PRODUCING AND MANAGING DYNAMIC STYLE GUIDES

MASTER THESIS (60 credits)

Christer Veland Aas
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UNIVERSITY OF OSLO
Department of Informatics
Abstract

In this thesis, I investigate the style guide processes in Telenor, a Norwegian mobile operator that is one of the largest in the world. The ‘style guide problem’ is well known, and it is difficult to handle guidelines, principles, and conventions in any organization. Most people agree that style guides are important to ensure consistency and quality in applications and various content utilizing style guides. No dedicated tool exists to produce and manage style guides in Telenor, but there are many general tools available. I argue that these general tools do not fulfill the requirements of a style guide process in Telenor. With ‘development research’ as my research approach, I gathered user requirements from users in the company. The result became a prototype of the style guide production and management tool, developed through multiple iterations in a development cycle. The purpose of the tool is to make the production and management of style guides dynamic. The tool was evaluated using expert walkthroughs and individual heuristic walkthroughs with real users and human-computer interaction (HCI) experts. The evaluation is the foundation for future development of the prototype, and research on the subject. I argue that my style guide tool is the solution for the style guide problem in Telenor, and can be used in any organization. The tool is a web application, using rich internet application (RIA) functionality. It is simple and easy for style guide developers and end users to utilize. It provides functionality such as revision handling, templates, approval, and reviews. The tool provides enhanced user experience and usability, and improves the users’ workflow in style guide processes. Altogether, the tool makes people work together in a dynamic collaborative environment that supports usable, accessible, and consistent style guides.
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1 Introduction

Style guides are important, but rarely used as intended. Many authors claim the use of style guides is important to ensure consistency in design, graphical profiling, and applications throughout an organization. Organizations use huge amount of resources into production and research on style guides. However, the end users of style guides rarely use them the way they were intended. In my thesis, I investigate the reasons and possible solutions to these phenomena.

My research has focus on the style guide production and management processes at Telenor. Telenor is one of the largest mobile operators in the world, with ownership interests in thirteen mobile operators across Europe and Asia. In a company of this size, many processes require guidelines, conventions, and principles, that I call style guides, to be documented in the present and for the future. Making the style guides accessible and standardized throughout the company is great challenge, with many obstacles. Developers of style guides may claim the style guides are important, but if end users cannot find them usable to solve their tasks, they are not used.

Traditional style guides were paper documents, created with word processor or illustrative tools. Today, digital collaboration tools are widely used in large organizations like Telenor to manage all different kinds of files. There are unlimited number of ways to produce a style guides. Developers of style guides use graphical design tools, rich text editors, plain text editors, web design tools, simulation tools, visualization tools and so on. There is no limit to what content a style guide consists of. It is up to the style guide developers or the company to choose what tools to use. Digital sharing of style guides gives the possibility to track changes, share information with others, publish in various formats, and to make it accessible to users. The choice of style guide tool however is not so easy. There exist many tools with collaborative support, such as word processors in a server environment. There are many ways to create the content and structure. The tools often used, are general design and word processor tools to create any kind of documentations and illustrations. However, the general tools do not guaranty usability and consistency in relation to a company's business and application goals.

My research goes into production and management of dynamic style guide. By dynamic, I mean something that is in constant change. Traditional style guides, published as paper documents and even digital style guides, are often static. Once published, the static style guides remains in their
current form. There is no change in the style guides, unless someone decides to update the documents and release them to a new version. Often, static style guides are used for a relevant period of time, and then archived or simply forgotten. Dynamic style guides can also be outdated. However, they live and evolve with the developers and end users of style guides. They are constantly updated with changes that are required to make them work the way they are intended. Being dynamic is no guaranty to the style guides’ success. The people meant to make use of the style guides actually have to use them to make them successful. If a mandatory style guide is developed, only to lay statically in an archive, it will not be useful. However, a constant evolving style guide being utilized by end users can prove to be valuable and priceless for both the business and the end users.

The motivation for my research is my interest in design and user interfaces. I always seek new and innovative solutions in my work, and I strive to discover new ways of solving problems. In my contact with Telenor research and innovation (R&I), they provided me with information on their problems and challenges in relations to style guides. They invited me to make research on the subject using their resources. I saw this as a change to use my creative and innovative skills in a known and wide research problem.

Early on, I had focus on the creation of a new tool and concept to reflect my research in practice. I present the production and management tool in section 4. In my research approach in section 3, I explain how development of new concepts and tools can give new information and empirical knowledge on the knowledge domain. Taking the tool through three phases in an iterative user-centered development cycle gives exiting and unexpected results. Development of a new tool and concept can enlighten and enhance the production and management of style guides as we know it.

1.1 Problem statement
In this thesis, I will examine the use of style guides in information systems, and the production and management processes of style guides. I will use existing theory on the subject and compare it with a study on a real organizations’ use of style guides. I conduct my research at Telenor. With this focus, I want to investigate patterns and practices using qualitative methods, which gives some insight in the personal opinions of style guide end users and developers. Using my gathered qualitative data and relevant theories on the field, I raise the following questions:

- Is there a need to improve the current way of using style guides in the Telenor?
  - If so, how can the current way of using style guides be improved?

In my research, I build a prototype based on user requirements in Telenor. I present the tool in section 4, which introduces new concepts in relation to work with style guides. I will use the
prototype to see what effects a dedicated tool for creating and managing dynamic style guides, will have on the organization.

- What important functionality does the tool provide?
- What is the general idea of a dedicated tool compared to existing ways to produce and manage style guides?
- What user requirements does the tool have to indulge?
- Will a dedicated tool provide what is needed to improve the use of style guides?

Using a tool as foundation for a new concept to produce and manage dynamic style guides, I bring the tool through various evaluation methods with real users in Telenor, trying to answer questions related to personal opinions about such a tool, and the quality and relevance of the tool.

- Is the tool usable?
- Will the tool engage users to participate in the development process of style guides and make them dynamic?

I will compare the tool to other existing solutions and frameworks for style guides and explain what is different with my concept tool compared to others. I will also question whether the tool is built on a concept that can be generalized in other organizations, and conclude the tool’s chances for success in Telenor.

1.2 Thesis procedure

To answer the questions in the problem statement (section 1.1), I organized the research as illustrated in Figure 1.1, which shows the style guide production and management tool I created is a result of multiple processes.

I first present relevant theory in section 2, concerning human-computer interaction (HCI) and style guides. In the description of style guides, I present various problems and challenges, and frameworks and solutions, used in the final discussion and comparison to my concept tool. In section 3, I present my research approach. The section describes how I conducted my research, the methods I use, and what results I can expect from the empirical research. In addition to the two theoretical sections, I present the style guide production and management tool in section 4. I explain the technology that powers and inspires the solution, and the main parts of the tool’s concept. I present the development project results analysis and discussion in section 5. Finally, in section 6, I discuss and conclude all the sections and compare existing theory in relations to my empirical results.
PRODUCING AND MANAGING DYNAMIC STYLE GUIDES

- HCI
- Usability
- Consistency
- User interface and metaphors

2. Theory
- Theory
- Problems and challenges
- Frameworks and solutions

2.2 Style guides
- Qualitative interviews
- Prototyping
- Evaluation

3. Research approach
- Development research
- Interpretive paradigm

5. Project results analysis and discussion
- ASP.net 2.0
- MSSQL 2005
- ASP.NET AJAX

4. Style guide production and management tool
- Web applications
- User interface
- 3-tier architecture
- Databases

4.1 Technology
- ASP.net 2.0
- MSSQL 2005
- ASP.NET AJAX

4.1.1 Web applications

Figure 1.1: Research roadmap - with thesis section numbers
2 Theory

In this chapter, I present relevant theory in relation to the production and management of style guides. I will first introduce Human-Computer Interaction (HCI) and describe the general focus in this discipline. Second, I describe the importance of consistency and the way metaphors are used in development of user interfaces. At last, I present style guides and its problems and solutions from various authors. In section 6, I discuss the theory in this chapter in relation to the empirical results.

2.1 Human-Computer interaction

Human-Computer interaction is known as HCI, alternatively as man-machine interaction (MMI) or computer-human interaction (CHI) (Human-computer interaction 2007). In this thesis, I use the term HCI. Dix et al. (2004:1-8) state the term HCI is known since the 1980’s. However, the authors claim the roots go back to the Second World War, which may have started the focus on the interaction between people and machines. As computers became widespread the study on human-computer interaction increased in number of researchers in physical, psychological, and theoretical aspects of the field.

The ideal designer of an interactive system would have expertise in a range of topics: psychology and cognitive science to give her knowledge of the user’s perceptual, cognitive and problem-solving skills; ergonomics for the user’s physical capabilities; sociology to help her understand the wider context of the interaction; computer science and engineering to be able to build the necessary technology; business to be able to market it; graphic design to produce an effective interface presentation; technical writing to produce the manuals, and so it goes on. (Dix et al. 2004:4)

Clearly, HCI is a multi-disciplinary subject, which is quite complex. However the basic goal of HCI is “...to improve the interaction between users and computers by making computers more usable and receptive to user’s needs”. (Human-computer interaction 2007)

The evolution of computer technology has made the prices go down on hardware and made it accessible to almost everyone since in the last millennium. The World Wide Web has connected all the computers together in a collaborative environment. The power and possibilities in calculation and graphical representation on computers, as well as new smart devices, such as tablet pc, cell phones, and PDAs using advanced technology with touch screens, camera, video, music, and wireless communication has taken the HCI into a new era. Due to the various platforms and interaction techniques, new research and exploration in the field of HCI is required to understand how humans
cope with tasks that are solved with support of advanced computers. User-centered design is a modern practice often used in HCI to explore new problems and concepts in collaboration with potential users. Research with a user-centered design process and other research processes often results in definitions of standards, guidelines, principles, and conventions through the gained empirical knowledge. These definitions are, by some, defined as style guides, but also as heuristics and advisory summary. There exists both, general theories to guide developers and users in various HCI situations, and very specific definitions related to product or business to enhance specific HCI situations.

2.1.1 Usability
Usability is one of the main focuses in HCI. Dix et al. (2004:5-6) present three ‘use’ words that must all be true for a product to be successful:

- **Useful**
  
  *Accomplish what is required: play music, cook dinner, format a document*

- **Usable**
  
  *Do it easily and naturally, without danger of error, etc.*

- **Used**
  
  *Make people want to use it, be attractive engaging, fun etc.*

The last of these bullets are about user experience. User experience has become more and more important recent years, due to the graphical interfaces and its possibilities. People interacting with an application often judge the quality of a product based on the user experience. The expression ‘quality’ can have diverse meanings to an application developer and to an application user. To an application user the word ‘quality’ is defined by the quality of the work process. If the user’s tasks and goals are completed as expected and the user experience gave the user a feeling of engagement, security, and efficiency, the application has high quality.

Dix et al. (2004:259-287) present three main categories of general principles that will help support usability in general:

- **Learnability**
  
  *The ease with which new users can begin effective interaction and achieve maximal performance*

- **Flexibility**
  
  *The multiplicity of ways in which the user and system exchange information*

- **Robustness**
The level of support provided to the user in determining successful achievement and assessment of goals.

The general principles above are divided into multiple subcategories: predictability, synthesizability, familiarity, generalizability, and consistency, which are all central guidelines to any user-centered development process. There is no doubt that the guidelines are important, and if developers have focus on the guidelines, it will enhance the overall usability of the applications. Usability is a central and implicit issue in my research. I develop an application with user-centered focus, and ultimately it is the users’ usability perception of the application that defines whether it is a success or not.

2.1.2 Consistency
Consistency is another main concern in my research. I have focus on consistency in the application prototype, but also on consistency between the various style guides in an organization.

Most organizations have graphical profiles that represent the company visually through commercials, software, websites, flyers etc. Consistency of a graphical profile across different media and within the same media is essential. Kenneth (Ohnemus 1997:191) says, “Consistency across interfaces reduces learning time, improves performance, and reduces accidental errors”. In most cases, it is difficult to achieve consistency, as there often are many developers involved in the different media and campaigns. The problems that arise in relations to maintain consistency seems to grow with the size and complexity of organizations. The more people that are involved in a project, the more diverse opinions and disagreements may occur. In addition, problems can occur with decision makers defining a project on the one side, and producers and developers on the other side. Distance between groups can lead inconsistency in the project, because decision makers and developers use different approach to solve tasks.

The same problem of consistency is also transferable to production of style guides, as the production in fact is a project. Misconceptions concerning the purpose, importance and content of a style guide can occur when many style guide developers and end users are involved in the process, and especially if the distance between the different groups is significant. The result of inconsistency in development of style guides can lead to:

- Various styles and content requirements in each style guide, which makes it hard to read and understand
- End users not using the style guide because they feel it is unusable
- Inefficiency and more costly development
E.g., a company wants to create a website for a new product. They have corporate guidelines for how they use their logo, color palette, and fonts. The company has one paper document with these guidelines, created by an external company related to the design of a new logo last year. The guidelines in the document are general, and do not include directions for websites. The company has a strict schedule and has to produce the product website as soon as possible. They end up using the general company style guide as a base for the webpage, without extending the style guide so it covers websites. The result is a webpage that has the logo and some of the color requirements. However, when people are asked what company the website represents, they cannot recognize it.

Consistency is clearly a central issue in every project. The company in the example above got themselves in a problem of consistency related to graphical profiling. The company wanted to expose a new product to their audience, but failed to express the company design in a way that was easy recognizable by the public. The new website will probably increase their sales on the product, but fail to increase sales of other company products since the company is hard to recognize. Therefore, consistency is crucial for increased sales in all product categories.

Many organizations and companies strive to express consistency in their design, products, and profiles. Some succeed and others do not. Outsourcing of products and services is a threat to such consistency, since external actors adopts internal style guides. These style guides can be clear and understandable to the internal employees, but outsourced actors may interpret the content of these style guides differently. The result of such misconceptions is delivery of products or services that do not fulfill the style guide and company’s requirements.

2.1.3 User interface and metaphors
In my prototype, I use the ‘paper document’ metaphor as the main inspiration. A word processor application also utilizes the same metaphor. In a word processor, the writer can view a document map on the left side with a structural overview of the document, and type text in the main window on a white space in resemblance to a regular piece of paper. I also used the document map in my prototype. Style guides are often published as paper documents, and are created using a word processor or other tools, using the ‘paper document’ metaphor. The use of a strong and good metaphor can enhance the way users understand the application.

Marcus (1998) presents the term ‘metaphor’ as the Greek word for ‘carrying across’. We often use metaphors in our daily speech to illustrate what we mean. The relation to the examples or illustrations depends on peoples’ backgrounds and references. Brown and Duguid (1994) state designers are great borrowers. Explaining to what extent borrowing goes, they state:
Pieces of Greece, Rome, Paris, or London can be found ‘borrowed’ on almost any high street, rocket fins have turned up on the tail pipes of cars, peasant clothes from one year appear on high fashion models in another, and the images of last week’s art films will probably reemerge in next week’s advertisements.  

(Brown & Duguid 1994)

The authors believe borrowing goes beyond metaphors, and designers can use the fundamental insights, concepts, and techniques that lay behind them as well as the metaphorical images themselves.

Marcus (1998) states the use of metaphors can increase the ease of learning, memorization, and use. When a user performs a task in an unknown domain, metaphors can make the user utilize knowledge from known domains with similar functions. Familiar metaphors can reduce learning time as users can sense how functions and structures work with experiences from other domains. However, Marcus (1998) states it is important to be aware of what effects inappropriate design and use of metaphors might cause. If not used right, metaphors can make the user misunderstand the user interface and make it alienated, which can decrease the user’s performance.

### 2.2 Style guides

Style guides are used in a wide range of areas from newspaper writing styles, general language and grammar, graphical design and websites to academic scientific papers, technical documentation, medical and economical papers, and international ISO standards etc. (Style guide 2007). Style guides can serve multiple purposes. They ensure documents and products match the corporate image and policy, and define which styles that is negotiable and which are not. Ohnemus (1997) describes style guides as a basis for development. He defines style guides as a collection of principles, guidelines and conventions, which ensures a consistent look and feel for products and services.

Recent years, development of web applications has become more like development of traditional applications and user interfaces. Now, web applications support dynamic interaction and server technology evolves rapidly, supporting advanced front-end solutions. Many authors stress the importance of using style guides to ensure consistency and user interface usability in development of user interfaces (Nielsen & Bennet 2002). In the more traditional application development there have been published many corporate style guides which a more general towards specific technology. As an example, three of the big software companies, Microsoft, Apple and IBM, have released general style guides on how to develop user interfaces using their technology, which is based on their own empirical research. Microsoft just updated style guides in relation to the release Windows Vista (Windows Vista 2007) and Office 2007 (2007 Office System Document 2007). The style guides specify what to do and not to do when developing Windows Vista applications and Office 2007 add-ons.
concerning user experience and usability. IBM has several guidelines, such as their ‘Web design guidelines’ (Web design guidelines 2007) that has focus on the middle level of design guidance, in a range from abstract principles to specific conventions. IBM states the style guide should be used in conjunction with a user-centered design process to get the best possible web solution. The ‘Apple Human Interface Guidelines’ (Apple 2006) are in comparison to Microsoft’s style guides more specific to a product line\(^1\) to provide end users with a consistent visual and behavioral experience across applications. In general, the purpose of the corporate style guides is to support a consistent user interface in applications and websites. Apple presents a number of advantages that can be grouped in the following categories when striving for consistency:

- Better learnability
- Increased efficiency
- Accessibility support
- User experience through well designed and modern user interface
- More intuitive interface and interaction

These advantages are well known in various usability theories and style guides (section 2.1.1). Nielsen (2005) defines ten heuristics that are similar to some of Apple’s categories. Nielsen calls the ten heuristic principles because they are more in the nature of rules, than specific usability guidelines. According to Gale (1996), it is well known in HCI literature that consistency is important, and he underlines some of the same points as the Apple style guide. Even though Gale emphasizes promotion of visual and function consistency he expresses, in resemblance with the IBM style guide (Web design guidelines 2007), that consistency does not ensure usability. Gale (1996) lists many benefits using style guides:

From the end user perspective, the following benefits may be obtained from a style guide:

- Reduced errors - less frustration
- Increased confidence in the system
- Reduced training requirements
- Increased morale
- Improved use of system functionality
- Improved productivity
- Reduced resistance to the use of new technology

\(^1\) The Aqua interface in Mac OS X
However, other groups can also expect to benefit from the use of a Style Guide. From the IT developers' perspective, style guides may have the following benefits:

- Maintain control over look and feel
- Control 3rd parties during the tendering and implementation phases
- Reduce arbitrary design decisions and re-invention
- Capitalize on learning / iteration
- Enable production of re-usable software
- Reduce development time

From the Business perspective, there are a number of potential benefits:

- Produce usable systems enhancing customer service/satisfaction
- Increase market awareness
- Increase product awareness
- Reduce training costs
- Facilitate helpline support
- Improve staff retention
- Increase user acceptance of new systems

The benefits above as Gale (1996) describes can be very persuasive if an organization succeeds with the development and integration of style guides.

### 2.2.1 Types of style guides

Quesenbery (2001) defines three categories of style guides:

- Platform (language) guides
- Design guides
- Corporate application guides

The categories may overlap, but they have their own focus. By platform guides, Quesenbery means operating systems and software languages. Quesenbery states that most publicly available style guides are this category. These style guides explains how to use standard elements that are available through platform interfaces correctly, such as buttons, drop down lists, colors, fonts, icons, page and screen layouts, spacing etc. The purpose of platform guides is to work as documentation and general guidelines for how to use the platform and its functionality in a way considered as standard. Most of these style guides contains general guidelines, and have according to Gale (1996) received moderate
acceptance because of the lack of details. He claims that because these style guides are so general they make room for radically different interfaces.

