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Designing Usability Guidelines for Evaluating the Usability of a Retailing Back-end System

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Designing Usability Guidelines for Evaluating the Usability of a Retailing Back-end System

Evaluating usability is an essential part of designing systems, and the goal of this thesis was to provide a set of general guidelines for evaluating a retail back-end system's usability during and after the development process. To achieve this, research about international usability evaluation methods and accessibility requirements was conducted. Accessibility is a part of usability, and there are international requirements for digital systems to be met. An accessible system can be used by people with varying disabilities. Therefore, accessibility was considered during the guideline design process. The thesis material was gathered from books and online references.

The designed guideline list includes 22 different criteria for evaluating system usability and to be used during the design process. From the research material it was also found that the design process includes a need for continuous usability evaluation and therefore the guidelines were designed to be used throughout the development process. The provided guidelines are to be used as a broad guide. The individual needs of a customer need to be taken into consideration when designing more specified guidelines for a specific system, but such a guide can be designed in the future

Keywords:

Accessibility, usability, usability evaluation, usability testing, user interface design, system design

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Vähittäiskaupan taustajärjestelmän käytettävyyden arviointiin tarkoitettujen ohjeiden suunnittelu

Käytettävyyden arviointi on tärkeä osa-alue järjestelmäsuunnittelussa. Tämän opinnäytetyön tavoitteena oli tuottaa lista yleisiä ohjeita, joita voidaan käyttää vähittäistavarakaupan taustajärjestelmän käytettävyyden arviointiin kehitysprosessin eri vaiheissa. Erilaisia käytettävyyden arviointimenetelmiä sekä käytettävyystestauksessa käytettäviä mitta-asteikkoja tutkittiin tavoitteen saavuttamiseksi. Käytettävyyteen liittyy läheisesti saavutettavuuden käsite. Saavutettavuus tarkoittaa, että myös toimintarajoitteiset henkilöt voivat käyttää järjestelmää. On kansainvälisesti laadittu tiettyjä vaatimuksia, joita kehitettävien järjestelmien tulee täyttää. Saavutettavuuden vaatimukset otettiin siksi huomioon ohjelistaa suunniteltaessa. Opinnäytetyöhön valittu materiaali kerättiin erilaisista kirja- ja verkkolähteistä.

Suunniteltu ohjelista käsittää 22 erilaista ohjetta käytettävyyden arviointiin sekä järjestelmän suunnitteluun. Suunnittelutyön huomattiin sisältävän tarpeen jatkuvalle käytettävyysarvioinnille, joten ohjelista muotoiltiin käytettäväksi suunnittelun tukena kehitysprosessin läpi. Tuotetut ohjeet toimivat yleisinä ohjeina. Yksilöllisten kohdekäyttäjien tarpeiden huomioon ottamista tarvitaan tarkempien ohjeiden suunnitteluun, jotta ohjeet voidaan täysin yksilöllistää koskemaan tiettyä järjestelmää. Tämä voidaan tehdä jatkokehityksenä.

Asiasanat:

Käytettävyys, käytettävyyden arviointi, käytettävyystestaus, käyttöliittymäsuunnittelu, järjestelmäsuunnittelu, saavutettavuus

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List of abbreviations

POUR	Perceivable, Operable, Understandable, and Robust. (Inclusion & Accessibility Labs 2024)
SUS	System Usability Scale (Sauro 2011)
UI	User interface (eAccessibility Joint Working Group of CEN/CENELEC/ETSI & ETSI Technical Committee Human Factors 2021)
USWDS	United States Web Design System (General Services Administration 2021)
W3C	The World wide Web Consortium (World wide Web Consortium 2024)
WAI	Web Accessibility Initiative (World wide Web Consortium 2024)
WCAG	Web Content Accessibility Guidelines (eAccessibility Joint Working Group of CEN/CENELEC/ETSI & ETSI Technical Committee Human Factors 2021)

1 Introduction

Usability can be defined as a general quality of an artefact, the appropriateness to a specific purpose. There are different perceptions of usability in various contexts compared to the studied artefact. From the information technology perspective, the ISO 9241-11 standard is used as reference. (Brooke 1995.) This thesis will consider the information technology usability and accessibility that are needed in designing user-friendly digital systems.

Evaluating system usability during development is an essential aspect of designing and developing usable and accessible systems. Usability evaluating includes three kinds of methods: usability testing, usability inquiry and usability inspection. Usability testing is the most common of the three. (User Testing 2024.) What is common for these methods is that they aim to improve the target system. In situations where the resources or timelines are short, evaluating a system's usability without testing can be conducted by usability inspection, which does not include testing (User Testing 2024).

Usability inspection includes for example heuristic evaluation and cognitive walkthrough (User Testing 2024). The usability inspection methods are not designed to fit a specific system but are instead intended to evaluate the usability on a large scale and they can be widely used in evaluating different kinds of systems (Nielsen 1994). A more specified method could be beneficial for the usability evaluation process of a specific type of system.

This thesis aims to design usable guidelines for evaluating the usability of a retail back-end system during the development and design processes. The guidelines will offer advice about the usability of the system, not direct answers. There are several methods of evaluating usability, and these guidelines aim to include a variety of advice in one list.

Evaluating the usability during the development can prevent costly changes later (User Testing 2024) and it therefore acts as a significant aspect of system development. Accessibility is closely linked to usability and there are international requirements for digital systems that need to be met, and the thesis will, therefore, include the accessibility perspective in the design.

The thesis will address the different methods of evaluating usability for the purpose of designing the usability evaluation guidelines, but the focus will be on inspecting usability without user testing or inquiries. Experience from the retail industry is also used to achieve the thesis goal. Additionally, studying accessibility is an important part of understanding usability from the point of view of individuals with disabilities (Joyner 2022), which is an important aspect to consider in designing different kinds of systems, and retailing back-end systems are no exception for that.

