A Usability Evaluation of Airline Websites in Northern Europe

A Comparative Study of Finnair, SAS Scandinavian Airlines, Norwegian Air Shuttle, and Icelandair Group

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Abstract:

This comparative study evaluates the usability of four Northern European airline websites; Finnair, SAS Scandinavian Airlines, Norwegian Air Shuttle, and Icelandair Group, using Jakob Nielsen’s heuristic evaluation and usability heuristics. The aim is to detect issues in websites and compare findings using descriptive, comparative, and qualitative content analyses, supported by an expert evaluation. The study underscores the significance of usability, UX and CX in the airline industry where online ticket purchases rank as the third most common online transaction. Significant usability issues are identified across websites, with Finnair exhibiting the highest number of issues. Problematic areas include 'help and documentation' and 'user control and freedom'. Despite variations among websites, 'consistency and standards' and 'recognition rather than recall' show challenges across websites, suggesting the applicability of general usability guidelines. The study recommends usability evaluations integrated into the web development process and addressing major usability issues promptly to avoid negative impacts on sales revenue. It suggests that digital-first airline websites have fewer usability issues compared to older counterparts. Limitations such as the lack of experienced evaluators and the small number of evaluated websites, are acknowledged. Overall, this study contributes to the usability evaluation in e-commerce in the context of airline websites, and emphasizes the importance of prioritizing user experience to remain competitive in the digital landscape.

Keywords:

Usability evaluation, usability inspection methods, heuristic evaluation, usability heuristics, user experience (UX), customer experience (CX), user interface (UI), airline websites

Contents

Figures

Tables

1 Introduction

This is a comparative study about the usability of four Northern European airline websites; Finnair, SAS Scandinavian Airlines, Norwegian Air Shuttle, and Icelandair Group. The chosen method for this research is usability evaluation using Jakob Nielsen's (1993) heuristic evaluation and ten usability heuristics as the main principles and tool for the usability inspection.

The concept of website usability falls under user experience (UX), which means that in a broad sense this research can also be viewed as user experience research. Furthermore, as user experience is a part of the theoretical framework of customer experience (CX), it means that from a holistic point of view this research also falls under customer experience research. CX covers all interactions and touchpoints across the entire customer journey, meanwhile UX is a subset of CX and focuses on the digital user experience and ensures it meets users' expectations. Usability on the other hand, is a component of both CX and UX and focuses on practical user interaction and ensuring that systems are easy to use and that users achieve their goals. Ultimately, CX, UX and usability all contribute to a positive overall customer experience which is presented in Figure 1. (Interaction Design Foundation, 2023)

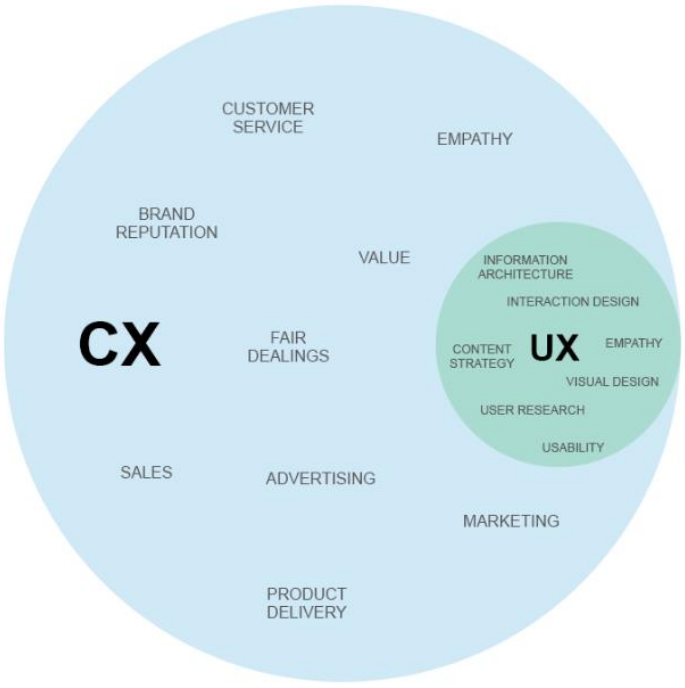


Figure 1. CX, UX and Usability as a concept. (Iyer, 2016)

The effortless usability, functionality, convenience, and user-friendliness of the website should be among the top priorities for any business, especially if they have e-commerce as one of the sales channels or as the main sales channel. The reasoning for this statement is, that in many cases the website is where a big proportion of the sales revenue of these businesses comes from. According to an e-commerce report from Statista (2024), the proportion of e-commerce of total retail sales has been growing during the recent years and is estimated to increase as high as one-fourth of global retail sales by 2027.

In addition to the increasing sales revenue perspective, a study from Jakob Nielsen (2011) encourages especially e-commerce businesses to improve the website usability because of increased competition in the field that pressures the websites to become better and satisfy increasingly demanding customers, with not only functioning but a pleasant overall customer experience.

Prioritizing user experience is essential for businesses looking to succeed in today's digital landscape. By understanding and meeting the needs of users, businesses can create products and services that are both valuable and enjoyable to use. A positive user experience leads to improved customer satisfaction, it encourages customers to return, and it increases brand loyalty and engagement. In today's competitive market, providing a superior user experience can be a key differentiator. (Luther et al., 2020)

1.1 The aim and research questions

The aim of the research is to detect and define any identifiable usability issues in the four airline websites that are selected as a part of this research, by using heuristic evaluation as the means of analysis. The research also aims to make feasible comparisons between the findings of the heuristic evaluation with comparative analysis and qualitative content analysis.

The following research questions are aimed to be responded to in this research:

1. What usability issues are detected in the websites that are a part of this research?
2. What comparisons can be made between the findings of the heuristic evaluation?

1.2 Motivation for the research

The topic of the research is relevant and purposeful because the scientific research around the user experience related topics has been on the rise over the recent years and the significance overall has been increasing, since the field is still rather new. This also means that the field of customer experience and user experience offer plenty of possibilities for further research in the field. User experience and usability have been mostly researched in the field of human-computer interaction (HCI) and not often in the field of business and e-commerce, even though it has been well established how user experience impacts competitiveness, customer retention and business performance. The user experience research deficiency in the field of business and e-commerce indicates that there are research opportunities to explore. (Becker & Jaakkola 2020; Luther et al., 2020)

As mentioned previously, the competition between websites has increased in a rapid pace and the customer behaviour is changing together with digitalization, which creates a clear research gap and need for research in the field of usability and user experience. This study is going to contribute to user experience research and usability evaluation by offering probable learnings and insights for the field of usability, airline websites and e-commerce that are aiming for improved website usability. Especially this study is aiming to contribute to the usability research in Northern Europe region and its airlines, where comparative usability research has a lot of undiscovered potential. (Nakushian, 2020)

Motivation for the research originates from the author's own professional experiences and discoveries from various websites, including airline websites. Having been working closely with e-commerce and websites for years, the existence of websites with poor level of usability has become apparent to the author. Author's curiosity towards understanding the usability issues of websites has grown and the demand for researching the topic further has developed in the process.

1.3 Scope of the research

As established previously, the scope of the research is user experience research with a focus on usability evaluation of websites by using heuristic evaluation as the method. After reviewing websites from various fields, airline websites selling commercial flight tickets online via their own website, are chosen as the topic of the research. The airline websites are chosen because

airline industry provides an interesting field for exploration and because as products, commercial airline flight tickets are clear, easily understandable, and distinguishable.

The research focuses on airlines founded and operating in the region of Northern Europe. The selection of airlines in this geographic location is made because of an identified research gap in the comparative usability evaluation of Northern European airline websites. As previously introduced, the selected airlines for this research are Finnair, SAS Scandinavian Airlines, Norwegian Air Shuttle, and Icelandair Group. Finnair is founded and headquartered in Vantaa, Finland and SAS Scandinavian Airlines is jointly owned by the Swedish, Danish, and Norwegian governments and it is headquartered in Stockholm, Sweden. Norwegian Air Shuttle is a low-cost airline based in Fornebu, Norway. Finally, Icelandair Group is headquartered in Reykjavik, Iceland. The selected airlines can be classified as each other's competitors, both regionally and globally, which increases the demand for research on the topic. The mobile apps of the selected airlines, as well as the mobile website versions are left without focus in this research. (Statista, 2023)

To narrow the scope of the research, other airlines are excluded from the research. There are two additional airlines in Northern European region, which are left out of scope of this research. These airlines are Atlantic Airways based in Faroe Islands and Air Greenland based in Greenland. These two airlines are excluded from the research because they only offer domestic flights, opposed to the chosen airlines offering international flights. In addition, Nordic Regional Airlines (Norra) is left outside of scope. Norra is jointly owned by Finnair Group and Danish Air Transport and offers only regional flights and no possibility of purchasing flight tickets directly from their own website, which makes it an unsuitable website for the research. (Centre for Aviation, 2024; Statista, 2023)

Final exclusion to the scope of the research is made in the product offering of the selected airline websites. SAS Scandinavian Airlines, Norwegian Air Shuttle, and Icelandair Group have other services in addition to commercial flight tickets. The airlines have flight complementing services such as hotels, car rentals and vacations. For keeping the scope consistent, other products apart from commercial passenger flight tickets on the selected websites are left out of scope in this research. Airline websites are discussed further in the theoretical framework section of the research.

1.4 Structure of the thesis

The thesis is structured as follows. First, theoretical framework introduces the theoretical foundation for the research, including the presentation of key concepts of e-commerce, particularly in the context of airline websites, relevant terminologies and theories related to user experience, usability and usability evaluation, and prior research focusing on heuristic evaluation and usability evaluation practices in airline industry. Theoretical framework is followed by the introduction of the research methodology and data analysis. Finally, results and analyses are presented and the research is concluded with discussion, conclusions, practical implications, and recommendations for future research.

2 Theoretical framework

As user experience and usability are the main topics of the research, it is important to introduce the theoretical framework and prior research of user experience, usability, and usability evaluation. As a starting point for the theoretical framework, however, it is necessary to begin by introducing other themes that are relevant to this research. As the research is closely connected to the field of airline e-commerce, it is important to have a brief introduction of e-commerce as a field.

2.1 E-commerce

E-commerce has been growing rapidly during the last years globally and it is estimated to keep on growing in the future. Especially the effect of the covid-19 pandemic has been remarkable on e-commerce growth and is estimated to have changed the course of the e-commerce trend for good. Because of the apparent growth trend, the power of e-commerce should not be underestimated. (Alfonso, 2021; McKinsey, 2021; United Nations Conference on Trade and Development, 2021)

By generic definition, e-commerce, or by more formally, electronic commerce, is buying and selling of products or services over the Internet. Buying and selling can be conducted between two parties, both businesses, and consumers. The exchanges occurring between the buyers and sellers are called e-commerce transactions. (Jain, 2022)

Internet, or more specifically the World Wide Web, is the most typical way for e-commerce to take place. In addition to the usage of regular websites on the Internet, there are many other platforms, systems, and technologies for e-commerce transactions. Mobile devices, mobile apps, and forms of social media such as Meta and TikTok, and e-mail are typical examples of these present-day forms of e-commerce. (Jain, 2022)

Cost efficiency plays an important role when the benefits of e-commerce are considered, and this applies to both sellers and buyers. When the transaction and payment are completed electronically, there is no need for a wholesaler or a mediator which makes the transaction more cost-efficient for both parties. Other cost-saving opportunities occur from not needing to have office spaces, physical stores, or many staff members, instead of having only cost for web hosting. (Jain, 2022)

Another important factor is time saved in e-commerce, compared to traditional commerce. As for consumers, they are saving a lot of time when a transaction can happen in a couple of minutes online, instead of physically having to move and spend time travelling to the location of the store, for example. For the same reason, more transactions can take place during a day, which makes it profitably attractive for the businesses. Another gain for both sellers and buyers is the connectedness that e-commerce offers. E-commerce is limitless, when it comes to a physical location and this means easy accessibility and selection for customers from all over the world and for businesses it means reaching more potentially buying customers globally. (Jain, 2022)

2.1.1 Forms of e-commerce

Most usual types of e-commerce include business-to-business (B2B) or business-to-consumer (B2C), or in addition to the most common forms of e-commerce, it can also be from consumer-to-business (C2B) or from consumer-to-consumer (C2C). Companies such as Amazon, eBay, Rakuten, AliExpress, Alibaba, and Etsy are focusing their entire business on the e-commerce shopping marketplaces. Perhaps the most notorious example of a B2C e-commerce would be Amazon.com, whereas a globally known example of C2C e-commerce is eBay.com. (Jain, 2022)

Retail is perhaps one of the most known areas of e-commerce. Well-known retail online stores include companies such as Asos, Zalando and Zappos, among many others. Many of the companies are targeting specific customer groups such as Net-a-Porter with hundreds of luxury fashion brands for high-end customers. The volume of the retail e-commerce websites is extraordinary. Also, the range of the products sold in these online stores is often notably large. Retail e-commerce websites are often well invested into and have a high level of usability and level of customer experience, which is empowered by the competitive pressure and online store often being the only sales channel in retail. (Graf & Schneider, 2016)

Another field of e-commerce is ordering groceries online. Online grocery stores are almost exclusively local to the market they are based. This is perhaps the biggest contrast to retail online stores that typically have the possibility of shipping internationally. Also, quite often customer’s location defines the specific grocery store that orders can be made from, which means one may not use the services of every grocery store because the online store may not

have the delivery options for one's location. Online grocery stores have not been around for a long time, compared to retail online stores. An important development in the sector of online grocery stores happened during and after the covid-19 pandemic, which pressured the grocery businesses to respond to customers' demand rapidly. (Tyrväinen & Karjaluoto, 2022)

Travel sector has many forms of e-commerce. Examples of travel e-commerce are travelling marketplaces such as Booking, Agoda, Expedia, Hotels, Ebookers and Trivago that offer both flights and short-term accommodations. Another group is formed by travel search sites such as Kayak, Scyscanner, Momondo and Kiwi, which are focusing on selling flight tickets of airlines that they have partnerships with. Many of the travel search sites do not offer purchasing directly on their website, but they redirect the customer to a service provider's website for the purchase transaction. Another field within travel sector are online travel agencies (OTAs) offering travel deals and travel packages. Examples of travel agencies include TUI, Tjäreborg, and Thomas Cook, among others. Finally, as airline e-commerce is the topic of this research, it is discussed more in-depth in the next section. (Polo Peña et al., 2023)

2.1.2 Airline e-commerce

Flight tickets are the third most purchased item bought online, which means airline e-commerce has visibly established its current position online. Airlines have invested in digitalization development from as early as the 1990s and significantly evolved from very basic offline services to a full-funnel platforms with services ranging from self-service and online booking to mobile applications and loyalty program management. Meanwhile, the physical inflight products and destinations cannot be fully digitalized, meaning that airline e-commerce remains only partially digital. (Hanke, 2016)

The first airline websites launched were www.southwest.com and www.cathaypacific.com, which both went live in 1995. That year also the first booking engines for online purchase transactions were launched by Alaska Airlines and British Midland Airways. Japan Airlines was among the first airlines to provide online booking and self-service on smart phones in already 1999, but the mass adoption of smart phones happened globally in 2007 which led to airlines developing their mobile apps and mobile websites vigorously. Simultaneously with the new generation websites, airlines also expanded physically by having localized websites outside of their home countries. These digitalization developments led to competition which

created a need for differentiation and investing on the e-commerce knowledge and resources. (Hanke, 2016)

Two generations of airlines can be distinguished. The old or “legacy” airlines that were established before the digitalization in the 1990s and the new airlines or in other words “dotcom” airlines that were established after the digitalization. Low-cost airlines are typically considered as a part of the latter airline category. Meanwhile new airlines have built their core functions around e-commerce and often have a high level of website usability, the old airlines often struggle shifting their sales online. Both generations of airlines, however, must keep growing their e-commerce capabilities to keep up with the competition. (Hanke, 2016)

Airline e-commerce differs from other types of e-commerce, when it comes to its personal data aspect of the customer. The booked ticket is often tied to the customer personally, meaning the information on the booking must match with the traveller. The amount of personal data input, such as passport and visa information, in the online booking is often quite high, which increases the touchpoints in the buying journey. For an optimized booking experience that does not exceed five clicks, airlines should aim for simplified online booking. (Hanke, 2016)

Even though the core products of airlines are not physical and material in the same manner as in retail e-commerce, airline e-commerce has become closer to retail by having various add-ons and ancillaries such lounge accesses, pre-ordered meals, wi-fi, seat selection, extra luggage booking, and many others. This revenue flow has become so lucrative for the airlines that it is unlikely that the airlines would ever return to the old model without merchandising. (Hanke, 2016)

Customer behavior in airline e-commerce differs from some other types of e-commerce because purchases are often planned well ahead by the customers. The flight itself may take place much later than the initial booking took place. Also, flight tickets are often rather expensive and prices may go increase with time because of the limited capacity on the aircraft, which encourages customers to act on their booking early on. Return policies depend on the purchased ticket type, meaning customers often cannot return their purchases if they change their mind. (Hanke, 2016)

Usability and user experience play an important role for airline e-commerce and websites. Usability is crucial for providing a seamless and pleasant experience for customers when they are booking flights, managing their reservations, and accessing important information. Important sections such as flight search, booking, check-in, and flight status should be prominently displayed and easy to access. Users need to feel confident that their personal and financial information is secure when using the website. By focusing on improving usability and user experience, airline websites can create a more positive experience for users and increase customer satisfaction, retention, and loyalty. (Ani et al., 2019)

As user experience is essential for airline websites, that is the topic of this thesis, the research takes a step towards the core of the theoretical framework of this thesis and introduces the key concepts of user experience, usability, and usability evaluation methods, which provide crucial theoretical background for the subsequent research.

