?

Network Settings

View current network settings:

IPv4 Address Configuration

Enable IPv4

Obtain IP address via DHCP

Use the following IP address:

IP address:

Subnet mask:

Default router:

IPv6 Address Configuration

Enable IPv6

Services

Enable ARP/Ping setting of IP Address

Enable AVHS

One-click enabled Always

Proxy:

Proxy port:

Proxy login:

Proxy password:

Proxy authentication method: Basic Digest Auto

AXIS Internet Dynamic DNS Service

Video Settings

AXIS COMMUNICATIONS **AXIS P3364-L Network Camera** [Live View](#) | [Setup](#) | [Help](#)

Video Stream Settings

Image Audio H.264 MJPEG

Image Appearance

Resolution: 1280x720 (16:9) pixels [View area size: 1280x720](#)

Compression: 30 [0..100]

Mirror image

Rotate image: 0 degrees

Video Stream

Maximum frame rate:

Unlimited

Limited to [] [1..30] fps per viewer

Overlay Settings

Include overlay image at the coordinates: X [0] [0..] Y [0] [0..]

Include date Include time

Include text: 00408CEAB005

Text color: white Text background color: semitransparent

Place text/date/time at top of image

Preview

View image stream while configuring. Video format: MJPEG [Open...](#)

[Save](#) [Reset](#)

Focus & Zoom

AXIS COMMUNICATIONS **AXIS P3364-L Network Camera** [Live View](#) | [Setup](#) | [Help](#)

- Basic Setup
 - Instructions
 - 1 Users
 - 2 TCP/IP
 - 3 Date & Time
 - 4 Video Stream
 - 5 Focus & Zoom**
 - 6 Audio Settings
- Video & Audio
- Live View Config
- PTZ
- Detectors
- Applications
- Events
- Recordings
- System Options
- About


Focus & Zoom

Basic **Advanced**

Focus position: Near << < > >> Far

Zoom: Wide << < > >> Tele

Focus is measured in the adjustable focus window below



The live view image shows a parking lot with several cars parked. A red rectangular focus window is overlaid on the image, centered on a red car. The background includes flagpoles and a building.

Camera Settings

AXIS COMMUNICATIONS

AXIS P3364-L Network Camera Live View | Setup | Help

- Basic Setup
- Video & Audio
 - Video Stream
 - Stream Profiles
 - Camera Settings**
 - View Area
 - Overlay Image
 - Privacy Mask
 - Focus & Zoom
 - Audio Settings
 - Audio Clips
- Live View Config
- PTZ
- Detectors
- Applications
- Events
- Recordings
- System Options
- About

Camera Settings

Enable View Area

Image Appearance

Color level: [0..100]

Brightness: [0..100]

Sharpness: [0..100]

Contrast: [0..100]

White Balance

White balance:

White balance window:

Wide Dynamic Range

Enable Dynamic Contrast

Exposure Settings

Exposure value: [0..100]

Exposure control:

Enable Backlight compensation:

Exposure zones: Auto Defined [auto]

Shutter & Gain

Shutter:

Gain:

Normal Light

Priority: Low noise Low motion blur

Max gain: dB

Max fast shutter: 1/1000 s

Low Light

Priority: Low noise Low motion blur

Max gain: dB

Max shutter: s

Enable automatic iris adjustment

Iris adjustment: [0..100]
F 2.4

Day/Night

IR cut filter:

Day/Night shift level:

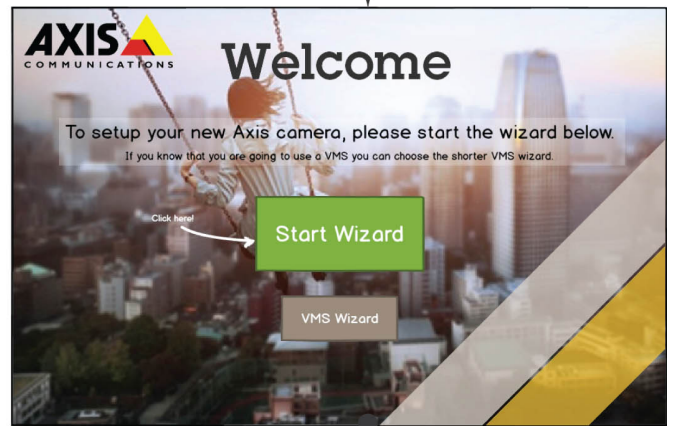
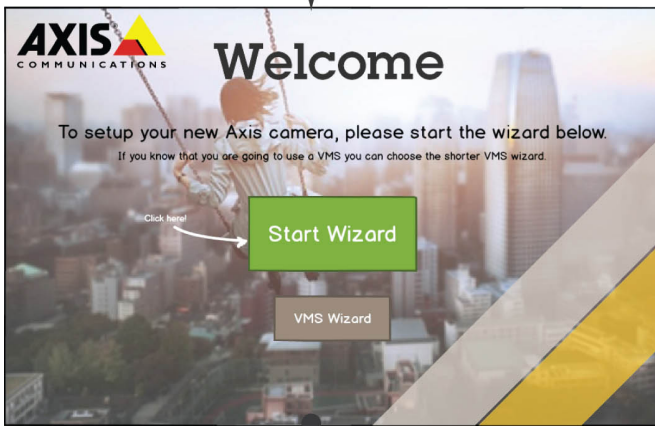
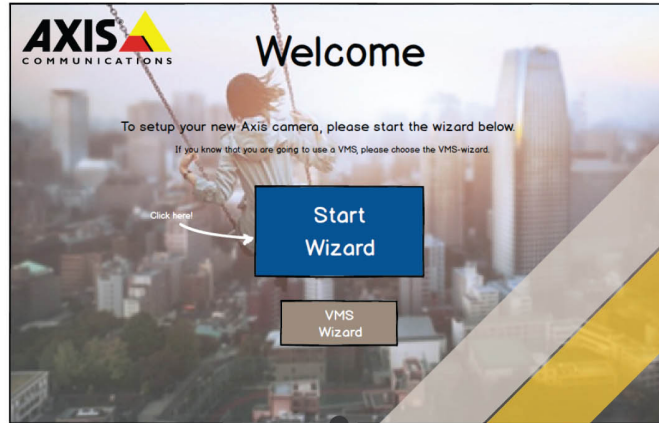
View Image Settings