The thesis will begin with chapter two by explaining primary information about the retail industry, followed by the third chapter, in which an overview of usability evaluation and accessibility are researched. After the overview, in chapter four, the thesis will address aspects of designing the usability evaluation guidelines that will be provided. The results will be presented in the fifth chapter, and the thesis will end with a conclusion chapter, chapter six, where the results and the process will be contemplated.

2 Retail industry

The retail industry is an industry where the retailer buys products from manufacturers in large quantities and sells them to the consumers. Retailers can include for example different kinds of franchises, network marketing, dealerships, or individual retailers. (Erply 2024.)

2.1 Retail franchises in Finland

There are multiple franchises in Finland, that are part of the Päivittäistavarakauppa ry, the Finnish registered association for retail industry franchises or other retailers. Such franchises are e.g. Prisma, Sale, K-franchise, Lidl and Tokamnni (Päivittäistavarakauppa ry 2023).

2.2 Retail back-end systems

A retailer needs a method of controlling the flow of sales and managing all aspects of their specific practices and services. The developing company can decide the base for the system, whether it is a desktop application or a website-based system, or possibly both. Users prefer making critical actions with a desktop system, but the usage of mobile applications has risen radically in the last 10 years. (GEOBO 2022.)

The back-end systems and point-of-sale systems form a combination that retailers need for successful sales. Point-of-sale (POS) systems handle the purchases with consumers, and back-end systems are used so everything behind the scenes is working properly. A traditional POS system needs a staff member such as a dealer, to operate it. The back-end system needs to be able to communicate with the POS system so purchases will be possible.

2.2.1 Functionalities

Depending on the needs of the franchise, the necessary functions may vary. One essential part for any retail franchise is product management which ensures the flow of product sales. Product management should include all necessary functions to manage different kinds of products and their features. Discount management is closely related to product management, and stock management should also be included.

Other important functions include monitoring, end of day -function, and reporting. Monitoring functionality may include functions such as receipt log, control log or audit log; all will ensure that the users with high enough user rights can supervise events and committed tasks. The end of day -function completes a day's sales and finishes the day, collecting all sales together and calculating the day's sales. It can be automated to a certain time or manually committed, depending on the system and customer wishes. In reporting, the customer can create reports of varying information that can be retrieved from the back-end system database. A report can

include e.g. information about sold products, inventories, or profits. Report packages may also be an option for reporting; the users can run a package of selected reports, that are collected. All of these are essential for following the sales. Every franchise may need other functionalities also, and it is crucial to consider what individual needs need to be met. Fuel management may, for instance, be an additional function. Fuel management can include information about tanks, tank volumes and fuel usage, for instance.

2.2.2 Users and user groups

There are different user groups with different rights to manage the system functionalities, and the system should answer to each user group's needs and restrictions. Groups may include franchise wide users, dealers and vendors, and various others. For example, a vendor user does not need as many rights to all the functions as a dealer, and a dealer does not need as many rights as a franchise wide user, who has rights to multiple stations. There is also a need for a user with system administrator rights to control the most vulnerable information in the system, including user group management.

3 Usability evaluation and accessibility

Usability and accessibility are closely connected; accessibility can be viewed as a part of evaluating usability. Digital usability evaluation focuses on user-friendly characteristics, and accessibility widens the concept by answering to the needs of individuals with disabilities. It can be argued that including users with disabilities in user testing will improve the usability of the target system. (Joyner 2022)

1.1 Usability evaluation methods

Designers of an information technology system should consider the ISO 9241-11 standard. The standard suggests that effectiveness, efficiency, and user satisfaction are covered by the used usability measures. Effectiveness includes the users' ability to complete tasks and the quality of the performed tasks. Efficiency measures the level of resource that is consumed in performing tasks, and satisfaction analyses the users' subjective reactions to the system. (Brooke 1995.)

Usability can be said to be one of the most important factors of quality for Web applications (Fernandez, Abrahão & Insfran 2012). There are three types of usability evaluation methods: usability testing, usability inquiry and usability inspection.

1.1.1 Usability testing

Usability testing is the most common among usability evaluation methods and consists of different kinds of tests that can be conducted with end users to determine the overall usability of the product (User testing 2024). Possible tests include automated summative evaluation, co-discovery learning, eye-tracking, lab-based testing, remote usability testing, think-aloud protocol, and traditional usability testing (Fernandez, Abrahão & Insfran 2012).

1.1.2 Usability inquiry

Using inquiries usability evaluators can receive information about users' understanding of the system in question, their dislikes, likes and needs by letting them answer inquiries in written form or verbally. Methods of inquiries include field observation, contextual inquiry, focus groups, surveys, and questionnaires, journaled sessions, self-reporting logs and screen snapshots. (Information Technology Systems and Services 2024.)

1.1.3 Usability inspection

To perform a usability evaluation without testing, an inspection of the system can be conducted instead. These methods include heuristic evaluation, cognitive walkthrough, pluralistic walkthrough, feature inspection, consistency inspection, standards inspection, and formal usability inspection. What these methods have in common is that they aim at finding usability problems especially in the design, although some of the methods consider the aspects of other usability issues, such as the severity of the problems. The inspection-based evaluation method has the advantage that inspection can be performed before the user interface specifications have been implemented. (Nielsen 1994.) The thesis will further concentrate on usability inspection methods and their main characteristics.