By design guides, Quesenbery (2001) means guides that takes a broader view, and focuses on the process for creating usable interface designs in addition to the overall structure, navigation and visual design elements. The overall purpose for design guides is to establish best practices and patterns. Quesenbery states design guides offers great advice for user-interface designers, but neither, platform guides or design guides, offer definite set of rules. Specific examples of design guides are the IBM’s ‘Web Design Guidelines’ (Web design guidelines 2007) and the ‘Web Style Guide’ (Lynch & Horton 2002), known as ‘Yale Style Manual’. Both of these design guides focus on visual elements, style, and process. In comparison to platform guides, the focus in design guides is to establish best practices in the design process and for common design problems, and the focus in platform guides is to establish a standard way for how to make standard elements available through specific platforms or programming languages.

Quesenbery (2001) defines corporate style guides as a hybrid of platform guides and design guides. The purpose of corporate style guides is to provide basic consistency across applications and support business goals. Quesenbery presents possible business goals as usability goals for efficiency, effectiveness, and satisfaction.

<table>
<thead>
<tr>
<th>Usability Characteristic</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient</td>
<td>Improved Quality: The time required to design of the user interface will be reduced because basic guidelines are clearly documented, tools are shared, and best practice guidelines is available for other discussions</td>
</tr>
<tr>
<td>Effective</td>
<td>Improved Process: User interface will be able to work together better because shared design guidelines are available. Initial designs will be more effective, with less re-work to solve usability problems required.</td>
</tr>
<tr>
<td>Satisfying</td>
<td>Improved Usability: The user experience will be improved, both for the designers and users. Designers will have the satisfaction of creating excellent interfaces, while users will benefit from increased usability.</td>
</tr>
</tbody>
</table>

The corporate style guide is different because it defines the purpose of a style guide in the business. The style guide emphasizes goals with characteristics transferable to usability. Documenting goals this way, end users of products are included in the process. As Gale (1996) stated, in 2.1, consistency does not ensure usability. Corporate style guides includes both usability and consistency goals.
Many authors specify differences between various types of style guides. Ratner, Forsythe and Grose’s (1996) study on differences between traditional vs. web style guides and how they differ, mapped several interesting results in the use and opinion of style guides. By traditional style guides, they mean established HCI style guides, and with web style guides, they focus on HTML based style guides. The study was a comparison on style guides development process and their content. The results showed a clear difference in development time of web style guides vs. traditional style guides.

Five web style guide developers used 3.26 weeks to develop the complete version of a style guide in an informal process. All the developers were from educational institutions. The resources used to write the style guide derived from fields of human factors, marketing, graphic arts, and public relations. In contrast, five traditional style guide developers used 54.2 weeks for the initial version, in a formal process. The developers had backgrounds from the military, the government, or corporate organizations. The guidelines were based on human factors, cognitive psychology, and military sources. The amount of time and comprehensive research that goes into the two different style guides is clearly different.

Ratner, Forsythe and Grose’s (1996) second phase of their study is a comparison of the content in traditional style guides and web style guides. They compared various guideline recommendations in the style guides and grouped these into categories. The result showed that both types of style guides, traditional and web style guides, overlapped in the number of guidelines per category, such as info display, labels, color, menus etc. There was also diverse focus on categories. Web style guides had more guidelines on navigation, structures, graphics and content. Traditional style guides had more guidelines on information display, mechanics, system response, message boxes, data entry and metaphors. This result shows the different focus in comparison of the style guides. They conclude their study saying that the web is a new phenomenon. The web has a very different structure than traditional applications. The diversity of sites introduces unique human-computer interaction concerns. Common look and feel is of greater importance when users browse through multiple sites with unique structure, layout, design, and functionality, compared to the use of traditional application interfaces. Due to the explosive growth of websites, the authors point out that the amount of web developers coming from diverse backgrounds are increasing. The authors suggest that one reason that web style guides are less rigid, compared to traditional style guides, is because of this diversity of web developers. Some developers would not think to look beyond the web to solve their interface problems, and many do not know where to look.

Beier and Vaughan (2003) state traditional user interface guidelines would be limited in its usefulness for web applications. They state that web applications delivered by web browsers, are dominated by metaphors like the page-centric view. On the other hand, desktop applications use window and
PRODUCING AND MANAGING DYNAMIC STYLE GUIDES

menu metaphors. Beier and Vaughan state that web applications support less interactivity than desktop applications.

2.2.2 Users and stakeholders

Users and stakeholders of style guides are defined in multiple ways. Gale (1996) defines end users as the ones performing tasks in a user interface or computer software that inherits style guides. By IT developers, Gale means the ones that develop user interfaces and computer software based on style guides. They benefit from easier development cycles and guidelines directly inherited from the style guides they read and use. The third group described by Gale is the business or organization, which is more like a stakeholder.

Quesenbery (2001) goes more into detail in describing and even extending Gale’s IT developer. In Figure 2.1, I have illustrated the users described by Quesenbery, and how they can be a part the modifiers group and the creators group.

Figure 2.1: Style guide users (Quesenbery 2001)

Figure 2.1 describes users involved with style guides directly in their work. All users may overlap all categories, but no group has to be a part of the creator or the modifier group. Furtado, Sousa and Colera (2005) present a new approach to the use of style guides. IT developers and HCI experts are responsible for the style guide creation process, which is a collaborative process using questions and answers to build knowledge around the style guides. The authors define the following users, working on style guides:

- UI designers
- System architects
- UI Designers
- Developers
- User Assistance
- Quality Assurance

Modifiers of style guides

Creators of style guides

All users
• Administrator
  
  *The development cycle coordinator, responsible for questions and answers*

• Multiplier
  
  *Has knowledge in specific areas, and brings a scientific approach to questions and answers regarding the style guide and content*

• General participants
  
  *Responsible for proposing reflective and basis questions, suggesting new style guides*

Clearly, there are many ways to define style guide users. The users defined by various authors above, all have focus on style guides used in computer software. In this thesis, I will use the following terms: developers, which develops style guides and end users that uses the style guides directly as a tool to perform tasks.

### 2.2.3 Problems and challenges

Gale (1996) has focus on a collaborative approach to development of style guide, and lists a number of reasons for why style guides fail. Solving the ‘style guide problem’ is a known challenge. Often style guides runs into hundreds of pages, and they become too complex and descriptive for people to use and read. The irony is that style guides should work as inspiration to create usable systems, but are hardly usable themselves. Many organizations tend to see style guides as the answer for usability problems. However, Gale states style guides do not solve the usability problem.

Gale argues that lack of user and developer involvement in the development process of style guides is a reason for failure. If there is given little consideration on how a style guide is introduced into an organization, then there is no support material if problems occur or people to encourage end users to use the style guide. When problems occur, there is no support through consultation. If the ones that are responsible for the systems usability impose guidelines on application developers, and the developers are not part of the guideline creation process, they are not responsible for usability in the application they create. Lack of responsibility can lead to lack of involvement and ignored style guides. The application developers will not feel responsibility for the style guide and its content.

These potential problems can lead to style guides not being updated or used. Gale also states style guides fail if they do not address how to be used in practice and integrated into development methods.

*No matter how high the authority, guidelines imposed on an unconvincing audience are often followed just to the letter of the law – if not simply ignored. (Quesenbery 2001)*
Quesenbery (2001) focuses on acceptance of style guides. It does not matter if a company creates a style guide with principles, guidelines, and conventions, if the end users ignore it. The style guide can follow what seem to be good guidelines, but it does not necessarily work in practice. Style guide developers and end users can have different views on the same situation. If one group does not consider the other, problems will occur. For each user group Quesenbery states the use of style guides shift during a project. Style guides first supply a conceptual overview, and then evolve into a role as a detailed reference guides. The mix of content make the style guides hard to structure. Quesenbery emphasizes that it is a big mistake to view the style guide as a narrative book. It should be viewed as a reference work. Only reviewers and authors will read the whole guide. The other users will look up the information they need.

Johnson (2007) has defined five social rules for creating style guides. Johnson states the real problem with style guides lies in the persuasion of departments, colleagues or some groups of people that adopts the new style guide principles. Hart (2000) argues that printed style guides are too static, and means that is a part of the reason why they are hard to use and are ignored. By static, he means a style guide printed on paper for several hundreds of pages. He suggests making style guides simple and dynamic, using the power of computer technology.

Furtado, Sousa and Colera (2005) has focus on what happens when developers who have been working on a system for a long time cannot work on it anymore. In this situation the knowledge, guidelines and principles is lost, if not documented in a style guide. The loss of such documentation is a known problem in many companies, as new developers come into a project to develop new functionality or to maintain the existing software. Furtado, Sousa, and Colera states that most companies do not create style guide documents. The companies worry more about conceptual models as relationship-entity model. The authors suggest a tool, which supports a participatory and evolutionary process to create style guides, supporting dynamic documentation of decisions, and questions and answers concerning various parts of a style guide. This way, new developers can look up the style guide they need, and find known problems that may be answered to their benefit. At the same time, it enhances the communication and participation in the development process of style guides.

Beier and Vaughan (2003) focus on web style guides, and tried to develop multiple style guides for web applications influenced by only one desktop style guide. In Beier and Vaughan’s case, the desktop style guide they used as template had focus on Java, and at widget level. They needed to create HTML guidelines, but had several obstacles in their way. Metaphors used in web applications are different compared to desktop applications. They had to create over a hundred different web-
based products across multiple domains with a great variety of users. There existed no centralization or support to design or implement style guides. Examining existing approaches to development of both web style guides and traditional desktop style guides, they found the style guides either too general or too specific. In response to all these challenges, they designed ‘The Bull’s-Eye’ framework described 2.2.4.

Ohnemus (1997) has focus on development of web style guides. As the World Wide Web (WWW) has a brief existence\(^2\), he claims there has been little opportunity for Human-Computer Interface domains to gain acceptance in the web development community. He suggests this has to do with the nature of WWW and associated technologies, but also with the different kind of web developers. Web developers range from industry developers for large companies following strict rules and validation requirements, to private users developing their own homepages without any rules or restrictions at all. Ohnemus emphasize the need for more comprehensive style guides because of the way the web is evolving. The web is moving from simple static web pages to increased interaction through dynamic frames and pages, combined with media, known today as Web 2.0\(^3\). Ohnemus is worried about the amount of web developers with limited knowledge and hands-on experience on corporate style guides and general HCI issues. With Web 2.0, there are many authors collaborating on web page content and information. This raises many issues. Do all these authors know how to create content that is compatible with multiple browsers and follows general guidelines? Are all of the authors capable of ensuring quality and usability on a web page? He points out that there is a need for tools to embody guidelines for quality to enable usable designs, so it is more difficult to create poor designs.

### 2.2.4 Frameworks and solutions

There is unlimited number of ways to produce style guides. There is no specific way that style guides should be developed and produced in general. There are only recommendations and frameworks publicly available. Corporations may internally define frameworks and policies to enforce inclusion of rules and guidelines in style guides.

Beier and Vaughan (2003) have a solution called ‘The Bull’s-Eye’, which is a multi-leveled framework for web application user interface design guidelines. They had to face multiple obstacles trying to use existing guidelines made for traditional user interfaces and to make them work with web user interface. They found existing guidelines either too specific or too general. ‘The Bull’s-Eye’

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\(^2\) Many scholars agree that the World Wide Web as we know it today started when it free to use for anyone, in addition to the release of the Mosaic graphical internet browser, in 1993.

\(^3\) Web 2.0 is loosely defined as a category of websites that are known for interactivity, collaboration, and community.
framework has five layers. The purpose is to divide guidelines into these layers. The layers are represented as concentric circles.

![Diagram of the Bull's-Eye: A Framework for web application UI design guidelines](image)

**Figure 2.2: The Bull’s-Eye: A Framework for web application UI design guidelines (Beier & Vaughan 2003)**

Beier and Vaughan’s study on products and applications at Oracle⁴ revealed a problem of consistency in many levels. They found inconsistency in the use of logos, page-flows, and templates. They felt they could enhance consistency across applications, creating a centralized framework. Even though a company wants a consistent looks, interaction and page flows, the company still has to pay attention to the specific needs in every solution. Every product has its own requirements, which the framework had to respect.

The system they built to support the framework was split into the five layers in Figure 2.2. The component layer supported simple UI elements as buttons, standard web widgets, and interaction texts. It could also contain complex UI elements such as tab navigation structures, table configurations, behaviors and tree components. Page templates define required controls and components. Within each page template there is defined guidelines for how to use the components.

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⁴ Oracle is a large software company
and various layout options to cover the scope of needs, and still support the overall goal of consistency. Page flows is the third level in the framework. This layer contains a combination of page templates with content that forms a specific task flow. If developers want to create a task flow for adding a new object, the task will include one or more pages for adding new objects and its data. It will also include a page to view the added object. The fourth layer is interaction models and patterns. This layer defines how common patterns and practices are for groups of page flows. Page flows can be different for various groups such as e-commerce, portal, or administrative applications. Therefore, this layer defines what types of page flows that are used in various sorts of applications. The fifth layer is surrounding the other layers. It consists of overarching features and principles. The layer provides guidelines, heuristics, and standards used throughout all the concentric circles. This layer ensures the same consistent user experience in all applications.

Each guideline or layer in the framework, is communicated in a consistent format and published as HTML pages for easy access and maintenance. Beier and Vaughan (2003) define the content of a complete guideline as follows:

- A general description of the guideline
- Guideline attributes, including a contact person from the UI group, a list of contributors, version number, products or product families using the guideline, and links to related guidelines
- Interaction and usage scenarios for the guideline, including general principles of use, options for the given component / template / etc., and page flows indicating how the component / template relates to other parts of the guidelines
- Visual specifications for the guideline that detail the color, size, minimum / maximum values, etc., and provide visual examples of the options for this component / template / flow
- Usability data where test results validate components, templates, or flows. These tests may be product specific tests, or guidelines-wide tests. Usability tests are ongoing and their data are incorporated into each guideline as results are available
- Open and closed issues pertaining to the guideline

Beier and Vaughan (2003) believe the multi-tiered guidelines are valid because they involve UI designers, usability engineers, product managers and development managers across the company in the development process. Every user group is involved with their expertise to help to guidelines evolve in the best possible way. A framework that supports a unified structure is important to map issues that occur during usability and heuristics tests on the guidelines itself. Beier and Vaughan confirms the validity by the degree of adoptions by product teams at Oracle. December of 1998,
Oracle had no products with common look and feel, and by December of 2000, all web based product teams, covering over a 100 web-based applications, used the guidelines. Beier and Vaughan conclude that Oracle went a step forward, using the framework. The framework helped the company to see how all the different guidelines work together, and it made the guidelines accessible.

Hart (2000) claims paper based style guides are too static, and suggest making them dynamic. Developers should not include every aspect of information in the style guides. There are many relevant style guides already existing that will meet most of the general needs. Hart suggest picking up one of the existing style guide that fits most needs, and start working from that. The focus should be on the parts not described in the general guidelines. Hart emphasize the importance of knowing the audience of a style guide. Most general style guides do not address relevant issues for end users. Once the audience is defined, Hart argues that the various people and user groups can help define problems and solutions to the style guide from their point of view. Hart suggest using word processors and templates to make the style guides dynamic. Templates are special word processor files that are only readable and not writable. That means, write fields, macros, text, layout and structure is pre-defined to give the document a unified look and feel. Templates can be used to write common guidelines and textual description that is standard to the style guide, so that editors and style guide creators do not have to repeat text and elements that is repeated in multiple style guides. In word processing templates, it is possible to create pre-defined logic. If a writer uses an existing template to create a new style guide, there will be pre-defined fields and areas to write in. These fields can read, “Type the title here to replace this text”. Setting the cursor on that field will mark the text area, and the author can start typing in the custom text. A date field is pre-defined with a specific formatting style, and the author just has to write in the date in the style that is defined by the template. In other sections of the document, it may read:

*Mention of product names does not constitute an endorsement by GeoffCo. [if there is a risk of personal injury, add the following text but if not, delete it:] Use of this product in any manner other than that described in these instructions may cause injury. (Hart 2000)*

The writer has the option to use the pre-defined field or delete it along with the information bracket. Using fields in the template with hints, helps the author to know what type of data and information that can and should be written. Sophisticated templates also use styles. Styles makes a consistent look throughout the document, and formats text, paragraphs, spacing etc. Styles help the user to create a well looking document, which is easy to read and follows the corporate visual design and guidelines. Hart states that in extreme cases it would be interesting to check out XML and SGML authoring tools, which support stricter divide of document styles and raw data. The authoring tools would provide rigorous document setup, rules, and layout. The writer would only worry about
putting the raw text into the right places. Hart argues that authors can achieve a reasonable compromise between power and complexity, with the use of word processing templates. Hart explains how to extend the templates with shortcuts and work aids, using programming languages. He suggests creating specific wizards to guide the authors through various processes, and to create macros to automate tasks. By dynamic style guide, Hart means that it is a document where help is given as the writing goes on. The process is dynamic in the sense that macros and template fields give authors clear direction on how to write. The templates also free authors from much of the mechanical aspects of their jobs, and it enables authors to focus more on the creative aspects of their work. Hart argues short and simple style guides that do not impose rules on end users, makes the end users easier, and improves the use of overall use of style guides.

Gale (1996) suggests a collaborative approach to development of style guides. He maps a number of problems and challenges in section 2.2.3. In order to overcome the issues Gale suggests a five step alternative approach:

1. Raising awareness amongst developers and end users
2. Building consensus
3. Documenting the style guide
4. Providing training and support material
5. Establishing an environment which enables the guide to evolve

Gale argues how this approach above can improve the use of style guides. He argues that end users need to know the reason why style guides are important. It is significant to know what sort of information that is described in a style guide, and how to use it. Gale suggests building consensus through meetings with style guide developers and end users. In the meetings, the agenda is to go through specific style guide topics to raise awareness and discussion, and to make everyone involved in the process. It is critical to have style guides as a part of the development process, and allow the style guides to evolve. Often style guides are developed isolated from the end users. Gale states such isolation often results in impractical and frequently un-implementable style guides. Therefore, it is important to build the style guide in collaboration across divisions and special fields, and document the best of everyone’s ideas. Everyone that is involved in the development of a style guide should also receive the documentation and help they need to collaborate in the development of style guides. Gale states that a collaborative approach would enhance the feeling of ownership for users involved in the development process of a style guide. The feeling of ownership is important in creation of effective style guides, so users can feel that the style guide is theirs, and not imposed by senior management or higher authorities.
Furtado, Sousa and Colera (2005) present a tool called MC2, that works as a knowledge system wrapped around style guides. The authors state style guides usually are hard to interpret and apply, and therefore they suggest using MC2 to elaborate knowledge contained in the style guides. The authors argue that information shared between developers is more efficient because the developers can reuse what others have done. A style guide does not only share technical information, but could also share practical knowledge through developers’ experience. The MC2 tool works as a question and answer system. The centre of knowledge is style guides for various applications and projects, and answers and questions are connected to style guides and its content. Style guide questions can be asked using the MC2 tool, is accessible in the central repository. This repository can be queried to group specific answers to find relevant answers in other parts of the style guide. It is possible to vote for questions to suggest changes in the style guide. The tool provides the possibility to discuss issues and methods. The MC2 tool works as a network, which ties together the style guide developers and end users. Furtado, Sousa, and Colera argue that the MC2 tool makes style guides easy to access and maintain. The tool enables documentation of empirical knowledge from the use of style guides. It also enhances the collaborative experience.
3 Research approach

I chose ‘development research’ as my research approach. The focus in the thesis is to enlighten problems and challenges with style guides, and the way they are used in a specific organization. That knowledge is then discussed and analyzed. Using the results of the analysis, I create prototypes to explore new solutions to the problems and challenges. The prototype is evaluated and compared to the existing work on style guides in the same organization. To gain new experiences and new data from real users, the whole process is iterative, supporting the build of new theory and empirical knowledge to the domain.

van den Akker (2000) describes development research as a research approach mostly used in education. van den Akker argues that motivation for using development research has a reference to the uncertain reputation of educational research. Lack of relevance and difficulties connecting science with practice, are some of the issues stated by policy makers, practitioners and many researchers themselves. They wish for direct impact from research to practical problems and theories. For this reason, the use of development research is highly relevant. In computer science, and software development in particular, development research is a powerful combination of practice and theory.