View image **after** saving.

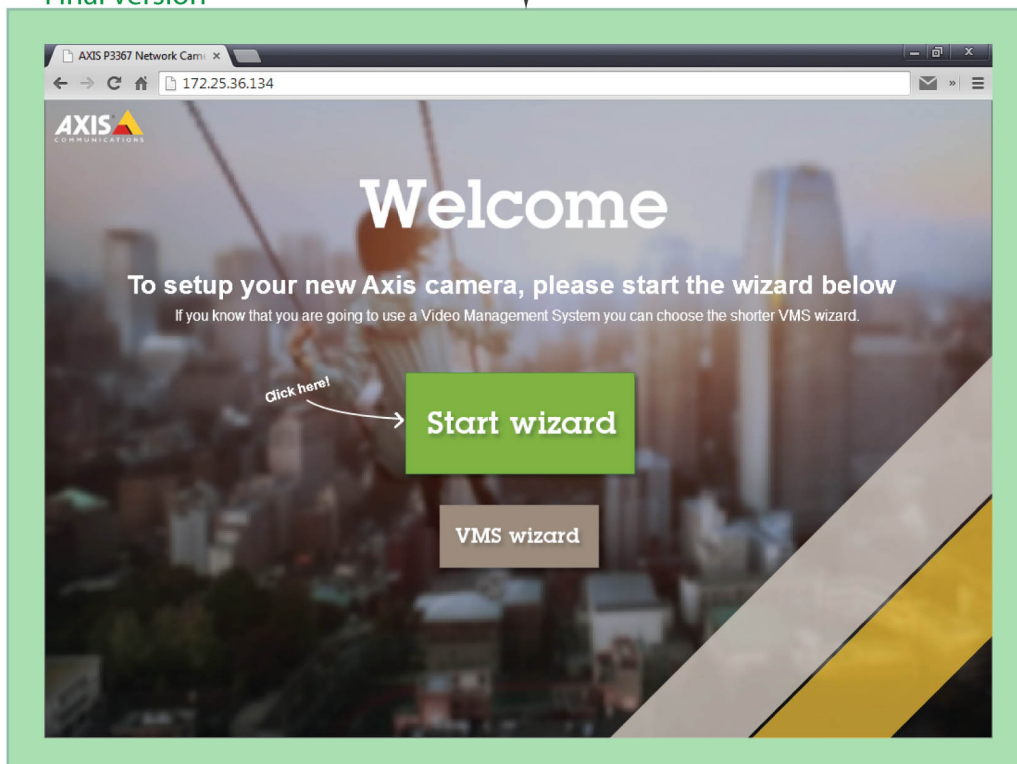
E

Evolution of the Design

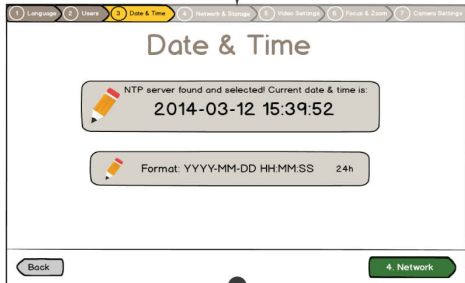
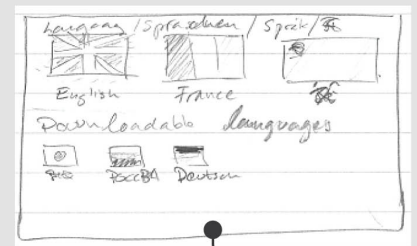
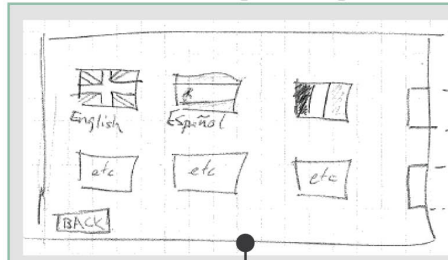
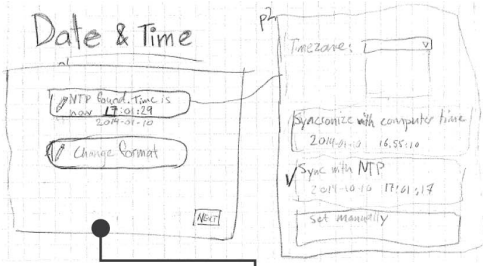
Evolution of Start