Heuristic evaluation

Heuristic evaluation is performed with a usability specialist team using Jakob Nielsen's ten usability heuristics, which are used for finding usability problems in a user interface design. The heuristics are not specific guidelines, but rather broad rules of thumb. (Nielsen 2020.) Using the heuristics to evaluate usability has advantages; it is fast to use and provides quick and relatively inexpensive feedback to designers, the feedback can be obtained early in the design process and using the correct heuristic the best corrective measures can be taken. The heuristic evaluation can also be used together with other usability testing methods. There are also disadvantages in using the heuristics, such as applying the heuristics effectively requires experience and knowledge and it can be expensive and hard to find trained experts, multiple experts should be used, and the evaluation might identify minor issues instead of major ones. (General Services Administration 2024.)

The ten usability heuristics include visibility of system status, match between system and real world, user control and freedom, consistency and standards, error prevention, recognition rather than recall, flexibility and efficiency of use, aesthetic, and minimalist design, recognize, diagnose, and recover from errors, and help and documentation. (Nielsen 2020.) The heuristics can be found in further detail in Table 1.

Cognitive walkthrough

To evaluate the learnability of a system from the new user's perspective a cognitive walkthrough can be performed.

The method does not involve users but is instead performed by a cross-functional team of reviewers who walk through each step of an in advance defined task, answer prescribed questions and use that information to assess the interface learnability. The team can consist of UX specialists, product owners, engineers and domain experts, whose goal is to identify challenging aspects that can derail new users. (Salazar 2022.)

According to Salazar (2022) there are 4 analysis criteria that are used in the walkthrough. First, will users try to achieve the right result. Second, will users notice that the correct action is available. Third, will users associate the correct action with the result they are trying to achieve. Fourth, after the action is performed, will users see that progress is made towards the goal.

Each of the criteria will then be addressed as “yes” and “no” answers by the team after performing the evaluation.

Pluralistic walkthrough

Much like the cognitive walkthrough, the pluralistic walkthrough is performed by a team. However, the team has a varying competence. The walkthrough has five characteristics, the first of which is the team with different competencies. Second, the system is presented as a low fi prototype or hard copy panels of a scenario. Thirdly, the team assumes the role of the intended user when conducting the walkthrough. Fourth, the participants write in detail what they would do in the presented scenario, and after that they have a common discussion about the results. And finally, fifth, the common discussion always starts with the team representative and after their comments the other members of the team can present their opinions. Pluralistic walkthroughs can be performed early in the system development process. (Thorwald, Lindblom & Schmitz 2015.)

Feature inspection

In feature inspection, different sequences of features that are used to execute typical tasks, complicated steps, steps that users would not try naturally, steps that require experience and long sequences are listed (Nielsen 1994).

Consistency inspection

Consistency inspection is conducted by designers who have multiple projects. They inspect the target interface and evaluate whether the interface performs similarly to their own designs. (Nielsen 1994.)

Standards inspection

Whether the interface being evaluated follows common standards and compliance is measured by an expert with expertise on interface standards, who conducts the standards inspection (Nielsen 1994).

Formal usability inspection

Most appropriate for complex software, the formal usability inspection is used by product teams tracking usability defects and establishing a process to manage major usability bugs (Wilson 2024). First, a team of four to eight inspectors is assembled, and each is assigned a role in the inspection context. The design documents are distributed to the participants to be inspected and each inspector conducts the inspection individually, after which all inspectors are gathered in a formal meeting. The found defects are forwarded to responsible parties to be corrected. (Information Technology Systems and Services 2024.)

1.2 Other noteworthy metrics to evaluate usability

1.2.1 SUS

System Usability Scale (SUS) is a simple scale that offers a global view of subjective assessments of usability. SUS consists of ten statements to which the respondent answers according to their agreement or disagreement using a five-point scale. The questions used are in Table 2. The SUS was developed by Digital Equipment Corporation. (Brooke 1995.)

Table 1. System Usability Scale (Brooke 1995).

1. I think that I would like to use this system frequently
2. I found the system unnecessarily complex
3. I thought the system was easy to use
4. I think that I would need the support of a technical person to be able to use this system
5. I found the various functions in this system were well integrated
6. I thought there was too much inconsistency in this system
7. I would imagine that most people would learn to use this system very quickly
8. I found the system very cumbersome to use
9. I felt very confident using the system
10. I needed to learn a lot of things before I could get going with this system

The respondents answer these questions using a five-point scale, where one is “Strongly disagree” and five is “Strongly agree”. The results are then collected, and points are calculated.

Scores of individual items are not meaningful without correct calculations. The scoring has a range of zero to hundred. (Brooke 1995.) An average SUS score is 68, which means that a score above that can be considered above average (Sauro 2011).

1.2.2 United States official website factors

United States official website (General Services Administration 2024) states six factors, that should be considered when evaluating website usability. First, intuitive design, which means that the site architecture and navigation should be effortlessly understandable. Second, ease of learning, which measures how fast a first-time user can perform tasks. Third, efficiency of use, which measures how fast an experienced user can perform tasks. Memorability is factor four, and it measures if a user can remember enough to use the site efficiently in the future. Fifth factor measures, how frequent and severe any errors that users make while using the site are, and how well the users recover from the errors. Finally, the sixth factor measures the subjective satisfaction of the users.

1.3 Accessibility in technology

Digital accessibility is closely connected to usability, and it addresses issues that individuals with disabilities may have using digital systems, websites, and other technology: digital accessibility aims at expanding the user-friendly characteristics by responding to the needs of disabled individuals. (Joyner 2022.) Digital accessibility means, that users should be able to perceive, understand, navigate, interact, and contribute to the web, and it should consider all disabilities including auditory, cognitive, neurological, physical, speech and visual disabilities (Lawton Henry 2022).

The significance of accessibility is growing, because it can increase brands' reach and recognition and maximize customer satisfaction (Joyner 2022). European standard EN 301 549 offers official and demanded directions for designing accessible solutions to digital systems and websites. The standard requires that systems follow, for example WCAG (Web Content Accessibility Guidelines) directions. (eAccessibility Joint Working Group of CEN/CENELEC/ETSI & ETSI Technical Committee Human Factors 2021.)

