USER EXPERIENCE ON AN ECOMMERCE WEBSITE – A CASE STUDY

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Author: Saima Ritonummi
Subject: Digital Marketing and Corporate Communication
Supervisor: Outi Niininen

JYVÄSKYLÄN YLIOPISTO
UNIVERSITY OF JYVÄSKYLÄ

ABSTRACT

Author	
Saima Ritonummi	
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Abstract

User Experience (UX) consists of user interacting with a system in a specific context. Usability addresses efficiency, effectiveness, and satisfaction (i.e. user's ability to use an interface), whereas UX describes the whole interaction, including user's thoughts and feelings about the interaction. In user-centered design practice, the goal is to help users work more efficiently and effortlessly. User needs are two-fold: the interaction should fulfill both pragmatic and hedonic user needs. Good UX is an important factor of efficient, satisfactory online customer journey. In this study, customer journey is the path user goes through on an ecommerce website. Planning the customer journey carefully will help users perform tasks efficiently and accomplish their goals and ease their decision-making process. Task performance and user satisfaction are predictors for positive UX, which predicts consumer trust and purchase intention. Ultimately, the goal for an ecommerce website is to generate more sales and increase customer satisfaction.

The purpose of website usability testing is to discover successful and unsuccessful features; pain points and problems that prevent users from accomplishing their goals and are likely to affect UX negatively. This study is conducted for a case company using qualitative usability testing method, cognitive walkthrough. Cognitive walkthrough helps to discover potential usability problems, reasons behind them, and possible solutions to them. In addition, exit interview includes UX questions, where participants evaluate their own subjective experience of the interaction.

This study aims to answer if the website facilitates good UX and customer journey. Findings suggest that case company's website is successful when it comes to usability, the pragmatic quality of the interaction. However, UX, the hedonic quality of interaction suffers from some design choices. The shopping process on the website is simple and intuitive, but at the same time one usability problem caused uncertainty and hesitation before purchase decision. Research findings support the idea that user needs are two-fold, and users have both pragmatic and hedonic expectations for interaction.

Key words
User experience, usability, web design, ecommerce, online customer journey, consumer decision-making
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Tiivistelmä

Käyttökokemus (UX) koostuu käyttäjän sekä käyttöliittymän vuorovaikutuksesta tietyssä kontekstissa, sisältäen myös kokemukseen liittyvät tunteet sekä ajatukset. Käytettävyys puolestaan käsittää käyttöliittymän tehokkuuden sekä käyttäjän tyytyväisyyden. Käyttäjäkeskeisen vuorovaikutussuunnittelun tavoite on luoda tehokkaampia ja vaivattomampia käyttöliittymiä, esimerkiksi nettisivuja. Suunnittelussa on huomioitava käyttäjien kahtalaiset tarpeet; vuorovaikutuksen tulee täyttää sekä käytännön tarpeet että hedoniset tarpeet. Hyvä käyttökokemus on tärkeä tekijä toimivan asiakaspolun luomiseksi verkossa. Tässä tutkimuksessa asiakaspolku käsittää nettisivulla tapahtuvan ostoprosessin. Asiakaspolun suunnittelu auttaa kuluttajaa saavuttamaan tavoitteensa sekä helpottaa päätöksentekoprosessia, jotka ennustavat positiivista käyttökokemusta – mikä lisää kuluttajan luottamusta sekä ostoaikeita.

Käyttötestauksella selvitetään, mitkä elementit ja ominaisuudet ovat onnistuneita käyttäjän näkökulmasta ja mitkä toisaalta aiheuttavat hankaluuksia sekä estävät käyttäjää saavuttamasta tavoitteitaan, vaikuttaen negatiivisesti käyttökokemukseen. Tämä tutkimus toteutetaan cognitive walkthrough -metodilla tapaustukimuksena yrityksen nettisivuille. Cognitive walkthrough on käyttötestauksessa laajalti käytetty metodi, jonka avulla paikannetaan mahdollisia ongelmia käytettävyyteen liittyen. Lisäksi tutkimukseen osallistuvat täyttävät haastattelun, joka sisältää käyttökokemukseen liittyviä kysymyksiä ja arvioinnin siitä, millainen käyttökokemus heidän mielestään oli.

Tutkimuksen tavoitteena on selvittää, ovatko yrityksen nettisivujen käyttökokemus sekä asiakaspolku onnistuneita. Tulokset viittaavat siihen, että käytettävyyden ja käytännöllisyyden puolesta nettisivut ovat onnistuneet, mutta itse käyttökokemus kärsii hieman suunnittelussa tehdyistä valinnoista. Ostoprosessi nettisivuilla on yksinkertainen ja intuitiivinen, mutta yksi käytettävyysongelma aiheutti osallistujissa epävarmuutta liittyen ostopäätöksen tekoon. Tutkimustulokset tukevat teoriaa, jonka mukaan käyttäjän tarpeet vuorovaikutukselle ovat kahtalaiset; pragmaattisen käytettävyyden lisäksi myös vuorovaikutukseen liittyvät tunteet vaikuttavat arvioon käyttökokemuksesta.

Avainsanat	
Käyttökokemus, käytettävyys, käyttöliittymäsuunnittelu, nettikauppa, asiakaspolku, kuluttajakäyttäytyminen	
Säilytyspaikka	
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1   INTRODUCTION

The topic of this thesis is user experience on a Finnish ecommerce website and how their redesigned website supports user experience (UX) and customer journey. The case company renewed their website last year to provide good UX, which can help them reach their business goals. The focus of this study is on investigating the role of usability and user experience in ecommerce context: how usability contributes to good user experience, and how it can be utilized in creating satisfying online customer journeys. In addition to academic research on these topics, there are plenty of design guidelines and principles for clear and enjoyable web design. Scope of the research will be following keywords: user experience, usability, web design, ecommerce, online customer journey, and consumer decision-making. Keywords are briefly introduced in this chapter and described in detail in literature review.

1.1   Background of user experience

What is a good website? What does it do? A good, well-designed website is easy-to-use and has functions that guide users to take the *desired action*. From marketing perspective, the desired action is a *conversion*. Websites should intuitively support this business objective. Conversion on a website can be for example buying a product or signing up for a newsletter. Also, conversion rate is a way of measuring the effectiveness of user experience. (Garrett, 2011)

User Experience (UX) is important for company's commercial success. The benefits of UX are two-fold: on one hand, design improves experience, and on the other hand, experience increases adoption (CareerFoundry, 2019). For an ecommerce business, good UX helps also to establish a trustful relationship with customers, as positive UX confirms customers' expectations (Al Sokkar & Law, 2013). The goal is to design useful, usable and delightful interfaces for a specific context of use, as well as to align user goals with business goals. If users achieve their goal, they have a good experience. A good experience is likely to result in users returning to use the service and recommending it, which increases website traffic and conversion rate. (CareerFoundry, 2019.)

To understand UX, it is important to define *usability*. According to Norman (2013), the *experience* of a product covers more than merely its usability; including experiential aspects, such as aesthetics, pleasure, and fun. Usability has a major role for transactional websites (ecommerce), as they need to enable users to achieve their goals *efficiently*, *effectively*, and *satisfactorily* (Díaz et al., 2017). Usability heuristics by Nielsen (1995) have long been general guidelines for good (web) design but there are also updated sets of heuristics, such as usability heuristics for transactional web applications by Quiñones et al. (2014).