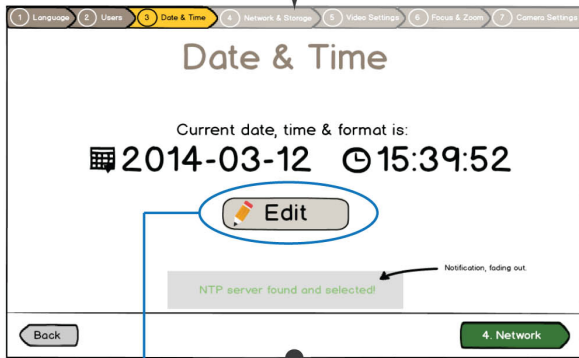
Final version



Evolution of Language & Time



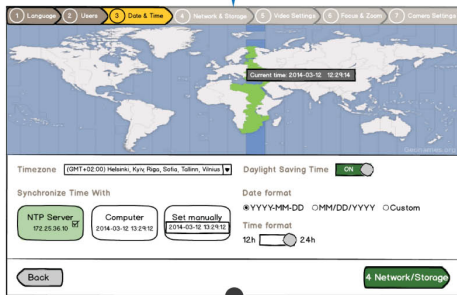
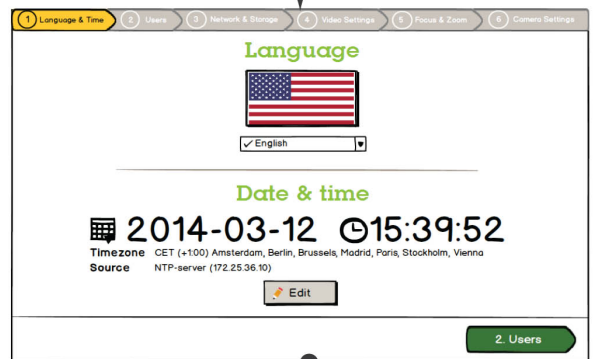
Evolution of Language only



Language

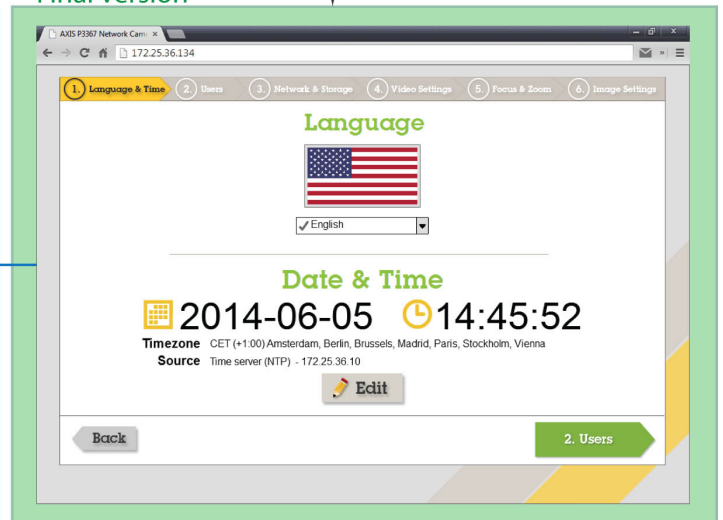
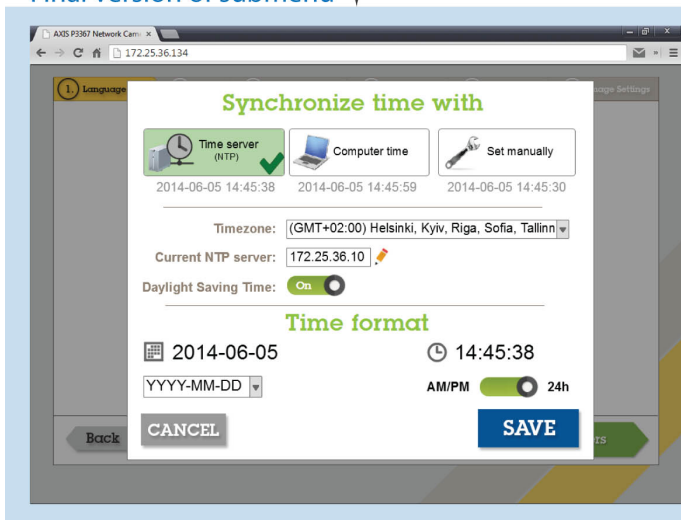
Merge of Date & Time