1.3.1 WCAG

WCAG, or Web Content Accessibility Guidelines, are guidelines that the European standard EN 301 549 instructs to be used when designing accessible systems. The standard requires that such systems meet the A- and AA-level criteria of WCAG (Aluehallintovirasto 2024). Level A is the minimum level of accessibility, level AA includes higher requirements but also includes all A level requirements. The third level is AAA level, which has the highest requirements and additionally includes all requirements from A and AA levels. (Inclusion & Accessibility Labs 2024b.)

Level A, AA and AAA requirements

In WCAG 2.1., level A can be described as the basic accessibility level. These criteria are essential for every website or web-like application. There are 30 criteria in this level, such as a rule for non-text content having a text equivalent, the access for assistive technologies should be allowed, and a rule that users must have access to the content using only the keyboard. (Inclusion & Accessibility Labs 2024b.)

A product that meets the criteria of level AA meets also all the criteria of level A, but there are additional 20 requirements, some of which include rules for minimum contrast for text and background, content being organized under headings and using a logical order, and navigation elements being consistent across the site or system. Most accessibility experts recommend this conformance level, and it is demanded by the European standard EN 301 549 that websites meet the requirements of level A and level AA. (Inclusion & Accessibility Labs 2024b.)

The highest requirements are set in the level AAA, that includes all the criteria from both levels A and AA, and an additional 28 requirements. For example, prerecorded video content must have a sign language translation, or the minimum contrast ratio between text and background should be 7 to 1. (Inclusion & Accessibility Labs 2024b.)

POUR

The main principles for web content accessibility that WCAG provides are known as POUR: Perceivable, Operable, Understandable and Robust (World Wide Web Consortium 2024a).

To make the content perceivable, presented content must be visible to users' senses and, for instance, alternatives for non-text content should be provided so that the content can be changed into other forms, such as translations, simpler language, or large print. (Inclusion & Accessibility Labs 2024a.)

The components and navigation can be made operable by adding other means than the most evident one to operate the interface e.g., the keyboard can be made accessible, so individuals with disabilities can use the system without a mouse. (Inclusion & Accessibility Labs 2024a.)

Understandable content can be achieved, for example, by offering labels and instructions to users in situations where content requires input from the user, e.g., login forms (Inclusion & Accessibility Labs 2024a).

Robust content means that the information can be interpreted by different user agents, such as assistive technologies, that are constantly evolving. Parsing can be an example of this. (Inclusion & Accessibility Labs 2024a.)

3.1.1 USWDS

The United States Web Design System (USWDS) offers components and guides for accessible web design. The USWDS states examples of accessible design factors that need to be considered when designing sites and systems considering the perspective of individuals with common disabilities. The USWDS also provides key accessibility considerations. They are shown in Table 3. (General Services Administration 2021.)

Table 2. Key accessibility considerations (General Services Administration 2021).

Can users navigate your site using only the keyboard?
Can users use a screen reader to access the page content?
Can users quickly understand the main points of your content?
Can users easily interpret content associated with graphic elements?
Can users easily understand and complete key tasks?
Are you testing your service with a broad range of users?
Do you know your agency accessibility team?
Is your site organized such that everyone can navigate it easily?
Are you using accessibility testing tools?
Did your accessibility testing tools provide accurate results?
Are you providing content in languages other than English as appropriate for the audience?

When using the USWDS guidelines it is important to remember, that they are designed to be used in United States, and although they have useful considerations for international use, e.g., the localization and internationalization should be used in the right context. The original language and ethnical differences can vary according to the region the system is designed in, but the logic behind the USWDS remains the same.

The most common disabilities according to General Services Administration (2021) are mentioned below, and some of the most important factors to consider are included.

Blind users

For blind users USWDS encourages using screen readers and e.g., braille displays, or other assistive technologies, as well as providing text equivalents for visual resources. Additionally,

informing the user about site state changes, and assuring all content has clear content and labeling are also important practices. (General Services Administration 2021.)

Limited-vision users

The readability and scalability of the content is mentioned to be important, in addition to linear layouts and adequate visual contrast. Colour-dependent functionalities and hover for critical information should be avoided. (General Services Administration 2021.)

Deaf users

For deaf users the design should provide text equivalent for possible audio resources and audio-exclusive functionalities should be avoided (General Services Administration 2021).

Limited-mobility users

Linear keyboard-only and touchscreen functionalities and conventions should be supported for users with limited mobility. It is also recommended that the layouts are linear and critical information should not be hidden behind a hover functionality. (General Services Administration 2021.)

Sensory-sensitive users

USWDS recommends that the site or system is designed to be as simple as possible. Flashing and repetitive animations should be avoided, as well as high contrast, alarming colours and images and automatically starting audio or video content. (General Services Administration 2021.)

4 Designing guidelines

What is common between the different usability inspection methods is that they consider different usability aspects of the artefact, system, or service in question. They aim at providing help for usability evaluation from different perspectives. What they have in common is that the user should be at the center of the design and development processes.

4.1 Aspects of user interface

User interface (UI) is the level where users interact with the system, and thus designing the interface is a vital segment of developing a usable system. However, even an attractive user interface does not equal to good usability and can, in fact, even complicate the usability testing. This phenomenon is called the aesthetic-usability effect. Kate Moran (2017) states, that users tolerate minor usability issues more, if the interface in use is visually appealing, and that can lead to masking user interface problems during usability testing and thus hinder the discovery of issues. According to Moran, the aesthetic-usability effect signifies that people perceive visually pleasing products to be more usable.