Usability is linked to UX, as the easier a product is to learn, the better the UX will be. To be usable and relevant for the user, a product has to solve a problem user has. Part of UX design is asking questions and finding out *what the problem is* and how design can solve that problem. The idea of usability testing is to identify usability problems users encounter when interacting with interfaces. (CareerFoundry, 2019.) Usability testing is an important aspect of user-centered design (UCD), which along with the concept of UX originates from Norman & Draper's work in the 1980's. It has long been the dominant approach for designing usable interfaces and it is associated with many disciplines of research, including e.g. Information Science, Cognitive Psychology, and Organizational Behavior. (Ritter et al., 2014; Eshet & Bouwman, 2017.) UX design is a dynamic process, where all stages of the process (including ideas, wireframes, and prototypes) can benefit from usability testing. User research and usability testing are fundamental to UX design: they allow improving the original design and eliminating problems users may have encountered otherwise. Even one round of testing can be critical for the interface's success. Usually five participants is suggested for usability testing in order to identify 85% of usability problems, but some researchers suggest that it might take few more. (Careerfoundry, 2019.)

1.2   Background of online customer journeys

According to PayPal (2018), we are going through an ecommerce revolution, which affects how people shop online and across borders: technology advancement creates opportunities for everyone, regardless of their location, device, or the time of day. Although Finnish ecommerce is growing fast (estimation is considerably higher than the 3% annual growth of Finnish economy), Nordic Countries are facing a challenge as a result of Amazon.com and other big players entering the markets (Paytrail, 2018).

As mobile technologies and social media have changed customer journeys to a direction where customers can choose which course they wish to take on the journey, customer journey mapping has become an important tool. Multi-channel consumer behavior, such as *showrooming*, *webrooming*, and *Zero Moment of Truth* are results of the integration of different channels in consumer's decision-making process (Wolny & Charoensuksai, 2014), but they will be out of the focus of this thesis, as will be different methods to approach journey analysis as a whole. Instead, online customer journeys are explained understand *customer journey on an ecommerce website*, and how it is related to user experience; how cognitive load, perceived irritation, and perceived website quality affect e.g. ecommerce website's performance and non-buyer behavior.

Improving UX is a relevant theme in ecommerce research. Web design is considered as an important facilitator of good UX, as well as online shopping attitudes and behavior (Wang et al., 2014). Retailers must be able to understand consumer needs and desires – not only to adapt, but to show their relevance in the very competitive marketplace of ecommerce (Djamasbi et al., 2010). This

includes finding out *what users struggle with*. Fazeli et al. (2019) suggest that possible challenges of online shopping include e.g. cognitive engagement and emotional attachment; online retailers need to overcome consumer skepticism and frame their message right in order to succeed. This could be related to a typical problem in online stores: shopping cart abandonment. Global cart abandonment rate (shoppers leaving the website without completing a purchase) is estimated to be around 70% (Statista, 2019). Common reasons for cart abandonment are e.g. total price including shipping costs is too high, customer's preferred payment method is not available, technical problems with the website, or uncertainty about the terms and conditions of ordering (Paytrail, 2018).

1.3   Research problem and objectives

The objective of the research is to study user experience at a specific ecommerce website after redesign, and how well the new design facilitates a positive user experience and a smooth online customer journey. The aim is to examine how web design affects perceived usability and UX. The objective for the case company is to gain insight about the usability of their new website and if the design supports their business objectives, most importantly conversion. To reach these objectives, this study aims to answer following research questions:

The first research question is:

Does the new design facilitate good user experience on the website?

The second research question is:

Does the new design of the website support conversion i.e. lead intuitively to purchase, measured by cognitive walkthrough research method?

The first question will find out how the new website accomplishes to meet usability criteria and facilitate good UX, which will be analyzed from the cognitive walkthrough feedback. The second question addresses the topic from customer journey view and its purpose is to find out, does the new design indicate clearly what users can do on the website and how to accomplish their goals. The research questions will be approached through theoretical and empirical research. Research method will be cognitive walkthrough, a widely used method in usability testing and UX research, which focuses on evaluating the design for its *ease of learning* (Andre et al., 2004).

1.4   Structure of the study

First chapter explains the outline of this thesis. Following two chapters include literature relevant academic research on user experience and online customer

journeys. Chapter two discusses user experience and some important web design considerations, such as user-centered design, responsive design, aesthetics and visual attractiveness, online flow experience, and designing for trust. Chapter three addresses online customer journeys and consumer decision-making on websites. Theoretical key concepts are presented in FIGURE 1.
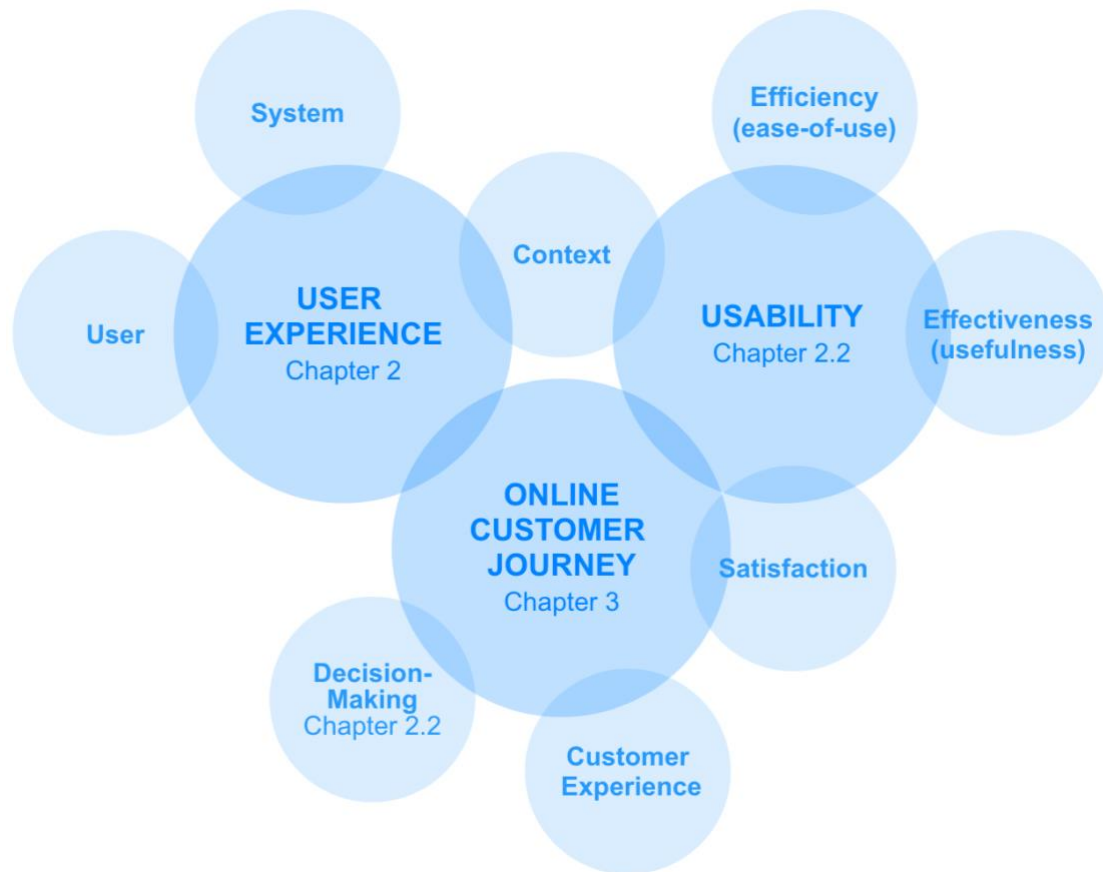
FIGURE 1 Topics covered in literature review

Chapter four introduces research methodology. Empirical research, cognitive walkthrough will be carried out to assess the user experience and customer journey on case company's website, to find out possible usability problems. The proposition is that if user experience is good, customer journey will be smoother, and the participants will encounter less usability problems. Research results are presented in chapter five. Results are followed by discussion about the theoretical and managerial implications of the study in chapter six, including the limitations of the study and ideas for future research. Finally, the conclusions are presented in chapter seven. Appendices are found at the end and they include website wireframes, cognitive walkthrough task list, exit interview, pilot study findings, participant demographics, and individual walkthrough task analyses.