Submenu

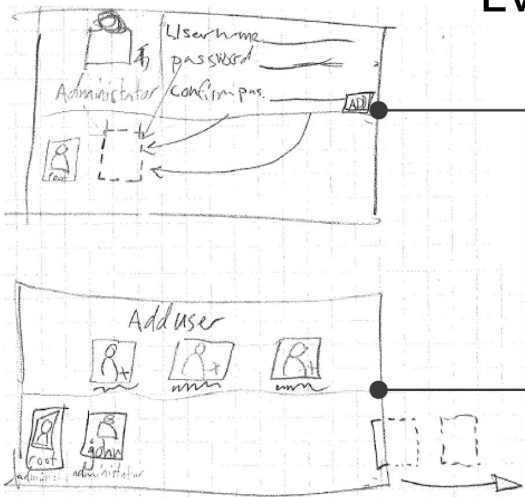


Final version of submenu

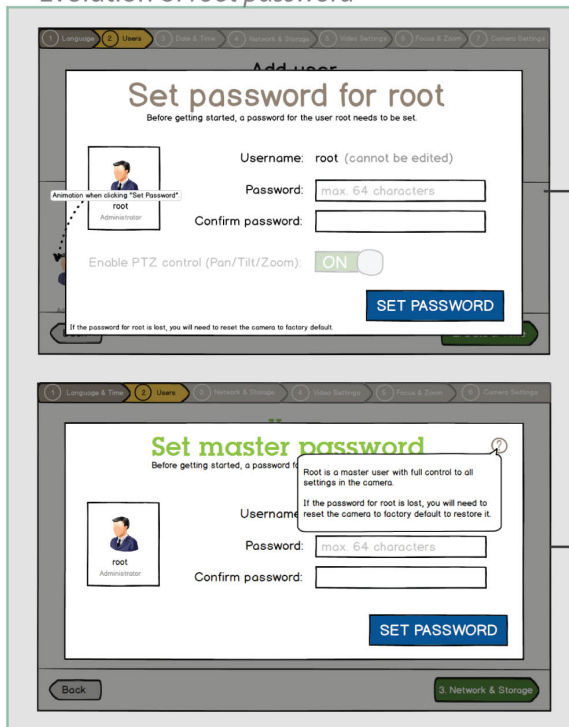
Final version



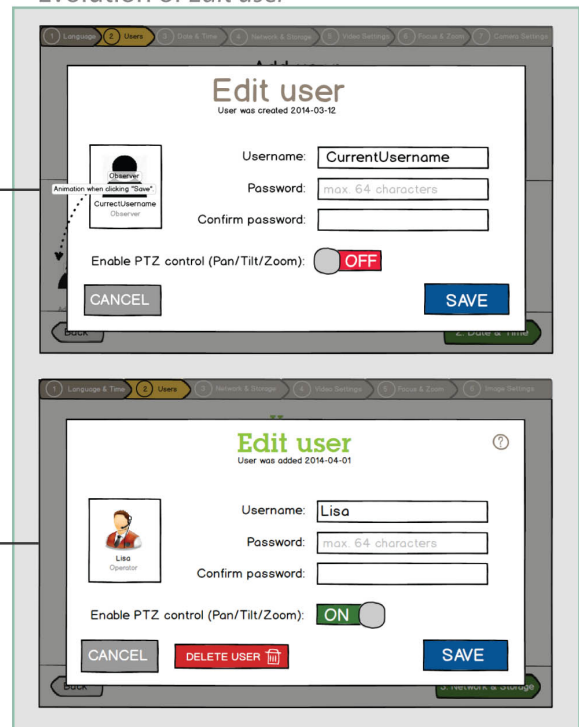
Evolution of Users



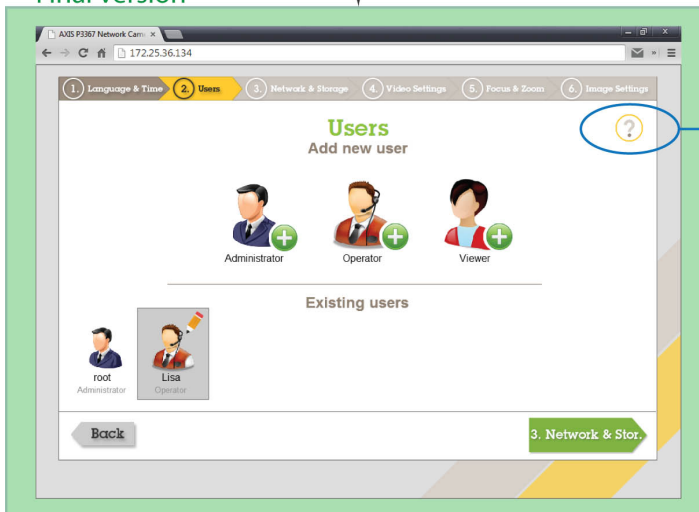
Evolution of root password