The aesthetic-usability effect needs to be considered during development, and the usability evaluation should start at an early development phase, even before a user interface is designed. According to Moran (2017), the users can be guided to think beyond the user interface during the usability testing, so the test results provide proper findings; it is also worth noting that the aesthetic-usability effect can be seen as a positive concept in the final product, because if there are some minor issues with the system the users are more likely to ignore them.

User interfaces should be designed to be as simple as possible, since all additional information or features are one more aspect of remembering, learning and possibly misunderstanding. If possible, all shown information should be relevant to the user and it should be shown at exactly the right time and place where it is needed. If there is excess information on the screen it risks confusing the novice users and slows down the expert users. This applies also to the choice of features available for the user. Nevertheless, offering alternatives is often a good quality of designing systems, and can be done, if the users can easily recognize which approach is optimal for the task at hand. (Nielsen 1993.)

Prototypes or mockups should be used to measure usability from the start of the design process, because changing them is less costly and faster than the product. There are two prototyping dimensions: horizontal and vertical. The horizontal prototype keeps the system features but eliminates the functionality depth, whereas the vertical prototype gives full functionality for only a few features. Scenarios are minimalist prototypes, that include a single interaction for the user. A good prototyping tool and an expert to use it are important investments, since it may take a long time for someone to learn the prototyping tool effectively. (Nielsen 1993.)

4.2 Users

It can be argued, that evaluating system usability is not possible without defining the intended users of the system, the tasks that the users will perform and the physical, organizational, and social environment characteristics the system will be used in (Brooke 1995). Considering the intended users should start the designing process and the concept of user should include all the different users who work with or whose work is affected by the product. For example, their work experience, age, educational level, and previous computer experience can be used to estimate possible difficulties they might experience while using the system. The time available for training the users in the use of the system will affect how complicated accomplishing the tasks can be designed. It should also be considered that users will evolve using the system, and while this cannot be completely forecasted, flexible design will be more likely to support the new uses. (Nielsen 1993.) Flexible use can include shortcuts for common actions, for example.

A pool of representative users who can have access to the system or prototype is important for the design process and it should be noted that the pool should be refreshed periodically, especially for larger projects, because the new users do not know the history of the design and are therefore more likely to question possible design problems. Every user is also different and pays attention to different aspects of the design. Including users to the design is called participatory design. (Nielsen 1993.)

According to Norman (1988) designers are not the typical users, instead they are experts on the device, service, or in this case, the system. The intended users are experts at the tasks, and the only way to learn if the users can understand the product is to test the design with the users. The interaction should happen in the early phases, so it is not too late to make possible fundamental changes to the product. (Norman 1988.)

4.3 Language

The language used in the system should be as intuitive as possible for the intended user and the terminology should fit the use. System-oriented terms should be avoided in e.g. error messages, so the message offers concrete information and solutions for the user. The correct measurement units for the region should also be used. (Nielsen 1993.)

User-oriented terminology also includes metaphors, such as icons (Nielsen 1993). An example of this may be deleting an item with a trash can icon since trash can as a metaphor refers to disposing objects. Although, metaphors can pose potential problems with internationalization; different metaphors have different meanings or no meaning at all (Nielsen 1993). Internationalization is needed, if the system is meant to be consumed internationally, and not only language should be considered, but also other items in the system (Nielsen 1993).

Internationalization is a process that aims at designing systems that meet the needs of users with different nationalities. This does not only include the language of the system, but also icons and other visual objects in the system, e.g. word length may differ between languages and that may raise issues with designing the layout objects such as buttons. (Hayes 2021.)

4.4 User errors and error correction

According to Norman (1988) humans tend to make errors in various situations, and there are two designing lessons to be learned from that. Firstly, preventing errors before they happen, and secondly, correcting the errors when they do occur.

Even if the system is designed to be as easy to use as possible, the system users may still make errors. Good error messages provide necessary information on the error, offer a way to solve the problem and are easy to understand. The best scenario is that users would not make any errors during their usage of the system, but there are some error-prone actions, such as user spelling an input, that can often lead to errors. Preventing errors can be achieved for example by adding confirmation messages, that ask the user if they want to commit the action they are doing. (Nielsen 1993.)

Notifications or confirmation messages do not, however, always prevent the error from happening. For example, when user wants to delete a certain file, they do not necessarily confirm the file they want to delete but the action instead. Thus, when the system asks for confirmation, the user may confirm the action without verifying the file they are about to delete. A secondary location for the deleted file can be an answer to these kinds of situations, such as the bin in computer operating systems. (Norman 1988.) In a retail back-end system this could be solved by not deleting most important entities from database only by the user actions, but it would require an admin or a service desk user to delete the entity permanently. An example of this may be for example naming the action performed by the user as “remove” rather than “delete”, or using other methods for controlling entities, such as using an “in use” selection possibility, that would set the entity either an in-use or not-in-use state depending on the selection. All actions in a system cannot be solved by this logic, but informing the users of the result of the action they are about to commit can prevent some errors. An informative notification, that the user needs to dismiss before continuing can be one possible solution for this.

4.5 Consistency

Nielsen (1994) states that in a consistent system content should remain the same as in other parts of the system, and (1993) that content should not leave the user wondering whether different words, actions, and situations lead to same results. This can be concluded to also mean, that in places where it is not possible to keep the content identical, it should be designed to remain as similar as possible for the system to be easily rememberable and facilitate recognition in new system areas.

4.6 Minimizing memory load

Objects or functions that require user memory should be avoided as much as possible when designing any systems. Use of generic commands can be mentioned as an example of this,

where user knows exactly what the simple command means throughout the system. (Nielsen 1993.) For example, a button that includes the word “new” always means that the function creates something new depending on the context. The user will know what this means with little effort. This also contributes to designing consistent structure and functions for the system. However, using the word “new” may not be enough in all situations. In Picture 1 there are three examples of a button designed to allow a user to create a new product. The buttons look similar, but the content is different; the highest button includes only the word “product”, the middle button includes the word “new” and the lowest button words “new product”. The most informative of the three is the New product -button, because it clearly states, what the button does and is not ambiguous, unlike the other two which may have multiple meanings; the button with only the text “product” could, for instance, include a possibility to inspect a product’s information instead of creating a new product, and the button with only the word “new” does not indicate what is created when the button is clicked.