2   USER EXPERIENCE

This chapter will discuss user experience (UX), focusing on user experience as a field of study, briefly addressing UX design practice considerations as well. Usability is an important aspect of user experience, which will be addressed after UX, and followed by introduction to important web design considerations, such user-centered design, responsive design, and accessibility.

2.1   What UX is

The history of UX starts from Don Norman's work in the 1980's. *User Centered System Design: New Perspectives on Human-Computer Interaction* (Norman & Draper, 1986) and *The Psychology of Everyday Things* by Norman (republished as *The Design of Everyday Things* in 2013) were great advances in Human-Computer Interaction field. The term user experience was officially established in 1995. Because UX has been a buzzword in Human-Computer Interaction (HCI) research and interaction design for long, the term can be associated with many meanings, all emphasizing some aspect of technology use. UX qualities include e.g. functionality, aesthetics, affordances, responsiveness, hedonic aspects of interaction, (Hassenzahl & Tractinsky, 2006) as well as affect, emotion, fun, and flow (Law, 2011). On the contrary to the preceding usability paradigm, which is more task related, UX goes beyond instrumental. Early on in the process of defining UX, beauty and aesthetics was recognized as a quality aspect of technology usage (see chapter 2.3.3 Aesthetics and visual attractiveness). Need for aesthetics can be derived from Maslow's hierarchy of needs. The interesting question is: are instrumental and non-instrumental quality aspects and user needs related to each other, or independent of each other – i.e. are beauty and usability related? Research on UX supports both views. (Hassenzahl & Tractinsky, 2006.)

UX is a widely used term with many definitions, depending on the perspective. It can be considered as a *phenomenon*, *field of study*, or *design practice*. As a phenomenon UX explains the circumstances and consequences of user experience and describes it as a subset of the general concept of experience: UX occurs in interaction with a system – it is always unique to an individual, their prior experiences and expectations, and social and cultural context. As a field of study, UX examines the phenomenon, *how* the experiences are formed. As a design practice UX is incorporated in designing user interfaces. As a verb UX describes the cognitive process of perceptions, interpretations, and resulting emotions in an interaction with a system. As a noun user experience refers to the interaction and the outcome of the interaction as an event. Also, co-experience might be worth to consider in UX, if the nature of the system is to provide a social experience. (Roto et al., 2011.)

2.1.1 Factors of UX

According to ISO 9241-210:2019 (International Standard on Ergonomics of Human-System Interaction), UX is user's perceptions and responses resulting from interacting with a system. It consists of three factors: *system*, *user*, and *context* (ISO, 2019). Many researchers agree on these three factors of UX (see TABLE 1), including Roto et al. (2011) and Hassenzahl & Tractinsky (2006). *System* refers to the system characteristics (functionalities, system performance, presentation, interactive behavior), *user* to the user's internal state (their experiences, attitudes, skills, abilities, and personality), and *context* to the context where the interaction occurs. A more recent view about the core factors presented by Sulaiman et al. (2015) acknowledges *temporal aspect* (time) as the fourth factor. The argument for including temporality to the core factors is that it is impossible to have an experience without having a sense of time, whether measurable (through clock) or psychological (personal sense of time). Personal sense of time has had more emphasis in UX research. (Sulaiman et al., 2015.) Although Sulaiman et al. (2015) present four core factors of UX instead of three, the temporal aspect is present also in Hassenzahl & Tractinsky's (2006) view, included in the *context* factor.

TABLE 1 Factors of UX

Factors of UX according to researchers				
ISO 9241-210:2019	System	User	Context	
Roto et al. (2011)	System	User	Context	
Sulaiman et al. (2015)	System	User	Context	Temporality
Hassenzahl & Tractinsky (2006)	System	User	Context	

Sulaiman et al. (2015) emphasize user's role in UX. User personality is studied in order to understand how it affects behavior during interaction and judgments that are made about the interaction. Personality is often said to consist of two variables: traits and attitude. Personality traits include openness, conscientiousness, extroversion, agreeableness, neuroticism (these five traits are called the Big Five). Attitude variable includes the user's perceptions, beliefs, and approach. An interesting research finding regarding personality traits and UX is that extroverts tend to find more usability problems than introverts. This supports the belief that user's personality has an impact on the behavior during the interaction and judgments of the experience. (Sulaiman et al., 2015.)

Also, user's abilities and disabilities (including spatial and cognitive aspects) affect their capacity to perform tasks and perceive system qualities. These can affect user performance. Studies have shown that e.g. age and other demographic factors have an effect on user performance. Some studies demonstrate that with age comes experience (which results in better

performance), and on the contrary, other studies have demonstrated that e.g. motor impairment and decrease in cognitive abilities (which usually comes along with aging) affect user performance. Given that, it can be inferred that personality, demographic factors, and user's needs and goals all have an impact on UX through affecting both user's cognitive abilities (knowledge), and spatial abilities (physical ability to perform). (Sulaiman et al., 2015.)

The system characteristics naturally define many aspects of the UX. Constraints and affordances of the system determine what is possible to accomplish with the system and what is not. Here, system refers to the features: functionalities, aesthetics, responsiveness, and other properties of the interface. Context is a combination of many circumstances, referring to the physical, social, technical, information, and task context. Thus, it is possible that UX changes even if the user or the system does not change, which makes UX a dynamic process. Also, user's resources (mental and physical), mood and expectations for the interaction can affect UX . (Roto et al., 2011.)

Although the factors of UX cannot describe UX as a whole, breaking down an experience to helps to understand, why a *particular user* experienced a *particular experience*, and what possible reasons are behind the experience (Roto et al., 2011). Another way to look at the composition of UX is Hassenzahl & Tractinsky's (2006) suggestion of three facets (see FIGURE 2). This experiential perspective on UX research emphasizes the temporality and situatedness (context) of technology use, meaning that the experience also has *facets* in addition to the core factors (system, user, context).
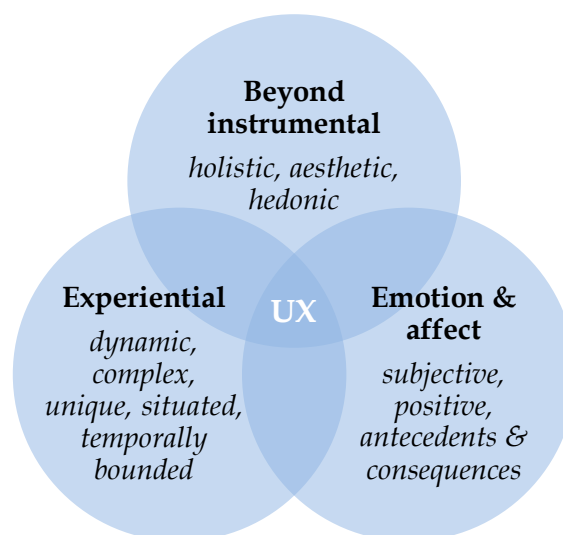
FIGURE 2 Facets of UX (Hassenzahl & Tractinsky, 2006, p. 95)

According to Hassenzahl & Tractinsky (2006), these facets contribute to the concept of UX, each increasing our understanding of UX, and conclude that none of the facets can explain UX by themselves, as UX is "a subjective, situated, complex and dynamic encounter" (Hassenzahl & Tractinsky, 2006, p. 95). Sulaiman et al. (2015) describe the nature of UX quite similarly as *subjective*,

dynamic, and *context dependent*. They also emphasize that the core factors of UX are interrelated and interdependent. Hence, it is challenging to define, model, measure, and validate UX – which is one of the reasons that there still is no consensus about the definition of UX (Sulaiman et al., 2015). Jokinen (2015), too, argues that UX is difficult to theorize, because it is a holistic and contextual experience in nature. However, the general consensus is that all factors of UX interact with each other, and thus modify each other and the whole experience.