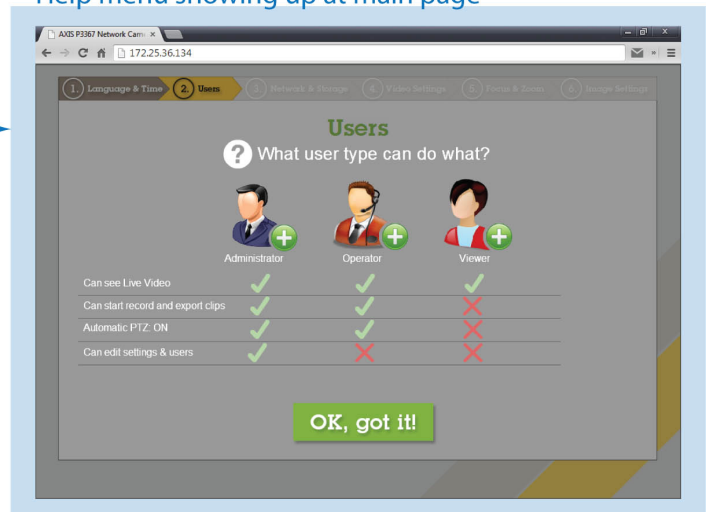
Evolution of Edit user



Final version

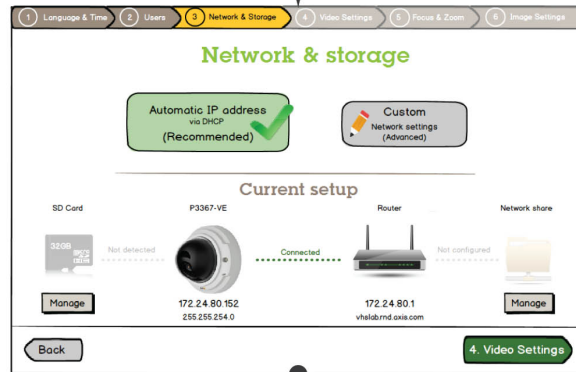
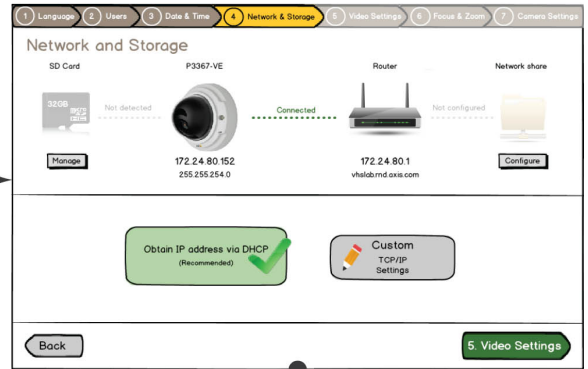
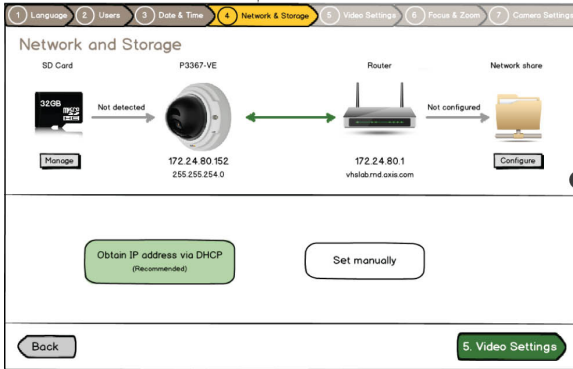
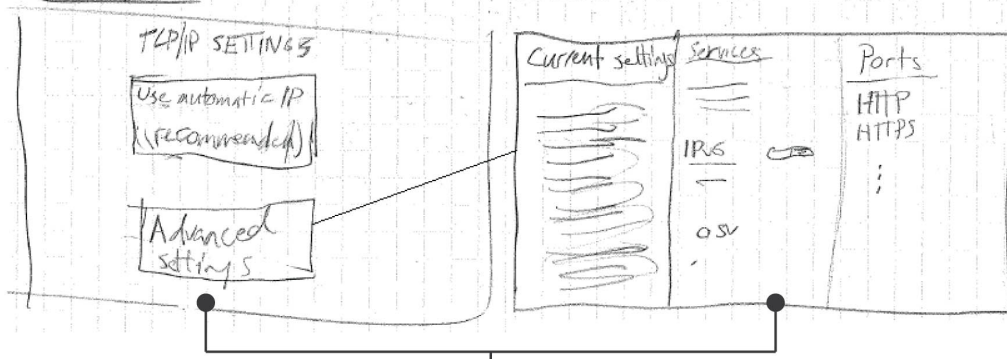