“Systems development as a research methodology can be used not only as a means of better understanding a research domain, but can sometimes even change the processes and products in a research domain.” (Nunamaker & Chen 1990)

de Villiers (2005) presents three approaches as pillars for interpretive information systems (IS) research: development research, action research and grounded theory. In this thesis, the chosen approach is development research. The author presents development research with dual focus:

1. It develops practical and innovative ways of solving real problems
2. It proposes general design principles to inform future decisions

de Villiers further states development research is not mainstream in IS, but is used by graduate students and researchers to pursue development goals to make practical and scientific contributions. Development research is a practical and problem-oriented approach, searching for new and innovative solutions. Development research aims to build design principles and methods that are empirically tested. The development research process is iterative, and is closely related to
evolutionary prototyping. The research is based on iterative analysis, design, development, implementation, and formative evaluation, which goes into redevelopment. The results that occur from the iterative process can lead to both immediate outcomes, and to distant outcomes that can be used to generalize principles.

In my research, I have three cycles in the development and research process. In the first cycle, I gathered problem areas and various user experiences on the use of style guides using qualitative semi-structured interviews (section 3.1.1). I then analyzed the gathered data, to define user requirements, define user groups and tasks related to style guides. The result of the analysis was used to create the first conceptual design, and development of a high-fidelity prototype (section 3.1.2), which was implemented on a local computer to be evaluated. The first evaluation was an expert walkthrough (section 3.1.3.4). The results of the evaluation were the foundation for a new iteration, which lead into a new iteration of the prototype with new focus and evolving issues. This prototype then evaluated again with heuristic walkthrough (section 3.1.3.5) using real users to test the concept and its usability, and then to talk about their thoughts and opinions in relations to the use of the concept. The result of that evaluation makes the foundation for a new possible iteration in future research on the subject.

3.1 Research methodology

A research methodology is a combination of the process, methods, and tools used to conduct the research. This research has an interpretive approach, considered as the paradigm. The research aims to find new interpretations and underlying meanings from the investigation of my research questions in section 1.1. To build a foundation for interpretation, I used qualitative research methods. There is no clear theory on how to use style guides, since style guides cover various special fields and used in unlimited number of ways in information systems. To understand how style guides are used in an enterprise organization requires the use of qualitative methods, to get deeper insight into the underlying obstacles and problems.

3.1.1 Qualitative interviews

I used qualitative interviews in both phase 1 (5.1) and phase 3 (5.3) in the thesis. An interview is a powerful technique to get detailed information about different users’ perception of a problem or specific field of knowledge, at any time in a user-centered design lifecycle. In the process of developing a style guide tool it is valuable to get information directly from users that have hands-on experience working with style guides or design manuals in some way. Interviews gives us an understanding of how the users feel, interact, and behave in addition to direct answers to questions (Kvale 1997:21). Jirotka and Goguen (1994:4) state that requirements engineers are usually advised
to use interviews as one of the methods to gather data. Without any knowledge of how style guides work in practice in an organization like Telenor, interviews was the clear choice to get deeper insight to persons opinions and experiences concerning production and management of style guides.

There are many ways to prepare and conduct interview. Kvale (1997:59,115,204) explains that general criticism of qualitative interviews are directed toward validation of analysis done by the researcher, the amount of interviewed participants, and the lack of objective view. It is difficult to know how many participants you need. Kvale (1997:58) argues that one should interview as many people you need to find out what you want. Before the interviews, I had little knowledge of what information and views the participants would hold, other than my own assumptions about their roles in the organization. Since the participants represented various background and special fields, I used open-ended questions in both the first and the last interview session. Preece (1994:628-630) presents flexible interviews as a method to conduct interviews with a set of open questions. This kind of interview is widely used in HCI research. Using open-ended questions and presenting the user with a topic, instead of a set of predetermined questions, makes the interviewer free to follow and explore the participants’ replies. Structured interviews are easier to conduct and analyze, but flexible interviews gives a bigger scope of information that can be valuable. Sharp, Preece and Rogers (2007:299) state semi-structured interviews are a combination of structured and unstructured interviews, using both open and closed questions. Every question in the interview should avoid bias (Sharp, Preece & Rogers 2007:304). The questions should also be easy to understand, free of academically jargon (Kvale 1997:77). To maintain some consistency through the interviews, the interviewer has a basic script as guidance (Sharp, Preece & Rogers 2007:299).

I created an interview guide to prepare myself before both the first and last set of interview sessions. The questions in the interview guide were categorized by subjects. I prioritized the questions I wanted to get answered first in each group. In addition to the main questions, I had extra questions to help me prompt the participants for further information on the subjects. The guide was intended as aid if the interview stopped unexpectedly. None of the questions was mandatory, so if the participant wanted to talk in depth about a specific subject of interest, I gave time to do so, even if that meant skipping less important questions. Kvale (1997) states it is easier to structure and analyze the interview later, if the interview has a well-defined and strict structure. However, in my research, I explore new theories for how to improve the existing use of style guides, and I wanted as many different views on that subject as possible. Therefore, I used semi-structured interviews in all of my interviews.
In the first interview session, I documented data using a digital audio-recorder in five interviews, and took notes in two interviews. In the second phase, I used a digital audio-recorder in all of the interviews. The advantages using an audio-recorder during an interview are many. The interviewer can observe how the participant reacts to questions through the body language, and can maintain eye contact throughout the interview as in a normal conversation between two people. The eye contact gives the participant a feeling of interest from the interviewer, and it can be easier to create follow-up questions directly through the normal conversation style.

*The interview is a stage, where knowledge is produced through interaction between the interviewer and the interviewee.*

(Kvale 1997:75)

As the citation above expresses, there are many expressions in an interview or on a stage. The interview encourages the interviewees to verbally express their opinions and experiences. Sharp, Preece and Rogers (2007:297) state the use of notes, with paper and pencil, is very flexible. Note taking has very low disturbance to users. If the interviewer is experienced, it is easy to record what seems to be important to the study, and ignore the rest. This makes it easy to transcribe and use the data for analysis. However, the reliability of the data may be low. It relies on the human capability to know what data is good to record and to make that decision during the interview. Sharp, Preece and Rogers state audio recordings are flexible and relatively unremarkable. It has low disturbance to users, but a microphone has to be placed in the room. The reliability of the data is high, if the recordings are clear and without noise. Using audio recordings in data analysis, critical discussions can be identified, and you always have the original data to support the analysis. Still, detailed transcription of data is time consuming. Taking notes during the interview compared to the use of audio-recorder can give slightly different results. When an audio-recorder is a part of the interview, both the interviewer and the participant can be more reserved than in a situation when there is only note taking. If a sensitive subject is brought up during the interview, the response can be quite different, in a comparison of the two methods. Some people may react by answering in short terms, automatically being more reserved because every response is recorded. Using note taking as method can also result in short answers, but there is a bigger change that the participant will not feel cornered in the same way. The chance to get deeper and more full answers are better. Using note taking, the raw-data is not accessible after the interview, and the interviewer have to trust in the data as it is. This can be a weakness. However, conducting many interviews, the amount of time that is saved can be significant.

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5 My translation
In phase 1 of my research, I transcribed parts of the interviews in both interview sessions. Due to my semi-structured approach, I got data that was not directed towards my research, which could be ignored. I listened to my audio recordings and grouped subjects, opinions, citations and attitudes in the interviews to make it easier to compare. Using the keyword transcription, I went through the interviews again to fetch the details from the keywords I found that fit into my research. I then did an interpretive analysis of the interviews based on research topics concerning production and management of dynamic style guides, and based on my research questions. The notes taken in two of the interviews, where easier to group as they already ignored irrelevant parts of the interview. On the other hand, I had the disadvantage of not having the raw data, to get a fuller description to my notes when needed. All together, the data analysis is a foundation for new knowledge on the research domain, which I use to discuss the empirical data in relation to existing work and theories.

Kvale (1997:115) states there are no standard methods to reach significant meanings and deeper implications through interviews. Interpretation can be as different as there are different researchers trying to understand the data. As stated early in this chapter, there is criticism towards the validity and objectivity in qualitative interviews. However, Kvale argues (1997:115) that trying to force reliability through mutual agreement in every research can lead to results being trivial. In contrast, using background information and exploring new knowledge using the researcher’s skills and interpretation can lead to extended knowledge on the research domain.

3.1.2 Prototyping

In my research, I create a prototype to explore new concepts in the research domain. The prototype is developed in two phases. The first prototype is a result of the gathered requirements in phase 1 (section 5.1) of the study, and the second prototype is developed in relations to the results of phase 2 (section 5.2).

In recent years, prototyping has been seen as a more flexible and reliable way of establishing requirements and building systems. It allows the technology to be respecified following a particular ‘iteration’, and provides a series of opportunities for reflecting on and reconsidering design. (Jirotka & Goguen 1994:266)

Sommerville (2004:381-383) argues that because of the dynamic nature of user interfaces, evolutionary prototyping with end users involvement is the only practical way to develop user interfaces. He further states it is difficult to comprehend abstract features in user interfaces. When people are presented with visual examples, it is easier to identify characteristics that one likes or dislikes. Dix et al. (2004:220-222) state that because humans are complex and designers not perfect, almost all interaction design ideas are evaluated through iterations. An idea often starts with a
mockup, which in later iterations becomes real programs and user interfaces. Any of the prototypes, can be evaluated to see if they are acceptable and to see if there is room for improvement. Dix et al. (2004:220) further state iteration and prototyping are universally accepted as best practice approach for interaction design. Sharp, Preece and Rogers (2007:530-531) state prototypes are useful discussing ideas with stakeholders. Prototypes also enhance communication between the people working together in the development process, and are great tools to test out new ideas for the researcher. However, they mention major pitfalls to be aware of when using prototyping. First, it is important to understand the user requirements that are the foundation for the prototype, and have good background information on the domain. Second, it is important to have a good starting point. Dix et al. (2004:221) present an example where the researcher climbs a mountain. The mountain is a metaphor for an information system or user interface. The goal is to reach the top, but if the researcher climbs the wrong mountain or begins developing the wrong kind of prototype, it will not help to solve the problem or extend knowledge in the best possible way. Finding a good starting point, or a good mountain to climb, requires the researcher to know the problem domain to identify what prototype to build.

Sharp, Preece and Rogers (2007:529-576) present two kinds of prototypes: low-fidelity and high-fidelity. A low-fidelity does not look much like the final product. The low-fidelity prototype is created using simple tools, like paper and cardboard, to sketch structures and concepts. This makes the prototype simple and cheap to create and modify multiple times. The combination of sketches and storyboarding is a good way to build consensus on the overall concept, but the lack of details requires a high-fidelity prototype to map usability issues and to review the users’ perception of the user interface. I used a high-fidelity prototype in both of my prototype iterations. Sharp, Preece and Rogers state high-fidelity prototypes uses the materials and environment users would expect to find in the final product. These prototypes are more costs more time and resources to build, compared to low-fidelity prototypes. On the other hand, high-fidelity prototypes are useful for selling ideas to people and to test out technical issues. The prototypes are fully interactive and give the users a more full impression of the tools capabilities.

3.1.3 Evaluation

Evaluation is an important part of any research to make the research valid and reliable and to have real users and experts test hypotheses or concepts. Sharp, Preece and Rogers (2007:586) state evaluation is about checking if the user understands and likes the concept. Traditional evaluation was about testing the usability of an application or user interface, but nowadays it also includes evaluation of user experiences. The introduction of World Wide Web made design an important part of web applications, and now traditional desktop applications too. The websites must therefore be
usable as well as aesthetically pleasing. Sharp, Preece and Rogers (2007:586) state that from a market and business perspective, evaluation is considered very useful: giving designers feedback on ideas in early stages; mapping major problems to fix them before release; and focus on real problems. Evaluation often costs time and resources, and that means more expenses. Stakeholders are in general interested high quality solutions to problems for a reasonable price. However, projects utilizing evaluation as a tool to fix problems and highlight important aspects of an application can reach those goals. Dix et al. (2004:319-320) state there are three main goals using evaluation:

- Evaluate accessibility of system functionality
- Evaluate user experience from interaction
- Evaluate and identify problems

Sharp, Preece and Rogers (2007:589) suggest in resemblance to Dix et al. (2004:319), that evaluation is used in iterative cycles. My research approach, development research (section 3), suggests the use of evaluation as a part of the iterations as well, and to use the results of the evaluation in a new development iteration.

3.1.3.1 Evaluation methods

There are many ways to conduct evaluation based on what needs to be evaluated and what results the evaluator is looking for. Axup (1998) has created a comparison table of usability evaluation methods, which makes it easy to compare many of the differences between them. Many methods are similar, but have small variations to them. In my research, I chose expert walkthrough (section 3.1.3.4) in phase 2 (section 5.2) and heuristic walkthrough (section 3.1.3.5) in phase 3 (section 5.3).

What distinguish my chosen methods compared to many other methods, such as usability testing and focus groups, is that I use Human-Computer interaction (HCI) experts as users. Since both, phase 2 and phase 3, in my research are early iterations in the development cycle; I wanted to map known and predictable usability issues, in addition to get feedback on the conceptual ideas. Due to the extensive background of HCI experts, they are in a good position to make general assumptions about the conceptual ideas. Dix et al. (2004:320) state that with the use of experts one can evaluate prototypes and concepts, and avoid taking the wrong path early in the development. However, potential users with no background in HCI should also test the application in later iterations in the development cycle, to avoid bias and make the results more objective. Sharp, Preece and Rogers (2007:630) state it is important to involve appropriate users. They suggest ranging users by level of experience on the subject under study, and describe them thoroughly.
3.1.3.2 Evaluation tools

In both of my chosen evaluation methods, I chose to use a screen capture tool with sound recording to gather my data. I used the trial version of Camtasia Studio from Techsmith (Camtasia Studio Screen Recorder and Video Editor 2007). The tool is well known amongst HCI experts and is excellent to capture the combination of voices and users’ interaction with application and computer software. The video formats can be converted to many known formats to easily share the content with other users using Internet or distribute CDs etc. The tool also supports various enhancements of audio and video, like noise reduction and image repairs on the data whenever needed. This tool works best in a laboratory test, and controlled environment. It can be used in a real user context, but the recording condition can be demanding. Doing recordings depends on the equipment in use. A high quality microphone is recommended to ensure good sound.

In addition to Camtasia, I used pen and paper during the evaluation to take note of special findings during the tests. In the expert walkthrough (5.2.2) I used an extra person to take notes on the laptop, in a word processing application. This person synthesized the discussion and issues into bullet lists and identified the participants with initials on each bullet. In the analysis of the gathered data, I used a word processing application and a spreadsheet program to organize the findings.

3.1.3.3 Important factors

Dix et al. (2004:357-360) describe a number of important factors with evaluation to consider. They suggest using laboratory studies in the early cycles, but also state it can be valuable to evaluate users in a natural context to get a real perspective. The use of laboratory, which is a stable environment, gives the evaluation high reliability according to Sharp, Preece and Rogers (2007:640). It ensures minimal disturbance and other factors to influence the evaluation. Validity is given by the choice of method to evaluate solutions and problems. If the method is correct and is used right giving good results, they can be valid.

There is always the problem of bias in evaluation and research. Bias gives a one sided perspective on a situation, which makes it hard to discover all potential problems and solutions. Sharp, Preece and Rogers (2007:640) state it is important to map possible bias through the evaluation results. There are many reasons why bias can occur in a research. One of the reasons is the use of subjective evaluation methods. They rely on the evaluator’s interpretation and on the evaluator’s expertise and knowledge on the investigated domain. In my research project, I have used subjective evaluation methods: expert walkthrough and heuristic walkthrough. It is my own interpretation and study on the evaluation that is the foundation for each iteration in the development cycle. However, being the developer of both the prototype and the conceptual idea, and having studied HCI, I believe I have the
knowledge to recognize problems and understand what the user is doing. Dix et al. (2004:357-360) state subjective evaluation can be powerful and reveal information that would not be accessible through objective evaluation methods. However, to avoid bias in subjective evaluation, they suggest using more than one evaluator. They further state that the more structured an evaluation is, the less bias will occur. They state controlled experiments are valid and reliable. “Ideally, both objective and subjective approaches should be used” (Dix et al. 2004:358). In my research, I am only one evaluator and interpreter of the results, which lead to bias. However, my evaluations are structured using scripts and guides to ensure consistency throughout the evaluation sessions, which I believe will help me identify and avoid bias. However, in the extent of this research and in future iterations in the development cycle I would recommend using objective evaluation methods to ensure a thorough and wide range of viewpoints on the concept and functionality.

3.1.3.4 Expert walkthrough

I used expert walkthrough in phase 2 (section 5.2) of my research. In Axup’s (1998) table of usability evaluation methods he describes expert walkthrough as a method utilizing HCI experts as participants. The participants use task scenarios to guide their analysis of the interface. They use no specified guidelines or heuristics in the evaluation, but they use the ‘heuristics they have in mind’. Since they are experts with HCI background, they know what usability problems to look for in the application. The evaluation session is conducted in a group. All the participants are in the same session, and they discuss usability and concept with each other and the evaluator. Axup states inherent bias can occur as result of the pre-selected tasks, and that the tasks do not necessarily cover the entire problem space. Using tasks and scenarios to guide the users through application can take the participants focus away from other significant problems. However, in the early stage of the development cycle, the application is not very large. The selected tasks are representative for the functionality at the time of the evaluation, and cover the most central functionality and concepts.

At first, the evaluator briefs the participants. In my research, I used a slide presentation to introduce the concept behind the tool, so the participants could understand the relationship between elements and objects. I then the participants, explaining and encouraging the users to criticize the concept and usability, which also Dix et al. (2004:343) suggest. I then presented the scenarios and tasks that I used to walk them through the application using two large monitors on the wall in the lab.

Sharp, Preece and Rogers (2007:592-594) describe expert walkthrough as an analytical evaluation method. Usability experts usually do the testing of user interface, and therefore it is often lab-oriented. They further state analytical evaluation is used at any time in the development cycle and often with prototypes. The analysis of the expert walkthrough is very open, but since the users are
HCI experts, the result is often a list with a mixture of summary of the conversation, usability issues, concept issues, and questions. The list is of issues and discussion is the base for interpretive analysis to map the users’ feelings and opinions to the concept and usability during the test. The result of the analysis feeds into a new iteration in the development cycle to fix problems that were found and evaluate the further developed application with new and improved features, but also new concept and usability issues.