Picture 1. Three examples of possible buttons which allow a user to create a new product.

As far as possible, the users should be able to operate the system without any instructions or labels (Norman 1988), and this relieves the users’ memory load, as they do not need to memorize different steps or operations from manuals or other forms of instructions.

4.7 Guiding the user

Users sometimes may need guidance even with the easiest and simplest systems (Nielsen 1994), and with a large and complicated system like a retail backend system can be, this is inevitable. According to Nielsen (1993) help and documentation should be offered and be easy to find, it should focus on the user’s task and include steps for the intended result, and the documentation size should not be too large. Designers should not, however, rely on help documentation and overlook the usability aspect of the system, especially if the customer feedback about the system is negative in terms of usability.

Users rarely use manuals before they absolutely need to, and this is why the manuals should be easily found, and even though manuals often come as physical manuals, in a modern system it would be recommended to include the guide directly to the system. A way to search for specific content about a subject should be included, and it is easily provided in online documentation with features like hypertext and search facilities. (Nielsen 1993.)

4.8 Personalization and customization

Personalization and customization can be provided for the user to improve the system usability, but they should be carefully implemented. Personalization is done by the system, meaning the content, functionality, or experience of the user should match the user role. This should not require any actions from the user, and there are two types of personalization: role-based and individualized personalization. Role-based personalizes the user experience according to previously known characteristics, such as user rights or their given user information. Individualized personalization is done by collecting information of the user's actions when they use the system. (Schade 2016.) The latter is not needed for a retail back-end system, since user rights determine the users' role, actions, and possible functions, and they do not need any further personal actions.

Customization, on the other hand, is done by the user, and can include modifying layout, content, or system functionality according to the user's needs and preferences, for instance, what kind of feedback they want to receive, or how given information is organized or displayed. (Schade 2016.)

Personalization according to user rights and their roles is compulsory in a system, that users with different roles have different rights and possibilities to use the system and e.g., possibly fundamental aspects for products or services. Customization can be used to enhance the user experience, but according to Schade (2016) it should not be used to fix a broken or poor site or system. It is recommended that this aspect of the system design should be implemented only after the system is otherwise implemented to be as easy to use as possible and is ready to use.

4.9 Standards

In a situation where there are no other solutions, standards should be followed. The ISO 9241-11 is the standard that offers usability information from the information technology perspective. It defines the used key terms and concepts, identifies the fundamentals of usability, and provides information on how to apply the concept of usability, as well as the relevance of usability. (International Organization for Standardization 2023.) It is recommended that designers familiarize themselves with this standard, so they can utilize the standard in their design work from the beginning and possible difficulties in designing areas that the standard gives answers to can be avoided.

4.10 Mobile or desktop

One thing to take into consideration is if the system needs a way for users to use it on mobile devices or desktop devices. Users prefer making critical actions with a desktop, but on the other hand the usage of mobile applications has risen radically in the last 10 years and the trend is continuing. (GEOBO 2022.)

It can be argued that the general users' needs, and use of the system are the main points of view to consider in addition to technical design. If the users need to make a lot of critical decisions and execute critical actions when using the product, they tend to prefer to use the desktop (GEOBO 2022). The desktop and mobile applications answer different kinds of needs. Mobile apps are generally meant for faster use with possibly limited time for executing tasks, whereas desktop users can execute more in-depth tasks. Many enterprise applications are first designed for desktop and possibly later for mobile. (Bharadwaj 2023.) It should be considered if the tasks meant to be executed on the system are of a large and complex scale, or a small and simple scale, or both. One important aspect is if the use of the system or application should require a download for it to work (Bharadwaj 2023). Responsive web view can be a solution for this, if developing a mobile application is not a plausible option, but some functions of the system are desired to be used remote from the desktop. Nevertheless, it is important to weigh all possibilities and focus on the users' perspective and needs.

5 Results

From the source material, it was found that evaluating usability and designing easy-to-use systems and web applications are closely related and the same principles of usability and accessibility affected both; evaluating usability is based on the same usability and accessibility principles as designing highly usable systems, and they are in close association with each other. This is why the guidelines were also designed to answer both needs, and thus, can be used for both purposes.

The results of surveying different usability inspection methods, designing instructions, and accessibility requirements in addition to my experience from the industry can be used to design guidelines for developing easy to use retail back-end systems and evaluating their usability in expert reviews. Some of the guidelines are common between variant kinds of systems and are not dependent on the type of system in question. The designed guidelines are combined in a list that offers help for designing and usability evaluation done during the development process, and for design coherence, the guidelines should be used throughout the design and development process. The list can be examined in Table 4.

The list consists of 22 different guidelines, that combine the essential parts of notice for usability evaluation done during design process or development. In the list there are numbered list items and their explanations.

The list takes into consideration whether the developed system should be designed for mobile or desktop, or both, according to the findings; users tend to execute critical actions on desktop but using some system functions with mobile could enhance the usability of the system when users can access the information away from the desktop. This needs to be a discussion for the development because developing desktop and mobile applications differ.

According to findings, accessibility is an essential and mandatory part of the design and development process, and it should be considered from the very beginning. In the list there are some notes collected from the accessibility requirements mentioned in chapter 3, so the list reminds the designers or developers of the main issues that need to be taken into account. The list does not include all requirements, though, because the requirement quantity is quite large, as mentioned before in chapter 3, and the guidelines list would be long and thus the usability of the list would be lower. This is why only some advice is included, however, the European EN 301 549 standard is mentioned in the description, so the designers or developers know where to search for more information.