2.2 User experience

As this research is focusing on user experience, it is necessary to define the meaning of user experience and its relevant sub-components. User experience is often formulated in practice simply as "UX" and to explain what user experience really means, ISO 9241-210 (2019) describes it as follows: "A person's perceptions and responses that result from the use and/or anticipated use of a system, product or service." Whereas according to a slightly broader definition formulated by Nielsen Norman Group (1998) "user experience encompasses all aspects of the end-user's interaction with the company, its services, and its products."

When describing user experience, an important part of the definition is the user. ISO 25010 (2011) defines a user as "any individual or group that interacts with a system or benefits from a system during its utilization."

There are five key elements that are included in the definition of UX. The first element is the user or a person, as mentioned above. The second element is a system, which can be either a product, software, service, organization, or brand. The third element is the interaction between the user and the system. The fourth element is how the user perceives the system. This can include for example feelings of satisfaction or frustration resulting from the usage. The last

element is how the user reacts or responds to the usage of the system. These responses are often actions and behaviours of the user. (Voil, 2020)

2.2.1 The importance of user experience

If user's experience with the system is poor, the system is failed. Even though a system can be outstanding from an engineer's point of view, it serves no purpose if the system cannot be used in real life by real users, and the goals are not reached in an efficient manner. As ISO 9241-210 (2019) puts it, "Products, systems and services should be designed to take account of the people who will use them as well as other stakeholder groups, including those who might be affected directly or indirectly by their use." (ISO 9241-210, 2019; Voil, 2020)

Cost reduction is one of the most notable gains of user experience. A well-done user experience can reduce operational staff costs by making staff execute their tasks faster and more accurately. There can also be significant development savings by eliminating the need for user interfaces to be rebuilt because of defects. User experience plays an important role in product development. Products and services that meet people's needs will eventually be stronger in competition and be more profitable and generate more revenue. (Voil, 2020)

2.2.2 User experience and user interface

It is important to differentiate the terms user experience (UX) and user interface (UI) from each other. These terms are often used in the form UX/UI design and used interchangeably in practice, which can misleadingly be assumed of meaning the same thing. User interface design is in fact often considered to be a part of the broader concept of user experience. UI is about the visual design and physical presentation of a product's interface, while UX is about the holistic experience and satisfaction that users derive from using the product. Both UI and UX are crucial components of successful design, and they often overlap and complement each other in the creation of user-friendly and engaging products. The key differences of UX and UI are summarized in Figure 2. (Voil, 2020)

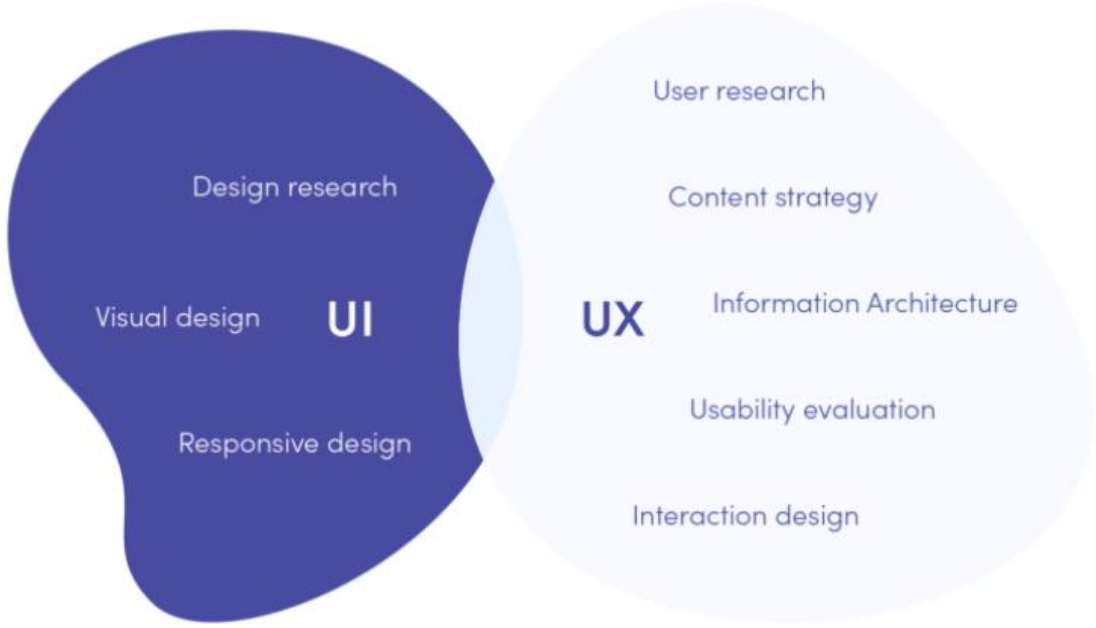


Figure 2. Key differences between UX and UI. (Zielonka, 2021)

User interface design is a part of human-computer interaction (HCI) theory and it studies how computers and humans work together to achieve the human's goals efficiently. The user interface is the physically appearing part of a computer and software that can be seen, heard, touched, or otherwise understood by the human, who is the user of the system. (Galitz, 2007)

User interface consists of two parts, input, and output. Input means the user's ways to give signals of the user's needs to the direction of the computer. Most typical examples of the tools used for signalling the needs are keyboard, mouse, or the user's voice. Output means the computer's ways to transfer the outcome to the user. The most usual computer output mechanism is the display screen of the computer. User interface is designed accurately if it satisfies the user's needs and goals in a way that it lets the user to focus on the information provided, instead of noticing the interface and its mechanisms itself. (Galitz, 2007)

2.3 Usability

A very closely connected but separate topic from user experience and user interface is the concept of usability. Most researchers argue that usability falls under the concept of holistic user experience. The key difference between usability and user experience is, that usability is objectively measurable, whereas user experience is subjective. While usability focuses specifically on the ease of use and efficiency, user experience considers a wider range of

factors, including emotional responses, perceptions, and overall user satisfaction. Good usability is a crucial component of a positive user experience. (Voil, 2020)

ISO 9241-11(2018) defines usability as: “the extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use.” The definition by ISO 9241-11 (2018) consists of users, goals, and context of use, the latter containing further three subparts of effectiveness, efficiency, and satisfaction. By splitting up the definition of usability into smaller pieces, the seemingly intangible concept of usability becomes easier to measure precisely. (ISO 9241-11, 2018; Voil, 2020)

2.3.1 Usability attributes

According to a slightly different definition by Jakob Nielsen (1994a), usability is a quality attribute that assesses how easy user interfaces are to use. To specify it even further, Nielsen distinguishes five different usability attributes to define quality. These components are learnability, efficiency, memorability, errors, and satisfaction.

Learnability means that the system should be easy to learn and adapt to and efficiency means that after learning the system, a user can be highly productive with the system. Memorability means that the system is easy to remember and does not encounter difficulties for the user to return to it later. The system should have a low rate of errors and if errors do occur, the user should be able to recover from making the errors effortlessly. Finally, satisfaction means that users should enjoy using the system. (Nielsen, 1994a)

All measures of usability are visually demonstrated in the Figure 3., which shows the relation between all the usability components. The usability subcomponents effectiveness, efficiency, and satisfaction are explained in more detail in the following chapters because of their relevance to the research and being the key measures of usability. In addition to the discussed key measures, Figure 3. includes goal-specific measures such as learnability and related outcomes such as accessibility, which are excluded from this research in the interest of narrowing the scope of the research sufficiently.

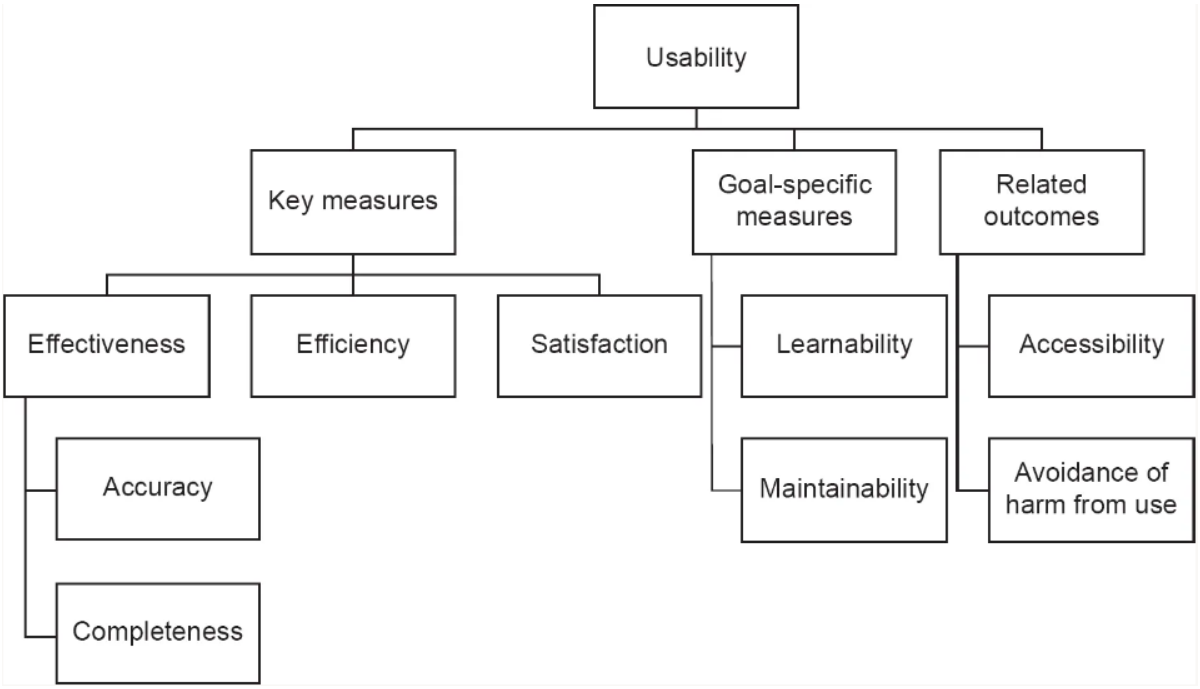


Figure 3. Measures of usability. (Voil, 2020, p.18)

2.3.2 Effectiveness as a usability measure

Formulated by ISO 9241-11 (2018), effectiveness is "the accuracy and completeness with which users achieve specified goals." This scenario focuses on the user's point of view, instead of the system's point of view, and the key question to be asked is whether the user can reach the goal that was originally intended, accurately and completely, by using the system. (ISO 9241-11, 2018; Voil, 2020)

ISO 9241-11 (2018) further defines accuracy as "the extent to which an actual outcome matches an intended outcome" and completeness as "the extent to which users are able to achieve all intended outcomes." To tell accuracy and completeness apart from each other can sometimes be difficult but it gets easier when something goes wrong. As an example, a purchase may be completed successfully but there might be an error in the purchase price or missing items, which is discovered later. This kind of error would be considered an example of an accuracy issue. Accuracy and completeness are often evaluated by making scenarios and asking questions such as what percentage of users achieved the goal both completely and accurately. This is often called success rate and effectiveness measures are usually presented in percentages. (ISO 9241-11, 2018; Voil, 2020)

2.3.3 Efficiency and satisfaction as usability measures

Efficiency is defined by ISO 9241-11 (2018) as “the resources used in relation to the results achieved.” A resource is most often considered in this context to be time, which is measured and reported as a duration of time in seconds that it takes for users to complete a certain task successfully. Another relevant resource in addition to time is cognitive load, which can be tested by having simultaneous tasks for the user to perform in sync with the task which is being assessed. In addition, goodwill and patience can be evaluated but these are mostly covered by satisfaction. (ISO 9241-11, 2018; Voil, 2020)

Satisfaction is defined by ISO 9241-11 (2018) as “the extent to which the user’s physical, cognitive, and emotional responses that result from the use of a system, product or service meet the user’s needs and expectations. Satisfaction includes the extent to which the user experience that results from actual use meets the user’s needs and expectations. Anticipated use can influence satisfaction with actual use.” There is a relation between satisfaction and user experience and satisfaction focuses on the quality of the user experience that comes as a result of using the system. (ISO 9241-11, 2018; Voil, 2020)

2.4 Usability evaluation

After defining the components of usability above, it is possible to evaluate the usability of a system. There are two ways for evaluating the usability of a system. There is usability inspection, which can be executed without having a group of testers for performing tasks, and only have as little as one person doing the inspection. Another way to evaluate usability is called usability testing, which involves multiple users testing the system. Several studies have shown that usability testing and usability inspection complement each other and often best results have been reached by combining both usability testing and usability inspection while evaluating the usability of a system. (Voil, 2020; Nielsen, 1994b)

In the next section, usability inspection and its methods are explained more in-depth, since usability inspection is considered more relevant and feasible method for this research than usability testing. The main reason for this is the lack of a proper usability testing group at disposal for this research, which would be needed for an efficient and trustworthy usability testing. For this reason, usability testing is excluded from the usability evaluation carried out in this research.

2.4.1 Usability inspection methods

Usability inspection means ways to evaluate user interfaces and discovering issues of usability. Because of its cost-efficiency and informality, usability inspection is often considered a tempting opportunity as a usability evaluation solution. Also, usability inspection can be executed at an early stage of usability engineering, which means that not all details have to be implemented before usability inspection is taking place. It is recommended to have usability experts running the usability inspections, but often ordinary developers act as evaluators themselves. (Nielsen, 1994b)

Nielsen defines seven different usability inspection methods. The most informal of them, heuristic evaluation, involves usability specialists checking if the elements follow certain usability principles. Heuristic evaluation is explained more carefully in the next section of this research. (Nielsen, 1994b)

Cognitive walkthroughs have a more specific procedure that replicates the user's process at every step to see if the goals are reached. Formal usability inspections combine heuristic evaluation and cognitive walkthrough in the procedure. Pluralistic walkthroughs are gatherings of developers and users going through scenarios and discussing those together. Feature inspection points out features that are necessary for performing the tasks and sees how long the series of steps are and how natural those are for the user to perform or if the steps require special skills from the users. Consistency inspection involves designers from other projects to see if the design is consistent with their own design. Standards inspection has a specialized expert on specific interface standards to check compliance. (Nielsen, 1994b)

2.4.2 Heuristic evaluation

As briefly touched upon previously, heuristic evaluation by Jakob Nielsen is a famous form of usability inspection. Heuristic evaluation has established usability principles, which makes it a very relevant tool for this research and a feasible way to measure usability in practice. Even though there exist many other guidelines for heuristic evaluation, Nielsen's ten usability heuristics is the most referenced one in prior research. In the next paragraphs, Nielsen's ten usability heuristics are described in detail. (Nielsen, 1993; Voil, 2020)

1. **Visibility of a system status**

   Visibility of a system status means that the users should always know what the system is doing and intends to do.

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

   There should be a match between the system and the real world, meaning that the language used should be matching with the language of the user and the system should make sense to the user.

3. **User control and freedom**

   User control and freedom means, that the user should be able to take any actions freely and the system should be able to resume any task.