3.1.3.5 Heuristic walkthrough

Axup (1998) describes heuristic walkthrough as another method of using HCI experts as participators. However, in this method the experts do the evaluation separately. I use heuristic walkthrough in phase 3 (section 5.3) of my research. Heuristics are rules based on common-sense knowledge and usability guidelines (Sharp, Preece & Rogers 2007:592). Heuristic walkthrough is similar to expert walkthrough. In both walkthroughs, there is use of experts to do the evaluation. There are defined scenarios and tasks to guide the users through the application, so user also knows what to do. The main difference is the expert users are doing individual and independent usability review with their ‘built-in HCI knowledge’ as heuristics, and they individually evaluate the concept. This way none of the users can influence each other’s opinions. Using a detailed task-set, it is easy to categorize usability problems and solutions, and compare them with each other in the analysis. Sharp, Preece and Rogers (2007:688) explain that Nielsen and Molich originally developed the heuristic evaluation method. Nielsen (2005) presents general principles for user interface design that expert users can use as overall rules to test user interfaces against. Axup (1998) states the validity of Nielsen’s guidelines have been questioned and that alternative guidelines exists. Nielsen’s rules are not specific enough for the testing of my research project, and therefore I trust the HCI experts to have the Nielsen’s general guidelines amongst other guidelines in their mind conducting evaluation on the application, and at the same time apply more specific usability rules known to the application domain.

Nielsen (Nielsen 2000) recommends using five participants. He argues a single participant discovers a third of all usability problems in the conducted test. On the other hand, he argues the use of at least three participants is necessary to ensure certain diversity in the findings. If one uses fifteen participants or more, Nielsen states that all usability problems are discovered, but the cost of using this many participants is significant and critical for business stakeholders. After the three first evaluations, more and more of the same usability issues will repeat themselves. Using five participants will confirm the diversity of usability issues and reveal unique usability issues by all participants. Nielsen states 85% of usability problems are found using five participants, and it is
better to use resources to fix those issues, and then redesign the application and test again instead of using the same resources on repeated usability issues for fifteen users.

At first, I introduced the fundamental concept to the users, so they had the same information and knowledge to start with. They were then given a set of tasks to solve. During the walkthrough, I asked them, using follow-up-questions: what they felt about what they did, the way they did it, and whether there was any other or better way to solve the task (Dix et al. 2004:343, 348). Using triangulation with multiple methods can give a more thorough result. The problem using triangulation can be disturbance for participators in their performance of task. However, the participants in my evaluation were HCI experts and were used to triangulation during user tests. When the participants talk aloud about what they do and what they feel during interaction, it is easy to evaluate the deeper and underlying assumptions.

In the end of the session, I presented the overall concepts of the application they evaluated (section 4), and extended the participants knowledge about the application and how it is meant to be used in a real situation. After that, I debriefed the user, conducting a short semi-structured interview for about ten to fifteen minutes, to go through general thoughts on the concept and usability issues. The interview gives further depth in the general usability issues in the application, and gives qualitative data used in the overall interpretive analysis.

Analyzing the heuristic walkthrough, I grouped all usability issues identified by the task numbers. I then went thoroughly through the audio and screen recordings to note problems and suggested solutions to usability questions. At the same time, I took notes of citations and expressions used in the qualitative analysis of evaluation. Sharp, Preece and Rogers (2007:701-702) state the heuristic evaluation should not be thought of as replacement for user testing. Expert predictions can be false alarms and actually wrong. In my research project, I had a special situation where real users are HCI experts as well. The application is a concept with focus on all divisions in the organization, and it includes the research and innovation (R&I) department. Many of the participants are therefore potential real users of the applications. This situation can result in bias, but can also give results that are more relevant.

3.2 Ethics
Ethics is always an important subject in any research. Doing research can have huge impact on various people in the society and work situations. In my research, I investigate the use and process around style guides. Style guides is a global well-known phenomenon, but the way they can vary from person to person in every organization. Conducting research directly with user, I use
pseudonyms on the persons, and inform them of the use through a textual and oral description which they sign to confirm their participation. The pseudonyms are confidential, but the participants’ opinions and expressions are a part of the research. It is vital in every research that participants do not feel they risk anything personal or organizational by participating, therefore the process is transparent, and every step were planned with guidance from my teaching supervisor in the organization. The supervisor also worked as internal contact and information manager with participants to avoid misunderstandings and conflicts. All together, it is important to be aware of what impact the research can have for participants and the organization. It is also important to be aware of bigger issues trying to generalize some of the concepts.
4 Style guide production and management tool

One of the main purposes of the thesis was to create a tool that could improve existing use of style guide in enterprise organizations. The concept behind the tool was to create an extensible and flexible solution to produce and manage every kind of style guide intuitively and easy, and engage all users and stakeholders in the production and management of the style guides. The tool makes every style guide in the organization accessible and usable, and gives all the style guides a consistent look and feel. It supports both, very small and very large and complex style guides, and it makes the style guide process dynamic. The tool saves all changes and revisions in the style guides, to document decisions and discussions. It has a technical and logical structure, which is easy to extend to the organizational needs. The tool is a central repository of guidelines, conventions and principles, and its architecture support users from any location to work with the tool and its content, due to its web based interface.

Screenshots with descriptions from the tool is presented in (Appendix A).

4.1 Technology

I used ASP.NET 2.0 from Microsoft as core technology creating the prototype. With ASP.NET 2.0 (Learn ASP.NET 2007) as basis for the development process, it was natural to choose MSSQL 2005 database (Learn SQL Server 2007) as data source for the application. MSSQL 2005 is fast and extensible, and has a tight connection to the ASP.NET 2.0 development framework. I chose the ASP.NET AJAX framework as a foundation to create an enhanced user experience and workflow. The result for the user is a feeling of more traditional application interaction in web pages.

4.1.1 ASP.NET 2.0 and ASP.NET AJAX

ASP.NET 2.0 is a rich programming framework for web applications, which enables developers to be creative, productive and ensure creation of secure applications. ASP.NET 2.0 supports code written in C# and Visual Basic to create business and data logic. The framework supports server controls, which enables developers to reuse code and logic. ASP.NET 2.0 has provider driven model to support extension of built-in functionality.

I built the high-fidelity prototype in ASP.NET 2.0, with support of the ASP.NET AJAX framework and ASP.NET AJAX Control Toolkit (About ASP.NET AJAX 2007). Both the AJAX framework and the control
toolkit were in beta test\(^6\) during the first prototype. However, Microsoft released the ASP.NET AJAX in a stable version 1.0, used in the second prototype. The reason for choosing such technologies was to be able to create and offer interactive user experiences in web applications. Working with has AJAX has become easy and accessible through the release of the ASP.NET AJAX framework, because much of the core functionality is accessible through the framework. This framework gives a possibility to create AJAX-enabled websites rapidly, using the ASP.NET AJAX Control Toolkit. AJAX is shorthand for ‘Asynchronous JavaScript and XML’. The intension behind the technology is to make the web application feel more responsive, intuitive, and usable by only changing the parts of a webpage that requires an update, and not loading the whole page all over. The use of JavaScript and DHTML is also known as rich internet applications (RIA), also called Web 2.0.

### 4.2 3-tier architecture

The tool is divided into three main layers; user interface (UI), business logic layer (BLL) and data access layer (DAL). Figure 4.1 illustrates the relationship between the user and the layers, and the layers and data source.

![Figure 4.1: 3-tier architecture of the style guide production and management tool](image)

\(^6\) The beta version of the ASP.NET AJAX framework was known as codename ‘Atlas’
DAL handles all direct data access and the data traffic between the tool and data storage. A MSSQL 2005 database is the main data storage for the tool. In addition, there are some XML files holding site map structures and other supportive data. Images and media are stored directly as files. DAL has the logic structure and methods it needs to handle all the various data type requirements. It handles reading and writing of data, and makes sure it is done correctly.

BLL accesses data through DAL. By doing so, BLL receives correct and secure data, regardless of what data source is used. BLL defines the tools logic and creates relations between data. It can generate lists and objects by any requirements, and delivers data in a usable way to the user interface.

The UI layer defines how the page looks and feels. It uses data from BLL and returns data back from the user to the BLL, which handles the data in some way. The interaction logic is implemented in this layer, so in the first prototypes it is very important to have a well-designed UI layer to provide the concept in the best possible way. The UI layer is a collection of JavaScript, ASP.NET 2.0, C#, XHTML, and CSS code. Therefore, the layer is the most complex to understand in the 3-tier architecture. It is the binding point in the application, where interaction functionality meets the data.

The 3-tier architecture has many advantages. It is easy to replace any of the layers to make it fit the context the tool is used. Further development on the tool is easy as developers have easy access to their area of expertise. Graphical designers, interaction designers, HCI experts, and UI developers can concentrate on the UI development of the application. Structures and business logic is developed on the BLL level. Database experts and data source developers work in DLL creating accessible data for the BLL. The 3-tier architecture makes the application more flexible and easy to handle for further development and maintenance.

4.3 Tool components

The tool has the components as showed in Figure 4.2. The style guide component is in the center of the illustration, which fits the general expression of the tool quite well. A style guide has its pages, which are sub-components of a style guide. Each page has its content elements that contain various types of objects. A content elements’ object can be anything. Typical content element objects are: text blocks, titles, images, videos, reference links and various files. If the object format is directly supported by the application, previews and full view of the object can be viewed directly from the browser. If the object format is not directly supported, the application will provide links or some other way to view or use the object. The internal structure of the style guide component and its sub-components is presented in 4.4.
The tag component can be used to write custom identifiers for style guides. A style guide describing contents for a corporate web site could have tags like ‘corporate’ and ‘web site’, to make the style guide easy recognizable. Tags are utilized search and browsing for style guides. They can also be used to create statistics on what kind of style guides that exist in the tool.

The project component is also working as an identifier of style guides. A style guide can belong to one or more projects. By project, I mean a job or task that goes over a certain amount of time and consists of one or more people working together to solve a job or task. The project component is a grouping functionality. By creating a project, it is easier for people involved in the project to find relevant style guides. The project can have its own page that lists the involved style guides. It is also easy to locate relevant collaborators through a project, since all participants is added to the project. A style guide does not have to belong to any project. The project association is optional. That means a style guide can be free and independent in the tool.

![Diagram of tool components and their relationships](image)

Figure 4.2: Tool components and their relationships

The template component looks very similar to the style guide component. It has the same structures and internal sub-components. Template has an optional association in resemblance to tags and projects. The difference is that the association is bidirectional. A template works as a pre-defined style guide. In can have a specific structure and content, and it can contain placeholders for both required and optional data. A template can be generated based on existing style guides. If a style
guide is created using a specific template to generate pre-defined content and structure, the type of association can be defined. The association is defined by the terms: strong, weak and transparent. If a strong association is selected the style guide have to fulfill all the template requirements for structure and content. If the association is weak, the style guide has to fulfill only the specified requirements in the template. If the association is transparent, the style guide does not have to fulfill any requirements, but has the option to use the template only as guidance and help to structure the style guide and use good practice on content. A template can always be changed and evaluated against its associate style guides. A template can also be forced upon any style guide to ensure consistent content and structure.

The security component is an all-embracing feature, that makes sure that every component and data follows the rules that are defined in the tool. The security component has associations to project, style guides and templates components. Users and groups can have different types of rights in the tool, depending on what project or style guide they work on, and what roles they comprise. Security plays a significant part in every business to keep trade secrets from leaking and avoid unwanted incidents. The security component ensures people with sufficient rights can read and use the style guides in the tool that are relevant to their work and protect the style guides from outside threats.

4.4 Style guide structure

The style guide component has three sub-components as shown in Figure 4.2: style guide, page, and content element. A style guide has pages in a tree structure. Every page has either another page as parent or the style guide itself as parent. A page can have unlimited sibling and child pages. By sibling, I mean on the same level. By child, I mean the first sub-level. Every page can have an unlimited number of content elements. Content elements can be any kind of object supported by the tool as described in 4.3. The content elements have a flat structure within each page. Every component, whether it is a page or a content element, is ordered within its own level. The ordering is fully customizable by developers of the style guide.

Figure 4.3 illustrates the structure of a style guide. The style guide has a tree of pages and each page has one or more content elements. The reason behind this structure is to give users and developers of style guides the possibility to create logic structure in the style guide. In resemblance to a word processor document map, the pages have the same structure with headings or chapters. A word processing document or paper document has a flat and linear structure, but it gives the impression of a tree structure as well, using various levels of headings.
A word processor document map can look like this:

- Heading 1
- Heading 2
  - Heading 3
    - Heading 4
  - Heading 5

The heading structure above has the same structure as the style guide in Figure 4.3. Using the document map as style guide structure makes the foundation for users to recognize the document metaphor and its structure in the tool, which enhances the intuitive user experience and usability.

Each style guide page has an unlimited number of content elements. The example in Figure 4.4 shows a page’s structure. The page title is the name of the page, and is the users’ identifier for that page. The title is also found in any other part of the tool that reveals the page structure, such as the document map. The text block element, found under the page title, is a simple text box. It can be as large as required and can contain any kind of plain text. The image element views any type of uploaded image. If the tool directly supports the image it can be viewed directly in the browser, otherwise it gives a link to download the file, to view it with a compatible program. The image element also supports image caption to comment the uploaded image. Subtitles define internal logical structure in the page, and are used as needed. A code element object gives examples on
implementation techniques. Developers can define type of code for easy retrieval and use. A link element contains one or more external or internal links. The links can point to any type of web address. The links gives the readers relevant information. In resemblance to the link element, the tool supports link to files or other style guide pages.

Figure 4.4: Style guide page elements

The style guide structure is very flexible and supports any kind of style guide content within the overall structural framework. The tree structure as framework supports a great variety of style guide presentations and can be translated into many other structures as needed, but mostly it supports intuitive building of style guides, with great help from known metaphors used in document structures.
4.5 User interface

The user interface has focus on user experience and usability. The system uses the paper document metaphors for users to recognize a style guide. However, the tool is not a paper document, and has to be supported by relevant functionality. Overall, the user interface enhances the user experience and is designed using web standards. It has an appealing design to make user want to utilize the tool, and enhance the readability of the content.

![User interface layout and structure](image)

*Figure 4.5: User interface layout and structure*

The structure of the user interface is illustrated in Figure 4.5. The global heading (1) gives the tool identification and expression. User information (2) gives a direct link to the logged in user profile. The user information area also shows general user status and the amount of projects and style guides that the user is involved in. There are several ways of navigation supported by the user interface. First, there is the global navigation (3). The global navigation is always visible to the users throughout the site. The navigation provides users easy access to all key areas and functions provided by the

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7 Screenshots from the application is presented in Appendix A.

8 The numbers in the parentheses is related to the numbers in Figure 4.5.
tool. The navigation bar is represented as a drop-down menu with many levels of functionality (Rosenfeld & Morville 2002:113-114). The tool also provides users with local navigation (5). If there is need to extend direct functionality to the active content, the tool provides local navigation to reveal these functions to the user (Rosenfeld & Morville 2002:114-116). In addition to the two navigational systems, there is context navigation represented in the web application. Context navigation reveals relationship to functionality and content relevant to the current context. Rosenfeld and Morville (2002:116-118) state contextual navigation is something that do not fit into local or global navigation structures. In a specific style guide page there may be contextual information showing that one can find similar information elsewhere, and functions saying that an element can be edited by clicking on the link. To further support navigation structures and enhance the user awareness, a navigation path (4) is implemented. Using a navigation path will give the user a possibility to navigate up the hierarchy of pages. Implementing all these navigational elements gives the user great possibilities to find the way around in the web site. There also exists alternative navigation (9) in some pages, such as the homepage. The alternative navigation gives users information of what style guides that was accessed during the last visits. When a user is browsing through a style guide and its content, the user will most likely use the document map (7), which appears on the left hand site. This navigation is a tree structure representing the style guide structure in Figure 4.3. The style guides should be easy to navigate through using the document map and the navigation path. The main content (8) is always displayed in the middle of each page. In addition, there is information (6) for how to use the page in some parts of the site.

Good readability is important as it is in a paper document. The tool has focus on user experience, both in design and interaction techniques. The graphical design use colors and fonts that gives a streamlined experience. Using fonts that is clear and anti-aliased on the screen is important for readability. Using high-quality fonts also encourage users to read the content. The spacing and layout of each web site makes it easy to point out the actual content and what part of the screen that represents functionality.

4.5.1 Rich internet application (RIA) functionality

Rich internet applications are evolving rapidly on the World Wide Web, and have engaged people to use internet applications in a new interactive way. In this section, I will present to core RIA functions used in my tool: tabs and tree view. The concept behind RIA is to make information accessible through asynchronous server calls. That means the web applications interface use JavaScript to send messages asynchronously to the web server, which returns new data that browser receives and updates specified fields in the web page. RIA provides user experience similar to traditional applications. Static traditional web pages are loaded once, as the web browser downloads a page to
the computer, and nothing else happens. With RIA, the web pages can first load data, and then continuously load even more data in a time interval or by user interaction events. It gives web pages a new dimensions, and makes web pages a more intuitive and efficient media.

Tabs are widely used in traditional applications. It organizes functionality and content into logic parts. However, the use of tabs in web applications is rather new. I used the new ASP.NET AJAX Control Toolkit (About ASP.NET AJAX 2007) to implement tabs into my application. It works just like traditional tabs and gives new possibilities to organize and structure content in a web user interface. As Figure 4.6 shows, the tabs looks just like tabs in modern user interfaces. The style is like the one in Windows XP. Users easily recognize the tabs interaction, because of their reference to traditional applications. The use of tabs is a very user-friendly way to organize many functions for the same element.

Figure 4.6: Organizing structure and functionality using tabs

I also used tree navigation and interaction functionality in the tool. The tree structure is one of the core structures for style guides in the concept, and therefore the use of a rich internet application component\(^9\) representing the tree structure will enhance the total usability, user experience, and consistency of concepts in the application. The tree structure supports drag-and-drop and direct textual edit functionality known from traditional applications. The drag-and-drop function is very

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\(^9\) I received a free license, from about inc, to use the ASPTreeView control in my research.
useful. As shown in Figure 4.7, the dragged nodes are transparent to show what elements that are a part of the interaction.

Figure 4.7: Tree view component with RIA functionality, supporting drag-and-drop and text edit

4.6 Functionality

In this section, I describe the most central functionality in the tool. These functions are evaluated in my research project, and are all based on the gathered user requirements. There are many more functions in the concept. However, I want to present the functionality that is the foundation for the current prototype 2.

4.6.1 Search

The tool has a search functionality to find any content throughout the system. The search function uses content from style guides, pages, and content elements to build relevant hits to the query. A user trying to find style guides can write a search phrase with relevant key words, just like in any other known search engine on the World Wide Web. In addition the user can click the button saying ‘Advanced search +’ to reveal new options.
Search

Use search to find style guides, projects and people - using titles, descriptions, tags and content as keywords.

Type your search phrase here
Example: Telenor branding project 2006

Limit search categories: □ Style Guides □ Style Guide Content □ Tags □ Projects □ People

Figure 4.8: Search functionality on the front page in tool

In Figure 4.8, the tool reveals the option to limit relevant categories for the search. If the checkbox for ‘Tags’ is marked, the tool will only search through each style guide’s tags for relevant hits. This gives the users great possibilities to find the style guides they need. The results are returned in a list view below the search area.