2.1.2 Time span of UX

The essence of UX is to understand emotions, preferences, perceptions, and beliefs that affect user's interaction with the system before, during, and after use (Eshet & Bouwman, 2017). The time span of user experience is longer than the actual usage, starting from an indirect experience prior to the first encounter (expectations formed through advertisements, similar technologies etc.), continuing with an indirect experience after usage (reflecting on usage afterwards). FIGURE 3 (modified from Roto et al., 2011) describes *when* (top row), *what* (second row), and *how* (third row) the process of UX takes place.

| *Before usage* **Anticipated UX** Imagining the experience | *During usage* **Momentary UX** Experiencing | *After usage* **Episodic UX** Reflecting on an experience | *Over time* **Cumulative UX** Recollecting multiple periods of use |
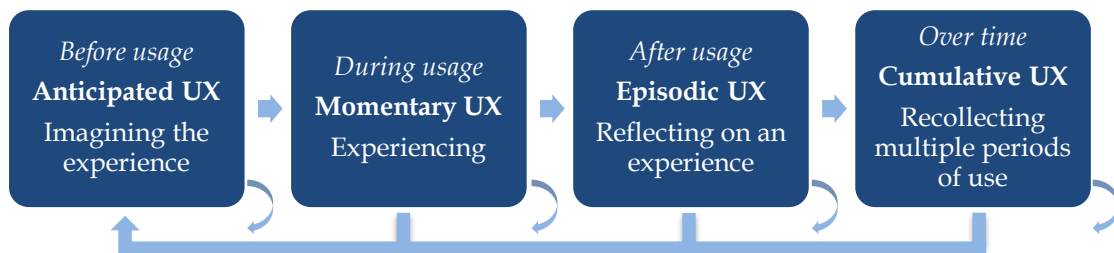
FIGURE 3 Time span of user experience

The observed time span defines the focus of what is studied: momentary UX, episodic UX, or cumulative UX. Momentary focus helps to get insight on user's emotional responses, whereas long term focus helps to understand the eventual impact of those momentary experiences. Long-term approach can help to design UX as a journey by taking into account the first encounter, episodes of usage, and post-usage reflection. (Roto et al., 2011.) According to Law (2011), the role of memory in UX – especially in its temporality – is to retain and recall past experiences and mental models.

2.1.3 Emotional UX

Emotional aspects in UX has been a rising theme in UX research. Recognizing *emotional user needs* is essential in UX practice. Removing usability problems and technical problems, which cause frustration and obstruct the use is important – but not enough. (Roto et al., 2016.) According to Law (2011), UX research is based

on many conceptual frameworks (such as theories of emotion), which address the relationship between *perception*, *action*, and *cognition*. Hassenzahl & Tractinsky (2006) argue that there are two basic ways to look at emotions in UX: one is to emphasize emotions as *consequences of use*, and the other is to emphasize emotions as *antecedents of use* and judgements. Generally, affect is seen as an antecedent, as well as a consequence and a mediator in UX research.

Interestingly, UX research is usually focused on positive emotions (Hassenzahl & Tractinsky, 2006), although we know that user experiences evoke both positive and negative emotions (Sulaiman et al., 2015). The positivity dominant approach comes from HCI tradition of trying to prevent frustration and dissatisfaction in technology use. For example, Norman (2004) emphasizes the importance of positive emotions to *learning*, *curiosity*, and *creative thinking*; happy people are more tolerant for minor difficulties and more wired to find solutions to problems. UX research adds in to HCI tradition of preventing frustration with studying positive emotional outcomes, like *joy* and *fun* (Hassenzahl & Tractinsky, 2006). Frustration is a negative affective response, usually a response to user experiencing usability problems, including affective responses, such as anger, fear, and unhappiness. Frustration is one criterion for classifying usability problems and their severity (Bruun et al., 2016).

Often-asked question in UX research is: can experiences and emotions be designed? The answer to the question seems to be that it is at least possible to establish a *context* for the experience and for emotion – rather than to design the emotion itself. Same question can be asked about experiences: is it possible to design an experience? Again, designers can establish the context *for experience*, but with so many elements affecting each other it seems quite impossible to design *an experience*. (Hassenzahl & Tractinsky, 2006.) Further, one could ask if user experience can be predicted. According to Law (2011), UX can be predicted to some extent with a margin of error.

Emotional user experience is dependent on several factors, including user's technological problem-solving tendency, frustration tendency, pre-task self-confidence, and task performance, for example. All of these factors affect the user's subjective emotional experience and coping while performing tasks. Subjective experience has received much attention in HCI research, and scholars widely agree that emotion is one of the most important dimensions of user experience. (Jokinen, 2015.) However, Jokinen points out that even though emotional UX has received attention in UX research, a psychologically valid theory of emotional UX is still needed. Both experiments and interaction design rely more on intuitional rather than theoretically valid methods. There is also debate whether emotion can be measured with measurement items, as emotion is still a debated topic in psychology. (Jokinen, 2015.)

Appraisal theory is applied mostly in psychology, but it is a helpful framework for understanding the emotional aspects of UX. According to appraisal theory, emotions can be seen as cognitive processes; they are a result of evaluating events and their significance. In line with general discourse in UX research, appraisal theory focuses on the subjective interpretation of events as the explanation for emotions. Primary appraisal is individual's evaluation of an

event, reflecting the event's relevance to their personal goals and values. Primary appraisal attaches subjective significance (the meaning) to the event. Secondary appraisal is individual's control over the event, their ability to cope with it and adjust to it. Appraisal is mostly an unconscious process; there is a difference between implicit emotional process and explicit representation of emotion. In appraisal theory, the conscious part i.e. the experience is called a *feeling*. Feelings are mental representations of emotional experiences, and more frequently occurring feelings are called *modal states* (e.g. anger, fear, and joy). Although basic theory of emotions can be criticized in many ways, understanding emotions is useful in UX research. Appraisal in human-technology interaction is for the most part an unconscious process, but even so, the user forms mental representations (emotions) which result in a conscious experience. (Jokinen, 2015.)

Appraisal process starts with a triggering event, which is followed by a cognitive process of evaluating the subjective relevance of the event and one's coping capacity. For example, *task performance* (triggering event) and *user satisfaction* (emotional response) have a positive correlation. Successful events tend to be appraised as pleasant, because they are aligned with user's goals. Conversely, obstructions in use result in frustration, anxiety, and confusion. They tend to be appraised as incongruent with user's goals. So, feelings of competence arise from successful task performance, and feelings of frustration arise from being unable to accomplish task goals. Feeling of competence is closely related to self-efficacy, but it is important to note that self-efficacy refers to user's *beliefs* in their own abilities, whereas competence is the *emotional result* of successfully employing those abilities. The feeling of competence and frustration can be explained with Competence-Frustration model. The model is bipolar, which means that competence and frustration are independent in their valence. Valence is a dimension of emotion; events are appraised usually as pleasant or unpleasant by their valence. Competence and frustration are not necessarily negatively correlated. Even if user faces obstacles during the interaction and feels frustrated, they can still be able to complete the task and feel competence after doing so. In research, frustration usually is associated with the features of the technology, while competence is associated with the user's skills. (Jokinen, 2015.)