4. **Consistency and standards**

   Consistency and standards mean following style guidelines published by major system operators like Google.

5. **Error prevention**

   The next principle is to prevent errors from occurring in the first place. For example, the system can offer to guide input fields that help the user navigate the process.

6. **Recognition rather than recall**

   Recognition rather than recall is the sixth principle of Nielsen and it means that for users it is more difficult to memorize something in the system like a username, than rather recognize something the user has encountered before, like pictures.

7. **Flexibility and efficiency of use**

   Users should be able to carry out tasks in the system efficiently and flexibly.

8. **Aesthetic and minimalist design**

   The system should be aesthetic and with minimalist design, meaning that there should not exist anything unnecessary in the system but only what is relevant for the user to achieve the wanted goal.

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

   The ninth principle is to help users recognize, diagnose, and recover from errors.

10. **Help and documentation**

    Help and documentation should be available for the user of the system for carrying out the tasks but the real aim is to have such an easy-to-use system that no documentation is necessary. (Nielsen, 1993; Voil, 2020)

2.4.3 Heuristic evaluation in prior research

After taking a deeper look at the usability heuristics above, it is important to introduce how usability evaluation and heuristic evaluation have been performed in practice and researched previously. To begin with, prior research from Jeffries et al. (1991) has concluded that heuristic evaluation can be efficient in saving costs and other resources.

The research took an approach of comparing four different usability evaluation methods by having four evaluation groups, one for each usability evaluation method. The methods used in the research were heuristic evaluation, cognitive walkthroughs, usability testing and software guidelines. Out of these four methods used in the research, heuristic evaluation was able to identify the biggest number of issues, including the most severe flaws, compared to all other techniques used in the research. Also, cost-efficiency of heuristic evaluation outperformed all other methods in the evaluation. (Jeffries et al., 1991)

The research also found that a notable limitation to heuristic evaluation is the evaluators' high level of knowledge and experience needed for the performing the evaluation adequately. In addition, it is recommended to have multiple evaluators perform the heuristic evaluation, which is often difficult to execute because of the lack of skilled professionals available. Another limitation that came up with heuristic evaluation, was finding large volume of issues with low priority, which could complicate prioritization in the correction process. Overall, the research found that both heuristic evaluation and usability testing rely on skilled professionals and can find severe problems but usability testing comes with higher costs compared to heuristic evaluation. The advantages and disadvantages of each evaluation method are presented in the figure 2 for comparison. (Jeffries et al., 1991)

	Advantages	Disadvantages
Heuristic evaluation	Identifies many more problems Identifies more serious problems Low cost	Requires UI expertise Requires several evaluators
Usability testing	Identifies serious and recurring problems Avoids low-priority problems	Requires UI expertise High cost Misses consistency problems
Guidelines	Identifies recurring and general problems Can be used by software developers	Misses some severe problems
Cognitive Walk-through	Helps define users' goals and assumptions Can be used by software developers	Needs task definition methodology Tedious Misses general and recurring problems

Figure 4. Summary of the study's findings. (Jeffries et al. 1991, p.5)

As established in the prior research of Jeffries et al. (1991) above, another research from Jacob Nielsen (1992) has found similarly, that the outcome of the heuristic evaluation is reached more successfully, if the level of knowledge of the evaluators is higher and experienced usability professionals are used in carrying out heuristic evaluation. The research included three evaluator groups with their levels of knowledge varying from junior to senior and the research attempted to find out what is the impact of the different knowledge levels to the end results and how do the results compare with each other.

As the usability of airline websites is the core topic of this research, it is necessary to introduce a few recent research in the field of usability evaluation of airline websites. In the next section, an overview of relevant prior research in the field of usability evaluation is presented, to conclude the theoretical framework chapter of this thesis.

2.4.4 Usability evaluation of airline websites

As it has been established previously, there is an identified research gap in the usability evaluation of airline websites, especially in Northern European region and using heuristic evaluation as the inspection method. There is, however, prior research connected to airline websites and usability, where methods of usability evaluation have been used.

Usability testing has been used as a method for usability evaluation by several researchers. A study from Nakushian (2020) compared the usability of booking flights on an airline's mobile app and on the same airline's website. In the study, participants gave detailed evaluations of their thoughts while using two separate platforms on laptops and smartphones. Initially results of the study indicated that the testers preferred using the app over the website. Testers found the app easier and faster to use, compared to the website with slow loading times. However, the study concluded that a possible reason for the results could be that the website development and user experience was ignored, meanwhile efforts were put into improving the app experience. Another finding worth mentioning is, that all testers reported that they have not used the specific app before for booking flights but have used the website for booking instead. The study therefore suggests, that using a website is still the preferred way of booking flights instead of the mobile app.

Another study from Agrawal et al. (2019) evaluated the usability of nine Indian airline websites. The evaluation focused on accessibility, usability, and readability of the websites using online automated tools. Accessibility evaluation of the websites was based on Web Content Accessibility Guideline (WCAG) 2.0. The results of the study show that none of the websites fulfilled the WCAG 2.0 accessibility guidelines. The study suggests that awareness regarding usability and accessibility standards is required for improving the accessibility of airline websites.

A study from Murillo et al. (2017) combined usability testing with heuristic evaluation. LATAM airline website was evaluated using heuristic evaluation and usability testing with postgraduate students as the participants who performed the evaluation individually as well as pre-test and post-test questionnaires. The evaluation highlighted issues such as lack of help, broken links, and consistency errors, as well as issues with the ticket purchase process and payment options. During the ticket purchase's process, the system did not provide the option to return to the previous step nor did it allow to save the information already entered so the information is lost when moving backwards in the process. The overall evaluation of the site was positive and mostly meeting its objectives, but improvements were needed based on the detected problems. The usability issues found in the heuristic evaluation were used as the basis for defining the tasks in the usability testing, which was the second phase of the evaluation. The study concluded that usability is crucial for the success of a website, as users will stop using it if it is difficult to navigate or understand. The study also emphasizes the wide use of

heuristic evaluation as a tool for evaluation of usability, given its advantages in time and cost versus analysis with participation of end users. The study also suggests that the results from heuristic evaluation and usability testing are complementing each other.

Similarly, research from Ekşioğlu et al. (2013) combined heuristic evaluation with usability testing methods. The aim was to identify and compare user experience issues and provide recommendations for the three airline websites in Turkey; Atlasjet, Pegasus Airlines and Turkish Airlines. Websites of the three airlines were evaluated according to the Nielsen's heuristics by three evaluators. Based on the identified major issues, two task questions were tailored for user testing with a total of 168 participants. The results indicated several design-related usability issues on all three airline websites. Heuristic evaluation reported basic design mistakes and user testing results indicated poor usability performance. The study highlighted usability issues related to navigation, poor contrast and text-heaviness, extensive use of acronyms, abbreviations and symbols and poor level of colour change as indicator to the user. Results showed that some main principles of web design for usability are not followed by the web designers of the three airline websites and major redesign efforts are required. Recommendations were made to improve the user experience related design mistakes of the websites. The study concluded that by improving the design of an airline website in terms of user experience, competitive advantage is created by satisfying and improving the customer experience.

2.5 Summary of theoretical framework

This chapter introduced many founding definitions, principles, and prior academic research that supports the aim, purpose, and findings of this research. The chapter outlined the theoretical foundation for the research on user experience (UX) and usability, particularly within the context of airline e-commerce. It introduced the broader domain of e-commerce, highlighting its cost-efficiency and rapid growth, especially influenced by the COVID-19 pandemic.

The chapter then delved into airline e-commerce, noting its establishment as a significant sector with airlines investing in digitalization since the 1990s. It described the evolution of airline websites and mobile apps, highlighting the distinction between legacy airlines and newer, digital-focused low-cost carriers.

The theoretical framework captured the key points of user experience, its importance, the distinction between UX and UI, the concept and attributes of usability, and the methods for evaluating usability, notably heuristic evaluation, and usability testing, underscoring their roles in identifying usability issues. The importance of usability and UX in airline websites was emphasized, noting the that these factors are crucial for seamless booking experiences and overall customer satisfaction. In the context of airline websites, prior usability research revealed common issues such as navigation challenges and slow loading times. Prior research suggested that combining heuristic evaluation with usability testing effectively identifies and addresses these issues, enhancing user experience and competitive advantage.

Introducing the theoretical framework and prior research about usability heuristics and heuristic evaluation is especially essential to this research, as Jakob Nielsen's (1993) heuristic evaluation is the selected usability inspection method and is therefore essential for the subsequent research and its methodology. In the following chapter, research methodology will be introduced, followed by the results and analysis of this research.

3 Research methodology

The approach of the research is partly qualitative and since user experience research and usability evaluation often have elements of quantitative research in addition, it has partly quantitative approach. Qualitative research focuses on understanding phenomena through in-depth exploration and interpretation of non-numerical data, such as observations, and textual analysis. Numerical quantitative data is used as a part of the comparative analysis for understanding the differences and similarities between the websites. (Braun & Clarke, 2013)

In heuristic evaluation, often the results tend to be qualitative, describing the usability improvement needed. Qualitative results, however, are often insufficient to determine how usable a website interface in fact is, which means that quantitative analysis is beneficial to evaluate the necessary efforts for a usable website interface. As a result, analyses are gathered from two angles; quantitatively by using statistical and countable methods, and qualitatively by using technical expertise of an evaluator in expressing the complexity of the findings. The qualitative analysis offers a rich and accurate observation and quantitative analysis can provide information that is statistically significant and results that may be considered generalizations. Therefore, it is advised to combine both types of analyses, while they are complementing each other in heuristic evaluation. (González et al., 2009)

Heuristic evaluation is considered having a mostly deductive approach because it begins with established principles, in this case the usability heuristics of Jakob Nielsen, and applies them to evaluate the interface of a website to identify potential issues. It is argued that using solely deductive or inductive approach may be problematic for the research which is why a mix of both approaches is used in research. In an inductive approach, themes are observations-based and data-driven, in contrast to deductive approach where existing theory is tested. (Saunders et al., 2019)

3.1 Data collection method

Data collection is based on heuristic evaluation principles that were introduced in chapter 2 section 4.2. Jakob Nielsen's ten usability heuristics are commonly accepted as good design practices in user experience research and design. Data used in heuristic evaluation is collected by the author, as the author is the main participant and evaluator in this research. The principal data collection is supported by a second data collection as a part of an expert evaluation by an

experienced UX professional, to increase the objectiveness and validity of the data and the analysis. Data is collected from secondary data sources, user interfaces of the airline websites of Finnair, SAS Scandinavian Airlines, Norwegian Air Shuttle, and Icelandair Group. The user interfaces of the websites have been accessed between the research period of 1.3.-31.3.2024 for the initial evaluation. The websites have been accessed the second time on the 14th of June, 2024, for the professional evaluation and analysis. The websites were accessed on computer desktop by using Google Chrome as the browser type. Other browser types have been excluded from the research. Each website's user interface is independently examined through interactive exploration.

The research concentrates on global language versions of each website interface, meaning the targeted language version in each airline's website is English without a targeted geographical location. Other language versions and geographical website versions are left out of scope of this research. Table 1. below demonstrating the four airlines' website URLs (Uniform Resource Locators) that are used for usability evaluation in this research. URL means a unique address of a given resource on the World Wide Web. (Berners-Lee, 1994)

Table 1. Airlines & URLs used in the research

Airline	URL	Location	Language
Finnair	https://www.finnair.com/en	Global	English
SAS Scandinavian Airlines	https://www.flysas.com/en/	Global	English
Norwegian Air Shuttle	https://www.norwegian.com/en	Global	English
Icelandair Group	https://www.icelandair.com/	Global	English

As a first step, each website is evaluated individually and special focus is given to the booking process of each website. Usability problems are identified by comparing the website interfaces' behaviour with the selected usability heuristics. Identified usability problems are documented with relevant information such as heuristics violated, severity of the problems, and any additional notes and observations. The documentation of the found usability issues is done in a written form, using spreadsheets. The documentation of the usability issues is found in Appendices.

After identifying usability problems, severity ratings are assigned to each problem. Severity ratings help prioritize issues based on their impact on user experience. Usability issues are summarized together with severity ratings and comparative and qualitative content analyses are used in data analysis to come up with suggestions and recommendations for improved user interfaces.

As always with research that includes data, it is crucial to explain how the data is handled in the research and what will happen to the data after the data analysis of the research is finalized. Any classified or personal information is not used as a part of the research. Any unused data will be disposed of after finalizing the research.

3.2 Data analysis methods

The first step of the data analysis is descriptive. Descriptive analysis is a method used in research and statistics to summarize and describe the basic features of a dataset. Its primary goal is to provide an overview of the characteristics of the data, such as patterns, variables, frequency, and tendency. Descriptive analysis helps to understand the nature of data before making other analyses and interpretations. (Spratt, Walker & Robinson, 2004)

To support the descriptive analysis and the findings of the heuristic evaluation, a comparative analysis is included as a part of the research. Comparative analysis is used as a method for comparing the data, such as patterns, variables, and frequency of the findings in the website interfaces to identify, asses and understand similarities and differences between the websites and for making educated decisions from data. Universalising comparative analysis is used for looking for similarities, patterns, and common principles, whereas differentiating comparative analysis is used to explain differences and variations between websites. A combination of both approaches is valuable in comparative analysis to gain a comprehensive understanding of the data. (Pickvance, 2001)

Additionally, qualitative content analysis is included as a part of the data analysis to gain a holistic view of the results. The type of the content analysis is conventional, which means that categories and sub-categories are derived directly from the data. Content analysis involves analyzing the content of textual and visual data to derive meaningful insights or patterns. (Hsieh & Shannon, 2005)

To validate the findings of the heuristic evaluation and to increase the overall objectiveness of the research, an expert evaluation of selected usability issues is included in the data analysis. The expert evaluation is compared with the findings of the initial heuristic evaluation. As prior research has shown, it is recommended to have multiple evaluators perform the heuristic evaluation and as a high level of knowledge and experience is essential for a trustworthy evaluation, the approach of combining insights from heuristic evaluation and expert evaluation is chosen for the data analysis. (Jeffries et al., 1991)

By integrating these methods, a richer set of data and perspectives can be collected, leading to a more robust understanding of the usability aspects of the websites. This approach helps to triangulate findings, validate results across different methods, and gain a more holistic view of the usability issues. Therefore, it can be concluded that the approach is multi-method because a combination of multiple research methods is used within a single study to gain more insights into the findings and to increase the overall understanding of the topic. (Spratt, Walker & Robinson, 2004)

3.2.1 Usability heuristics in data analysis

Jakob Nielsen's ten usability heuristics which have previously been introduced in chapter 2, are used in the data analysis as the usability principles for heuristic evaluation, and as a part of the research methodology. This evaluation is an analysis to determine if the elements of a website's interface comply with widely accepted principles, Jakob Nielsen's heuristics. The usability heuristics are presented in the Table 2.

Table 2. Nielsen's 10 usability heuristics. (Nielsen Norman Group, 1994a)

Usability heuristics
1. Visibility of system status
2. Match between the system and the real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition rather than recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recognize, diagnose, and recover from errors
10. Help and documentation

Heuristic descriptions of each usability heuristic are used to evaluate each user interface, keeping the applied usability heuristic in mind. Each user interface is evaluated and findings are promptly documented for each usability heuristic. The Table 3. demonstrates the analysis descriptions together with the applied heuristics.

Table 3. Nielsen's heuristic evaluation descriptions

	Usability heuristics	Heuristic evaluation descriptions
1.	Visibility of system status	Clear indication of the current system status such as loading times, progress bars during searches, and error messages
2.	Match between system and the real world	Terminology and concepts are familiar, understandable, and consistent with what users expect, like "departure" and "arrival" instead of technical words or abbreviations
3.	User control and freedom	Users should be able to easily navigate back, correct errors, and modify their choices without having to start over
4.	Consistency and standards	Consistent layout, navigation, and design elements across different pages and sections of the website
5.	Error prevention	Clear instructions and validation to prevent users from making errors, such as selecting invalid dates or incomplete forms
6.	Recognition rather than recall	Necessary information, such as booking details or flight status, should be prominently displayed rather than relying on users to remember previous steps or actions
7.	Flexibility and efficiency of use	Provide shortcuts or advanced options for experienced users while keeping the interface simple for novices
8.	Aesthetic and minimalist design	Clean and visually appealing layout with appropriate use of colours, fonts, and whitespace to enhance readability and usability
9.	Help users recognize, diagnose, and recover from errors	Clear error messages that explain what went wrong and how to fix it, along with suggestions or links to relevant help resources
10.	Help and documentation	Easily accessible help resources, FAQs, and customer support contact options for users who need assistance

3.2.2 Evaluation criteria and severity ranking

Jakob Nielsen's severity ranking is presented below in the Table 4. with five levels from zero to four and each rank has a description of the evaluation criteria it is having. This evaluation criteria are used to rank the severity of the discovered problems and other findings from the four airlines' user interfaces while conducting the heuristic evaluation of each website.