4.6.2 Revision handling

One of the most central parts of the tool is the revision handling. Style guides, its pages, and its elements support revision handling. Every change made to structure or content is tracked and stored. Revision handling can be quite irritating and difficult for many users. Mainly there are three known storage models used to support revision handling in software systems: file locking, version merging, and distributed version control. The easiest strategy for users to understand is file locking. Users check-out or lock files to make changes to them. However, a user needs to check-in the file to make it available for other users to update. Other users can read the file, but not write to it, as long the file is locked. This model is easy to understand, but has one big problem. If a style guide were created using a word processing file, the whole file would have to be locked, even when the user only wants to change parts of it. Working in a web environment it is easy to overcome this challenge. The tool supports locking, down to content element level, and the user will not have to worry about checking elements in and out. If a user tries to enter a locked element the user will be notified, and is given a choice to contact the user working on that element, or be notified when it is possible to edit the element. If the element is open, the user can start to edit the element directly, and the element is locked in the background. When the user has finished updating the element, it is unlocked automatically. If a user forgets to finish the edit procedure, the session times-out to give other users access to the element. Any timed out changes is saved to give the user possibility to use the information for later changes.
When the user changes a style guide, page or content element, the tool takes current information and creates a new revision object, as Figure 4.9 illustrates. The tool saves the previous version and performs relevant business logic and relevant structural changes, and makes the new object the current revision. This way every change is tracked and a user can view the history of any object. The tool also tracks information about the user performing the changes and creates a timestamp.

A revision handling system does not have to be complicated for end users. In this tool, revision handling is integrated in the process of creating and updating content. The only time the users have to pay attention to the revisions is when a user wants to browse previous decisions and history of content, and if another user tries to update the exact same element.

### 4.6.3 Templates

A central part of the tool is the template functionality. A template is a style guide framework. The template can contain specific structure, content, and rules. A template can contain the same structure and content as a regular style guide as described in section 4.3. Therefore, a template can be generated as a copy of any style guide in the tool. This functionality makes it easy to develop new templates. The templates define the structure, layout, and content in style guides. Once a style guide is created with a connection to a template, it follows the templates rules.

The rules are defined in three levels: strong, weak, and transparent. The rules give the persons responsible for templates and style guides the possibility to enforce a certain style on the content and structure. If a template created with a strong relationship to a style guide, every rule has to be followed. If the template is defined with a hundred different pages with fifty text blocks and placeholders, then the style guide must also have the same hundred different pages with the same text blocks and placeholders. However, the placeholders can be replaced with custom information.
However, can be information in the template that must exist in the style guide and is not editable. The strong relationship is great in an organizational environment with thousands of style guides, because every style guide using strong relationships with style guides are consistent. A style guide created with a weak relationship is almost equal to the strong relationship. The difference is that templates can contain element exceptions. If a placeholder for a text block is defined as optional, and the relationship is weak, the style guide developer can decide whether to use the placeholder or not. In a transparent relationship, the template is available as assistance to create and define structure and content, but none of the template rules has to be followed. Using a transparent relationship does not ensure consistency between various style guides, but can guide style guide developers to use best pattern and practices.

![Diagram of template and style guide relationship](image)

**Figure 4.10: 2-way relationship between template and style guides**

The template functionality has a 2-way relationship with style guides as shown in Figure 4.10. A style guide developer can use templates to influence the structure and content in the style guide. But decisions makers and template responsible can use the template to check for consistency problems in related style guides. A template can be used to list all related style guides and their relationships, and give useful consistency reports for all style guides in the tool.
4.6.4 Approval

The approval functionality ensures quality in style guides content together with the templates (section 4.6.3). The idea behind the approval functionality is to make sure the style guide content are reviewed and controlled by project leaders and high authorities in the style guide process. When a style guide developer creates a new page or content element, it is automatically marked as tentative. That means the page or element has to be approved or rejected by someone with sufficient rights.

Figure 4.11 illustrates the approval relationships between pages and content elements. A tentative style guide can contain tentative, approved, and rejected pages, but must contain at least one tentative element. For a style guide to be ready for publish and be given a full version number, all the pages in the style guide must be approved or rejected. However, a style guide that only consists of rejected pages becomes a rejected style guide, which in practice would not be a useful style guide at all. The same approval pattern applies to content elements in pages as well. A tentative page can contain tentative, approved, and rejected elements, but must contain at least one tentative element. An approved page contains only approved and rejected elements, but at least one approved element. A rejected page contains only rejected elements.

![Approval relationships of pages and content elements](image)

The tool provides information to style guide developers and end users of what elements that are approved and ready to use. The tool also updates those responsible for approval of style guides.
when someone have changed existing or created new parts in the style guides, so they can approve or reject changes. The tool supports both, approval of individual parts and batch approval of all tentative elements, for style guides.

4.6.5 Reviews

Reviews and comments is an important part of the tool to build a community around style guides. It is important that style guides can be commented and reviewed by everyone. End users and developers can review the style guide as a whole, specific pages or elements in pages. End users are often co-developers of style guides and make changes directly to the style guide, and these changes needs approval from higher authorities (section 4.6.4). For those without sufficient rights to edit style guide content directly, the review functionality is excellent. Visitors from external companies and other viewers can give feedback to the content, ask questions, and suggest changes to the style guide content. The review functionality binds people together through discussion and feedback. It is very useful for style guide developers to get feedback on style guide issues as well. Once a user is logged in, the user can review any style guide and its content.
5 Project results analysis and discussion

In this chapter, I will present relevant findings in relation to the problem statement and focus in this thesis. My research contains three phases. Phase 1 contains the results of multiple qualitative open-ended interviews with participants from various parts of Telenor. The goal of phase 1 was to gather data of general thoughts and opinions on the current use of style guides, and map any experiences from creation and use of documentation. Phase 2 contains an expert walkthrough with HCI experts from Telenor, to investigate usability issues and to review the concept. Phase 3 contains a heuristic walkthrough with experts, only this time, the prototype has functionality for the participants to test individually. After the heuristic walkthrough with each user, I conducted qualitative post-walkthrough interviews to review the concept. Phase 3 is the last phase in my research, and it lays the foundation for future development and research on the concept.

I my research approach (section 3), I suggest the use of multiple iterations in the development cycle. Phase 1 starts with the gathering of user requirements, which leads into prototype 1. In phase 2, I evaluate prototype 1 with experts and the results is the foundation for prototype 2. In phase 3, I test prototype 2 and the evaluation with experts is the foundation for new development cycles in future research.

5.1 Phase 1

Phase 1 was the initial part of my research, with little knowledge of what style guides were and how they were used in an organization like Telenor. I used interviews to be the foundation for the first development iteration, and the interviews became the user requirements for prototype 1.

5.1.1 Participants

I interviewed seven participants as a part of the user requirements gathering process. The participants represent various backgrounds: development and management of style guides for mobile applications; self-service systems; design and interactions; web solutions; and usability. Mainly there are three identified user groups in the interview series: decision-makers, developers, and end users of style guides. They are related to the same organization and they have all worked in some way with style guides. Some of the participants are both developers and end users of style guides.
Table 5.1: Phase 1 qualitative interview participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Position</th>
<th>Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>Telenor R&amp;I researcher</td>
<td>Design and usability in user interfaces. Develops style guides and guidelines.</td>
</tr>
<tr>
<td>2</td>
<td>Male</td>
<td>Web designer</td>
<td>Design and usability in user interfaces and web. Work with design production and decisions in Telenor</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>Web developer</td>
<td>Design and usability, and implementation techniques in web applications. User and developer of style guides.</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>Project leader</td>
<td>Process and collaboration in development projects, and use and development of style guide.</td>
</tr>
<tr>
<td>6</td>
<td>Female</td>
<td>Mobile usability expert</td>
<td>Usability in mobile user interfaces, general guidelines and principles.</td>
</tr>
<tr>
<td>7</td>
<td>Male</td>
<td>Web developer</td>
<td>Web usability and development. End user of style guide guides.</td>
</tr>
</tbody>
</table>

5.1.2 Qualitative interviews analysis

The interviews were open-ended and semi-structured due to little knowledge on the domain. The interviews were my first gathering of user requirements. I wanted to know the participants, and started to ask them about their work situation and opinions on style guides. I asked them further how they worked with style guides, and what tools they used in their work. I was also interested in their pros and cons in relations to style guides. Finally, I asked them if they believed a new tool could enhance their experiences and practice with style guides, and what requirements a tool should fulfill.

5.1.2.1 User groups and stakeholders

Telenor is a complex organization and therefore it is difficult to map the different users and groups working on style guides in the organization. I was able to map several users working on style guides through the qualitative semi-structured interviews. I conducted the interviews on a wide range of users, representing various parts of the organization, to get an overview of which users that works on specific tasks.
Figure 5.1: User groups in the style guide process

Through gathering of user requirement, I mapped the following user groups: end users, designers, engineers and developers, decision makers and project managers as Figure 5.1 illustrates:

- **End users**
  
  *End users are any user utilizing a style guide to solve tasks. The users can be working in Telenor or external company. Guests and random viewers can also be invited to participate in the style guide process as end users.*

- **Designers**
  
  *Designers can be any one working with the visual design process for a style guide. This user group consist of graphical designers, typographers, web designers, and Graphical User Interface (GUI) designers. They create visual examples, aspects, and guidelines in style guides.*

- **Engineers**
  
  *Engineers are people coding and implementing various parts of a project. They have focus on the technical aspect of a project and a style guide. They provide code examples and implementation techniques for elements in a style guides.*

- **Decision makers & project managers**
  
  *Decision makers are one or more persons with sufficient right for a project to take critical decisions when needed in various parts of a project cycle. They can perform tasks like approving, reviewing, and allocating resources to style guide projects.*
Project leaders can be a part of the decision makers group, leading the development and use of a style guide.

Because there is no clear border between groups and people, one person can belong to multiple user groups, but can also be limited in participation and only belong to one of the groups. The participants representing developers are a part of the Telenor’s design group. Telenor has established a design group to enhance the process of creating consistent and unified user interface designs. Several participants state that most style guides of considerable size are created through the new design group, involving people across many divisions in Telenor. Some participants work as developers and some as decision makers. Developers also being end users are considered valuable in design group, due to their empirical knowledge through use of style guides to solve specific tasks. The process of developing and using a style guide is a highly iterative process, which makes the style guide dynamic. Every user group is evaluating and developing a style guide using the group’s concepts, theories, and guidelines for developing a style guide. As all user groups work simultaneously, evaluation and development have to be an iterative process for all the user groups to be up to date with the style guide. In this thesis, I discuss developers and designers of style guides as one unified group called style guide developers. All the user groups are considered stakeholders. However, there are additional stakeholders. The administrative board, shareholders and every employee is a part of the tools indirect context. The tools purpose is to improve the existing use of style guides, which could affect to the organization as a whole, and by that the organization’s stakeholders. In this thesis, I focus on the direct user groups defined above.

5.1.2.2 Tasks

User tasks are descriptions of what each user group is doing, working with style guides. Figure 5.2 shows layers of tasks. The concentric circular shape represents inheritance from the inner the outer circles. Decision makers and project managers have their own set of tasks, in addition to the inherited tasks from the developers layer, and end users layer. When a user group inherits inner layers, the user group does not have to use the inherited the responsibility and tasks themselves. By inheritance, the user group is able to perform the tasks that are defined in the inner layers. Therefore, decision makers and project managers can perform any task on style guides, developers can perform developer tasks and end user tasks, and end users are restricted to only perform end user tasks.
The following lists give an overview of identified tasks for each user group. The tasks were identified with the user requirement data from phase 1.

**End user tasks:**
- Read
- Print
- Review

**Developer tasks:**
- Manage style guide elements
  - Add
  - Edit
  - Suggest delete action
  - Move
- Manage history / revisions
  - View
  - Roll-back

**Decision makers & project manager tasks:**
- Manage projects
  - Add
  - Edit
  - Delete
  - Move
- Manage style guide and templates
  - Add
  - Edit
  - Delete
  - User rights
  - Approval
  - Suggestion decisions
- Manage users
  - Add
  - Edit
  - Delete
  - Roles
5.1.2.3 **Important findings**

Through the interviews, it was possible to discover special aspects of the use and production of style guides in the organization. I gained information about the participants’ personal opinions and experiences. Important findings are feelings of the use and production of style guides in general, personal experiences, collaboration with partners and colleagues, thoughts on tools and existing systems used in production and use of style guides, and thoughts on new tool to address their problems.

All of the participants agree that style guides have varying degree of support throughout the organization. One participant mentioned that the cost of developing style guides and documentation has a huge effect for stakeholders and decision makers when deciding how much effort to put into development of such documentation. The participant also stated that many of the software applications and products developed in the organization are poorly documented, and that documentation is given a low priority in many development projects. Three participants state they should document everything they do and make it available to partners and people in the organization, but they said they feel it is a time consuming and demanding process to make documentation from scratch and publish it to a system they feel is difficult to use. They stated the publishing system lacks intuitive user interface and hardly inspires them to work with it. The workflow is complicated and it feels outdated compared to newer competitive software.

Style guide developers all agree on the importance of standardizing elements for a project. The elements in a style guide may vary for each project. It can be everything from user interface elements, code snippets, typographies, textual guidelines to video, audio, animations, and sketches. Style guide developers worry about how the style guides are used, and emphasize the importance of using style guides to maintain a consistent and reliable end-result. The style guide developers further state that end users should not interpret the style guides with their own opinions, but should discuss obscurities with the style guide developers and decision makers. Both style guide developers and end users confirm that end users often interpret unclear and unspecified parts of style guides.

For the participants that represent the end users of style guides, it is the reliability and the ease of utilizing style guides that affects their view on them. The end users state that there often is a gap between the guidelines that the style guides express and how the guidelines are carried out in the ‘real world’. The end users further state that it is necessary to use the style guides as an inspiration and not as a mandatory manual in many cases when the style guide developers clearly has not understood the target domain or is unaware of its existence. Participant 7 worked on a project developing a specific solution for web in Telenor. The participant had never worked on that web
platform before. The participant was also not aware of the corporate style guides that existed for web sites in the company. Creating mockups and sketches for the web application without any guidelines from the company, other than user requirements, gave the application developers too much design freedom according to the participant’s own view. The participant wanted style guides or any guidelines that could help them make design decisions, but were told that such style guides did not exist. The participant thought that was strange, but continued to develop the application without any influence from a corporate style guide.

5.1.2.4 Production of style guides

There are many different ways to produce style guides. Its target project and end users often define the format and type of style guide to be used in various projects. The participants state most official style guides are published as PDF documents\(^\text{10}\). The style guides contain everything from screenshots to code examples and textual instructions for how to implement and design various elements.

Some style guide developers working in the same building at Telenor often meet face-to-face to discuss problems and challenges. They discuss elements of the style guide and delegate design responsibility to each member of the group. They create a base design as a guideline for how the different elements look and feel. Some style guide developers are responsible for gathering all designs and guidelines for a specific project and for merging them into one document. The document is then available for reviews, approvals and can be revised and published.

According to the participants, there are no standards within the organization for structure and layout of style guides. They have style guides to define standards, but no standards to define style guides. An example of a style guide that is an overall standard for Telenor is the recently developed corporate design style guide. The style guide is meant to be the superior of all other style guides at Telenor, to make sure the organization maintains a consistent expression. Even though all style guides in some way descend from the superior style guide, each project requires its own solution.

The overall guide is very general and cannot cover all needs. Special projects require special solutions. The overall style guide does not cover websites for mobile phones, which need special guidelines in many ways. It is a different platform compared to print media and desktop computers with large screens. A mobile phone has limited space on the device screen and a limited color palette. A mobile phone also differs in terms of navigation and workflow. Three participants said there has been a group established across divisions in Telenor that creates design and manages style guides for several websites. Participants that are a part of that group state they have to create style guides for web sites when the superior style guides does not cover the problem area.

\(^\text{10}\) PDF is a document standard, established as a cross-platform document supporting various types of media.
Telenor outsource many projects to external companies. As designs and style guides are created externally, three of the participants express that, there can be communication problems and economical self-interest by companies involved in the development process. Release of documentation and style guides to Telenor can be a part of the commercial agreement with an outsourced company, or there is no such agreement at all. One participant mentioned that it could be strategic not to give away style guides in some situations for an external company, so they can use its content, which holds a certain value, in negotiations for possible future project.

E.g., a company that creates a web site for a specific product in Telenor is often the one that creates style guides and documentation for the project and related products as a part of the job. Face-to-face meetings are difficult and expensive because the company is located abroad in other cities. Meetings can be held virtually using: computers, e-mail, video, and telephone, but it increases the possibility for misconception and divergence in project details that are exchanged during the meetings between Telenor and the external company. The company creates a full style guide with the perception that all parts of the style guide is accepted and approved by Telenor, when actually, there are parts of a style guide that are not discussed and will cause conflict, or Telenor is unaware of the parts. When the style guide ships, Telenor discovers that the style guide does not handle digital media but only print media, and they have to come up with a fix for the style guide. The fix to handle digital media worked, but since this had to be done rather quickly, there are digital media such as web sites and mobile applications that differ to some degree with the company style guide.

5.1.2.5 Updating existing style guides

When a project or part of the organization changes so must the style guides that describes the related projects. Participants representing the designers state the update process can be very difficult in many cases where there is lack of documentation.

External companies can have different policies than Telenor concerning documentation of their work. When a style guide developer needs to look into the history of style guide elements for a specific product or project, it is in generally difficult to find such information according to the participants. Either external companies may not want to share old documentation due to self-interest, or it does not exist at all. One of the participants says that a company that creates style guides would normally like to continue updating style guides for projects, so if the external company gave away all project related documentation or sold it to Telenor, the external company could give away their job.

Three participants said that when their design team needs to update a product within Telenor they mostly look into the finished product and starts working directly towards the next edition of that
product. The participants said they would not know where to find all different kinds of style guides and other documentation for every product. They will sometimes have to create new style guides based on analysis of the current product. This is both costly and time-consuming, and it is normal to skip the use of style guides.

One participant said the development team had some style guides from the first release in the development cycle of a product. They managed to take care of the documentation and sometimes managed to make use of earlier decisions in new releases. This has been a great help in many projects, so the design team can avoid past pitfalls and bad decisions. The style guides can also be an inspirational source for future development.

There are situations as when a team of people that developed the original style guide is to update the same style guide. The team knows what issues and challenges they have to face during the previous development and can use their empirical knowledge in future updates of the style guide. On the contrary, there are situations that are more complex, as when the original team of style guide developers or key persons is unavailable. When a team of new developers is updating a style guide, they do not have the empirical knowledge of past project processes as the original team of developers.

Updating a well-documented project can be easier than updating a project with no or poor documentation. However, if the documentation has bad structure or give the wrong directions, it can also complicate the update of a project. Even though a project is well documented, it does not necessarily describe everything style guide developers need to know about decisions that were made. A declared responsibility to style guides are important to the documentation, says one of the participants, so that the new style guide developers can ask people about the previous style guides. Responsible persons should be available at all times.

E.g., a project is finished and the leader leaves the company for another job. The leader introduces a new main responsible for the finished project and guides him through processes that gained the theoretical and empirical knowledge. The new leader will then inherit the responsibility and the tradition of passing it on.