When primary appraisal has determined the *personal significance* of an event as pleasant or not pleasant, secondary appraisal is the user's *evaluation* of their ability to cope with the event. Feeling of competence is a result of feeling in control, whereas feeling of frustration is a result of feeling powerless over the events. Coping strategies can be divided into two main categories: problem-solving centered approach and emotion-centered approach. Usually, when feeling of control is appraised high, problem-solving approach is more likely to be employed, and conversely, when feeling of control is appraised low, emotional approach is more likely strategy to deal with the emotional responses. *Frustration tendency* describes the tendency to get frustrated with technological difficulties to the extent that user's emotional stability is interfered if they are not able to solve the problem at hand. Moods are considered as an important part of UX, because they can affect users' beliefs about their own abilities. Compared to emotions, moods are more persistent and might lack a clear antecedent (whereas

emotions are results of events). Pre-task self-confidence can affect the UX by increasing the feeling of competence and reducing the feeling of frustration. Also, individuals may have both high frustration tendency and high problem-solving trait, i.e. they do not dismiss each other. (Jokinen, 2015.)

Designing for experience approach has been adopted in many applications, including consumer-oriented ecommerce websites. As individual coping traits seem to affect both appraisals and resulting emotional experiences, it is important to understand these underlying factors of emotional user experience in order to design efficient user interfaces. (Jokinen, 2015.) Feeling of frustration is also linked to consumer behavior, which is discussed in next chapter. The importance of affective qualities of experience arises from the very basic psychological human needs for stimulation, relatedness, competence, and popularity. Depending of which aspect of user experience is emphasized, UX frameworks can be divided into interaction-centered, user-centered, and system-centered. Regardless of the framework, the goal is to design more useful, pleasant, and attractive interfaces. (Sulaiman et al., 2015.) Similarly, Law et al. (2014) argue that although each UX framework has their own emphasis, they often address same psychological constructs and they all are focused on advancing interaction design.

2.1.4 UX and user interfaces

When talking about UX, it is also important to define briefly User Interfaces (UIs). UIs are part of UX, they are the functionalities and visual design that facilitates the experience. The purpose of UI design is to maximize usability and enhance UX. Effective UI design takes into account common web conventions, such responsive design and accessibility (Interaction Design Foundation, 2019b) According to Díaz et al. (2017), user interfaces consist of following components: *metaphors*, *mental models*, *navigation*, *interaction*, and *appearance*. Metaphors are concepts communicated via words, photos, or sounds (e.g. shopping carts). Mental models include organization of data, functions, tasks, and roles (e.g. content hierarchies and task hierarchies). Navigation allows moving on the interface (e.g. menus, control panels and icons). Interaction include the input/output techniques (e.g. drag-and-drop selections and action sequences). Finally, appearance includes the overall appearance of the interface, including visual and auditory characteristics: colors, fonts, and verbal style, for example. (Díaz et al., 2017.) Essentially, UIs include the layout, colors, typography, imagery and iconography of the website (Interaction Design Foundation, 2019b).

Some key considerations for UI design are *predictability*, *discoverability*, *simplicity*, *hierarchy*, *readability*, *control objects*, *system feedback*, and *brand consistency* (see TABLE 2) (Interaction Design Foundation, 2019b). These considerations include very similar aspects as Norman's famous *Seven Fundamental Principles of Design* (2013), which are applied both in digital and physical design context. Norman's principles are *discoverability*, which is a result of appropriate application of the following principles: *feedback*, *conceptual model*, *affordances*, *signifiers*, *mappings* and *constraints*. Discoverability helps the user to understand

what actions are possible. Feedback provides continuous information about the results of actions and the current state of the system. Conceptual model about the system creates a feeling for the user that they understand what is going on and have a feeling of control over the process. Affordances are possible interactions between the user and the interface; they exist to make desired actions possible and tell us what a thing *is for* (for example, a button on a website affords clicking it – therefore, the button is for clicking). Signifiers communicate most importantly the affordances (a button on a website signifies that it can be clicked), but they also make sure discoverability and feedback are communicated clearly. The practical difference between affordances and signifiers is that some affordances are perceivable (others are not), but all signifiers *must* be perceivable, otherwise they fail to function. Mappings are the relationship between controls and their actions, i.e. the spatial layout of an interface. Constraints guide the actions and interpretations about the interface, and provide physical, logical, semantic, and cultural cues about the possible interactions. (Norman, 2013.)

TABLE 2 User Interface design principles

User Interface Design Considerations *(Interaction Design Foundation, 2019)*	Seven Fundamental Principles of Design *(Norman, 2013)*
Predictability	Discoverability
Discoverability	Feedback
Simplicity	Conceptual model
Hierarchy	Affordances
Readability	Signifiers
Control objects	Mappings
System feedback	Constraints
Brand consistency	

From psychological point of view, Johnson (2010) presents two important categories of UI design: *perception* and *cognition*. Johnson states that all design rules are essentially based on human psychology. Especially cognitive science has had an impact on UX and UI design principles, because they are related to how we perceive, learn, remember and reason, and how all these are converted into action. Perception is closely related to human vision, which is optimized to perceive structure. Structure is what we seek when interacting with interfaces as well. However, there are many constraints: perception is often biased (as a result of experiences or goals), and our color vision and peripheral vision are limited. When it comes to cognition, attention and memory are limited as well. These

limits on attention and memory shape our thoughts and actions. Recognition is easier than recall and it is easy to learn something from experience and execute those learned actions. Problem-solving, novel actions and calculation are harder and require more cognitive effort. (Johnson, 2010.) How we perceive and group objects can be examined with Gestalt principles (principles of grouping). They originate from psychological research but are widely used in UI design. Some commonly known Gestalt principles are *connectedness*, *continuity*, *closure*, *proximity*, and *similarity*. For example, *Law of Closure* describes the mind's tendency to fill in gaps between elements that are seen as a whole. *Law of Unified Connectedness* describes how elements connected by colors, lines, frames, or other shapes are perceived as whole. *Law of Proximity* describes the tendency to perceive closely situated elements as related to each other. (Interaction Design Foundation, 2019c.) Also, *Fitts' law* is related to the law of proximity. Fitts' law examines hand-eye coordination and pointing at things and it applies to any kind of pointing (mouse, trackpad, touchscreen). However, individual abilities and the features of the device affect how fast the pointing movement can be. Based on Fitts' law, HCI research has demonstrated that the larger the target on the screen and the nearer the target is to user's starting point, the faster the pointing process will be. When distance to the target increases, time to reach the target increases. Consequently, when target width increases, the time to reach the target decreases. (Johnson, 2013.) Fitts' law is an example of model-based empirical method, which is used in quantitative UX research (Law, 2011).

When users perceive an interface hard to interact with, that might cause problems and discourage them from using the interface. *Perceived ease-of-use* is the degree to which using a particular system seems effortless. It is often implied that when users are able to customize an interface, they feel *sense of control* over it, resulting in higher perceived efficiency, overall satisfaction, and enhanced UX. The benefits are two-fold: both customers and developers benefit from customizable user interfaces. For users, freedom to customize helps them to shape the UI to fit their needs. For developers, customizable UI means they can provide for a wider audience. (Hui & See, 2015.)