Table 4. Severity ranking with five levels (0-4) (Nielsen Norman Group, 1994b)

Ranking	Severity ranking definition
0	Not a usability problem, no need to be fixed
1	Cosmetic usability problem, no need to be fixed
2	Minor usability problem, low priority to be fixed
3	Medium usability problem, average priority to be fixed
4	Major usability problem, high priority to be fixed

In addition to the evaluation criteria and severity ranking above, each usability problem detected in the heuristic evaluation of each website is given a unique code which identifies and classifies each finding. It is important to have unique labelling for each finding to have a clear and structured overview of the collected data and to be able to efficiently analyze the data and come up with reliable results. Qualitative content analysis is used to get additional qualitative insights from the collected and coded data.

3.3 Trustworthiness of the research

The combination of qualitative and quantitative approach and the flexibility of the descriptive and comparative analyses and heuristic evaluation can be seen as barriers to the trustworthiness of the research. Also, the research relies strongly on author's own observations and user satisfaction in the data analysis. Therefore, an expert evaluation is included to support the author's analysis and increase the trustworthiness and objectiveness of the research by having a skilled professional to perform a cross-evaluation. Therefore, there may be a potential of the research not being entirely reliable, even though the usability principles are strictly followed in the heuristic evaluation.

Another challenge is the difficulty of keeping the scope of the research controlled with descriptive, comparative, and content analyses. There are endless possibilities of finding new insights and making comparisons with the data, which is why it is important to keep the scope as focused as possible throughout the research.

Also, there is a possibility that the conclusions of the research are not supported appropriately by the data. This highlights the need for a consistent interpretation of the data throughout the research. Additionally, it is important that theoretical framework supports the interpretation of the data. (Braun & Clarke, 2006)

4 Results and analysis

In the following sections, the heuristic evaluation results and analyses of each website are presented individually, followed by comparative analysis and qualitative content analysis of the findings of heuristic evaluations. As a final section, findings from the expert evaluation of a user experience professional are presented and compared with the initial heuristic evaluation. The complete heuristic evaluation with all found usability issues in the four websites can be found in the Appendices.

4.1 Heuristic evaluation of Finnair

In Finnair website, usability issues were detected in all ten categories of usability heuristics. Overall, 24 usability issues were detected in Finnair website when heuristic evaluation took place in March 2024. The usability heuristic ‘help and documentation’ contained the highest amount of usability issues with overall six issues in that category. ‘Match between system and the real world’ had the second highest amount of usability issues detected.

When the severity ranking of the usability issues is evaluated however, the most severe usability issues with an average score of four on the scale of zero to four were found in the ‘user control and freedom’ and second most severe usability issues were found in ‘help users recognize, diagnose, and recover from errors’ category. The number of usability issues detected, together with the average severity is presented in the Table 5.

Table 5. Heuristic evaluation of Finnair

	Usability Heuristics	Number of usability issues found	Average severity 0-4
1.	Visibility of system status	3	2
2.	Match between system and the real world	5	2
3.	User control and freedom	3	4
4.	Consistency and standards	1	1
5.	Error prevention	1	2
6.	Recognition rather than recall	1	1
7.	Flexibility and efficiency of use	1	2
8.	Aesthetic and minimalist design	2	1
9.	Help users recognize, diagnose, and recover from errors	1	3
10.	Help and documentation	6	1,83

Finnair website had four major usability issues with the highest rank. The major usability issues are presented in the Table 6. Three of the major usability issues were in the category of 'user control and freedom' and one major usability issue was in the category of 'help and documentation'. 'User control and freedom' usability issues are all related to the freedom of navigating back and forth in the booking flow and being able to change booking details and currency freely during the booking process. The major usability issue in 'help and documentation' category is related to the poor findability of special assistance on the website.

Table 6. Major usability issues of Finnair

Issue ID	Usability Heuristics	Usability issue with severity rank 4
P9	User control and freedom	After selecting the flight details and moving further in the booking, it is not possible to navigate back and modify choices like dates, destinations, or passengers easily and the user must click many steps back and start the whole process all over again.
P10	User control and freedom	User cannot change the currency at all, the currency is tied together with the chosen location and either currency nor location and language cannot be changed in the middle of booking process.
P11	User control and freedom	When arriving to the payment method phase of the booking, there is no possibility of returning to the previous page and user is pushed back to the beginning of the booking.
P24	Help and documentation	Special assistance is hard to find on the website, it is not visible directly on the main page and very few forms or channels for special assistance found on the website.

4.2 Heuristic evaluation of SAS Scandinavian Airlines

Overall, 21 usability issues were detected in SAS Scandinavian Airlines website when heuristic evaluation was conducted. Usability issues were detected in all ten categories of usability heuristics principles. The usability heuristics 'visibility of system status', 'match between system and the real world' and 'help and documentation' all contained the highest amount of usability issues with overall four issues in each category.

When the severity ranking of the usability issues is evaluated however, the most severe usability issues with an average score of four on the scale of zero to four were found in the 'user control and freedom' and in 'help users recognize, diagnose, and recover from errors'

categories. The number of usability issues detected, together with the average severity is presented in the Table 7.

Table 7. Heuristic evaluation of SAS Scandinavian Airlines

	Usability Heuristics	Number of usability issues found	Average severity 0-4
1.	Visibility of system status	4	2
2.	Match between system and the real world	4	2,50
3.	User control and freedom	2	4
4.	Consistency and standards	1	1
5.	Error prevention	1	3
6.	Recognition rather than recall	1	2
7.	Flexibility and efficiency of use	1	2
8.	Aesthetic and minimalist design	2	2
9.	Help users recognize, diagnose, and recover from errors	1	4
10.	Help and documentation	4	3,25

SAS Scandinavian Airlines website had eight major usability issues with the highest rank. The major usability issues are presented in the Table 8. The major usability issues of SAS Scandinavian Airlines were spread out to five different categories of the usability heuristics.

The usability issue of insufficient error message on the phone number format is related to both ‘visibility of system status’ (P26) and ‘help users recognize, diagnose, and recover from errors’ (P41). Both ‘User control and freedom’ usability issues are related to the freedom of navigating back and forth in the booking flow and being able to change booking details and currency freely during the booking process. The usability issues related to the inconsistency and misleading information of the Customer Service are found in both ‘match between system and the real world’ (P30) and ‘help and documentation’ (P43, P44) category.

Table 8. Major usability issues of SAS Scandinavian Airlines

Issue ID	Usability Heuristics	Usability issue with severity rank 4
P26	Visibility of system status	No error messages appear when phone number is inserted in a wrong format (without the country code) but plus signs remains there even if number is without the country code which can lead to incorrect information in the passenger details easily.
P30	Match between system and the real world	Customer Service (Help & Support) link at the bottom of the front page directs to a page "SAS Customer Service" which is in fact no customer service page but a page with more subcategories and articles about different areas but not a direct way to getting support by contacting the airline. This is not understandable and consistent with what users expect to find on a customer service section of the website.
P33	User control and freedom	After selecting the flight details and moving further in the booking, it is not possible to navigate back and modify choices like dates, destinations, or passengers easily and the user must click many steps back and start the whole process all over again.
P34	User control and freedom	User cannot change the currency at all, the currency is tied together with the chosen location and either currency nor location and language cannot be changed in the middle of booking process.
P41	Help users recognize, diagnose, and recover from errors	No error messages appear when phone number is inserted in a wrong format (without the country code) but plus signs remains there even if number is without the country code which can lead to incorrect information in the passenger details easily since the user is not able to recognize the error.
P42	Help and documentation	No support chat option is available on the front page of the website.
P43	Help and documentation	Customer service is not found in the main page navigation but at the bottom of the page as "Customer Service" (Help & Support) which directs to a page with more subcategories but not a direct way to getting support by contacting the airline.
P44	Help and documentation	As a subcategory under "Customer Service" is "Assistance" drop-down and under that "Special travel needs" available but the information is very confusing and misleading and user cannot know “Assistance” means people with disabilities and special travel needs and may confuse the meaning with regular customer support function and the location of the information is difficult to find by the user.

4.3 Heuristic evaluation of Norwegian Air Shuttle

Overall, 14 usability issues were detected in Norwegian Air Shuttle website in the heuristic evaluation. Norwegian Air Shuttle did not have usability issues in all ten categories of usability heuristics principles. In the categories ‘error prevention’ and ‘help users recognize, diagnose,

and recover from errors' zero usability issues were detected. The usability heuristics 'help and documentation' and 'aesthetic and minimalist design' contained the highest amount of usability issues with overall three issues in both categories.

Meanwhile, the most severe usability issues with an average score of four on the scale of zero to four were found in the 'user control and freedom' and the second most severe usability issues were found in 'aesthetic and minimalist design'. The number of usability issues detected, together with the average severity is presented in the Table 9.

Table 9. Heuristic evaluation of Norwegian Air Shuttle

	Usability Heuristics	Number of usability issues found	Average severity 0-4
1.	Visibility of system status	2	1,50
2.	Match between system and the real world	1	2
3.	User control and freedom	2	4
4.	Consistency and standards	1	1
5.	Error prevention	-	-
6.	Recognition rather than recall	1	1
7.	Flexibility and efficiency of use	1	2
8.	Aesthetic and minimalist design	3	2,33
9.	Help users recognize, diagnose, and recover from errors	-	-
10.	Help and documentation	3	2

Norwegian Air Shuttle website had two major usability issues with the highest rank. The major usability issues are presented in the Table 10. Both major usability issues were in the category of 'user control and freedom'. Both major usability issues are related to the freedom of navigating back and forth in the booking flow and being able to change booking details and currency freely during the booking process.

Table 10. Major usability issues of Norwegian Air Shuttle

Issue ID	Usability Heuristics	Usability issue with severity rank 4
P49	User control and freedom	After selecting the flight details and moving further in the booking, it is not possible to navigate back and modify choices like dates, destinations, or passengers easily and the user must click many steps back and start the whole process all over again.
P50	User control and freedom	User cannot change the currency at all, the currency is tied together with the chosen location and either currency nor location and language cannot be changed in the middle of booking process.

4.4 Heuristic evaluation of Icelandair Group

In Icelandair Group website, usability issues were detected in all ten categories of usability heuristics. Overall, 19 usability issues were detected in Icelandair Group website when heuristic evaluation was conducted. The usability heuristic 'aesthetic and minimalist design' had the highest amount of usability issues with overall five issues in that category. 'Visibility of system status' and 'help and documentation' had the second highest amount of usability issues detected with three usability issues in both categories. However, when evaluating the severity ranking of the usability issues, the most severe usability issue category with an average score of three was 'consistency and standards', meanwhile the single most severe usability issue was detected in 'user control and freedom'. The number of usability issues detected, together with the average severity is presented in the Table 11.

Table 11. Heuristic evaluation of Icelandair Group

	Usability Heuristics	Number of usability issues found	Average severity 0-4
1.	Visibility of system status	3	1,33
2.	Match between system and the real world	1	1
3.	User control and freedom	2	2,50
4.	Consistency and standards	1	3
5.	Error prevention	1	1
6.	Recognition rather than recall	1	1
7.	Flexibility and efficiency of use	1	1
8.	Aesthetic and minimalist design	5	2
9.	Help users recognize, diagnose, and recover from errors	1	1
10.	Help and documentation	3	2,33

Icelandair Group website had a one major usability issue with the highest rank. The major usability issue is presented in the Table 12. The single major usability issue found was in the category of 'user control and freedom'. The major usability issue is related to the freedom of being able to change currency during the booking process.

Table 12. Major usability issues of Icelandair Group

Issue ID	Usability Heuristics	Usability issue with severity rank 4
P64	User control and freedom	User cannot change the currency at all, the currency is tied together with the chosen location and either currency nor location and language cannot be changed in the middle of booking process.

4.5 Comparative analysis

Overall, 78 usability issues were discovered in the heuristic evaluation of the four websites. The highest amount of usability issues was detected in Finnair website, meanwhile the lowest amount of usability issues was detected in Norwegian Air Shuttle website. The overall number of usability issues found in heuristic evaluation are presented in the Table 13.

The overall average severity ranking for all four websites combined was 2,17 on the severity scale of 0-4. The average severity was the highest in SAS Scandinavian Airlines website, meanwhile the average severity was the lowest in Icelandair Group website.

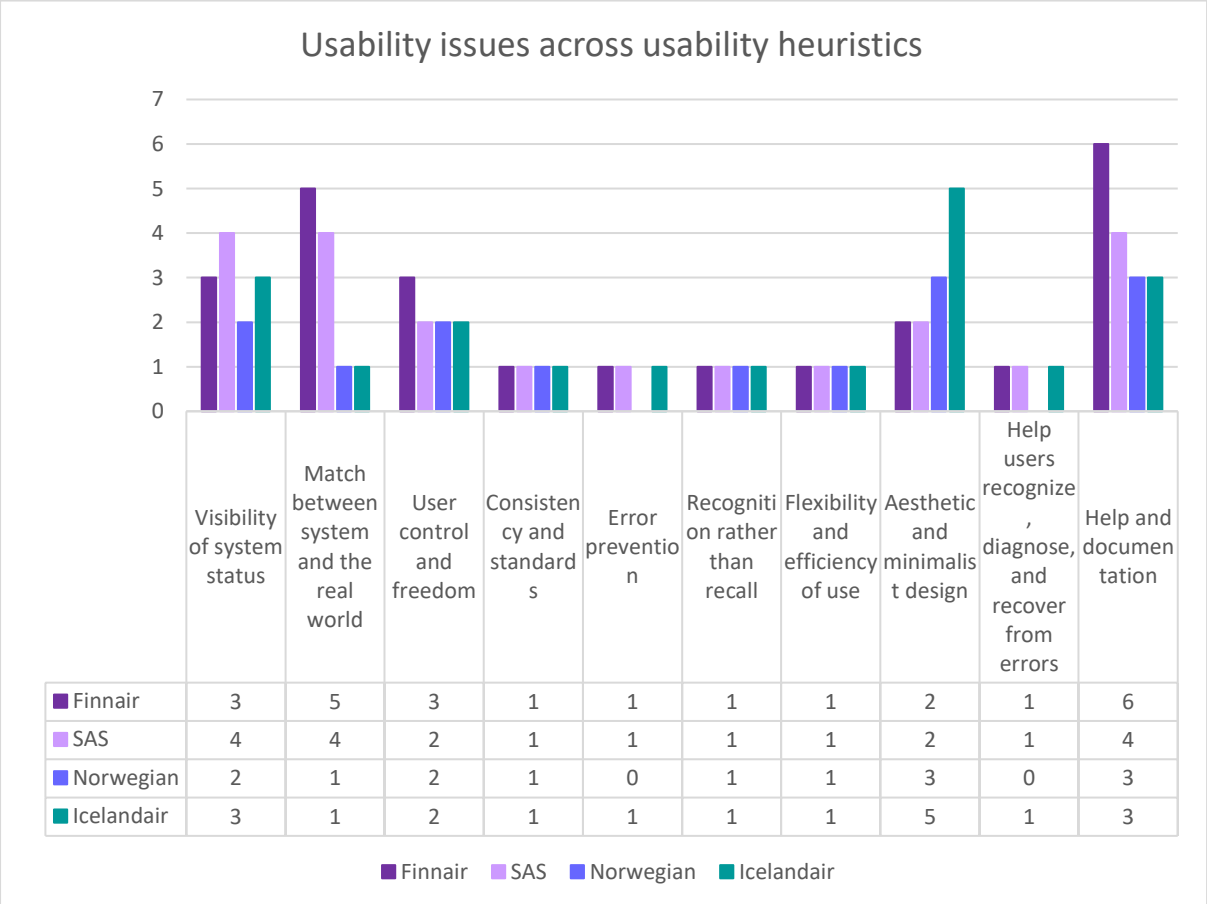
Major usability issues with the highest rank (4) were discovered in all four websites. The highest number of major usability issues was found in SAS Scandinavian Airlines website. Meanwhile, the lowest number of usability issues with rank four was found in Icelandair Group website. The overall average severity ranking and the number of overall major usability issues is presented in Table 13.