5.1.2.6 Feeling of ownership

Feeling of ownership through the work with style guides is an important issue expressed by three of the participants. One participant stated that mandatory style guide productions are a problem, because style guide developers do not enjoy work and process required by higher authorities. When style guide developers are told what to do and what requirements to fill, they rarely put extra effort
into the development. If developers were a part of the decision-making process, the developers would feel more inspired to participate with ideas and suggestions to further development and improvement on the style guide. This could benefit the style guide development by a higher frequency of quality updates since the developers would in general have a more positive attitude in the process and feeling of ownership.

5.1.2.7 Collaboration and communication

All participants state that they use e-mail as their main communication tool. They feel e-mail is easy and it has the possibility to send unlimited types of attachments and textual information to users that are in need of style guide information. Two participants especially points out that there are problems using e-mail as the main communication tool in projects due to lack of structure in messages and difficulties finding old messages.

In Telenor, the collaboration between many divisions seems to be a challenge when it comes to the coordination and communication in production of style guides. Telenor is an international company with divisions all over the world. A well-defined infrastructure is required to support good communication. Today this infrastructure consists of telephones, virtual meetings, e-mail, SharePoint\(^\text{11}\), E-doc\(^\text{12}\) etc.

E.g., the organization starts a new project, where part of the objective is to create a style guide. The project team consists of people from various divisions and they need to collaborate. Some team members have base in foreign countries and a physical meeting is hard to accomplish. The team decides to communicate using e-mail and telephone meetings, and share their work files and documents using SharePoint. They pass sketches by e-mail and keep the style guides on the SharePoint portal. Since the team consists of more than ten people, working on the same files, it can be hard to track changes using Microsoft Word as the main tool. When project becomes large, it can be a complex situation communicating and working on the same project without a tailored tool for the job.

5.1.2.8 Tools

All participants are used to work with style guides in different formats. Official and superior style guides such as the organizations overall style guide are mostly published as PDF. Other style guides can be published as Word, HTML, and CSS files etc.\(^\text{13}\) Tools that are used to create style guides are Adobe Photoshop, Adobe Illustrator, Adobe InDesign, Microsoft Word, Adobe Acrobat, Macromedia

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\(^\text{11}\) SharePoint is a server platform from Microsoft to support a collaborative approach to workflows and sharing

\(^\text{12}\) E-room is a collaboration solution in Telenor to share all documents in a digital environment

\(^\text{13}\) The various files are well-know industry standards for text and web site productions
Dreamweaver etc. Style guides are handled with revision handling systems on per project basis in tools like SharePoint, E-doc, and Intranet etc. According to the participants, there are no standardized tools to create style guides. The style guides are created with whatever tool that fits the purpose and type of project.

SharePoint gains popularity in some parts of Telenor because it is easy to share documents and files with other users, and because of its usable and intuitive interface and workflow. In the organization, they create a new project space for each new project, so users and content are handled per project. SharePoint supports revision handling of files, so the users can review the history of the elements in the projects. The portal can be customized to match the projects requirements in layout, structure, and style.

5.1.2.9 Summarization of the interviews

The participants had various experience with style guides. The developers and end users of style guides have diverse opinions about the use of style guides in the organization. For style guide developers it seems there is a problem to express the importance of the use of style guides to the end users. The end users on the other hand feel that style guides are meant as more general guidelines and that they do not explain in full details how to implement and carry out the guidelines in the technical solutions.

Based on what the participants reported, the production and use of style guides in Telenor is inconsistent throughout the organization. All participants think the general concept of using style guides is good, but there is a lack of a tool or system that is used consistently in the organization to produce style guides with high standards that are accessible for every person involved.

Many projects use SharePoint as a project portal, but this leaves it to the users of a project to create and maintain their own style guide system. Using Word files as placeholders for all elements in a style guide can often be a mess when the project is large and complex. It is also hard to create routines and standards for approving specific elements in a Word file, as well as updating certain elements and then re-approving that element. It is easy to get lost in these kinds of projects, and such difficulties are not appealing to users.

Some participants have stated that because it takes too much time and is too difficult to document and create style guides, they do not do it. They express a need for a simple and easy tool, that is

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14 The various tools are well-known industry standard tools for web site, illustration, photo and text productions
accessible when needed, and that gives the users an expected and familiar structure and layout, independent of projects.

5.2 Phase 2

This phase of the research started right after the first prototype was finished. The high-fidelity prototype was an application with static example data. I created an expert walkthrough and gathered HCI expert from within the organization to evaluate the prototype usability and concept. The results were analyzed, and became the foundation for the next iteration in the development cycle.

5.2.1 Participants

Table 5.2 shows an overview of the participants in the expert walkthrough. Participant number 5 was mainly the meeting recorder, but could also make comments and points concerning the prototype, being a HCI expert as well. All participants work with HCI in some way in Telenor. Some of the participants are researchers and concept developers, and others work operational with design and implementation. Some participants would say they work with a combination of these two methods. They know the domain of style guides in Telenor.

Table 5.2: Phase 2 evaluation participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Position</th>
<th>Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>Web designer</td>
<td>Design and usability in user interfaces and web</td>
</tr>
<tr>
<td>2</td>
<td>Male</td>
<td>Web designer</td>
<td>Design and usability in user interfaces and web</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>Telenor, research and innovation (R&amp;I)</td>
<td>Design and usability in user interfaces</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>Telenor, research and innovation (R&amp;I)</td>
<td>Design and usability in user interfaces</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>Meeting recorder / Telenor, research and innovation (R&amp;I)</td>
<td>Design and usability in user interfaces</td>
</tr>
</tbody>
</table>

5.2.2 Expert walkthrough analysis

The expert walkthrough was conducted to give an open discussion between multiple experts with knowledge on the use of style guides in Telenor, to identify concept problems and clear usability issues with the prototype. The participants were invited to a two-hour session held in a meeting room at Telenor. I first walked them through the basic concept and structure. I explained that the paper document metaphor with headings and internal structure was the basic inspiration for the
document map tree structure in the style guide tool. Further, I explained terms like style guide, template, project, AJAX, rich internet applications, and the concept behind these terms. After the concept instruction, I started walking them through three scenarios. (Appendix B)

5.2.2.1 Conceptual discussion

In the first scenario, the participants started to discuss what a template is, and how it works. Participant 2 felt style guides and templates were overlapping ideas. Participant 1 thought it was difficult to relate anything to the terms project, style guide, and template. The participant felt the expressions were confusing. Once the first scenario was completed, the participant agreed on the use of these expressions. However, they suggested a conceptual change. In the prototype, I suggested that every style guide had to belong to a project. The participants stated that it is not the way it works in practice. The new solution was to use tags and projects with optional relationship to each style guide. Projects and tags should be used to find and group style guides, and should not have to embrace the guide into a specific context in the application or in the organization. A style guide can be used in multiple projects, and it would be wrong to only bind it to one specific project.

The participants could see the possibilities using the style guide tool, however they were not able to try the tool themselves, which would give them a richer experience and a different perspective on the usability of the application. Therefore, the expert walkthrough was more about mapping usability issues, than testing the concept.

5.2.2.2 Usability issues

Entering the front page of the style guide, the participants felt it was hard to tell what was functionality and what was the style guides’ content. It is interesting however that the participants said, “Where is the style guide?” and “Where do I start?” The front page in prototype 1 can be seen in Figure 5.3. The participants clearly expected a more functional interface. They did not expect a style guide in a readable format like in a word processor. The idea behind the front page design was to create a readable document style. Instead of a traditional application user interface, I wanted to express the style guide content using a typical published paper document style. When the participants saw the ‘Style Guide Elements’ tree structure (section 4.4) on the right hand side, it made more sense to them. They easily recognized the style guide structure. However, they would call it ‘Document Map’, to be consistent to the paper metaphor. In addition, the participants would like the document map on the left hand side, to be increase familiarity with word processing applications.
In the first prototype, the application offered two sets of edit functionalities on a style guide page. One function was called ‘Edit’. The function revealed the content elements in a style guide page. The content elements have their own revisions and can be moved independent of other elements in the page. The other function was called ‘Edit in context’. This function was similar to the ‘Edit’ functionality, but only the elements that the mouse hovered over revealed the edit functionality. The participants had problems understanding the necessity of this function, and they were more confused than exited over the functionality. Therefore, the ‘edit in context’ functionality was removed in prototype 2.

When the participants first entered a style guide page, the participants wondered what the icons on the left hand side meant, and what functionality they provided (see Figure 5.4). However, they could not recognize any of the functions by the graphical images. The participants suggested using textual buttons or local navigation structure in resemblance to the global navigation structure to give users a consistent set of interaction techniques throughout the application.
During creation of a new style guide, the participants agreed that it was difficult to understand the action flow used in the page. In the prototype, I divided the page into expandable boxes that would appear and populate its content depending on the previous action as Figure 5.5 illustrates. In the figure, all the boxes are populated. Participant 4 suggested not using box style on each option to save space on the page. The participant further suggested making the user interface more compact and to make it reveal all the choices as default. The participants felt it was too difficult to make choices that were not visible at all times. Participant 3 suggested to filter the selection of templates. The participant said Telenor would have many templates in such a tool. Templates should be filtered using a dropdown list to choose media. It would make the templates easier to find.

![Style Guides](image)

**Figure 5.5: Population of new options based on the previous action, during creation of style guides**

In addition to the usability issues above, the participants pointed out minor issues:

- Change the textual description on revision buttons
- Too much background gradient color in the content field
- Lack of sort and filtering functionality in the overview of existing style guides
- Show the style guide content in the navigation path
- Make the buttons look more like traditional hyperlinks
- Make the search functionality visible on the front page of the application to make style guides more accessible

Most of the above issues were fixed in the next iteration of the prototype. However, prototype 2 is also an early iteration testing the concept and usability with hands-on experience.

5.3 Phase 3
Phase 3 consists of heuristic evaluations and a qualitative post-walkthrough interviews as described in section 3.1.3.5. The purpose was to gather qualitative information about the concept and usability issues, discuss the findings in relations to existing literature on the field, and find out how the information can be used in future research.

5.3.1 Participants
In phase 3 of the evaluation, I invited the five participants described in Table 5.3. The participants all work in Telenor, and with usability. Some participants focus on mobile applications and others focus on general projects concerning usability of user interfaces. They are all considered HCI experts with extended knowledge about usability and with some relation to style guides, guidelines, principles, conventions, and the processes that goes into style guide documentation.

Table 5.3: Phase 3 evaluation participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Position</th>
<th>Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>Telenor, research and innovation (R&amp;I)</td>
<td>Design and usability in user interfaces.</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>Telenor, mobile usability</td>
<td>Usability in mobile user interfaces,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>general guidelines and principles.</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>Telenor, mobile usability</td>
<td>Usability in mobile user interfaces,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>general guidelines and principles.</td>
</tr>
<tr>
<td>4</td>
<td>Female</td>
<td>Telenor, research and innovation (R&amp;I)</td>
<td>Design and usability in user interfaces.</td>
</tr>
<tr>
<td>5</td>
<td>Male</td>
<td>Telenor, research and innovation (R&amp;I)</td>
<td>Design and usability in user interfaces.</td>
</tr>
</tbody>
</table>

5.3.2 Heuristic walkthrough analysis
Table 5.4 shows mapped usability issues, identified through the heuristic walkthrough. The usability issues are ranked by severity and importance. The rankings are defined as follows:
• High (H)

High severity means a critical issue that needs to be resolved. The issue can be a result of users being stuck and not being able to use the application as intended, or the user is very confused. Fixing the issue would cause the application to enhance user experience and usability.

• Medium (M)

Medium severity means an issue in need of a fix. The issue is not critical and it should be considered if there are other and better solutions to the problem. The issues are not stopping the user from completing the tasks, but fixing the issues could enhance user experience and usability in the application.

• Low (L)

Low severity means issues are classified as minor bugs and obvious application mistakes that would be fixed in the final version or next revision of the application. The issues are important to track, to remember the issues when the application is improved.

The Nr column contains unique numbers of identified issues. Task is the task number found in Appendix C. The issue occurred during the specified task. P is the id of the participant in the test.

Table 5.4: Identified usability issues from heuristic evaluation, ranked by severity

<table>
<thead>
<tr>
<th>Nr</th>
<th>Task</th>
<th>P.</th>
<th>Context</th>
<th>Issue description</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.1</td>
<td>2, 4</td>
<td>Front page of application</td>
<td>Search functionality takes too much space on front page and the advanced functionality should be always visible.</td>
<td>L</td>
</tr>
<tr>
<td>2</td>
<td>1.1</td>
<td>4</td>
<td>Application front page</td>
<td>Lack of favorites and most used style guides on the application cross users. Such navigation will increase the direct shortcuts to important style guides both for the user and the corporation.</td>
<td>M</td>
</tr>
<tr>
<td>3</td>
<td>1.1</td>
<td>2</td>
<td>Application front page</td>
<td>Information about the user is duplicated on the front page. This is in the content field plus the user information field in the heading. Unnecessary to use the space with the same information.</td>
<td>L</td>
</tr>
<tr>
<td>4</td>
<td>1.1</td>
<td>1, 2, 3, 5</td>
<td>Browse style guide page; table</td>
<td>Table ID-column is misleading. Making the title clickable would be a better approach</td>
<td>M</td>
</tr>
<tr>
<td>5</td>
<td>1.1</td>
<td>1, 2, 3</td>
<td>Style guide front page</td>
<td>Document status and information in main content placeholder feels misplaced, could be moved to the sidebars</td>
<td>M</td>
</tr>
<tr>
<td>6</td>
<td>1.1</td>
<td>1, 2</td>
<td>Style guide front page</td>
<td>Document map should be moved to the the content windows. The result is a better understanding of the document metaphor and viewing it as table of contents</td>
<td>H</td>
</tr>
<tr>
<td>7</td>
<td>1.1</td>
<td>1</td>
<td>Browse style guide page; table</td>
<td>There are lack of signs or status on style guides in the table view, when browsing for existing guides. It would be helpful to identify what style guides that are finished and usable.</td>
<td>M</td>
</tr>
<tr>
<td>Nr</td>
<td>Task</td>
<td>P.</td>
<td>Context</td>
<td>Issue description</td>
<td>Rank</td>
</tr>
<tr>
<td>----</td>
<td>------</td>
<td>----</td>
<td>---------</td>
<td>-------------------</td>
<td>------</td>
</tr>
<tr>
<td>8</td>
<td>1.1</td>
<td>4</td>
<td>Browse style guide page; table</td>
<td>The table should have more categories and columns to group and sort style guides and related information to make it more accessible to the user.</td>
<td>H</td>
</tr>
<tr>
<td>9</td>
<td>1.2</td>
<td>4</td>
<td>Style guide page</td>
<td>The style guide page should have a header describing to what style guide the page is belongs. It will raise the user’s ability to localize the page in the application.</td>
<td>H</td>
</tr>
<tr>
<td>10</td>
<td>1.2</td>
<td>4</td>
<td>Style guide page</td>
<td>The user misses a print button on the page to print the guide. The user prefers to print pages for reading.</td>
<td>L</td>
</tr>
<tr>
<td>11</td>
<td>1.2</td>
<td>4</td>
<td>Style guide page</td>
<td>The subtitle style in the page content should not be underlined. It can be misinterpreted as a hyperlink.</td>
<td>M</td>
</tr>
<tr>
<td>12</td>
<td>1.2</td>
<td>2</td>
<td>Style guide page</td>
<td>The user has problems understanding the document map tree and its interaction model. It could be clearer with different icons to illustrate the collapse and expand functionality.</td>
<td>L</td>
</tr>
<tr>
<td>13</td>
<td>1.2</td>
<td>2</td>
<td>Style guide page</td>
<td>The navigation path is very long, when the pages has long titles. Not seeing the first relation in the navigation path is the consequence of the long titles, which makes it difficult to navigate back. Could be wrapped over multiple lines or shorten the titles and make the whole title visible on mouse-over.</td>
<td>M</td>
</tr>
<tr>
<td>14</td>
<td>1.2</td>
<td>2</td>
<td>Style guide page</td>
<td>Highlight the current page position in the document map tree.</td>
<td>L</td>
</tr>
<tr>
<td>15</td>
<td>1.3</td>
<td>4</td>
<td>Edit style guide page; Tabs</td>
<td>Every tab container should be marked with color or symbol to illustrate the various types of elements used on the page. This will enhance the user’s ability to eye-scan fast over the page to recognize elements.</td>
<td>M</td>
</tr>
<tr>
<td>16</td>
<td>1.3</td>
<td>3</td>
<td>Edit style guide page; Tabs</td>
<td>The tabs felt scary to the user. The user was not sure of the interaction technique with tabs. The content in view tab disappeared on the change of active tab. Could possibly make the view content visible at all times.</td>
<td>M</td>
</tr>
<tr>
<td>17</td>
<td>1.3</td>
<td>1, 5</td>
<td>Edit style guide page; Edit tab</td>
<td>When inserting image element: the button text should say &quot;Add element&quot; instead of &quot;Add new image&quot; to be consistent to the element phrase</td>
<td>L</td>
</tr>
<tr>
<td>18</td>
<td>1.4</td>
<td>1, 3, 5</td>
<td>Edit style guide page; Edit tab</td>
<td>Using earlier revisions of an element, the &quot;Use this revision&quot; - button should be placed under the revision content</td>
<td>H</td>
</tr>
<tr>
<td>19</td>
<td>1.4</td>
<td>1</td>
<td>Edit style guide page; Edit tab</td>
<td>&quot;Revert changes&quot; button should say &quot;Undo&quot;, as it is a known phrase and metaphor</td>
<td>M</td>
</tr>
<tr>
<td>20</td>
<td>1.4</td>
<td>1, 2, 4</td>
<td>Edit style guide page; Edit tab</td>
<td>When clicking on &quot;Use this revision button&quot; - no need for confirmation. Could instead show a status line with what revision number that is used as base, and when successful or failed changes occur to enhance user awareness and system feedback.</td>
<td>M</td>
</tr>
<tr>
<td>21</td>
<td>1.4</td>
<td>1</td>
<td>Edit style guide page; Edit tab</td>
<td>Change &quot;Save revision&quot; button to &quot;Save to new revision&quot;, being more explicit to the user, so the user is more aware of what is going to happen</td>
<td>M</td>
</tr>
<tr>
<td>22</td>
<td>1.4</td>
<td>2</td>
<td>Edit style guide page; Edit tab</td>
<td>The divide between the current revision and the earlier revisions should be clearer in the design. Also, the earlier revisions should have clearer separation between them in the design to avoid mistakes.</td>
<td>M</td>
</tr>
<tr>
<td>Nr</td>
<td>Task</td>
<td>P.</td>
<td>Context</td>
<td>Issue description</td>
<td>Rank</td>
</tr>
<tr>
<td>----</td>
<td>-------</td>
<td>----</td>
<td>----------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>23</td>
<td>1.4</td>
<td>1</td>
<td>Edit style guide page; Edit tab</td>
<td>When saving revision: Expected to stay in the edit tab mode, but jumped back to view mode in the tab panel. The user feels more in control staying in the same view, only viewing the changes.</td>
<td>M</td>
</tr>
<tr>
<td>24</td>
<td>1.5</td>
<td>2</td>
<td>Edit style guide page; Move tab</td>
<td>Support drag-and-drop when moving elements on a page would enhance the intuitive use of move functionality. Could be added as extra functionality to the move buttons to support both options.</td>
<td>M</td>
</tr>
<tr>
<td>25</td>
<td>2.1</td>
<td>3, 5</td>
<td>Create new style guide page</td>
<td>The user expected a more step-by-step flow on the page. It was hard to notice the template and project functionality on the page. Could create boxes around each step and mark the optional steps using colors.</td>
<td>M</td>
</tr>
<tr>
<td>26</td>
<td>2.1</td>
<td>2, 3</td>
<td>Create new style guide page</td>
<td>The user expected the “Create New Style Guide” – button to the right on the page to support more natural interaction flow.</td>
<td>M</td>
</tr>
<tr>
<td>27</td>
<td>2.1</td>
<td>1</td>
<td>Create new style guide page; Select Template</td>
<td>Change the textual description: &quot;...to influence the style guide&quot; to &quot;...to base the style guide upon...&quot; or similar</td>
<td>L</td>
</tr>
<tr>
<td>28</td>
<td>2.2</td>
<td>1, 3, 4, 5</td>
<td>Style guide page; Document map</td>
<td>Edit link in top right corner should be more explicit to understand what it means. It should state something like &quot;Edit style guide document map&quot;</td>
<td>M</td>
</tr>
<tr>
<td>29</td>
<td>2.2</td>
<td>5</td>
<td>Style guide page</td>
<td>The user was looking for a local menu for the style guide to use the edit function on that menu, but could not find it.</td>
<td>L</td>
</tr>
<tr>
<td>30</td>
<td>2.2</td>
<td>1, 3</td>
<td>Edit document map page</td>
<td>The participant lost localization; was confused of where in the system this page was. Could be clearer distinction between function pages and style guide content pages</td>
<td>M</td>
</tr>
<tr>
<td>31</td>
<td>2.2</td>
<td>1, 2</td>
<td>Edit document map page</td>
<td>Problems using the description box for something useful. It is hard to read and understand. Either remove it, to give more room to other functionality, or hide it in some way</td>
<td>M</td>
</tr>
<tr>
<td>32</td>
<td>2.2</td>
<td>1</td>
<td>Edit document map page; Edit options</td>
<td>Event on radio buttons are no good, and was unexpected. Buttons would be more efficient and more intuitive, and tabs may be the best solutions to be consistent with other parts of the application</td>
<td>H</td>
</tr>
<tr>
<td>33</td>
<td>2.2</td>
<td>1, 2, 3, 5</td>
<td>Edit document map page; Document map</td>
<td>Problems understanding if a page was selected in the tree, which requires clearer marking of selected elements. Could be blue or gray background color to it more explicit to the user.</td>
<td>H</td>
</tr>
<tr>
<td>34</td>
<td>2.2</td>
<td>2, 3, 4</td>
<td>Edit document map page; Add page</td>
<td>Problems understanding that a page has been inserted. Hard to see the new page in the document map tree without any confirmation. User should get confirmation through a status line or something similar. However, not alert box.</td>
<td>H</td>
</tr>
<tr>
<td>35</td>
<td>2.3</td>
<td>1, 2, 3, 4, 5</td>
<td>Edit document map page; Move page options</td>
<td>Hard to understand the various move options. The user has to think too much before understanding the use of the options. Would be better to avoid these options and make it available in the drag and drop interaction as in traditional applications.</td>
<td>H</td>
</tr>
</tbody>
</table>
Using the table above with forty registered issues, I ranked nine as high, twenty-two as medium, and nine as low. I ranked the issues using my own interpretation on how the participants found the issues, their recommendations for how to solve them, and their reactions to the problem. In addition to the participants’ reactions, I also used my skills as a web developer and concept creator together with my HCI skills to influence my decision on the grade of severity. Due to my knowledge of what I have planned in the future concept, I was able to rank several of the issues with low severity, as I know the issues are to be fixed at later development stages. All together, the results are qualitative and subjective, but can be expressed quantitatively in Table 5.5.