Help menu showing up at main page

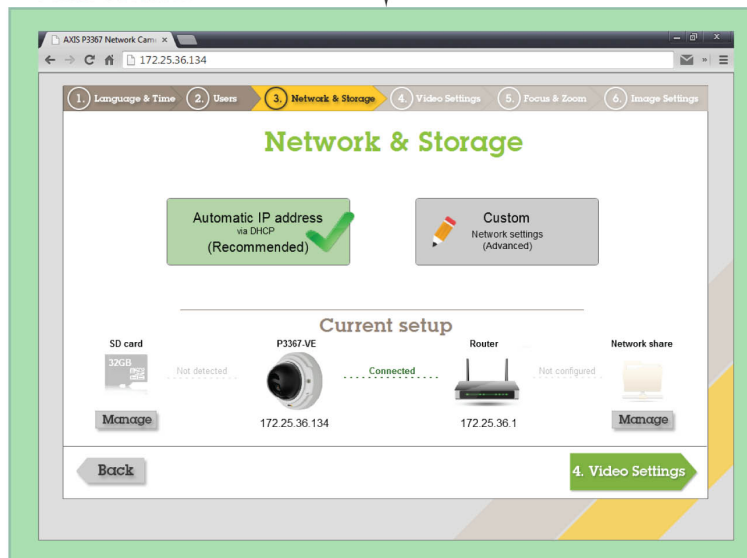


Evolution of Network

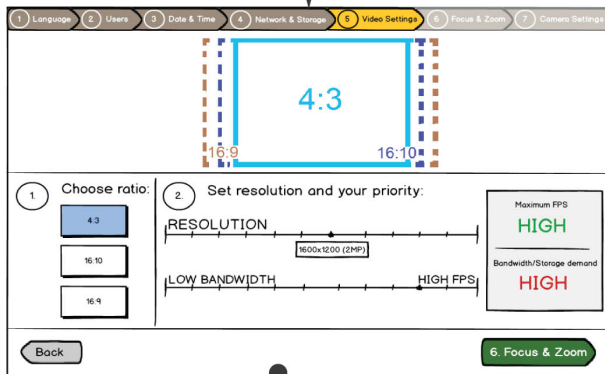
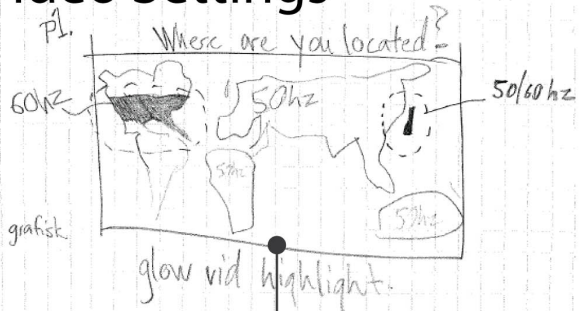
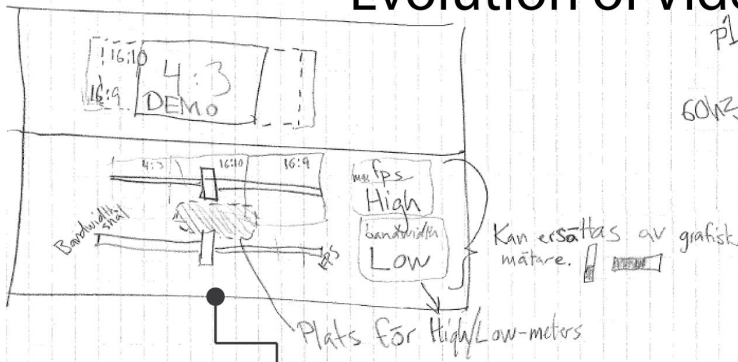
"TCP/IP" Network?