The challenge of UX is the application of theoretical frameworks and knowledge about UX into concrete design practice (Law et al., 2014). According to Webflow (2019), UX design is simply about knowing the audience. What are their needs and goals? What are they looking for? How the design can make finding those things easy? Essentially, UX and UI design principles are quite similar: keeping everything simple and intuitive, communicating concepts in logical sequence, and meeting the needs of the audience. The interface is supposed to serve the audience and stimulate emotions. (Webflow, 2019.)

2.1.5 Measuring UX

There are two approaches to researching UX: qualitative and quantitative. Qualitative approach (design-based approach) is the prevalent approach in UX research. A strong argument for qualitative approach is that often it can give better insight on cognitive and emotional processes of users. However, UX

questionnaires are fairly popular, which indicates that there is a need for quantitative, model-based approach as well. According to Law, recommended approach is combining both qualitative and quantitative methods in UX research, and presents a profound question: is it possible to break down an experience into quantifiable constructs? The holistic camp believes that it is not, and the reductionist camp believes that it is, by modeling. (Law, 2011.)

The challenge is that some things are more measurable than others and how to assess constructs, such as fun, beauty, and trust. Some researchers believe that numerical values do not provide useful, valid, and meaningless information about the complex human-computer interactions. Further, some even deny that it is possible to measure affective states and emotions, such as love, happiness, and frustration. However, other views argue that almost anything is measurable in some way. Everything can be measured arbitrarily, but the concern is how *meaningful* the data is. There is a change that the data can be useless or even misleading. Hence, it is critical for the success of measuring UX to plan the data collection procedure, in order to gather meaningful data about UX. (Law, 2011.)

2.2   Usability

Usability is a significant aspect of UX. Usability is the extent to which a system can be used in a specified context to achieve goals effectively, efficiently and satisfactorily. ISO 9241-210:2019 standard describes usability as a result of perceived *effectiveness*, *efficiency*, and *satisfaction*. (ISO, 2019.)

According to Coursaris & van Osch (2016), two dimensions frequently associated to cognitive aspects of usability are *effectiveness (*how accurately and completely user can achieve the goals that are to be achieved) and *efficiency* (resources that are used to achieve that goal in an effective manner). Studies have demonstrated a strong relationship between *effectiveness* (usefulness) and *efficiency* (ease-of-use). The easier an interface is to interact with, the more resources can be allocated to additional activities, resulting in increased task performance. Research also suggests that the two cognitive factors have an impact on *user satisfaction*, the *affective* result of enjoyable experiences, including feelings of fun and enjoyment. Aesthetic perspective of affection emphasizes the conception of beauty (what is pleasing for our senses), and it is especially associated with *perceived usability*. Another perspective on affection addresses playfulness, the more interactive aspect of experience, which is linked to motivation towards continuing the usage. Acknowledging both cognitive and affective dimensions helps to understand how perceived usability affects user satisfaction. Research suggests that the more organized and visually pleasing an interface is perceived as, the less effort user needs to put into using the interface, which results in increased user satisfaction. (Coursaris & van Osch, 2016.)

2.2.1 Usability and UX

According to ISO 9241-210:2019 standard, usability includes same kind of emotional and perceptual aspects that are typically associated also with UX. Usability contributes to good UX, especially in ecommerce context where they are extremely important for commercial success. Usability is an established and well-researched concept, whereas UX is still less clearly defined. Common consensus in HCI research about the relationship is that usability is a part of UX. Another approach suggests that UX is a broad term for *satisfaction*, which is a dimension of usability. Third approach describes UX and usability as close and intersecting, but still separate concepts with distinct features: usability can be seen as user's *ability to use* an interface or do a task, while UX regards the *whole interaction*, including thoughts, feelings, and perceptions – users engaging in an interactive environment and leaving either with positive or negative emotions, which is why many UX definitions address the role of emotions and focus on well-being, the *outcome* of interaction, not so much on *performance*. (de Villiers & van Biljon, 2012.) Also Law (2011) mentions that there are many differing views of the UX-usability relationship, but there is an agreement that a certain threshold level of usability is required in order to experience positive UX.

Also, what is measured in UX and usability research is slightly different. Usability tests measure task-related performance (efficiency, effectiveness, error rate) and methods are usually based on cognition related factors, whereas UX studies focus more on affective qualities (sensation, meaning, value) in addition to task-related performance. (Sulaiman et al., 2015.) Hence, UX goals are more subjective in nature (user's evaluation), whereas usability goals are more objective in nature (performance). This dualism can also be described as pragmatism and hedonism. Pragmatism refers to behavioral goals and the ease-of-use (usability goals), and hedonism to enjoyment and stimulation (UX goals). (de Villiers & van Biljon, 2012.) The difference between UX measures and usability measures is that UX measures describe usually the *outcome* of interaction (e.g. level of fun) and might not reveal what is the source of the problem, whereas usability measures can lead to the *origin* of the problem (e.g. number of errors) and possible solutions. In practice, however, UX and usability data collection methods overlap. They include e.g. questionnaires, interviews, observations, video-recordings, focus groups, and think aloud. (Law, 2011.)

Designing good UX is complex: many key factors of usability and UX are inter-related, but sometimes design trade-offs between usability principles and enhancing UX have to be made. Everything cannot be achieved and there are always constraints that need to be taken into account. Thus, ecommerce website should aim for optimal balance between good UX and usability. Delivering good UX is a competitive advantage, a way to differentiate from competitors, and to improve customer trust and loyalty. (de Villiers & van Biljon, 2012.)

2.2.2 Usability heuristics

There are several principles for designing for usability. Probably the most widely used usability principles are Nielsen's *10 General Principles for Interaction Design* (1995), i.e. Nielsen's 10 usability heuristics (see TABLE 3). More than specific guidelines, heuristics are meant to be used more as *rules of thumb*. Usability and design principles are closely related but design principles are usually more tangible, as they are aimed to inform the designers. (Abdul Majid et al., 2013.)

TABLE 3 Nielsen's 10 usability heuristics

	Nielsen's 10 usability heuristics	Explanation
H1	*Visibility of system status*	What is going on
H2	*Match between system and the real world*	Real-world conventions; phrases and concepts that are familiar to user
H3	*User control and freedom*	System includes undo and redo functions
H4	*Consistency and standards*	Following general platform conventions
H5	*Error prevention*	Eliminating error-prone situations and including confirmation option before committing an action
H6	*Recognition rather than recall*	Instruction should be visible or easy to retrieve when needed
H7	*Flexibility and efficiency of use*	The possibility to tailor actions that user's use frequently
H8	*Aesthetic and minimalist design*	Keep it simple: only relevant information should be included
H9	*Help users recognize, diagnose, and recover from errors*	Error messages should be clear and indicate what went wrong and how to fix the situation
H10	*Help and documentation*	Although the systems should be easy to use without help, it is good to include necessary information for the users in case they need it

Nielsen's heuristics can still be considered as valid for interaction design, but researchers point out that through fast development of technology, traditional methods for evaluating usability (especially heuristics) are lagging (Gonzales-Holland et al., 2017; Rusu et al., 2011) and there is a lack of formal methodology in developing usability heuristics, which may be a result of increased number of domains in which they are applied. Many proposed usability heuristics are often either adaptations or extensions based on Nielsen's. Quiñones et al. (2014)

presented new set of 15 usability heuristics for transactional websites, based on Nielsen's heuristics but better aligned with new interaction paradigm and specific for ecommerce context. In TABLE 4, Nielsen's heuristics are presented on the left and the new heuristics by Quiñones et al. on the right.