Table 13. Overall usability issues found in heuristic evaluation

Website	Usability issues found	Average severity 0-4	Major usability issues (rank 4)
www.finnair.com/en	24	2,08	4
www.flysas.com/en/	21	2,62	8
www.norwegian.com/en	14	2,18	2
www.icelandair.com	19	1,79	1
Total	**78**	**2,17**	**15**

Meanwhile usability issues were found in all categories, some of the usability heuristic categories stand out as including more usability issues than others. All websites reported issues for ‘help and documentation’ category but Finnair website stands out by having the most usability issues of all websites in this category, followed by SAS Scandinavian Airlines. However, all airlines show a significant need for improving the ‘help and documentation’ in their websites. Another category where both Finnair and SAS Scandinavian Airlines stand out by having the most usability issues, is ‘match between system and the real world’. SAS Scandinavian Airlines also stands out in the category ‘visibility of system status’. Icelandair however, is standing out by having the highest number of usability issues in category ‘aesthetic and minimalist design’, followed by Norwegian website.

Meanwhile some level of variation in results can be seen between the websites as mentioned above, there are many categories that have very similar number of usability issues across the usability heuristics, such as ‘consistency and standards’ and ‘recognition rather than recall’. The division of usability issues across usability heuristics is presented in the Figure 5.



	Visibility of system status	Match between system and the real world	User control and freedom	Consistency and standards	Error prevention	Recognition rather than recall	Flexibility and efficiency of use	Aesthetic and minimalist design	Help users recognize, diagnose, and recover from errors	Help and documentation
Finnair	3	5	3	1	1	1	1	2	1	6
SAS	4	4	2	1	1	1	1	2	1	4
Norwegian	2	1	2	1	0	1	1	3	0	3
Icelandair	3	1	2	1	1	1	1	5	1	3

Figure 5. Usability issues across usability heuristics

In addition to analysing the division of usability issues across different usability heuristics above, it is also necessary to analyse comparatively the division of usability issues in different severity rankings. To summarize the results, it is important to note that each website is reporting the highest number of usability issues in one of the ranking categories.

It is evident of the results in the Figure 6. that Icelandair has the highest number (10) of usability issues with rank one, meaning cosmetic usability problems that do not need to be fixed. Finnair is following closely with nine usability issues with rank one. Norwegian and Icelandair are remarkably behind the two former mentioned websites in rank one usability issues.

Perhaps the most even results are usability issues with rank two, meaning minor usability problems with low priority to be fixed. Finnair has the highest number (8) of usability issues but both SAS Scandinavian Airlines and Norwegian are close behind Finnair, meanwhile Icelandair has the lowest number of usability issues with rank two.

Results show that the overall amount of usability issues with rank three is the lowest of all usability issue rankings. Rank three stands for medium usability problems with average priority to be fixed. Icelandair reports the highest number (4) of usability issues with rank three, meanwhile SAS Scandinavian Airlines and Norwegian have the lowest number of usability issues with rank three.

SAS Scandinavian Airlines reports the highest number (8) of usability issues with rank four, meaning major usability problems with high priority to be fixed. Finnair has the second highest number of major usability, meanwhile Icelandair has the lowest number of major usability issues. The division of usability issues across severity ranking is presented in Figure 6.

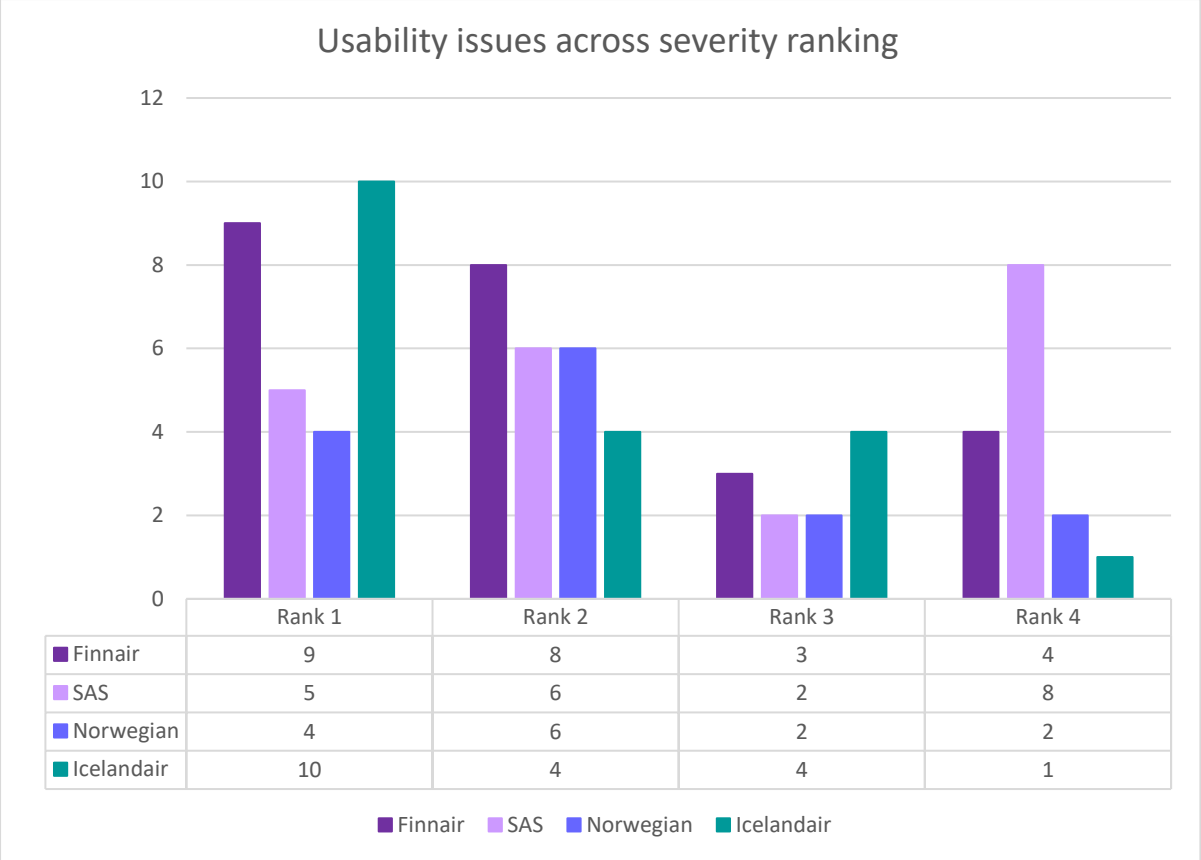


Figure 6. Usability issues across severity ranking

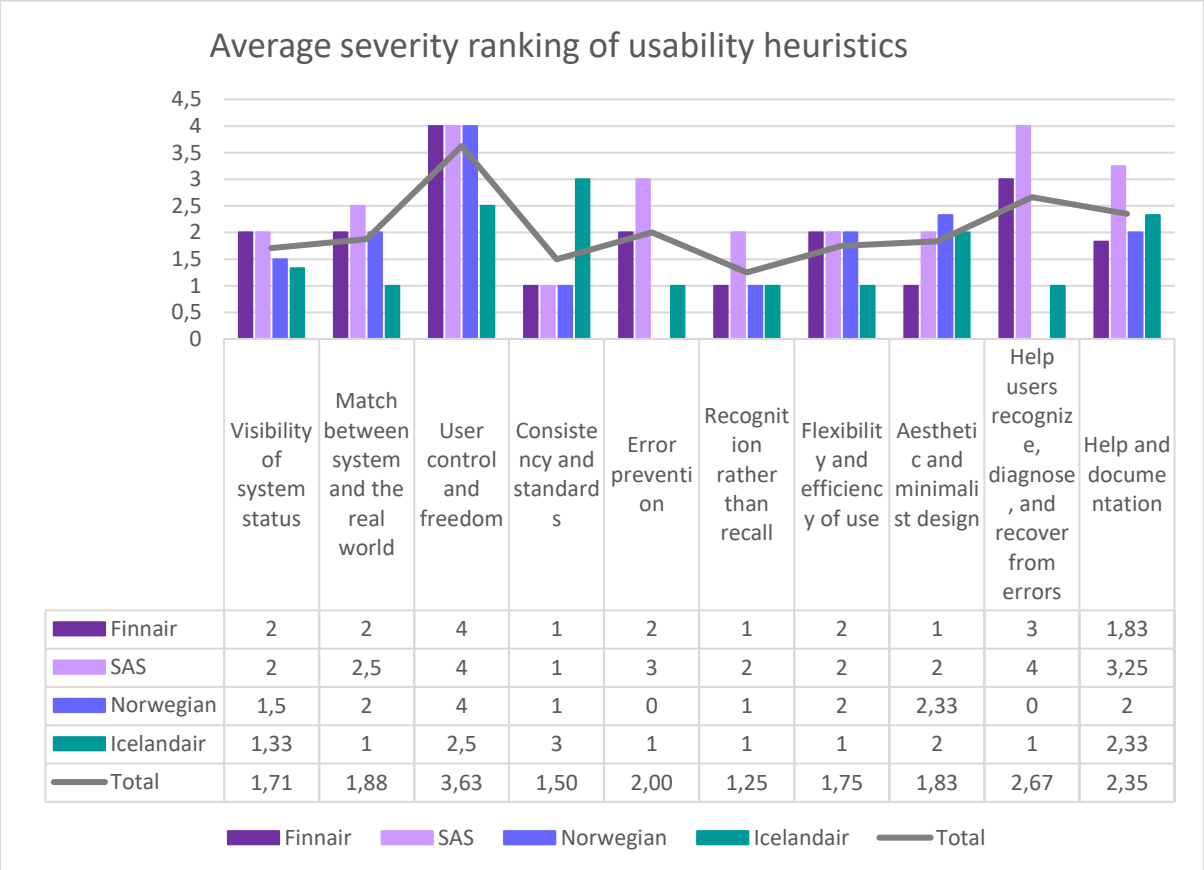
To understand which areas of the websites are having usability issues with a higher average severity ranking, it is valuable to analyse the average severity rankings of each usability heuristics category together with each website. This approach offers insights of potential focus areas and prioritization of fixing the issues on the websites.

Results in Figure 7. demonstrate that ‘user control and freedom’ has the highest overall severity across websites. Finnair, SAS Scandinavian Airlines and Norwegian all report the highest possible severity rank (4) on average, Icelandair being the only one with a slightly lower average severity. However, all websites report a significant need for improvements in the usability of ‘user control and freedom’ category.

SAS Scandinavian Airlines reports another category with an average severity ranking of four, in the category ‘help users recognize, diagnose, and recover from errors’. Also, Finnair ranks rather high in the mentioned category. Two other categories where SAS Scandinavian Airlines stands out by having a high average severity ranking are ‘help and documentation’ and ‘error prevention’.

Icelandair stands out in the category ‘consistency and standards’ with a higher average severity ranking compared to other websites. Icelandair reports ana average severity of three, while other websites report an average of rank one. Additionally, it is worth mentioning, that Norwegian was the only website that did not report any usability issues in two categories, ‘error prevention’ and ‘help users recognize, diagnose, and recover from errors’, while other websites reported usability issues in all usability heuristics.

There are four usability heuristics where the overall average severity is at or above rank two, meaning minor usability problems with low priority to be fixed, meanwhile still exceeding the level of usability issues that do not require fixing because the issues are only cosmetic. The usability heuristic with the highest severity is ‘user control and freedom’ with a total average severity of 3,63. It is followed by ‘help users recognize, diagnose, and recover from errors’ with a total average severity of 2,67. The third highest overall average severity is in ‘help and documentation’ and finally the fourth usability heuristic having issues with rank two or above is ‘error prevention’ with a total average severity of 2,00.



	Visibility of system status	Match between system and the real world	User control and freedom	Consistency and standards	Error prevention	Recognition rather than recall	Flexibility and efficiency of use	Aesthetic and minimalist design	Help users recognize, diagnose, and recover from errors	Help and documentation
Finnair	2	2	4	1	2	1	2	1	3	1,83
SAS	2	2,5	4	1	3	2	2	2	4	3,25
Norwegian	1,5	2	4	1	0	1	2	2,33	0	2
Icelandair	1,33	1	2,5	3	1	1	1	2	1	2,33
Total	1,71	1,88	3,63	1,50	2,00	1,25	1,75	1,83	2,67	2,35

Figure 7. Average severity ranking of usability heuristics

As a complementing finding to the overall analysis, it is worth mentioning the payment options offered in each website. Selectable payment methods do not directly fall under the scope of any usability issues in the light of usability heuristics, but are nonetheless an important factor in the holistic user experience, which is why this topic must be mentioned as a part of the comparative analysis.

Finnair has by far the most payment options available of all the websites. Payment is allowed with credit or debit card, various online banks, gift card, MobilePay or Avios points. SAS Scandinavian Airlines on the other hand allows payment only with payment cards, PayPal and a gift card or a voucher. Similarly, Icelandair offers payment with payment cards, Saga Points, gift certificate or a travel credit voucher. Norwegian reports the lowest number of payment options available to the user, payment being possible only with a payment card.

4.6 Qualitative content analysis

To support the findings of heuristic evaluation and comparative analysis and to gain a more holistic understanding of the found usability issues, a qualitative content analysis of the usability issues is conducted. In the qualitative content analysis, a deeper look is taken into the usability issues in five selected usability heuristics which are presented in Figure 8. The usability issues have been grouped into categories that summarize the themes of the issues found. This helps in getting a quick overview of the issues. All five selected usability heuristics have four categories with codes summarizing the content of the issues.

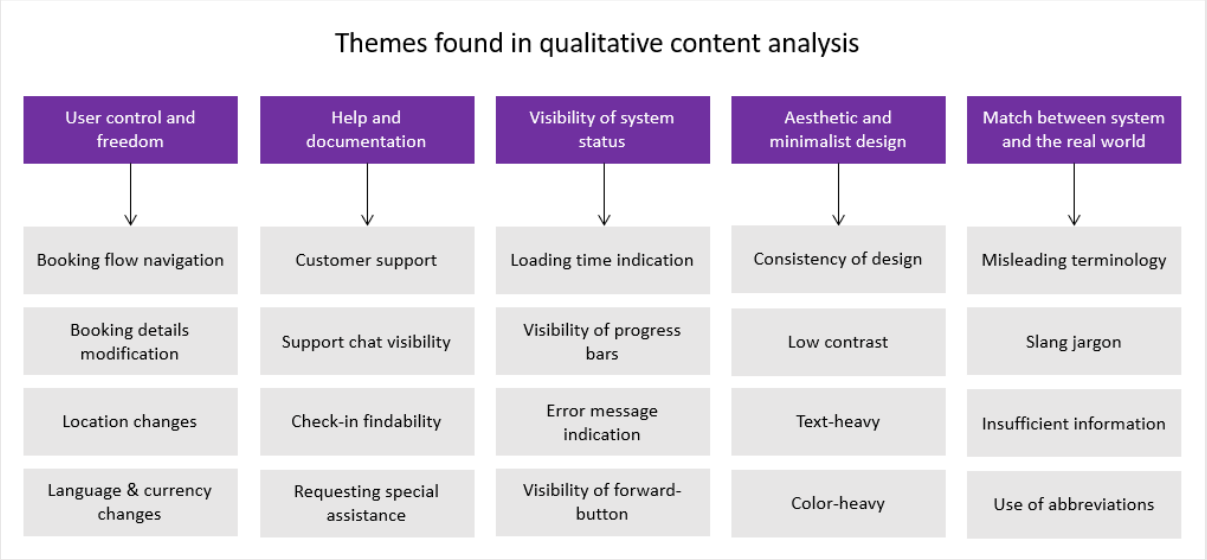


Figure 8. Themes found in qualitative content analysis

In the following sections, the qualitative content analysis of usability issues in five selected usability heuristics is presented. First, ‘user control and freedom’ with the highest average severity ranking of all usability heuristics is presented. This is followed by an analysis of the four selected usability heuristics with the highest volume of usability issues.