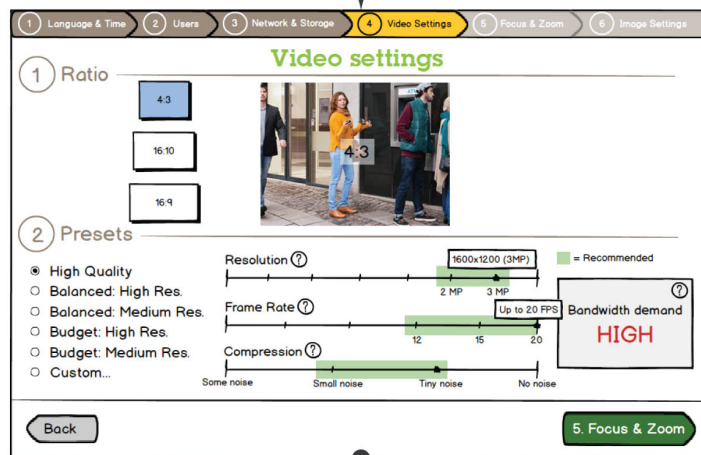
Final version



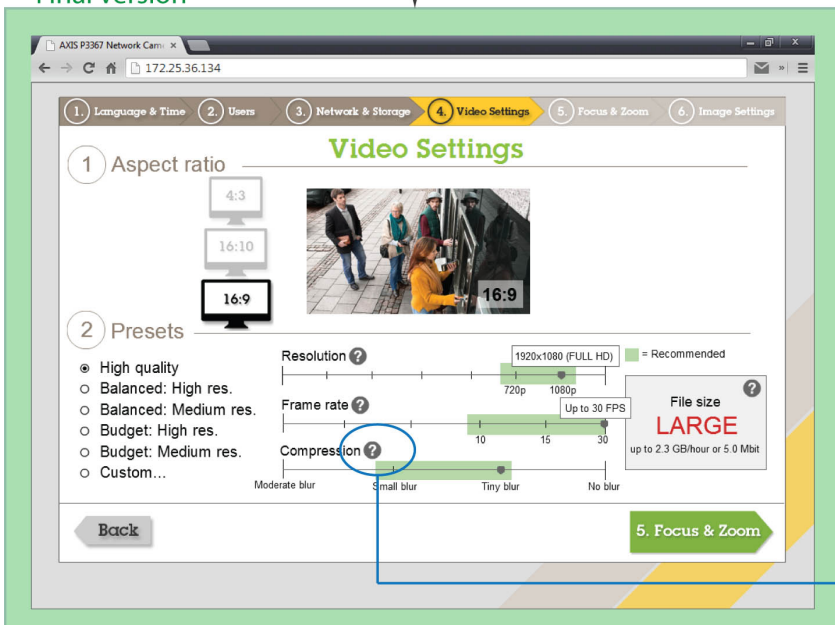
Evolution of Video Settings



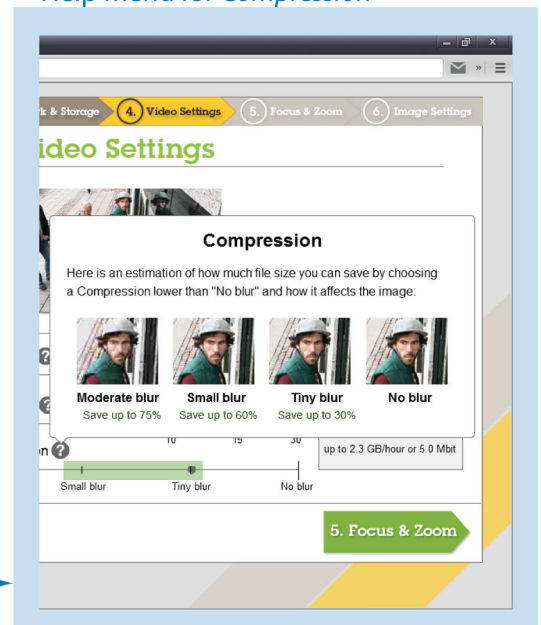
Automated



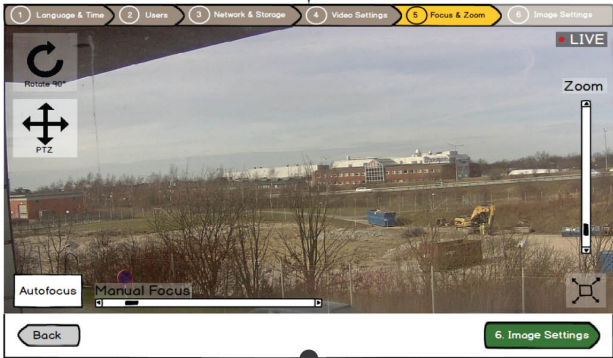
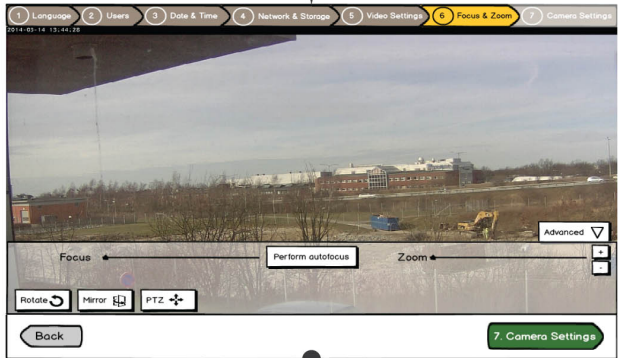
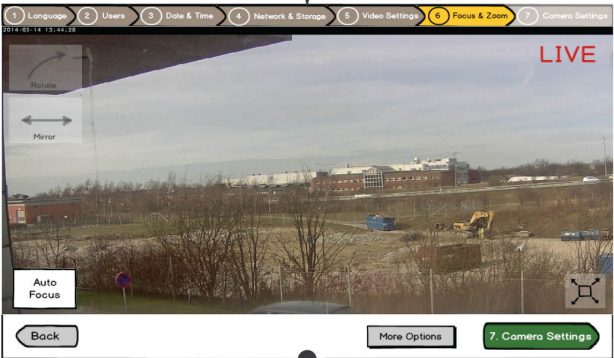
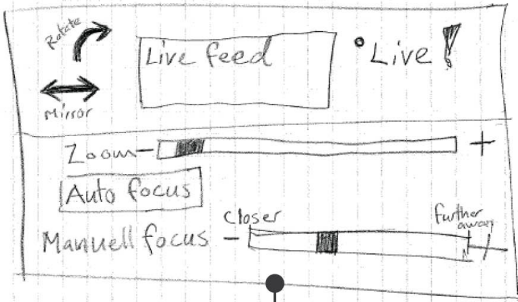
Final version