TABLE 4 Comparison of usability heuristics

Usability Heuristics for User Interface Design (Nielsen, 1995)		Transactional Web Applications Heuristics (Quiñones et al., 2014)	
H1	*Visibility of system status*	F2	*Visibility of system status (H1)*
H2	*Match between system and the real world*	F1	*Visibility and clarity of system elements (H2)*
		F3	*Match between system and user's cultural aspects (H2)*
H3	*User control and freedom*	F15	*User control and freedom (H3)*
H4	*Consistency and standards*	F7	*Standardized symbology (H4)*
		F5	*Alignment to web standards design (H4)*
		F6	*Consistency in system design (H4)*
H5	*Error prevention*	F9	*Prevention, recognition and error recovery (H5, H9)*
H6	*Recognition rather than recall*	F14	*Minimize the user's memory load (H6)*
H7	*Flexibility and efficiency of use*	F10	*Appropriate flexibility and efficiency of use (H7)*
H8	*Aesthetics and minimalist design*	F8	*Aesthetics and minimalist design (H8)*
H9	*Help users recognize, diagnose, and recover from errors*	F9	*Prevention, recognition and error recovery (H5, H9)*
H10	*Help and documentation*	F11	*Help and documentation (H10)*
		F4	*Feedback on the final state of transaction (H10)*
		F12	*Reliability and speed of transactions (H10)*
		F13	*Correct and expected functionality (H10)*

As it can be seen, the new usability heuristics proposed by Quiñones et al. (2014) are from the most part same as the traditional heuristics by Nielsen (1995), with the exception that there are more in the latter. In other words, the new set of usability heuristics is more specific and most importantly, designed for

transactional websites. Also, cultural aspect of user experience is acknowledged in the new heuristics. Díaz et al. (2017) point out that cultural differences and local culture perspective affect the users' evaluation of usability. They propose that cultural-oriented usability is an effective means of enhancing website usability and communication of the intended message.

In ecommerce website context, findings by Goh et al. (2013) also support Nielsen's usability heuristics as a valid base for usability evaluation. Goh et al. (2013) identified following categories: *language and content*, *user guidance and support*, *flexibility and control*, *visual clarity*, *consistency and standard*, *navigation*, *functionality*, and *informative feedback* (see TABLE 5). There can be seen many similarities between Nielsen's usability heuristics these categories. For example, *flexibility and control* is equivalent to Nielsen's H7 Flexibility and efficiency of use, *visual clarity* to H8 Aesthetics and minimalist design, and *consistency and standard* to H4 Consistency and standards.

TABLE 5 Usability problem categories

Usability Problem Categories (Goh et al., 2013)
1. Language and content
2. User guidance and support
3. Flexibility and control
4. Visual clarity
5. Consistency and standard
6. Navigation
7. Functionality
8. Informative feedback

In line with the aforementioned usability heuristics, user experience consultant Whitney Hess has declared that the five most important principles of web design are making a good first impression, providing feedback, being consistent, making actions reversible, and being credible and trustworthy. The good first impression can be achieved with an easy-to-digest layout. Providing feedback should be immediate after system reacting to user's actions. For consistency, navigation and the structure of a website should be predictable and follow common conventions. System should provide suggestions if an error occurs and help user to correct the action. Credibility and trustworthiness can only be earned if the users find the website reliable. (Johnson, 2012-)

2.3   Web design considerations

Many of the traditional design principles apply also to web design. This chapter covers relevant web design considerations, including user-centered design, responsive design, accessibility, aesthetics and visual attractiveness, online flow experience, and designing for trust.

2.3.1 User centered design

User-centered design (UCD) is an established method for designing interactive software systems. It is a broader view of usability; both a *philosophy* and a *variety of methods*, describing design processes in which end-users can influence how a design takes shape. It is understanding interactions – the dynamic space between user and product – and bringing together expertise from different fields, such as Computer Science, Cognitive Psychology, and Visual Design. (Abras et al., 2004; March, 1994.) The roots of UX design are in UCD (also known as Human-Centered Design, to emphasize the human aspect). When the academic research started to focus on UCD issues in the HCI field, the paradigm shifted from *people controlling the systems* to *people interacting with the systems*. Task analysis became an important tool to assess design in usability testing, as a way to find out the potential discrepancy between designer's *vision* and user's *experience*. It became clear that there is a need to understand how people perceive problems, make decisions and act based on their estimations. Both UX and UCD were introduced by Norman and Draper in the 1980s. Their theory focused on acknowledging user's needs rather than focusing on the tasks and system itself. They are similar in many ways, but UX adds into traditional UCD view and broadens the scope by addressing affect, interpretation, and meaning. (Eshet & Bouwman, 2017; Hassenzahl & Tractinsky, 2006; Ritter et al., 2014; Roto et al., 2011.)

Ritter et al. (2014, p. 50) describe the focus of UCD as follows: *particular people doing particular tasks in a particular context*. Context of use is an important aspect of the design process, since all actions and usage is inevitably happening within a specific context, including spatial settings, social surroundings, physical resources, and the dynamic changes between these settings (Eshet & Bouwman, 2017). ISO standard (2019) highlights the importance of implementing human-centered methods throughout the lifecycle of the design, focusing on user needs, effectiveness of use, and user satisfaction. The reasons for adopting UCD approach are simple: usable systems are more likely to be successful commercially and technically, hey help to improve user experience, allow a wider range of users with different capabilities to use them, and help to reduce user stress and discomfort, which might even provide a competitive advantage for a company. (ISO, 2019.)

According to Garrett (2011), the levels of user experience that should inform user-centered design are *strategy*, *scope, structure, skeleton*, and *surface*. The levels start from more abstract concepts (strategy) and end on the surface (concrete). Strategy level includes defining the basic user needs and product objectives, e.g.

what are the business goals and what do users get out of it. The functional specifications (the "feature set" of the product) and content requirements are defined on scope level. Structure level includes information architecture and interaction design; the arrangement of elements and how system behaves in response to user using it. Skeleton level is the actual interface design (ability to do things), navigation design (ability to go places), and information design (communicating ideas and metaphors to the user). Finally, surface level includes sensory design, i.e. the visual design, which functionality-wise is defined earlier on interaction design level – and forms the actual *experience*. (Garrett, 2011.)

Essentially, user-centered design is about helping users work faster and make fewer mistakes. In other words, work more *efficiently* (Garrett, 2011). Designer's role is to facilitate the tasks for the user and to make sure user is able to make use of the product *as intended* with *minimal effort to learn*. The product should be suitable for its intended purpose in the environment it is used. Hence, it is important that users are involved in the design process. This can be done e.g. when requirements for the interface are gathered, or when usability testing is conducted. (Abras et al., 2004.) Usability testing is always a good idea after designing or redesigning a website. Often incremental changes in design are better than radical redesigns. Customers are task-oriented, so content and structure should be the bases for design decisions. (Loranger, 2015.)