4.6.1 User control and freedom

As mentioned in the comparative analysis, the usability heuristic with the highest average severity among all websites is ‘user control and freedom’ with an average severity ranking of 3,63. Finnair, SAS Scandinavian Airlines and Norwegian all report a major ‘user control and freedom’ issue in the booking flow navigation and freedom to modify the booking details after the flight selection. None of the mentioned websites offer the possibility to change booking dates, destinations or passenger information freely and flexibly and instead force the user to start the whole booking process again from the beginning. The only website that provides a possibility to modify booking details to the point that the passenger details are filled in, is Icelandair website.

Another major ‘user control and freedom’ issue that is found in all four websites, is also an issue in the booking flow. The user cannot do any changes into the chosen location or the chosen currency in the booking flow. The currency is tied together with the location selection and no changes are freely allowed in the booking process to either language nor currency of the booking. These location and currency restrictions create a major barrier to the freedom of use on all websites.

In addition to analysing the major usability issues in the category ‘user control and freedom’, it is necessary to analyse the usability heuristics that reported the highest volume of usability issues. There are four heuristic categories with more than ten reported usability issues. These heuristics are ‘help and documentation’ with overall 16 usability issues, followed by ‘visibility of system status’ and ‘aesthetic and minimalist design’ with 12 usability issues each. The final category that reported more than ten usability issues is ‘match between system and the real world’ with 11 usability issues. In the following sections, the usability issues within these four heuristics are presented.

4.6.2 Help and documentation

‘Help and documentation’ reported the highest number of usability issues. All websites report usability issues related to the findability and visibility of customer support. SAS Scandinavian Airlines is the only website with no support chat available on the front page of the website. Meanwhile, all other websites also report poor visibility of the support chat, either by not having a sufficient level of information such as a visible enough design of the support chat, or merely an icon at the bottom of the page without a text-format indication of support chat.

Additional ‘help and documentation’ issues are related to the findability of the customer support other than support chat and check-in on the website navigation. Also, requesting special assistance has a poor level of findability on the websites, SAS Scandinavian Airlines and Norwegian being the only ones that have the possibility of requesting special assistance in the booking flow.

4.6.3 Visibility of system status

‘Visibility of system status’ issues are mainly focused on clear indication of loading times and appearance of progress bars in the booking flow. Most websites report having some level of information regarding the booking being processed but no clear indication of the loading time other than ‘one moment’ or ‘loading flight details’ is provided to the user. Norwegian and Icelandair are the only ones reporting progress bars appearing in the booking flow to inform the user about the progress of the booking. Finnair and SAS Scandinavian Airlines also report several issues related to error messages indication in the booking flow.

SAS Scandinavian Airlines, Norwegian and Icelandair also report issues related to the forward-button of the booking flow. There is no visible colour-change in the forward-button, or any other visible status-change indicating to the user that the selection of the flight details has been fulfilled correctly and that the user is free to move forward in the booking flow. Finnair reports to be the only website having the status-change visible in the forward-button.

4.6.4 Aesthetic and minimalist design

‘Aesthetic and minimalist design’ has a lot of variation in the nature of the usability issues of the websites. Finnair reports only cosmetic usability issues in this category and has in that sense

the highest level of ‘aesthetic and minimal design’ of all websites. SAS Scandinavian Airlines on the other hand has a consistent design but user is easily distracted by the various promotions and special offers appearing on the website.

Norwegian reports not having a high level of minimalist design on the website by having many text-heavy and design-heavy elements, especially in the booking flow. Colour red is also very dominant in the website, making it difficult for user to stay focused and find what is needed efficiently.

In contrast to Norwegian, Icelandair has almost too minimalist and ‘white’ design with a low level of contrast, especially in the booking flow, which makes it challenging for the user to find what is needed and navigate efficiently. Consistency is also on a poor level in Icelandair website. The design experience is almost as if the user is dealing with two separate websites, booking flow being minimalist and white and front page being vibrant and colourful.

4.6.5 Match between system and the real world

‘Match between system and the real world’ reports mostly issues related to terminology used in the websites matching with the expectations of the user. Finnair reported the highest number of issues in this category by having misleading and insufficient terminology in the main navigation such as ‘prepare’ instead of prepare for your flight, and ‘manage’ instead of manage your booking.

All other websites in addition to Finnair, report similar usability issues that do not match with the expectations of the user. SAS Scandinavian Airlines for example, reports terminology such as ‘just a sec’ which can be considered a slang term instead of a more universally understandable ‘just a second’. Norwegian and Icelandair reported only a few cosmetic usability issues in this category and report a higher level of ‘match between system and the real world’ than Finnair and SAS Scandinavian Airlines.

4.7 Expert evaluation

As mentioned previously in the research methodology; to support the heuristic evaluation conducted by the author and to increase the trustworthiness and objectiveness of the results and analysis, an expert evaluation of selected usability issues was included as a part of the research.

An experienced user experience professional was consulted for the research and the expert was requested to perform an individual evaluation based on the same heuristic principles and severity ranking as were used in the initial heuristic evaluation conducted by the author. The expert evaluation was performed on the 14th of June, 2024. These two evaluations carried out by the author and the expert evaluator were then compared with each other for validating the overall results and supporting the findings and the reliability of the first evaluation. It is crucial to mention, given that there were several months in between the two evaluations, that it is possible that changes and updates have been taken place on the airline websites during this period, which may have impacted the comparability of the results.

In the expert evaluation, focus was given to the 'user control and freedom' heuristic principle, which was chosen as the focus area by the professional evaluator. The selection was made as 'user control and freedom' reported the highest overall severity across all inspected airlines and the professional evaluator estimated that it would be valuable for the research to evaluate if the severity of the 'user control and freedom' usability issues in the user interfaces were in fact as severe as was found in the initial heuristic evaluation. Also, the booking flow's importance for the user and user's overall experience was highlighted by the expert evaluator, which is why the booking flow served as the focus area of the evaluation. The booking flow of each of the four airlines was inspected separately by the professional evaluator. A comparison of the initial evaluation and professional evaluation is presented in the Table 14.

Table 14. Comparison of the evaluations

Airline	Usability heuristic	Initial ranking	Professional ranking
Finnair	User control and freedom	4	4
SAS Scandinavian Airlines	User control and freedom	4	2-3
Norwegian Air Shuttle	User control and freedom	4	1-2
Icelandair Group	User control and freedom	2,5	4

In Finnair's booking flow, the evaluator noted that there was not a back-button for the user to move freely backwards in the booking flow, if necessary. The missing back-button qualified as a severe usability issue, according to the professional evaluator. Another usability issue detected by the professional evaluator was the inability for the user to edit the selection in the booking flow. The user was pushed back to the beginning of the booking flow, when details

were modified which can cause frustration to the user. Modify-link was also moving to different places in the interface during the booking flow, which adds to the confusion of the user. The concern regarding the editability was also remarkable from the safety perspective. When users give personal information in the booking flow, the users may experience concern when the information disappears while being pushed back to the beginning. Also, if in the absence of back-button the user is forced to use the browser back arrow to move back in the booking flow, it is considered as a major usability issue according to the professional evaluator. Overall, the professional evaluator ranked the 'user control and freedom' issues of Finnair as major usability issues with rank four, with a high priority to be fixed. The professional evaluation was in line with the initial evaluation of the author, where the severity was ranked equally as a major usability issue with rank four.

Similarly, SAS Scandinavian Airlines reported having usability issues with the missing back-button in the booking flow. At SAS Scandinavian Airlines' booking flow however, step navigation links could help users to navigate back in the booking flow directly to the steps that they desire to go with one click, which increased the level of navigation possibilities, according to the professional evaluator. The step navigation links were visible to the user but the visual indication could be clearer, which is why in combination with the missing back-button, the overall rank to the 'user control and freedom' issues in the booking flow of SAS Scandinavian Airlines were ranked by the evaluator at the level of two to three, being minor to medium usability issues with a low to average priority to be fixed. The initial evaluation by the author was ranked as more severe than the evaluation of the expert, as the severity was on the level four, a major usability issue.

Icelandair Group booking flow had similar usability issues with the missing back-button, as Finnair and SAS Scandinavian Airlines. Icelandair did not offer any other means of moving back in the booking flow than the browser back arrow, which created a major 'user control and freedom' usability issue according to the professional evaluator. The missing back-button resulted the evaluation to be ranked as a major usability issue with rank four, with a high priority to be fixed. The initial evaluation of the author was ranked as less severe than the expert evaluation, the severity of the 'user control and freedom' being on the level of two and a half.

Norwegian Air Shuttle was the only one of the investigated airlines that offered a back-button in the booking flow. Back-button increased the safety of the user and enabled the user to move

back freely in the booking flow. Step navigation links would have increased the usability even further but the main impacting factor according to the professional evaluator was that the back-button was present in the booking flow, which is a-must-have, as it serves the majority of the users. The professional evaluator also noted that Norwegian's booking flow was different from other airlines' booking flows, with a more e-commerce-like shopping experience to the user. The shopping cart event was logical to the user and the order of steps in first selecting the flights and only then filling in the passenger details created an increased safety for the user. The only minor usability issues that were mentioned by the evaluator, were related to the visuality in the booking flow, as the button colour was grey and grey was extensively used in the booking flow, which is not considered a best practice in user experience research as grey is not always legible and it can misleadingly indicate to the user that the process is not ready and the buttons cannot be clicked because they are disabled. Based on the above findings, the professional evaluator ranked the 'user control and freedom' usability issues as cosmetic to minor usability issues with rank one to two, with a no priority or a low priority to be fixed. The initial evaluation by the author differed drastically from the expert evaluation, as the initial evaluation was ranked as a major usability issue with a rank four, with a high priority to be fixed.

Overall, the professional evaluator stressed the importance of the back-button in the booking flow for all airlines, as it is considered a best practice in the user experience research and serves most users. It was additionally noted that the freedom to move in the booking flow is especially important in the beginning of the process but after the passenger details have been filled, it is often so that the user has locked the purchase decision and personal details and the intent is very strong at that stage of the booking flow. Therefore, the presence of the back-button is essential in the selection-phase of the booking flow. It was also mentioned by the professional evaluator that the freedom to change currency is a noteworthy limitation in the 'user control and freedom' principle.

5 Discussion

The discussion of the research is started by summarizing the research and its background. In this chapter, the research questions are responded to and discussed together with results in the following sections of the discussion.

Usability evaluation of the four selected airlines was conducted by using Jakob Nielsen's heuristic evaluation and ten usability heuristics as the main principles for the evaluation. Heuristic evaluation turned out to be an efficient method for evaluating usability, as was previously proposed by research from Jeffries et al. (1991). Heuristic evaluation was complemented with descriptive, comparative, and content analyses for achieving a holistic understanding of the usability issues. As prior research from Agrawal et al. (2019), Murillo et al. (2017) and Ekşioğlu et al. (2013) have shown, it is common to combine heuristic evaluation with other methods for validating the findings, which indicates that the selection of multi-method approach has been correct for the purpose of the study. Also, combining qualitative and quantitative methods is supported by prior research from González et al. (2009).

As introduced by Becker & Jaakkola (2020) and Luther et al. (2020), user experience and usability have not been greatly researched in the field of business and e-commerce, even though the impact of user experience on competitiveness, customer retention and business performance has been well established. This is an indication that there are plenty of research opportunities in the field of user experience research, focusing on e-commerce, and room for the findings of this usability evaluation. This research supports the prior findings, as this research was able to contribute by delivering insights for user experience research in the field of e-commerce, focusing on airline websites. As it was established previously by Hanke (2016), flight tickets are the third most purchased item that users buy online, which underlines the importance of research in the field of airline e-commerce and highlights the essence of the findings in this research.

The importance of website usability for e-commerce was additionally emphasized in prior research of Jakob Nielsen (2011), where it was concluded that increased competition pressures the websites to become better and satisfy increasingly demanding customers, with not only functioning but a pleasant overall customer experience. Similarly, Luther et al. (2020) highlighted that by understanding the needs of users and providing a superior user experience

can be a key differentiator in the competitive market and digital landscape, and leads to improved customer satisfaction and retention, and increases brand loyalty and engagement. This research supports the findings of prior research and additionally suggests that in the light of the results, prioritizing user experience as a strategic decision can be an essential differentiating factor and considered as competitive advantage in airline websites worldwide.

5.1 Detected usability issues

The first research question to be responded to in this research is as follows; “What usability issues are detected in the websites that are a part of this research?”

Overall, a wide range of usability issues were found across the selected websites. Usability evaluations were conducted on four airline websites: Finnair, SAS Scandinavian Airlines, Norwegian Air Shuttle, and Icelandair Group. For Finnair, usability issues were detected across all ten categories of Jakob Nielsen’s usability heuristics, totalling 24 issues. The most problematic areas were 'help and documentation' and 'match between system and the real world', each with six and five issues respectively. Four major usability issues were identified, three in 'user control and freedom' and one in 'help and documentation'. The usability issues with highest average severity were found in ‘user control and freedom’ and in ‘help users recognize, diagnose, and recover from errors’.

SAS Scandinavian Airlines also exhibited usability issues across all ten categories, totalling 21 issues. The most problematic areas were 'visibility of system status', 'match between system and the real world', and 'help and documentation', each with four issues. Eight major usability issues were identified, spread across five categories. The usability issues with highest average severity were found in ‘user control and freedom’ and in ‘help users recognize, diagnose, and recover from errors’.

Norwegian Air Shuttle had 14 usability issues, with deficiencies noted in eight out of ten categories. Notably, no issues were detected in 'error prevention' and 'help users recognize, diagnose, and recover from errors'. The most problematic areas were 'help and documentation' and 'aesthetic and minimalist design', each with three issues. Two major usability issues were found, both in 'user control and freedom'. The usability issues with highest average severity were found in ‘user control and freedom’ and in ‘aesthetic and minimalist design’.

For Icelandair Group, 19 usability issues were identified across all usability categories. The most problematic area was 'aesthetic and minimalist design', with five issues. 'Visibility of system status' and 'help and documentation' followed with three issues each. The most severe average score was in 'consistency and standards', while only one major usability issue was detected, in 'user control and freedom'.

In conclusion, all four airline websites exhibited usability issues, with varying degrees of severity and distribution across Nielsen's usability heuristics. 'User control and freedom' and 'help and documentation' were commonly problematic areas across the evaluated websites. As emphasized by studies from Murillo et al. (2017) and Jeffries et al. (1991), usability is crucial for the success of a website, as users will stop using it if it is difficult to navigate or understand. Both studies also emphasize the wide use of heuristic evaluation as a tool for usability evaluation, given its advantages in time and cost. Similarly, this research finds that addressing these usability issues is recommended since actions taken towards improved usability across websites could significantly enhance the user experience on these website interfaces and improve the overall customer experience.

Findings discussed here are in line with findings in prior research from Murillo et al. (2017) among others pointing out that usability issues can efficiently be discovered by using heuristic evaluation. The evaluation of Murillo et al. (2017) highlighted issues such as lack of help, broken links, and consistency errors, as well as issues with the ticket purchase process and payment options which demonstrate similarities with the findings of this research. A study from Ekşioğlu et al. (2013) had similar findings revealing numerous design-related usability issues across websites, including navigation difficulties, poor contrast and text density, excessive use of acronyms and symbols, and inadequate color differentiation.

5.2 Comparisons among findings

The second research question to be responded to in this research is as follows;
"What comparisons can be made between the findings of the heuristic evaluation?"

Several comparisons can be made between the findings, as results indicate similarities, as well as diversity and fluctuation among the results of the four websites. Overall, 78 usability issues were detected in the heuristic evaluation of the websites, Finnair exhibiting the highest number

of issues and Norwegian Air Shuttle showing the fewest. Severity rankings revealed SAS Scandinavian Airlines with the highest average severity, followed by Finnair, while Icelandair Group had the lowest.

Major usability issues with rank 4 were found across all websites, with SAS Scandinavian Airlines having the most, and Icelandair Group the least. Icelandair reported the highest number of usability issues with rank 3, meanwhile Finnair had the highest number of usability issues with rank 2, meaning minor usability problems with low priority to be fixed. The severity rank 2 was perhaps the most even category among the websites, indicating that all websites report minor usability issues and variation across websites is stable. Icelandair had the highest number of usability issues with rank 1, meaning cosmetic usability problems that do not need to be fixed.