Prioritizing intuitive solutions over memorizing, and learnability are included in the list, as well as the importance of consistency throughout the system. Training time and necessary tasks' visibility are especially mentioned in the list because they are the key points of these instructions, along with overall consistency of all elements, steps, functions, and terminology.

Language and terminology should be industry related and specific, and it should follow real life words and phrases instead of system-oriented ones. For example, it could be better to include a "product selection" phrase instead of a "product database" phrase. Possible translations for localization or internationalization should always be made by native speakers who are experts

in the retail field. This ensures that the language and phrases are correct for each language region.

The system visibility is important and thus it is included in the list. The users should always be able to tell which state the system is in and it should be shown informatively. Possible actions and the results of those actions should be visible.

All user groups and types of intended users must be considered, and the experience of the system should be personalized according to their needs. A franchise admin may have wider user rights to different parts of the system than a dealer, for example. It should also be thought, who can control these given rights.

The intended users should be considered in every aspect of the design process. As mentioned in chapter 3, designers are not the intended users of the system, and this is why they need user testing to be able to contemplate the design usability. The different aspects of including users in the design and development process are highlighted in the list but no specific instructions can be given in these guidelines, because every situation demands different kinds of user testing and user involvement.

Customer specific functions can vary between franchises and the system must be agile to answer many different needs. Designing with the customer is a good way to map possible needs and prioritize them to different stages of the development process. Prioritizing is essential for system development because it can help determine e.g. the pricing of the system and different functions.

Similar functions should be grouped together so they can easily be found. For example, settings can be divided to general settings and organization settings according to the function; settings related to the organization can be grouped in organization settings, and settings that affect the system in general can be included in the general settings. The arrangement of menu elements should be intuitive, and the most frequently used functions should be the easiest to find.

Effective shortcuts should be designed for the more experienced users who know they do not need to finish every step in a task. The shortcuts can be used to e.g. to create a new product from anywhere in the system or duplicate the selected product. The shortcuts must always be considered carefully using intended users for information about needed shortcuts, and they cannot replace the more apparent steps for achieving the corresponding action, but instead they should enhance the experience of the more experienced users.

Error management is essential for a well-functioning and highly usable retail back-end system. One aspect of this is error prevention, which aims to prevent users from making mistakes. User errors cannot always be prevented, but some errors can be prevented with careful designing. The user should always be aware of the actions they are executing. This can be achieved e.g. with notifications, when the user is executing a major change to the system. However, notifications may not always be enough to prevent errors from occurring; deleting a product from the database may not be reversable and then deleting it accidentally should be otherwise prevented. One way to prevent the user from deleting important information could be to not let the user delete the information at all. Instead, the information could be set to a not-in-use state and deleting the information from the database could be committed by an admin user if it is necessary. Backtracking in the system should be possible e.g. through dialog or a shortcut,

such as the undo function. Users should be able to avoid major changes from occurring by reacting to appearing notifications, which should have the cancel function available, if possible.

The second aspect of error management is error messages. They need to be understandable and offer as much information about the occurred error as possible, e.g. it is more informative to have an actual explanation of the error than the error code that is meant for the troubleshooting party; “error 404” is less informative than “file not found”. A good error message also includes a possible solution to the error, such as re-entering a wrong password while logging in. Polite and simple language is also to be used.

If there is no apparent answer to a design question, standardizing the design should be the solution. The ISO 9242-11 standard has suggested solutions to varying situations, and it should be recommended that the system designers familiarize themselves with the standard.

Users may need directions to a situation and guidance that is offered directly where it is needed is better than relying on one large manual. This can include e.g. tooltips or hover effects that can give precise guidance in a complicated or error prone situation. Additionally, manuals should be offered. A good manual includes clear steps for tasks and is easy to understand. Manuals should be easy to find and navigate, and the used language should be clear and simple.

Customizing the back-end system can also be a way to enhance the user experience, but it can be thought of as an extension for the functions that are necessary for the system. The users can be offered a way to affect the layout or to control their own profile, such as changing the password. In addition, expert users can benefit from personal hotkeys.

Finally, user testing is essential for both evaluating the system usability and good design. Users should be included in the design and development process from an early stage. This can be achieved by providing prototypes on small and large scales. These can be used to find possible issues in the design from the beginning. In addition, time and effort is saved. Using different user testing methods provides more and different information of the system and offers a better image of the system usability, and this is why using several methods for usability testing is recommended. The final note for user testing is that real system users should be used as much as possible to provide the most accurate information. Using only experts from inside the development company may offer some insight, but real intended users can have different perspectives.

6 Conclusion

The goal of this thesis was to provide broad guidelines for evaluating the usability of a retail back-end system. Multiple sources were used to inspect the different usability evaluation aspects and accessibility requirements which should be included in the list. The sources were selected to include a wide pool of information. Upon inspecting the source information, it became apparent that evaluating and designing systems, websites, and applications are so closely related, that both aspects needed to be taken into consideration during this thesis. Thus, the provided guidelines include steps that can be used in both evaluating the usability and designing the retail back-end system. Information for the guidelines was collected from various books and online references, and it was gathered as a 22-step list of guidelines. The guidelines include all information that was found relevant to the broad rules of thumb, that the guidelines are meant to be.

Several varying methods can be used to evaluate usability, and although this thesis aimed for providing guidelines for doing so without user testing it is noteworthy that user testing should always be used in addition to other inspection methods to achieve the most informative evaluation. Including expert reviews, in which the guidelines designed in this thesis can be used, can enhance the evaluation results, but it cannot be recommended to only rely on them. The designed guidelines table can, however, be used to support the designers in the design process. However, it should be noted that designers are not the intended users of the system: what may seem easy-to-use for them might not be so for the users.