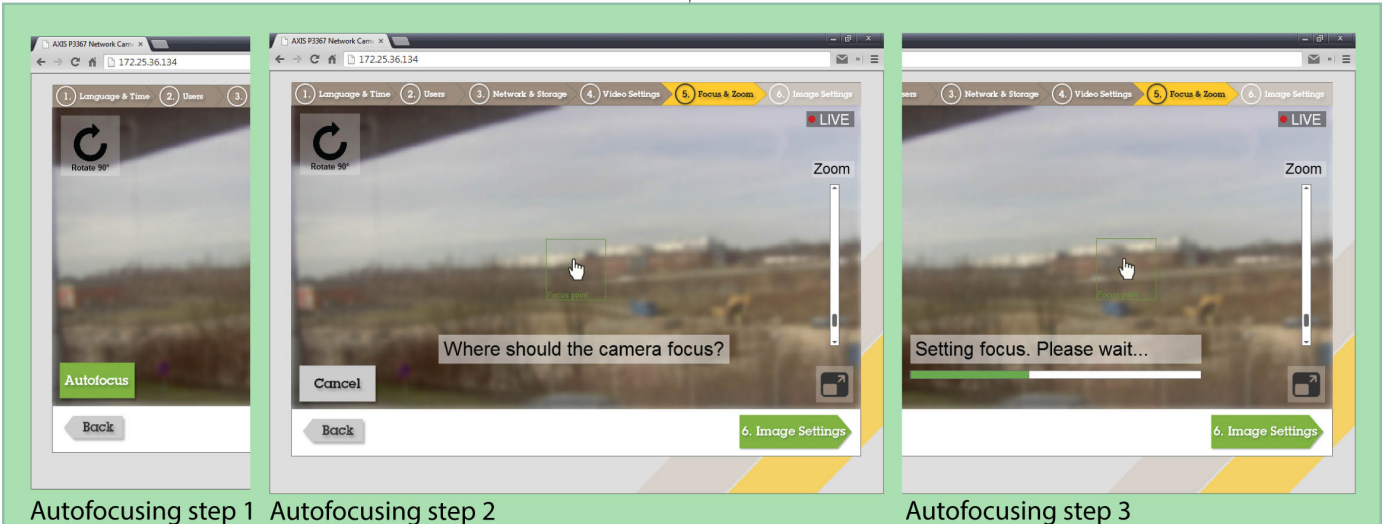
Help menu for Compression



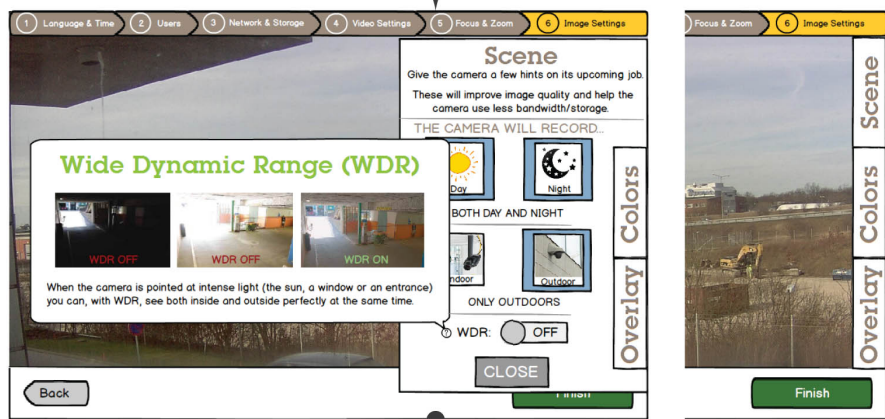
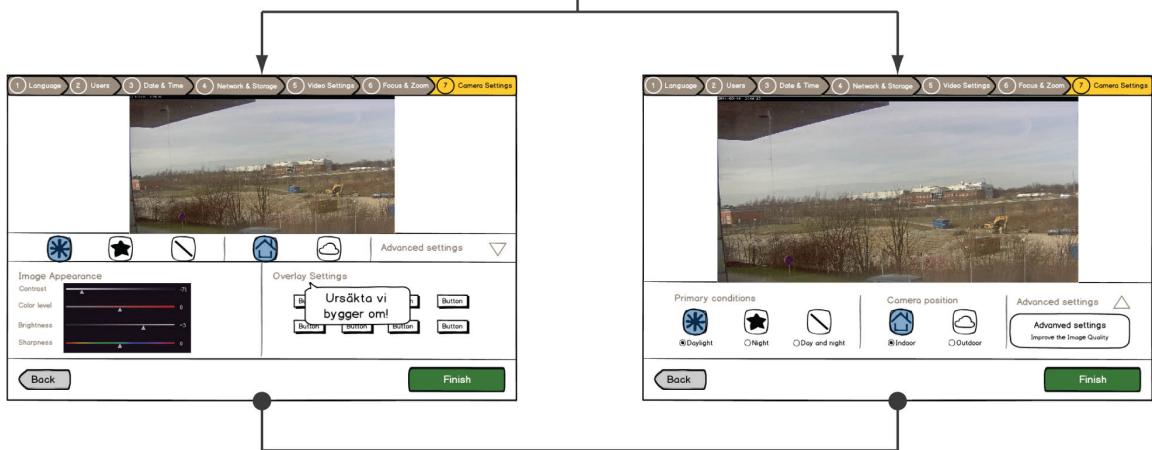
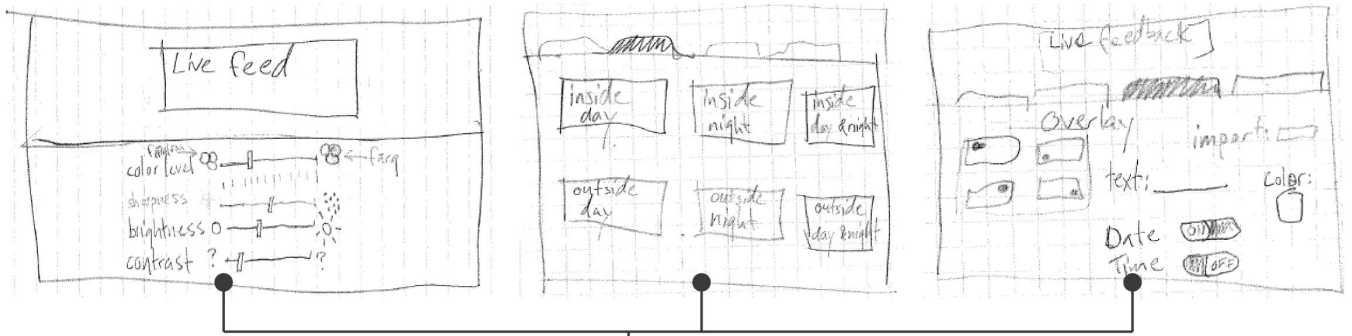
Evolution of Focus & Zoom



Final version



Evolution of Camera Settings



WDR Help

Tab menu collapsed

Final version