Key areas of concern included 'help and documentation', which had the most usability issues across all airlines, with Finnair leading followed by SAS Scandinavian Airlines, as well as 'match between system and the real world', and 'user control and freedom'. Notably, Finnair and SAS Scandinavian Airlines stood out for having significant usability issues in these areas. SAS Scandinavian Airlines stood out having usability issues in 'visibility of system status', meanwhile Icelandair Group had the most issues in 'aesthetic and minimalist design', followed by Norwegian Air Shuttle. Norwegian Air Shuttle notably lacked any usability issues in the 'error prevention' and 'help users recognize, diagnose, and recover from errors' categories.

Regarding the severity ranking comparisons, 'user control and freedom' had the highest overall severity across all airlines, with Finnair, SAS Scandinavian Airlines, and Norwegian Air Shuttle reporting the highest possible severity rank. SAS Scandinavian Airlines stood out in 'help users recognize, diagnose, and recover from errors', 'help and documentation', and 'error prevention'. Icelandair Group showed higher severity in the 'consistency and standards' category.

Additionally, payment options were compared, with Norwegian Air Shuttle offering the fewest payment options, limited to payment cards, whereas Finnair providing the most diverse options including credit and debit cards, various online banks, gift cards, and mobile payments.

Overall, while each airline exhibited specific strengths and weaknesses in usability, all websites showed significant room for improvement, particularly in areas such as 'help and documentation' and 'user control and freedom'. Addressing these issues could enhance the overall user experience and competitiveness of the respective airline websites.

Furthermore, while there were visible variations among the websites, some categories had similar numbers of usability issues across airlines, such as 'consistency and standards' and 'recognition rather than recall', which indicates that some generalizations can be made from the findings in the websites and best practices of usability guidelines are recommended to be used by all airlines. A comparative study of three airline websites from Ekşioğlu et al. (2013) similarly suggested that results demonstrated several design-related usability issues on all three airline websites. Heuristic evaluation reported basic design mistakes and user testing results indicated poor usability performance. Results showed that some main principles of web design for usability are not followed by the web designers of the three airline websites and major redesign efforts are required.

Based on overall results it is evident that all websites are reporting significant usability issues, meanwhile some differences can be spotted from the results. It is suggested based on the results, that one factor behind the level of usability and the number of usability issues could be related to the generation of the website. Older websites such as Finnair and SAS Scandinavian Airlines appear to have more usability issues in volume than the new-generation websites such as Norwegian Air Shuttle. The suggested generation-factor is supported by theory from Hanke (2016) that pointed out that new generation airlines are built digital-first, whereas older generation airlines have had to adapt to digitalization and the volume of usability issues often reflects this transition. It is mentioned that low-cost airlines are typically considered as a part of the digital-first airlines, which supports the findings related to low-cost airline Norwegian Air Shuttle, which reported the fewest usability issues of all websites.

5.2.1 Comparisons within usability heuristics

For gaining a holistic understanding of the findings, qualitative content analysis of the most severe usability issues across websites, and the highest amount of usability issues across Nielsen’s usability heuristics, was conducted. Comparisons between airlines in five selected usability heuristics were identified and the findings are summarized below.

1. **User Control and Freedom:**

All airlines faced major issues regarding user control and freedom in the booking flow navigation and the ability modify booking details after flight selection. None of the airlines allowed flexible modification of booking dates, destinations, or passenger information after flight selection, except for Icelandair, until a certain point in the booking flow. Restrictions on changing location, language, or currency during the booking process were observed across all airlines.

2. **Help and Documentation:**

Help and documentation had the highest number of usability issues, particularly related to the findability and visibility of customer support on each website. SAS Scandinavian Airlines lacked a support chat on the front page, while others had issues with the visibility and findability of support chat. Findability of customer support function and contact information and requesting special assistance were common issues across all airlines.

3. **Visibility of System Status:**

Issues in this category centred around clear indication of loading times and appearance of progress bars in the booking flow. Most airlines lacked clear indication of any loading times, with only Norwegian and Icelandair displaying progress bars. Issues with error message indication and visibility of the forward-button were reported by several airlines.

4. **Aesthetic and Minimalist Design:**

Finnair reported only cosmetic usability issues in this category, indicating the highest level of aesthetic and minimalist design among the websites. SAS Scandinavian Airlines had a consistent design but was criticized for distracting promotions and special offers. Norwegian's website lacked minimalist design with several text-heavy and design-heavy elements, while Icelandair's design was overly minimalist with low contrast and its design could not classify as consistent throughout the website.

5. **Match Between System and the Real World:**

Usability issues in this category were mainly related to terminology not matching user expectations. Finnair reported the highest number of issues with misleading and insufficient terminology in main navigation. SAS Scandinavian Airlines used slang terms like 'just a sec', while Norwegian and Icelandair had fewer issues in this regard.

Overall, each airline had its unique set of usability issues across these selected heuristics, highlighting areas for improvement to enhance user experience and usability of their websites. In the light of the findings, it is advisable to focus on improving usability and user experience as a whole, for creating an improved customer experience and ultimately increase customer retention. As it was similarly proposed in the prior research from Ani et al. (2019), usability is crucial for providing a seamless and pleasant experience for customers booking flights, managing reservations, and accessing important information, such as flight search, booking, check-in, customer support, and flight status.

5.3 Comparison of the evaluations

As established previously, a professional evaluation performed by an expert in the field of user experience research was included in the research to support the findings and validate the results of the initial heuristic evaluation performed by the author. The expert focused on the "user control and freedom" heuristic principle due to its high severity in the initial evaluation, particularly in the booking flow of each airline.

As the author had no prior knowledge of user experience research or professional capabilities for the heuristic evaluation, it was essential to include a professional analysis for the robustness of the results. Similarly, prior research from Jeffries et al. (1991) and Jacob Nielsen (1992) found that the outcome of the heuristic evaluation is reached more successfully, if the level of knowledge of the evaluator is higher and experienced usability professionals are used in carrying out heuristic evaluation. Also, according to Jeffries et a. (1991) a recommendation is to have multiple evaluators perform the heuristic evaluation, which is often difficult to execute because of the lack of skilled professionals available. Therefore, it is important to mention that meanwhile two individual evaluators were involved in the research, it is probable that the validity of the results could be even higher if more than two evaluators would perform heuristic evaluation and if more professional evaluators would partake. The results of the evaluations tend to fluctuate more, when only a small number of evaluators is involved in the evaluation, as has been in this research.

Several comparisons can be made between the professional evaluation and the initial evaluation by the author and the rankings of the usability issues of the airlines. When comparing the two evaluations with one another, it is evident that the results are varying quite drastically between

the two evaluations, which confirms the assumption from prior research that professional skills are indeed essential for a successful evaluation. There is fluctuation between the results, as some airlines have similar severity in the two evaluations, meanwhile some airlines have varying rankings in the two evaluations. As the scale of severity ranking is consistent in the evaluations, it is proposed that the expertise level has a strong impact on how the severity is observed.

For Finnair, the expert noted major issues with the absence of a back-button and the inability to edit selections in the booking flow. Users were pushed back to the beginning when modifying details, causing frustration and potential safety concerns. The expert and the author both evaluated these as major usability issues, ranking them at level four. Finnair was the only airline where the ranking was consistent in the two evaluations, even though the author did not highlight the missing back-button in the evaluation as the main cause for the level of severity.

SAS Scandinavian Airlines had similar issues with the missing back-button, but the presence of step navigation links allowed users to navigate back more easily. However, the visual clarity of these links could have been improved. The expert rated these issues as minor to medium, with a rank of two to three, while the author rated them as major, with a rank of four. Differences in ranking could be explained with the different levels of experience of the evaluators.

Icelandair Group also had major issues due to the absence of a back-button, forcing users to rely on the browser back arrow. The expert rated these issues as major, with a rank of four, while the author rated them as less severe, at a rank of two and a half. Similarly to SAS Scandinavian Airlines, the differences in the evaluations could be caused by the lack of professional experience in the first evaluation, in contrast an experienced evaluation. It is also possible that there have been changes on the website in between the two evaluations.

Norwegian Air Shuttle was the only airline with a back-button, enhancing user safety and navigation. The expert noted only minor visual issues with button colours but found the overall usability to be good. The expert rated these issues as cosmetic to minor, with a rank of one to two, while the author rated them as major, with a rank of four. In Norwegian Air Shuttle website, the fluctuation between the two evaluations of the ‘user control and freedom’ was perhaps the most drastic of all four websites. It is likely that improvements in the booking

flow's usability have been made during the period of the two evaluations. However, the initial evaluation of Norwegian Air Shuttle showed overall the least amount of usability issues across websites with low severity, which indicates that the results of the two evaluations are in line with each other in the overall usability evaluation of the Norwegian Air Shuttle website.

Overall, the expert emphasized the importance of a back-button in the booking flow, especially in the initial stages, and noted the limitation of changing currency as part of the 'user control and freedom' heuristic principle. Notably, a major difference between the two evaluations was related to the purpose of the back-button, as it was the main factor in the professional evaluation having an impact on the severity of the final rankings of the 'user control and freedom' issues. In the author's initial evaluation however, the meaningfulness of the back-button in the booking flow was not as strongly impacting the severity of the usability issues as in the professional evaluation. This is a noteworthy difference and indicates that a certain level of deeper understanding of the best practices and principles of user experience is vital for the heuristic evaluation, as was shown in the prior research of Jeffries et al. (1991) and Jakob Nielsen (1992).

Based on the results it can be suggested that younger airlines demonstrate overall higher usability, as the initial evaluation of Norwegian Air Shuttle reported. This insight is also supported by prior research of Hanke (2016) finding similarly that new generation airlines are built digital-first, whereas legacy airlines are not. The expert evaluation supports this conclusion, as the severity of usability issues was merely cosmetic or minor in Norwegian Air Shuttle and the evaluator also underlined the smooth shopping experience from the user experience point of view that was different to other websites of this research, having the most features that had characteristics of e-commerce.

6 Conclusions

This comparative study evaluated the usability of four Northern European airline websites. The research focused on user experience (UX) and customer experience (CX), emphasizing the importance of usability in ensuring that users achieve their intended goals. The study used a combination of qualitative and quantitative approaches with heuristic evaluation, together with descriptive, comparative, qualitative content analyses and expert evaluation, to identify, classify and analyse usability problems on each website.

The study found numerous usability issues across all websites, with the highest number of issues detected in Finnair website, in contrast to Norwegian Air Shuttle reporting the fewest. Major rank-4 usability issues were found across all websites, with SAS Scandinavian Airlines having the most, and Icelandair Group the least.

Major problem areas were identified, particularly in the flexibility of the booking flow regarding passenger details and moving back and forth freely, changes in currency, language, and the locale of the websites, finding help efficiently, demonstrating inconsistencies in design and insufficiencies in terminology used on the websites.

The expert evaluation confirmed many findings of the initial heuristic evaluation, emphasizing the critical importance of the ‘user control and freedom’ heuristic, particularly in the booking flows of airline websites. The absence of a back-button emerged as a significant usability issue for Finnair, SAS Scandinavian Airlines, and Icelandair Group, impacting user navigation and satisfaction. Norwegian Air Shuttle stood out positively for including a back-button, enhancing user experience and safety despite minor visual issues. These findings underscore the necessity of incorporating back-buttons and ensuring clear navigation options to improve user experience and meet the best practices of user experience research. The differences in severity rankings between the expert and the author highlight the complex nature of usability evaluations and the potential impact of changes over time on website functionality and usability. The importance of professional skills and deep understanding of user experience principles in heuristic evaluation is evident.

6.1 Conclusions of findings

Based on the previously introduced results of heuristic evaluation and professional evaluation, and comparative and qualitative content analyses, a few generalizations of the findings can be proposed. It is evident that heuristic evaluation is an efficient tool in examining the usability of websites. Findings show that there are quite a few problem areas among the websites, such as help and documentation and user control and freedom, where all airlines reported usability issues and which had altogether the highest amount of usability issues and the most severe usability issues.

The results suggested that younger airline websites, such as Norwegian, had fewer usability issues compared to older airline websites such as Finnair and SAS Scandinavian Airlines, highlighting the importance of digital-first design from usability and user experience point of view. Recommendations include investing in usability evaluation regularly and integrating it into the web development process of the company. Overall, the findings provide valuable insights into the usability of airline websites, emphasizing the importance of addressing usability issues to enhance customer satisfaction and competitiveness in the digital landscape.

6.2 Practical implications

There are several practical implications to be considered of this research and its results. First, it is recommended that each of the four airlines that were investigated, would invest time and resources in usability evaluation in the future. Usability evaluation should be a part of every organization's web development process and ideally there would be a team of people improving the website usability as their main duty.

A recommended best practice would be to evaluate usability regularly, or in evaluation cycles, and especially before, during and after any major changes to the website. It is important to highlight that the usability evaluation is an ongoing process and never really finished, as new usability issues may appear over time since websites are constantly developed further and changes and updates are made in the user interfaces of the websites.

It is also highly advised that the airlines selected for this research would act on fixing the major usability issues on each website at their earliest convenience. It is important for the airlines to

understand that usability issues should be not overlooked and that by not fixing the issues a negative impact on sales revenue in a long run is possible.

Based on the results of this research, it can also be seen that there is a lot of variation in the usability between the selected airline websites. Meanwhile many of the usability issues are similar among the selected websites, there are several usability issues that are more unique to each website. This indicates that there are potential learnings and insights that could be taken from competitors' websites. Additionally, it indicates to the author that meanwhile the competitors often observe the routes, marketing campaigns and other visible actions of their peers, it seems evident based on the results that the usability of competitors' websites is often overlooked by the peers and the impact of usability on the overall customer experience is not fully emphasized.

6.3 Critical review of the thesis

As a starting point for the critical review of the thesis, it is worth noting that the evaluator, in this case also the author, did not have any prior experience for evaluating usability of the websites, using heuristic evaluation as the method for the inspection. Prior research from Jeffries et al. (1991) and Jacob Nielsen (1992) have concluded, that the outcome of the heuristic evaluation is reached more successfully, if the level of expertise of the evaluators is higher and experienced usability professionals are used in carrying out heuristic evaluation. Therefore, a professional evaluation was included in the research at a later stage, to support the initial evaluation. It must be highlighted that the outcome of the research could be more comprehensive if more professional evaluators with a long experience in usability evaluation would be used as evaluators for this research.

Another noteworthy mention from the prior research of Jeffries et al. (1991) and Jacob Nielsen (1992) is that it is recommended to have multiple evaluators perform the heuristic evaluation. Therefore, it must be noted that the absence a group of evaluators in this research may have influenced the reliability of the results.

The selected number of airline websites chosen for the research can be identified as a possible limitation. It could be argued that four websites are not sufficient for conducting a reliable usability research with trustworthy comparisons. As a supporting argument for the low volume

of websites, it is argued that the geographical closeness, competition, and similar product offering matter more to the relevancy of the research than increasing the amount of the airline websites for the sake of volume. Also, prior research from Nakushian (2020), Murillo et al. (2017) and Ekşioğlu et al. (2013) have focused on similar number or even less websites in their research, which indicates that the number of websites of this research is sufficient.

It is important to mention a few external factors for critically reviewing the research and usability evaluation in general. Most companies have brand guidelines which are used as the principles for the web design. These guidelines may create a barrier for some usability heuristics such as aesthetic and minimalist design and match between system and the real world. Additionally, technical capabilities of web development may create obstacles to the websites in matters such as how flexibly the user can move in the booking flow, which refers to the usability heuristic of user control and freedom that demonstrated the highest severity among all websites.

6.4 Recommendations for future research

There are multiple potential directions for future research on the topic of usability evaluation in airline websites. Future research on other airlines' websites in addition to the four selected websites in this research, is recommended for expanding the understanding of the usability in the field of aviation more holistically. It is recommended to include a small group of professional evaluators for the heuristic evaluation, as was also recommended by Jeffries et a. (1991) for a successful outcome.

It is also feasible to consider other types of usability evaluations on the four websites that were investigated in this research. As is similarly suggested by prior research of Murillo et al. (2017), it could be valuable to combine usability testing using participants as a testing group together with heuristic evaluation, for achieving more in-depth and comprehensive results as the evaluation methods complement each other. Similarly, accessibility evaluation could be a relevant additional and complementing research to heuristic evaluation, as is suggested also by the research from Agrawal et al. (2019).