Table 5.5: Usability issues distribution – number of participants in relation to grade of severity per issue

<table>
<thead>
<tr>
<th>Nr. of participants</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 participant</td>
<td>7</td>
<td>13</td>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>2 participants</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>3 participants</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>4 participants</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>5 participants</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sum</td>
<td>9</td>
<td>22</td>
<td>9</td>
<td>40</td>
</tr>
</tbody>
</table>

Using the quantitative Table 5.5 to interpret the qualitative results in Table 5.4, makes it easy to see the distribution of identified issues and to analyze the results. Table 5.5 shows that the majority of issues were found by only one participant. As the number of participants that identify the same issue
increases, the number of identified issues decreases. The more serious identified issues are the more participants identify the same issues. I ranked the majority with medium severity.

I believe the results I got through the heuristic walkthrough are very natural due to the early iteration in the development cycle. It is the second evaluation on a high-fidelity prototype with basic functionality. It is the first time any users or experts have hands-on experience with the application. The feeling of using a user interface first-hand is quite different than watching another person doing the interaction. Interaction techniques are big part of the total user experience and raises different usability questions. The total number of forty issues was detected, but as the developer behind the tool, I know that the nine of the issues ranked with low severity would not occur in a later developed prototype. However, the issues ranked with medium severity, are very important. They require change in some way in the application. The relevance of the issues has to be discussed with real users and experts for how to solve them. It is also important to be aware of potential false alarms. If there is doubt about any of the issues, it should be tested again with different users. Since real users in my research are both HCI experts and non-HCI experts, the potential false alarms should be checked using an objective usability test with non-HCI experts to be sure it is a real problem.

Issue number 16 in Table 5.4 is a typical issue that needs further investigation. Participant nr 3 was unsure how to tab interaction worked. One tab said, ‘Delete’ and the user was not sure whether pressing the tab would directly delete the content in the tab, or if new options to delete the content would be visible in the tab. None of the other participants had this interpretation of the tab interaction in the application. I believe the participant is not used to tabs in web applications. Tabs are often seen in traditional applications where the users expect instant interaction with elements. I think many web users think of web pages as static pages that have to reload to show new information, even though what we know as rich internet applications (RIA) is quite common on most web sites today. Once the user tried the tabs and used it, it did not seem that scary anymore because the user understood the interaction through empirical knowledge. Therefore, I believe issue number 16 is a false alarm. I also believe issue number 40 is a false alarm. The same participant, nr 3, discovered the issue. It is about a textual description on the tabs saying ‘View’. The user would like it to say ‘Preview’ instead. Only one user reacted to the textual description on this tab, and I believe it is more intuitive for users to relate to one expression. There are two view modes on a style guide page. View page and edit page. In edit page, the users see ‘View’ in the first tab, and I believe the users understand that the content in this tab shows what the element would look like in the page’s view mode. In contrast to participants 3’s assumptions of how the tabs work, issue nr 32, found by participant 1, is about a group of radio buttons. The radio buttons group changes the content in a specific part of the page, and the user would like a tab component to do the interaction more
intuitive. I believe issue 32 confirms my interpretation of tabs being useful and understandable in a web application. To eliminate any possible mistakes of this interpretation, I would test the hypothesis with real users.

I believe the other issues are important to fix in future iterations to enhance usability and user experience. However, some issues are more complex to fix than others are. Issues with number 12, 16, 20, 23, 24, 32, 33, 34, 35, 36, and 40 are all related to rich internet application (RIA) functionality in the application. In total the issues constitutes 27.5% of the total identified issues by the experts. So why are nearly a third of the problems related to (RIA) functionality and interaction techniques? RIA is often a combination of various techniques and methods to create broader and richer support for user interaction. The technology often used behind rich websites is not new, but the way it is used together is relatively new. There is a trend using traditional desktop metaphors and interaction techniques on the web. There exist spreadsheets, word processors, image tools, direct content manipulation, and editing functionality directly in web browsers. As rich internet applications are still new to many users it can also be confusing. From the heuristic walkthrough, I interpret that RIA functionalities, such as tree navigation and tabs, are unexpected in some situations for the participants. Both, tree structure and tab components, are well-know and often used in traditional applications. Why is it then so difficult for users to understand the same interaction techniques in web applications? I believe that the lack of clear borderlines between the two application domains, traditional desktop applications and rich internet applications, is the problem. Internet is in constant change and develops rapidly using rich content such as Macromedia Flash, AJAX, embedded movie clips, JavaScript, DHTML etc. There are no standard across web applications for how these technologies are used together, and there are as many different web applications as there are web developers. Clearly, the use of rich elements erases the clear borderline that existed between static pages and traditional dynamic applications, and most web applications experience enhanced usability and increased amount of users through the use of rich internet applications. I believe the era of web pages only containing static information pages are gone, and that users eventually have to learn new ways of interacting with web pages. However, it is difficult to say how rich elements should be used in web applications, since the term ‘web pages’ are still used. Maybe there should be distinction between ‘web pages’ and ‘web applications’. If the user knows this is a web application, the user could expect more or less the same interaction techniques and functionality as in traditional applications, and the only difference is that the application is accessible anywhere, without any installing, and through the browser window.

First, I believe that the style guide tool easily can be learnt through hands-on experience. When users have tried the tool for ten to fifteen minutes, many interaction techniques are mapped and
recognized. However, it requires the application to deliver interaction experiences as close to traditional applications as possible to remain consistent and avoid confusion. Second, I believe that once the user have learnt the concept and interaction techniques, the tool will offer a more intuitive approach to solve tasks in relations to style guides, compared to static web pages. As a contrast to the issues concerning RIA above, participant 2 suggested using more RIA functionality in issue 24 to solve that specific issue. The user wanted more drag-and-drop functionality.

5.3.3 Qualitative post-walkthrough interviews analysis

After the heuristic walkthrough, I interviewed the participants. Through the interview, I tried to figure out what they felt of the overall concept and idea, and the general usability of the application. At first, I summarize what the participants expressed directly after the heuristic walkthrough. Second, I present the participants opinions on the concept. I asked the participant two open ended questions: “What do you feel about the concept and idea?” and “How do you feel about such a tool in your work situation?” With these questions, I gathered long and descriptive answers that gave interesting insight into the future, which defines the relevance for a style guide tool in an organization such as Telenor.

5.3.3.1 General usability and user experience

Participant 1 expressed that the design on the web application is very appealing, but the application could offer a set of themes. People have different backgrounds. Some users would like the user interface to be as glossy as possible, and others want gray and flat design. A choice of multiple themes could enhance the user experience for various types of users.

Participant 1 expressed that using the tool as a collaboration tool to create documentation, would require the application to give status and feedback on other users’ activities. In a situation where two users are working simultaneously on the same style guide page, the users need to be aware of what the other user is doing. If one user moves an element on the page, the other user needs information that this has happened, so the page can be updated to view the new structure.

As discussed in section 5.3.2, the rich internet application (RIA) functionality can be confusing. However, I argue that once the users have learnt the interaction techniques and possibilities the user will gain increased efficiency and usability. When participant 1 had tried the document map tree and its interaction techniques, the participant said, “I feel it is natural to use tree structure to represent the style guide’s content. It’s definitely the most propitious workflow”. Participant 2, 3, and 5 stated the tree structure was very good and easy to understand. Participant 2 would like more drag-and-drop functionality all over the application, because the user meant it would make the web application more intuitive and even more easy to use.
Participant 2 said, “I like the small elements on each page”. The participant felt the granularity of elements on a style guide page made sense. The participant also felt it was easy to create and update new elements on a page. The RIA functionality was easy to understand, and made the process simple and intuitive once learnt, and it did not take long time to learn the interaction techniques.

5.3.3.2 General concept in relations to Telenor
When I asked the participant 1 to express general thoughts on the concept, the participant answered, “The way we work, I perceive the tool as essential”. Participant 1 considered the tool as essential and useful the way Telenor works. The participant further stated that style guides in Telenor are a combination of guidelines produced by Telenor and documentation created by external companies. One person, either in Telenor or in an external company, is often in charge of a style guide. If this person quits the project or the job, a huge problem occurs. The style guide becomes hard to use and difficult to find. Since there is no existing structure for how to create and store documentation, it can be found anywhere, from local hard drives to the intranet. Alternatively, not found at all. Participant 3 said, “A system like this would be really smart, because there are no tools like this in the company at all. There is no typical place to look for existing style guides”. When I ask participant 1 if Telenor could require that external companies create and manage documentation and style guides in the style guide tool, the participant means it is not too much to ask for when Telenor is outsourcing projects. Such project requirements would be essential to create a unified and consistent production and management of style guides. The participant stated the organizing of Telenor structure the last couple of years makes it possible to work together using the tool as a central repository for documentation and style guides. The participant further stated the tool is incredibly useful, making the style guides accessible and support easy collaboration. It would enhance the processes in Telenor. A gathering of all style guides in the organization would make it possible to follow the work on style guides in the organization, share it, and learn from it. The participant also stated that the concepts’ various export functionalities, such as ‘send by e-mail’ and ‘export to PDF’, would be important and speed the process of sharing. Participant 2 argued that good import functionality could be the key for the tool’s success. The import functionality should support automatic conversion of style guide structure and content from existing PDF and Microsoft Word documents, based on headings and internal document styles. The support of such import functionality would make it easy to import all existing style guides into the tool, which rapidly could become the central repository for all style guides.

5.3.3.2.1 The tool’s metaphor and style guide structure
The participants had in general no problems understanding the paper document metaphor used in the web application. Participant 2 and 3 said the tool was very good and easy to use in general. Style
guides have previously been represented as a printed document and lately as a word processing files or PDFs. The style guide tool represents the style guides in a tree structure in a web application. Participant 3 stated the tool would be good for large style guides, but could seem a bit too much for small style guides. I understand what participant 3 means, if the style guide contains two or three pages and five paragraphs. So far, I have not seen style guides this size. Once the style guides contain more than five pages or chapters, it becomes quite large, and I believe the tree structure is a good way to represent a style guide at any size. Splitting a page into elements with only a few pages, can seem to be overkill, but the developers never know how the style guided can be used in the future, as part of the concept is to keep the style guides alive and evolving. Therefore, any style guide should be extendable and support collaboration in every page.

5.3.3.2.2 Tool context
Participant 1 said, “I have to be aware of the context. I have to think I’m working with style guides and not with regular web sites”. The participant tends to forget that the content on the web page is not actually a web page, but is a representation for a style guide page. However, I do not see this as a problem. It does not matter if the user feels that the style guide is documented as web pages, as long as the user is aware of the web page context and that the page is a part of a style guide structure. In addition, it is important that the user is aware of the export and sharing functionality. However, the tools can sometimes feel like an online community with multiple users sharing content, and working together creating style guides.

5.3.3.2.3 Distribution, updates and consistency
Participant 2 expressed concerns about today’s work on style guides in the organization. It is hard to keep the style guide updated at all times and then distribute the updated style guide to all partners. Therefore, participant 2 felt the possibility to invite users to view the style guides directly in the tool would be great. Participant 3 said, “It is really smart to be able to send invitations to external partners, so they can access the style guides directly in the tool”. The partners would always have access to the most recent style guide, and could even give direct feedback and perform changes in the guide when needed. Participant 2 also feels it is difficult to use existing revision handling on documents properly. By existing revision handling, the participant refers to the use of document collaboration through a SharePoint project portal. Together, the two issues, distribution and updates, take up too much time. In addition, there is always the problem of consistency from one style guide to another. One thing is consistency in the content, but on the other hand, it is a huge problem maintaining consistency in style and structure in each style guide. If the tool has few obstacles, the more usable it will be for users.
5.3.3.2.4 Revision handling
When participant 1 explored the revision handling functionality, when performing the evaluation, the participant said, “I’m thinking, how useful this is? Yes, it is very useful. Quite simply”. Participant 2 felt the revision handling functionality was very good as well. Locking only elements in pages instead of whole documents or whole pages, opens up the tool for enhanced collaborative work in the style guides. After explaining to the participant how the locking system is invisible until someone else works on the same element, as one would like to edit, participant 2 felt it was great solution. The users should not have to think of functionality like checking-in and checking-out elements or files, but should only worry about editing the content itself.

5.3.3.2.5 Personal use of the style guide tool
The general feedback on the style guide tool was very positive after the heuristic walkthrough. Participant 2 said, “Using the tool was very easy. It would take me half the time I use now to create a style guide with this tool. If the tool was available now, I would use it. Absolutely”. When I presented the concept of inviting external users to an always-updated style guide, participant 3 said, “The tool would make my work much easier”. Clearly most participants see that the style guide tool would enhance their work processes in many ways. However, there are some concerns. Participant 4 explains that work habits could require change introducing a new style guide tool. The participant has own ways of conducting work with style guides. The participant uses all different kinds of tools, such as Adobe Illustrator, Adobe Photoshop, Microsoft Word, and Microsoft Visio etc. to create best possible documentation. Participant 5 said, “Some people could see the tool as a limitation of expression”. Both the concerns from participant 3 and participant 5 indicate a possible problem, if a style guide tool is introduced into the organization. The tool is designed to handle every kind of information, and make it accessible through a consistent interface and structure. Any media created with a custom tool can be imported into the tool in original format. Yet, some designers and developers will feel they lose control over the document’s structure and expression. Is the individual expression important to communicate the principles and guidelines in the best possible way in style guides, or is it more important to keep a consistent structure and expression throughout the organizations style guides? I believe a consistent structure and expression on elements and content in style guides is most important. During the interviews in my research, I have discovered that style guides are hardly used the way they are intended. Style guide are published on the Intranet or corporate web site for end users to use. The style guides varies in style and content structure, and they may be hard to read. I believe both, style guide developers and style guide end users, would use style guides more if they could look up the information they need in seconds, as with any reference tool.
6 Discussion and conclusion

In this chapter, I will discuss existing theories on production and management of style guides from section 2 and compare the theories with my concept, described in section 4. To support the discussion I will use my empirical results from section 5. I will also discuss the use of development research (section 3) as the research approach, and suggest how future research and development on the concept should be conducted. In the discussion, I will give answers the questions in the problem statement in section 1.1. Finally, I give conclusive remarks on my research.

6.1 The overall position of style guides

In phase 1 of my research (section 5.1), I discovered the participants various opinions on the use of style guides. All participants agreed that style guides are good, but their experiences are diverse. From style guide developers’ perspective, it is difficult create style guides using previous knowledge and existing style guides. Telenor have many collaborative frameworks at hand, but they are not used consistently throughout the organization. A style guide can be found anywhere: from a local hard drive on someone’s computer or on the enterprise’s internal servers. Both, style guide developers and end users, see the localization problem as a major issue to the efficiency and use of style guides in practice. I believe, not having a solid foundation and routine in the sharing and accessibility processes for all style guides makes them unusable to some degree. If a style guide is unreachable when needed, the style guide will not fulfill its purpose, simply because it is unavailable. However, if a style guide is received or accessed within a reasonable timeframe it will help end users to solve their tasks, but the efficiency is depending on the time it takes to receive the style guide. My impression, from end users of style guides in Telenor, is that they interpret the style guides to their own specific needs. What style guide developers have meant to be strict guidelines, conventions, and principles, are interpreted as loose rules by end users. However, the end users think style guides are good as an inspirational source to accomplish their tasks.

In resemblance to the participants’ overall view on style guides in Telenor, authors like Gale, Quesenbery, Johnson, Beier and Vaughan, and Ohnemus all agrees that style guides are important to ensure consistency in various productions and applications throughout an organization. However, they describe the overall impression of style guides in resemblance to the participants’ description in phase 1. The authors describe problems and challenges organizations need to overcome for style guides to be successful in section 2.2.3. Gale argues the lack of involvement by style guide end users
is a reason for failure. He also suggests planning the introduction of style guides carefully into the organization. Quesenbery and Johnson state style guide can be quite complex and it is important to keep them simple and dynamic. On the other hand, Ohnemus states style guides needs to be more comprehensive to meet the requirements of the new web application era. In addition to these problems, Beier and Vaughan describes lack of centralization as a central issue.