The gathered information from examining different kinds of usability inspection and designing methods was similar between the methods and guides. The designed guidelines are based on these findings and provide easy-to-follow steps to evaluate the system usability in the varying development stages. The guidelines should be used continuously throughout the process for coherent design.

To further design the guidelines provided in this thesis, a survey of precise user groups and functionalities is required, but that would mean that the guidelines were for a specific retail back-end system, and not to be used widely across the industry of designing these kinds of systems. This was not the thesis goal, and because of that the designed broad guidelines are sufficient at the present time. The organization developing the system should invest on a more precise evaluation plan and widen the scope of the provided guidelines by adding user testing to the agenda, and they should specify the exact customer needs to achieve the best possible solutions.

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Appendix 1. Nielsen’s heuristics

Table 3. Nielsen's heuristics (Nielsen 2020).

Visibility of system status	The system status should be visible for users by informing them of it through appropriate feedback within a reasonable time.
Match between system and the real world	The system language should be the same as the user's: words, phrases, and concepts rather than system-oriented terminology. Real-world conventions should be followed to make the information appear in a natural and logical order.
User control and freedom	Users can choose functions by mistake and a clearly noticeable exit from the unwanted state without extended dialogue is needed; undo and redo are good examples of this.
Consistency and standards	There should not be different words, situations or actions that mean the same thing across the platform.
Error prevention	Good error prevention in design is always better than error messages. A good design can prevent errors from occuring.
Recognition rather than recall	Objects, actions, and options should be visible and easily recognized and the user should not have to remember information from other parts of the dialogue to another. Instructions should be readily available or easily retrievable whenever possible.
Flexibility and efficiency of use	Accelerators can possibly make the interaction faster for expert users. Frequent actions should be possible to be tailored.
Aesthetic and minimalist design	Interfaces should not contain information that is irrelevant or rarely needed, since all extra content of information diminishes the relevant units of information's visibility.
Help users recognize, diagnose, and recover from errors	No error codes should be used for error messages, instead plain language should be used. Precisely indicating the problem and suggesting a solution for it is good usability.
Help and documentation	If the system needs additional explanation, it should be provided as documentation.

Appendix 2. Usability evaluation and design guidelines

Table 4. Usability evaluation and design guidelines.

1. Mobile or desktop	It is recommended to allow users to execute critical actions on desktop, but an additional mobile application or responsive web view may widen the possibilities of using some of the system functions outside of the office. The development requirements differ between these two applications, so a discussion before the decision is needed.
2. Consider accessibility	Colors, fonts, shapes, and icons should be easily recognized, noticed, and understood even if users have some sort of visual disabilities. Simplify the design and add high enough contrast. Navigating the system without a mouse should be possible. Using assistance systems, such as text-to-speech systems should be enabled. - Follow the European EN 301 549 standard requirements. - The system should meet at least the levels A and AA requirements that are set in the standard.
3. Prioritize intuitive solutions over memorizing.	Use informative terminology, recognizable icons, and other elements. Make the necessary task steps clear for the users.
4. Make it learnable.	Consider the time and effort that can be used to train the users.
5. Be consistent.	Logic should remain the same throughout the system. Keep key elements, such as buttons and icons, the same. Use the same terminology throughout the system.
6. Use industry specific language.	Terminology should match the industry terminology and language should follow real life words and phrases. System-oriented phrases and words should be avoided.
7. Hire native speaker experts for possible translations.	This ensures the terminology and phrases are correct for each language region.
8. Visibility is key.	Show possible actions and the results of the actions. The state of the system should be visible and easy to understand.
9. Consider all different users.	Use personalization for different user groups with different rights. Consider who can control these rights.
10. Involve the potential customers into the development process from the start.	Without the customer perspective the system cannot be designed according to their needs. Have discussions and utilize user testing for this purpose.
11. Survey what functions are necessary for each customer.	These can vary between franchises and even sites in franchises. Ensure the system is agile and can be modified according to customers' needs. Utilize discussions with the customers to prioritize different needs to varying stages of the development process.

(continues)

Table 4. Continues.

12. Use logical arrangement of functions.	Group similar functions together and arrange menus intuitionally for the intended users. Make the function steps apparent. Most frequently used functions can be arranged to be the easiest to access.
13. Design effective shortcuts	Expert users may want to use shortcuts instead of the most apparent steps.
14. Prevent errors.	Clear indicators of possible error situations e.g. notifications. Enable backtracking in the system. Inform users if changes they make are major. Prevent users from permanently deleting important entities from database.
15. In case of errors, offer clear error messages	Use simple, polite, and understandable language. The messages should include precise information and offer help in the situation.
16. Use standards if there is no good solution	The ISO 9241-11 standard should be studied for this purpose. It is recommended for the designers to familiarize themselves with this standard.
17. Offer guidance directly where it is needed.	Use e.g. tooltips or hover effects to give precise guidance in situations that are error prone or might need further explaining. Do not hide critical information to tooltips or hover effects, they should otherwise be apparent in the page.
18. Offer manuals.	Make sure they are easy to navigate and find. They should have simple and understandable language. Include clear steps for functions.
19. In addition, consider offering the user a possibility to customize the system.	Layout modifying or controlling profiles can be used to make the system more personal. Adding personal hotkeys can improve the system usability for expert users.
20. Include user testing from an early stage of the design and development process.	Provide prototypes on small and large scales, which can be used in the earliest testing to find possible issues from the beginning. This also saves time and effort.
21. Use different testing methods to receive as much information as possible.	Using several different testing methods provides different results and from the results a better whole image of the state of the system can be reconstructed.
22. Use real users for evaluation as much as possible.	Using real potential users for usability evaluation offers different perspectives than using only expert users from e.g. inside the development company.