As there are indications that mobile-first approach is growing its importance, future research focusing on comparisons between each website of this research and their respective mobile

apps, could be a valuable additional usability evaluation. The suggested usability evaluation would assist in gaining another point of view from usability of the websites compared to the mobile apps, as was done in the research from Nakushian (2020).

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Appendices

Appendix 1: Heuristic evaluation of Finnair

ID	Problem	Severity
	Visibility of system status	
P1	"Loading flight details" message appears when a user is making a booking and choosing a flight but no loading time indication or progress bar in the flight search or booking flow appears at any point of the booking.	1
P2	Error message "The phone number may contain digits only. Enter the number in the international format." comes up when entering the phone number in a wrong format while filling the passenger details. Guidance for inserting the number in the right format is confusing and not clear.	3
P3	There is no error message appearing when the gender is left blank but user cannot move forward in the booking before filling the gender	2
	Match between system and the real world	
P4	The subcategory page for preparing your flight is named "Prepare" which is not the most informative communication, instead "Prepare for your flight" would be more concrete message and matching with users' expectations	2
P5	The subcategory page for during travelling is named "Travel & fly" which not indicating clearly to the user what it means and what the user can expect to find in the page. Instead "During the flight" would be more informative and matching with users' expectations.	2
P6	The category page "Manage" is not indicating clearly to users that the page is in fact a manage your booking page. Instead, the page could be called "Manage booking" for offering users clearer instructions on the page and matching with the users' expectations.	2
P7	Support chat bot is named "Chat" which is not clearly indicating what falls under chat and is not informative enough. Instead "Support Chat" would offer users more information and faster help and match user's expectations when looking for support channels.	2
P8	In the booking flow it says "Select departure flight" which is not a clear indication of selecting the first flight in a return-trip. Either "Select outbound flight" or "Select first flight" or simply "Select flight" would be more informative and clearer for the user and matching with user's expectations since all the flights have departures which is why this is misleading.	2
	User control and freedom	
P9	After selecting the flight details and moving further in the booking, it is not possible to navigate back and modify choices like dates, destinations, or passengers easily and the user must click many steps back and start the whole process all over again.	4
P10	User cannot change the currency at all, the currency is tied together with the chosen location and either currency nor location and language cannot be changed in the middle of booking process.	4
P11	When arriving to the payment method phase of the booking, there is no possibility of returning to the previous page and user is pushed back to the beginning of the booking.	4
	Consistency and standards	
P12	The layout, navigation and design seem consistent throughout the website and the booking flow but with every page in the booking flow the user has scroll down immediately after entering the page which causes unnecessary usability issue for the users.	1
	Error prevention	
P13	There is no error message appearing when the gender is left blank but user cannot move forward in the booking before filling the gender	2
	Recognition rather than recall	
P14	In the end of the booking flow directly before payment, the flight details are fairly visible but more details about the flight details like departure and arrival times have to opened up from drop-down, which seems to be an unnecessary obstacle for the user. Instead, the flight details could be fully visible to prevent the user being forced to recall the flight details and having to click the drop-downs open constantly.	1

ID	Problem	Severity
	Flexibility and efficiency of use	
P15	There are no shortcuts in the booking flow because users cannot easily move back and forth not skip sections or change booking detail flexibly and the user has to go back to the beginning to start over.	2
	Aesthetic and minimalist design	
P16	Meanwhile design is minimal, visually appealing, and consistent with the brand guidelines, the layout and design could be clearer when it comes to designing the "Chat" chat bot in the right down-corner.	1
P17	Meanwhile design is minimal, visually appealing and consistent with the brand guidelines, the layout and design could be clearer when it comes to designing the "Feedback" button on the right side of the main page.	1
	Help users recognize, diagnose, and recover from errors	
P18	Error message "The phone number may contain digits only. Enter the number in the international format." comes up when entering the phone number in a wrong format. Guidance for inserting the number in the right format is confusing and not clear and it is missing a clear guidance on which format to use for the number.	3
	Help and documentation	
P19	Customer support page is findable under main menu navigation but not directly on the front page.	1
P20	Support chat is in the right down-corner so fairly easily findable but for people with disabilities the indication could be more visible.	1
P21	Feedback button is on the right side of the main page so it is fairly easily findable but for people with disabilities the indication could be more visible.	1
P22	Request special assistance doesn't come up in the booking flow (compare SAS)	3
P23	Check-in possible directly on the front-page main navigation, so it is fairly easy to find by the user but it could be indicated even clearer for easy access	1
P24	Special assistance is hard to find on the website, it is not visible directly on the main page and very few forms or channels for special assistance found on the website.	4

Appendix 2: Heuristic evaluation of SAS Scandinavian Airlines

ID	Problem	Severity
	Visibility of system status	
P25	No clear indication of loading times and progress bars appear during a flight search and booking flow.	1
P26	No error messages appear when phone number is inserted in a wrong format (without the country code) but plus signs remains there even if number is without the country code which can lead to incorrect information in the passenger details easily.	4
P27	"Just a sec while we process you request" message appears in the booking flow before the payment options are visible which is somewhat an indication of loading time but the format is very informal and therefore not sufficient as a clear indication of a loading time	1
P28	The button that takes users forward in the booking flow doesn't change its colour when the flight selection or passenger details have been made correctly, the colour remains peach. It would be recommended to have the button change colour as an indication to the user to move forward in the process, for example from colour peach to darker orange to highlight that the step is ready.	2
	Match between system and the real world	
P29	"Just a sec while we process you request" message appearing in the booking flow before the payment options is not clearly indicating to the user what it means and what the user can expect because the style of the message is not formal enough. Instead "Just a moment" or "Just a second" could be more informative and universally understandable compared to the slang sentence "Just a sec"	1
P30	Customer Service (Help & Support) link at the bottom of the front page directs to a page "SAS Customer Service" which is in fact no customer service page but a page with more subcategories and articles about different areas but not a direct way to getting support by contacting the airline. This is not understandable and consistent with what users expect to find on a customer service section of the website.	4
P31	"Assistance" is found as a section in "SAS Customer Service" and under "Assistance" "Special travel needs" but the user cannot know if "Assistance" means assistance for people with disabilities or regular customer support function. Instead, there should be a clear indication for customer service as a whole, clear separation between regular customer support and special travel needs assistance. Even "Special Assistance" instead "Assistance" would be more clear and informative naming convention.	3
P32	In the booking flow it says "Select outbound" which is not a clear indication of selecting the first flight in a return-trip. Either "Select outbound flight" or "Select first flight" or simply "Select flight" would be more informative and clearer for the user and matching with user's expectations.	2
	User control and freedom	
P33	After selecting the flight details and moving further in the booking, it is not possible to navigate back and modify choices like dates, destinations, or passengers easily and the user must click many steps back and start the whole process all over again.	4
P34	User cannot change the currency at all, the currency is tied together with the chosen location and either currency nor location and language cannot be changed in the middle of booking process.	4
	Consistency and standards	
P35	The layout, navigation and design seem consistent throughout the website and the booking flow but with every page in the booking flow the user has scroll down immediately after entering the page which causes unnecessary usability issue for the users.	1
	Error prevention	
P36	A clear instruction on how to insert the phone number in the passenger details in the booking flow, is missing. There is a plus sign but no instructions about entering the number in international format which can lead to wrong passenger details in the booking.	3
	Recognition rather than recall	
P37	The flight details are visible throughout the booking flow and departure and arrival details reappear in the end next to the payment options but the flight details like departure and arrival times are not visible midway the booking process for no apparent reason. This seems like an unnecessary usability issue for the user because the user has to recall the details. Instead, the flight details could be fully visible to prevent the user being forced to recall the flight details all the way through the booking flow.	2
	Flexibility and efficiency of use	
P38	There are no shortcuts in the booking flow because users cannot easily move back and forth not skip sections or change booking detail flexibly and the user must go back to the beginning to start over.	2

ID	Problem	Severity
	Aesthetic and minimalist design	
P39	Design is clear and consistent but partly not very minimal and pages have a lot of going such as promotions and other "special offers" kind of content which is distracting users and making it difficult to navigate on the page and find what the user is looking for on the page	2
P40	In the booking flow, the colour of the button that takes the user further in the booking process, is peach colour which is not the most recognizable colour against white background and the colour doesn't change when the selection has been made correctly, which could indicate to the user that the user can move forward in the process	2
	Help users recognize, diagnose, and recover from errors	
P41	No error messages appear when phone number is inserted in a wrong format (without the country code) but plus signs remains there even if number is without the country indication which can lead to incorrect information in the passenger details easily since the user is not able to recognize the error.	4
	Help and documentation	
P42	No support chat option is available on the front page of the website.	4
P43	Customer service is not found in the main page navigation but at the bottom of the page as "Customer Service" (Help & Support) which directs to a page with more subcategories but not a direct way to getting support by contacting the airline.	4
P44	As a subcategory under "Customer Service" is "Assistance" drop-down and under that "Special travel needs" available but the information is very confusing and misleading and user cannot know “Assistance” means people with disabilities and special travel needs and may confuse the meaning with regular customer support function and the location of the information is difficult to find by the user.	4
P45	Check-in possible directly on the front-page main navigation, so it is easy to find by the user but it could be indicated even clearer for easy access.	1

Appendix 3: Heuristic evaluation of Norwegian Air Shuttle

ID	Problem	Severity
	Visibility of system status	
P46	"Your booking is being processed. Please wait.." is appearing in the booking flow together with the progress bar before getting the payment options but no loading time is indicated to the user	1
P47	The button that takes users forward in the booking flow doesn't change its colour when the flight selection or passenger details have been made correctly, the colour always remains red. It would be recommended to have the button change colour as an indication to the user to move forward in the process, for example from colour red to darker red, or another colour to highlight that the step in question is ready.	2
	Match between system and the real world	
P48	Chat bot is only an icon with a face in the corner and it is not indicated that it is in fact a chat bot before the user clicks it. This is not clear enough indication of support chat and does not match with the expectations of the user	2
	User control and freedom	
P49	After selecting the flight details and moving further in the booking, it is not possible to navigate back and modify choices like dates, destinations, or passengers easily and the user must click many steps back and start the whole process all over again.	4
P50	User cannot change the currency at all, the currency is tied together with the chosen location and either currency nor location and language cannot be changed in the middle of booking process.	4
	Consistency and standards	
P51	The layout, navigation and design seem fairly consistent throughout the website and the booking flow but with every page in the booking flow the user has to scroll down a lot on the page which causes unnecessary usability issue for the users.	1
	Error prevention	
	-	
	Recognition rather than recall	
P52	The flight details are visible throughout the booking flow and departure and arrival details reappear in the end next to the payment phase. The format of the flight details is slightly messy and text-heavy and it is difficult for the user to get a quick overview of the booking details. It would be clearer to the user if the flight details would be presented in a clear and compact way which is easily understandable and readable.	1
	Flexibility and efficiency of use	
P53	There are no shortcuts in the booking flow because users cannot easily move back and forth not skip sections or change booking detail flexibly and the user must go back to the beginning to start over.	2
	Aesthetic and minimalist design	
P54	Design throughout the website is not very minimalist, there are a lot of heavy elements visible to the user at all times and a lot of them seem unnecessary information such as aircraft types in the booking flow	2
P55	The colour red is used extensively throughout the website which is supporting the brand guidelines but makes it difficult for the user to find what they want efficiently and user get distracted easily	2
P56	In the booking flow, the selectable flights are laid out in a format which is very text-heavy and it causes the user to scroll all the way down for making the selections and moving forward and it is making it difficult for the user to keep focus	3
	Help users recognize, diagnose, and recover from errors	
	-	
	Help and documentation	
P57	Request special assistance comes up in the booking flow but it is difficult to notice and could be highlighted more	1
P58	Support chat is in the right down-corner but it is not marked as a support chat and it is only an icon so it is difficult to recognize the indication could be more visible.	2
P59	Check-in is not findable on the front page and any navigation. The user must go to the "travelling with us" section in the main menu and under that the user can find check-in and finally under that the online check-in options. The user expects to find resources like check-in fast so it is recommended that the check-in would be possible directly from the front page.	3

Appendix 4: Heuristic evaluation of Icelandair Group

ID	Problem	Severity
	Visibility of system status	
P60	"Augnablik - This means "one moment" in Icelandic, literally "blink of an eye"" appears in the booking flow when flight details have been chosen but no loading times or progress bars appear in the beginning of a booking flow.	1
P61	Progress bar appears after a flight search has been made and the flight options are appearing for user's selection and user can see how many steps there is to go until booking is finished and what is each step containing. The visibility of the progress bar could be improved, it does not stand out from the white background.	1
P62	The button that takes users forward in the booking flow doesn't change its colour when the flight selection, passenger details or terms and conditions have been performed correctly, the colour remains green. It would be recommended to have the button change colour as an indication to the user to move forward in the process, for example from colour green to darker green, or another colour into green, to highlight that the step in question is ready.	2
	Match between system and the real world	
P63	Meanwhile the text "Augnablik - This means "one moment" in Icelandic, literally "blink of an eye"" appearing in the booking flow when flight details have been chosen is unique, witty, and even cute way of telling the user that the process is loading, it not fully agreeable that this matches with user's expectations fully because it is not familiar	1
	User control and freedom	
P64	User cannot change the currency at all, the currency is tied together with the chosen location and either currency nor location and language cannot be changed in the middle of booking process.	4
P65	The dates and other flight details can be edited later in the booking flow and the user can move back quite freely in the booking process until the passenger details are filled in but the edit button can be easily missed since it is not very visible to the user.	1
	Consistency and standards	
P66	The layout, navigation and design seem to be varying a lot on the website which indicates that the consistency is poor. The design of the front page is very different from the design of the booking flow. Front page has plenty of colours and vibrant design, whereas the booking flow is very white and blank. The inconsistency is causing confusion for the user because the experience is not consistent throughout the customer journey on the website.	3
	Error prevention	
P67	A message "Your emergency contact cannot have the same phone number as a passenger included in the booking" appears when identical number to the passenger's number is inserted in the booking. Clear instructions and validation to prevent users from making this error are not included.	1
	Recognition rather than recall	
P68	The flight details are visible throughout the booking flow, including in the end in the payment phase but to be able to see full flight details the user needs to scroll down frequently. The format of the flight details is slightly unclear for the user and it is difficult for the user to get a quick overview of the booking details. It would be clearer to the user if the flight details would be presented in a clear and highlighted way which is easily understandable and readable.	1
	Flexibility and efficiency of use	
P69	There are no shortcuts or advanced options for experienced users even though some level of editing and moving back and forth in the booking flow is possible for the user before the payment options.	1

ID	Problem	Severity
	Aesthetic and minimalist design	
P70	Meanwhile design seems aesthetic and minimalist, in the booking flow the design is almost "too white" with a lot of white background but not very much contrast with the elements, making it difficult for the user to find what the user is looking for. Readability is on a high level mostly because there is a lot of white space but usability suffers from the extensive white space	2
P71	Layout of the flight options is barely visible from the background and it is hard to estimate where another flight end and another starts	2
P72	Meanwhile the progress bar in the booking flow is aesthetic and minimalist, the design of the progress could be darker which would improve the visibility of the progress bar and it would stand out from the white background.	1
P73	The design throughout the website is not consistent. The design of the front page is very different from the design of the booking flow, front page having plenty of vibrant colours and a lot of contrast in design, whereas the booking flow is very white and blank without colours. Design experience is like two different websites.	3
P74	In the booking flow, the colour of the button that takes the user further in the booking process, is green and the colour doesn't change when the terms and conditions have been read and ticked the box correctly. Colour change in the button could indicate to the user that the user can move forward in the process.	2
	Help users recognize, diagnose, and recover from errors	
P75	A message "Your emergency contact cannot have the same phone number as a passenger included in the booking" appears when identical number to the passenger's number is inserted in the booking. Clear error messages that explain what went wrong and how to fix it are partly present because the error message is clear but it doesn't explain how to fix it.	1
	Help and documentation	
P76	Support chat is on the front page right down corner but the visibility and findability of the chat is not on a high level because the id doesn't say "support" and it is only an icon, which blends into the background and hence cannot easily be seen by the user.	1
P77	Request special assistance doesn't come up in the booking flow (compare SAS)	3
P78	Check-in is not findable on the front page and any navigation. The user must go to the "pre-flight" section of the navigation and under that the user can find check-in possibility. The user expects to find resources like check-in fast so it recommended that the check-in would be possible directly from the front page.	3