My impression is that people are divided in their opinions on the overall position of style guides. In general, the participants in my research and the authors claims style guides are good and that they are great tools to ensure consistency and being a foundation for usability. However, I identify various impressions and concerns in different groups. Developers of style guides are very positive to the development of guidelines, principles, and conventions to be shared as a foundation for style guide end users to solve their tasks. I believe the developers not using style guides as end users have problems understanding why the style guides are not used the way they intended. On the other hand, I believe the end users not working on style guides as developers cannot see the true importance utilizing style guides as the main influence in their work. I believe some end users see style guides as a limitation, and something that have been pushed upon them from higher authorities. I believe stakeholders, such as higher authorities, project managers, and decision makers judge the style guides by usefulness in relations to efficiency and profitability. In every company and organization, money is an important factor for all major decisions. It costs money and resources to develop style guides, and the development of style guides have to be prioritized along with other major decisions. For a style guides to be successful, I believe they need support from higher authorities, but as Quesenbery states, it is not enough. There has to a specific plan introducing style guides into a company, and every user group has to participate and feel involved in the process.

6.2 A need to improve style guide processes

From the participants feedback in all my research phases (section 5), I believe there is a clear need to improve the style guide processes in Telenor. Quesenbery states corporate style guides supports consistency and business goal (section 2.2.1). He states the use of corporate style guides improve quality, process, and usability in the business goals. The result is sharing of experiences, design, usability decisions, and easy access to best pattern and practices. Participant 1, in phase 3 of my research, stated Telenor went through a large reorganization a few years back. The collaboration processes changed when all departments moved into the same building. The new organizational framework and structure would now support a change in style guide processes. As my findings reflect, there is no standard way to produce and manage style guides in Telenor. Users trying find relevant style guides to solve tasks and usability problems may not find any relevant style guides at
6.3 The style guide production and management tool in Telenor

In this thesis, I have presented my style guide production and management tool and the concept in section 4. The tool is based on user requirements gathered in phase 1 (section 5.1). The last prototype is a result of multiple evaluations and is still a prototype in need of new evaluations. However, the concept should be clear, and it is possible to evaluate the usefulness of the application in Telenor. The last evaluation, in phase 3 of my research, gave style guide developers and end users the possibility to use the style guide tool themselves and explore the functionality (section 5.3). They reviewed the concept and usability of the tool in relation to style guide processes in Telenor. Based on my findings, I believe there is no doubt that the tool I present can improve the way style guides are produced and managed in Telenor.

The tool being a web application is the first big step to support easy access to all style guides in the company. Telenor is a large company situated in many different countries and many projects are outsourced to external companies all over the world. Having all style guides available through the web browser, compatible with various platforms, is essential to build a solution supporting collaboration and participation with all user groups.

I believe key functionality that can make the tool a success is the combination of revision handling (section 4.6.2), templates (section 4.6.3) and the user interface with its user experience (section 4.5). These functionalities bring together a new concept in production and management of style guides. It enables the style guides to be dynamic. Multiple users can work on the style guides simultaneously,
and the style guides can evolve to meet new requirements. All existing knowledge is kept, so anyone can view decisions and knowledge from earlier stages of each style guide, and use it as an inspiration or source for new style guides and requirements. The 2-way template system gives full control on all style guides. Using a template creating a new style guide, the style guide developer knows what information to produce in the style guide, and how to structure the content. From the project leaders and decision makers perspective it is possible to control that all style guides that are based upon templates follows the rules that are defined for those templates. With the 2-way template functionality, the company is in full control on all style guide activity, and is at the same time able to control quality and usability of each style guide through the templates.

The user interface enables all the tools’ functionalities to be easy, simple, intuitive, usable, and accessible. The web application is developed using rich internet application functionality (RIA), which is a part of the term ‘Web 2.0’. Web 2.0 is loosely described as a category of websites with interactivity, collaboration, and community functionality. During the last evaluation in phase 3 (section 5.3), I learned that all participants could see the Web 2.0 functionality as very useful, however many of the participants were not used to the interaction techniques known from traditional user interfaces in a web environment. On the other hand, after using the interaction techniques for a while, they were all positive to the solution and they felt the use of RIA functionality was the only good way to solve the tasks. Hardy (2007) argues the web 2.0 wave starts to take hold. He explains that the use of online tools is a rather new concept. He argues simplicity often is the key. Web 2.0 applications emphasize a more logical simplicity for humans than traditional static web sites. As Microsoft, Adobe and Google bring traditional desktop software online and accessible through the web browser as Web 2.0 applications, it might be a new era for software. People will get used to the web becoming a place for applications with multiple interaction techniques to support a new kind of simplicity. I believe Web 2.0 is the future for web applications. The interaction concept in my tool works well to simplify advanced tasks. However, I believe that the prototype needs further adjustments and evaluation with more users to reveal potential usability issues and improve those issues.

6.4 A dedicated production and management tool compared to existing frameworks and solutions

What is different with my tool comparing to other frameworks and solutions? In section 2.2.4, I present Beier and Vaughan’s ‘The Bull’s-Eye’ framework. The framework consists of five-layers as concentric circles. The layers represent component level as the inner layer to overarching features and principles in the outer layers. The idea is to cover platform, design, corporate style guides in the
framework. The main idea behind the framework is to ensure consistency through all the applications in the company. Because the scope of the framework is so large, it includes designers, usability engineers, product managers and development manages in the process. Beier and Vaughan’s framework was a success in Oracle. This is a software company using style guides mainly to overcome consistency issues with application development. Telenor has a different focus. The style guides in Telenor can cover anything from print productions for cars, paper, and flags to mobile applications, web applications, and traditional software applications. My impression from the interviews with participants in Telenor is that once the style guides are too complex they will not be used. I believe the diversity of the end users in Telenor has a significant impact on the use of style guides in the organization. Therefore, style guides have to contain precise information and be a reference tool. I do not believe end users will read the style guides from start to finish, but will look up what they need, and use that information to solve their tasks quickly and efficiently. I think a multi-layered concept is too advanced and too complex for an organization like Telenor. If the style guides are used as reference tool, the end users will not comprehend the relationship between the various layers. However, a multi-layered framework could be used in the template functionality of my concept tool. It would be a great idea to implement inheritance between layers. If one layer with overarching principles could surround other layers with template information and rules, it would be a fast and easy way to use the concentric layers in the various style guides to ensure consistent and high quality style guides. End users would have to relate to the ‘Bull’s-Eye’ framework, because the framework would be incorporated into the template system that defines structure and content for the actual style guides.

Hart states paper based style guides are too static (section 2.2.4). He suggests using word processors its built-in template functionality to make the style guides dynamic. The main point of this approach is that style guide developers should not have to reinvent the content of a style guide every time a new style guide is needed. He suggests using templates that will define structure and predefined content to ease the development process of the style guide. I share the same opinion as Hart on this subject. However, he suggests using word processor as the main approach. In a large organization as Telenor, this would be a weak solution. Because of the diversity of style guides in the organization, I believe it would best to divide the raw data, used as content in each style guide, and the style guide’s layout and design. Hart also suggests using XML and SGML tools in extreme cases to support the divide of raw data and design. Telenor is an extreme case due to its size and complexity as an organization. Hart also argues that a style guide should be used as a reference tool and not include every aspect of in the style guides. Quesenbery, Johnson, the participants and I, all argue that style guides should be easy and simple.
Furtado, Sousa and Colera are the only authors that present a specific tool (section 2.2.4). It is a knowledge management tool wrapped around style guides. The authors argue that the tool improves end users’ interpretation and the ability to apply the style guides. Users and developers of style guides can build knowledge through questions and answers, which supports a collaborative and dynamic evolvement of style guides. The purpose is to save decisions, problems, and solutions so it can be used later in other situations and by other people. My tool supports the same functionality, which I believe is important to engage users to participate in the process. My tool has a review functionality, which enables all user groups to comment, suggest changes, praise, and criticize style guides and their content. In addition, the tool has an approval functionality that enables style guide developers with sufficient rights to approve or reject style guides and their elements. When changes are made, the history of those changes is saved in the revision handling functionality of the tool. All together, these three functionalities cover the goals of Furtado, Sousa and Colera’s tool. I believe these three functionalities are essential for the tool’s success. It enables the end users to give direct response to style guide issues, and propose changes directly in the tool. I believe the possibility to influence style guides will make end users feel a part of the development process. I also believe the result is a feeling of ownership to the style guide, which Gale, in section 2.2.4, states is important so users do not feel higher authorities impose the style guide upon them. The result can be that end users, who are intended to use style guides to solve tasks, actually use them.

Alternative tools, not presented in my theory chapter, but worth mentioning due to similarities are the Wiki, Microsoft SharePoint, and various collaborative writing and editing tools, presented by various authors. Wiki is a website that allows visitors to edit the content. Wiki often use a simplified markup language to ensure a consistent look and feel throughout the content. Some Wikis also use WYSIWYG editors to give the visitors a more intuitive way of editing the content. Hasan and Pfaff (2006) describe the Wiki as a knowledge management tool in a corporation. They state the Wiki is easy to use and makes the content accessible to all users in the corporation. A wiki organizes knowledge data into logical fragments, which can be customized to the end users need. Everyone can participate in the updates and editing of the Wiki content through the web browser, which makes the Wiki dynamic. The Wiki places less emphasis upon centralized content control, however there are many risks related to the use of Wiki. I believe the problem of knowledge inaccuracy is a major concern in a style guide process. Hasan and Pfaff state incorrect data can be entered into the Wiki without any control mechanisms to fetch the false data. In my tool, I have the approval functionality (section 4.6.4). The approval functionality can be set to mark all edited pages and elements to tentative status. That means persons with sufficient rights in the style guide must approve or reject

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15 Rich text editors called ‘What You See Is What You Get’
DISCUSSION AND CONCLUSION

Hasan and Pfaff state formal and structured environments, such as the approval and template functionalities, are a contradiction to the ‘community approach’ of knowledge management. I believe the Wiki is a great knowledge management tool for many purposes, but in the case where the knowledge is in the form of style guides, I believe there has to be support for a more centralized control and structure. Style guide content is actual guidelines, principles, and conventions for other types of content and therefore I believe the quality and reliability of the data is very important. However, the accessibility and collaboration methods in addition to the web interface are great concepts, which I have used in my tool as well.

Microsoft SharePoint (Collaboration in MS Office SharePoint 2007) is a collaboration platform that supports all different kinds of collaboration techniques: sharing documents, calendars, total integration with Microsoft Office, Wiki, and so on. Telenor uses SharePoint to share documents and organize projects, however, the participants feel the tool is too general, and does not solve ‘the style guide problem’. I believe SharePoint is a comprehensive tool that would be great to use in addition to my tool to improve the collaborative experience. The raw data that is used in the style guides, such as images, word processor files, presentations, spreadsheets etc., have to be stored in a tool that supports a collaborative approach to raw files of various formats. I do not think my tool can replace SharePoint and other collaborative tools in the work of style guides, but I believe my tool could be the main publish and creation tool of the actual style guides to keep them simple, easy and usable to any user group.

In addition to the concepts and tools described above, there exist several collaborative document tools. Hodel, Gall and Dittrich (2004) present a tool based on the TeNĐaX architecture. The main concept is to support editing of the same content at the same time by multiple users. The interesting part of this approach is that the authors suggest breaking a document down to character level. These characters are objects with relations to each other, and the architecture supports real-time changes by multiple users. Baecker et al. (1993) also present a tool that supports both synchronous and asynchronous collaborative writing through a tool they called SASSE. In my tool, the style guide is broken into pages and element parts in each page. Only one person can edit each part at the time. However, multiple authors can edit different parts at the same time. I believe this is a more intuitive and simple approach to collaborative writing. I also believe the use of Hodel, Gall and Dittrich’s approach to support editing in the same paragraphs in a text simultaneously would be confusing for users. Baecker et al. state the tool SASSE has support for collaborator awareness. I believe it is essential for style guide developers to know who is editing the same page, together with information on what changes that is done by other users. Baecker et al. also suggest the use of color-coding for each author, which I believe is a great idea to have as a view option. If a user views a page with color-
coding it would be easy to see the parts on the page that is edited by multiple authors. Both the collaborative solutions above are prototypes, and so is my tool. I believe the collaborative writing experience needs further testing, but that my tool is a simplified and easy approach to build on in future developments.

6.5 Conclusive remarks

In this research process, I have investigated the use of production and management of style guides in Telenor. Utilizing gathered user requirements from my research, I have developed a prototype to support dynamic style guide processes involving all user groups. By using this prototype as foundation for research, I have answered my problem statements (section 1.1). I believe there is a need to improve the way style guides are used in Telenor. My interpretation is that Telenor develops many style guides, but they are diverse in many areas like structure and layout, the way guidelines are defined, the way style guides are used, and the way they are distributed. In other words, there is no consensus on the style guide processes. I believe higher authorities in Telenor must stress the importance of style guides in the company. To achieve consensus, the higher authorities need a practical and dynamic way to introduce new style guide processes. I argue that style guides can only be truly successful when everyone in the company has learned what a style guide is, how to use it, and how to participate in its dynamic development processes. I believe the use of my tool is one practical way of introducing successful and dynamic style guides into the organization and engage users. It can be extended in every direction to support business goals and is easy accessible through the web browser for anyone in the organization.

The tool provides core functionality I believe is essential to be successful: it provides easy and almost invisible revision handling to save all experiences and work (section 4.6.2); a 2-way template system (section 4.6.3) and approval functionality (section 4.6.4) to ensure quality and consistency across all style guides; and review functionality to build a community with comments, questions, and answers around style guides (section 4.6.5). These are all functionalities built on user requirements from my research, and the way they are implemented using rich internet application (RIA) functionality enhance the total user experience and usability (section 4.5.1). Through evaluations, the participants have clearly stated that this tool is something Telenor needs in the future. The functionality that was evaluated has a number of usability problems, but nothing that blurs the image of the concept or cannot be easily fixed in a future development process. The participants’ mutual positive impression is significant for the future of the concept. The tool is definitely something to build on in the future, as a somewhat new approach to the ‘style guide problem’. Nevertheless, the tool needs to be thoroughly tested in multiple iterations in future development cycles to map new requirements from
other user groups. The complexity and size of Telenor requires further qualitative and quantitative usability tests and evaluations to cover all user groups and stakeholders’ needs.

I find my research approach successful in this project. Since it is an educational study, I was able to define and explore new concepts using development research as my approach. The use of other research approaches could have resulted in a different tool or concept. Since I only used qualitative evaluations with an interpretive approach, and have been the only interpreter of the collected data, my research may in some cases be somewhat biased. I believe I have added new research and information to the style guide domain. To strengthen or criticize my research and to take my concept and research further, I recommend using multiple perspectives and research approaches.

From my point of view, the dedicated style guide tool opens up many possibilities in an organization like Telenor. The tool makes people work together in a collaborative environment that supports usable, accessible, and consistent style guides. I believe the tool can solve many daily problems that occur in production and management of style guides, and I believe the tool can be used in any organization or company. I have studied the use of style guides in Telenor, but style guides are used everywhere, and through existing literature I know there are similar issues in other companies. The tool is still an early prototype, and is built on user requirements gathered at Telenor. However, emphasizing flexibility and extensibility of business goals in future development of the tool, any company should be able to use the tool to solve their style guide problems in the future.
7 References


PRODUCING AND MANAGING DYNAMIC STYLE GUIDES


Appendix A

This appendix contains screenshots and descriptions from the final prototype in this research. The prototype’s functionality and concept is explained in section 4. The screenshots in this appendix represents the tools concept during the prototype 2 evaluations. The image descriptions are located under each screenshot.

Screenshot 1: Front page

The front page is informative and esthetically pleasing. On the top the web page, there is a heading with user profile information. The global menu is on the bottom in that heading, and is accessible in all pages. The user gets relevant activity information of what has happened in the tool since the last visit. The search functionality is placed central on the front page an provides an easy way to find style guides in the tool. In the right column, the tool provides the user with related style guides and activities.
Screenshot 2: View style guides page

In the page, it is possible to browse for style guides in a table format. It is also possible to filter the table columns.
Screenshot 3: Create new style guide

In this page, it is possible to create new style guides. Type in style guide information to the left, and optionally select templates and projects to relate the style guide to.
Screenshot 4: View style guides page

This is the style guide front page. There is a description text and navigational document map in the left column. The style guide title and a description is the top of the content area. Below the description, there are various information fields about the style guide status.
Screenshot 5: Edit document map page

This is the page to edit the document structure and pages. The document tree to the left is drag-and-drop enabled, can be used drag-and-drop node, or mark them for editing. The functions to perform on the document map are defined in the edit options to the right.
Screenshot 6: Style guide page

This is a page in the style guide with content in the main frame to the right. The page has a ‘| Edit page’ link in the top right corner of the content area, bringing the page into edit mode. There is also a ‘| Edit’ link in the document map top right corner, bringing the user to the edit document page. Also, notice the navigation path right above the content and below the heading. It shows exactly the users’ position in the style guide and system.
Screenshot 7: Style guide page

This is a page in the style guide with content in the main frame to the right in edit mode. The page has a ‘View page’ link in the top right corner of the content area, bringing the page into view mode. The page shows the different tab functionalities. The ‘View’ only shows the current content as in screenshot 6. Under the edit functionality, the user has the option to use previous revisions to create new revision. The user can move elements up and down under the ‘Move’ tab, and delete the element under the ‘Delete’ tab.
Appendix B

The content in this appendix has the scenarios and tasks used in the expert walkthrough used in phase 2 (section 5.2).

This is the first prototype on the application. The purpose is to show the main concept, find usability issues, and create guidance for the prototypes that follows in the development cycle.

Scenarios and tasks:

1. Create a new style guide based on an existing template
2. Find an existing style guide. Edit and comment elements in the style guide.
3. Style guide and style guide elements approval and publishing.
Appendix C

The appendix contains the usability tasks used in phase 3 (section 5.3) of the research.

Task 1:

1. Find and open a style guide named “User Interface Design Guidelines for WAP Applications”
2. Find the page “The generic WAP interface” in the same style guide
3. Edit the style guide document by adding “Image1.jpg” from the desktop, between the subtitle “Heading” and the paragraph below. Write a custom caption for the image
4. Find a previous revision 3 of the same paragraph. Use this revision and add “Test line” as the last line of text in the new paragraph
5. Move the image below the paragraph

Task 2:

1. Create a new style guide based on a template for web. The template is named “Internet - corporate”. Call the style guide “Telenor test guide” and add “Test” as description
2. Add a new page named “Test page” as sub-element to the “Design” - page
3. Move the new page as the first sub-element to the “Design” – page
4. Change the name on the page “Heading3” to “Subtitle”
5. Move the page “Page flows” as sub-element to the page “Layout and structures”
6. Move the page “Layout and structures” above the page “Graphical user interface”

Task 3:

1. Go back to the front-page in the style guide you created in exercise 2.
2. Copy the text from “Lorum.txt” on the desktop and on to the page “Usability”
3. Add “Image2.jpg” from the desktop below the paragraph with custom caption
4. Delete the bottom part of the text
5. Move the image above the paragraph
6. Delete the rest of the paragraph