2.3.2 Responsive design

Responsive design has been one of the dominant trends in web design for a decade. Introduced in 2010, responsive design established adaptive websites, where content is able to adapt depending on which kind of device or screen size it is viewed in – i.e. the interface looks different to a mobile user than to a laptop user. (Marcotte, 2010.) The growing use of mobile devices and *mobile-first* paradigm emphasize the importance of responsive design (Kim, 2013). However, displays are getting larger at the other end of spectrum, creating a challenge as designers need to serve both ends of the spectrum (Abdul Majid, 2015). The objective of responsive web design is to create websites that look good regardless of whether they are viewed from a desktop, tablet, or mobile device screen. This objective can be achieved using three techniques in layout design: a flexible grid-based layout, flexible images, and media queries. Flexible grids use a relative unit for measure (percentage), rather than absolute unit (pixels). Media queries enable applying cascading style sheets (CSS) for customizing the media to device's screen size. In essence, responsive web design allows the website to adjust itself according to screen size. (Kim, 2013.) Thus, it brings usability to the center of interface design (Abdul Majid et al., 2015).

The drawback of responsive web design is that if done poorly, the results are poor and the advantage to nonresponsive websites is lost. For example, is the website is cluttered, the problem (cluttered structure and content) should be fixed before making the website responsive. (Kim, 2013.) Today, responsivity is a vital condition for web design, but responsivity alone does not provide any rules of thumb or guidelines for the usability of the website. Hence, designers should

consider, in what context users are interacting with the website and what are the facilitators of good UX. Also, Abdul Majid et al. (2015) point out that most of the established usability principles are not taking into account responsive interface design, which is why it would be important to investigate usability principles in responsive design context. However, principles for responsive web design presented by Abdul Majid et al. are based on widely recognized design principles, including e.g. Nielsen's Usability Heuristics.

2.3.3 Aesthetics and visual attractiveness

In website context visual attractiveness refers to visual elements, such as colors and overall lay-out of the website (van der Heijden et al., 2003). Visual aesthetics has been a topic of interest in HCI research for a long time, and many scientists agree that visual design is a powerful way to evoke emotional appeal and therefore affect user's behavior and satisfaction when interacting with a website. Not surprisingly, aesthetics has been found to be a strong predictor of user satisfaction. (Coursaris & van Osch, 2016.) Aesthetics is also related to pleasure and perceived usability. According to Krauss & Hoffmann (2004), aesthetics is a *process*, which involves viewing and interpreting the environment: we make conscious and unconscious aesthetic choices all the time; examine visual elements and react to them. The elements of aesthetics work together to create an overall effect. In case of a website, the aim of visual aesthetics is to induce the user to involve in activities on the website. (Krauss & Hoffmann, 2004.)

The principles of visual hierarchy are straightforward. For example, images and graphics are processed first, size of an object indicates its importance, and the positioning of an element indicates its importance (see TABLE 6 Factors of visual hierarchy). Eye-tracking studies suggest that pictures on the website seem to be more important than the text for the users.

TABLE 6 Factors of visual hierarchy

Factors of visual hierarchy on a website (Djamasbi et al., 2010)
1. Motion (animated elements attract attention)
2. Size (larger objects attract more attention)
3. Images (images attract more attention than text)
4. Color (brighter colors attract more attention than darker colors)
5. Text style (typography and non-verbal cues from typefaces)
6. Position (elements on the top attract more attention than elements below)

Aesthetics has an impact on user's decision-making process: it is an important factor when user evaluates whether or not to trust a website. Trust is important

for ecommerce, and it can predict purchase intention. (Krauss & Hoffmann, 2004.) Aesthetics and visual appeal are found to play an important role, when user is making a decision about using an information system (especially a website). Particularly consumer marketing research has noted that attractive products are more likely to be perceived as favorable – and thus more likely to be purchased. (van der Heijden et al., 2003.)

Research supports the idea that perceived visual attractiveness has an influence on perceived ease-of-use, usefulness, and enjoyment (i.e. usability) of an interface (Al Sokkar & Law, 2013; Djamasbi et al., 2010; Krauss & Hoffmann, 2004; van der Heijden et al., 2003). If websites are easy to learn, use and navigate, they are more likely perceived as useful. Likewise, perceived ease-of-use is linked to perceived enjoyment: easy-to-use systems are perceived as more enjoyable (perceived enjoyment is also linked to the concept of *flow*). However, visual attractiveness seems to contribute the most to enjoyment, and not as much for usefulness. (van der Heijden et al., 2003.)

Well designed, visually appealing websites are a good way to attract new visitors. Visual attractiveness can help to reduce bounce rate, i.e. users exiting the website. In addition to reducing bounce rate and attracting new users, perceived visual attractiveness can also affect the whole evaluation of the website: how enjoyable it is to use. Known as confirmation bias or halo effect, the perception of visual attractiveness can even lead to users continuing the usage of a website once they have had a positive first impression, despite of encountering usability flaws later on. Confirmation bias of the positive first impression can have long lasting effects and make users undermine contradicting evidence to their positive impression. (Djamasbi et al., 2010.) Al Sokkar & Law (2013) suggest that there is yet no certainty of whether halo effect applies in ecommerce context.

Also, the increasingly shorter attention span of consumers on the internet supports relying on visual aesthetics, as consumer's impression of the website reflects their expectation of the merchandise quality (Djamasbi et al., 2010). Studies support the idea that visual appeal plays an important role when users evaluate *website quality*, which has been proved to be a good predictor of purchase intention. In order to stay competitive, draw visitors, and increase revenue, ecommerce websites need to take into account aesthetic considerations. Earlier, during the usability paradigm, emotional aspects of interaction were not as widely recognized as now during the UX paradigm. The focus of HCI research was earlier more on efficiency considerations, rather than aesthetics. Recently, studies have addressed the aesthetic dimension of user's evaluation of a website. Knowledge of guidelines on visual aesthetics, and ability to apply them is an effective way to support and reinforce the communication of the intended message. Visual performance is a tool for communicating brand identity and product differentiation. Aesthetics should support the intended message – a beautiful website is not good if it misses its goal. (Krauss & Hoffmann, 2004.) Similarly, King et al. (2016) point out that website attractiveness is proved to have an influence on consumer satisfaction and attitude towards purchase intention; visual appeal is found to have a positive effect on creating favorable attitudes (e.g. trust and satisfaction) toward the website. The assumption is that positive

interactions with the website influence consumers' ability to better understand and visualize the product, and these positive interactions influence their attitudes toward online purchases in general, making purchase decisions and visiting the website again. (King et al., 2016.)

There are naturally other factors in addition to visual appeal, which affect user's intent to continue using the website. These other factors include technical factors (e.g. long download times) and content factors, i.e. is the information on the page is relevant or well organized. (Djamasbi et al., 2010.) When these basic functionalities of a website allow users to conduct the things they are about to do *with ease*, it leaves space for pursuing higher order desires, such as aesthetics. The analogy is similar to Maslow's hierarchy of needs: when our basic desires are satisfied, the higher order desires become relevant. The needs at the lower end of hierarchy dominate the motivation until they are satisfied, and when lower-level needs are satisfied, individuals strive for achieving self-actualization in higher-level needs. (Pace, 2004.) Hence, visual appeal of an ecommerce website might be of particular importance, because it enables the user to focus on higher order desires and the enjoyment of the shopping experience (Djamasbi et al., 2010).

An important consideration regarding aesthetics is web accessibility, the degree to which all users, including people with disabilities can understand, navigate, and interact with the website. Technological advancements (e.g. high-resolution screens) enable developing and designing websites with rich graphics. Browsing the web has become a very visual experience in nature for most users. The importance of aesthetics is so significant in web design that aesthetics is at times referred to as a website *functionality*. However, for users with disabilities, such as visual impairments the aesthetics paradigm might cause problems and result in poor usability. (Bonavero et al., 2015.) In many cases, website designers do not take into consideration accessibility guidelines or their understanding of the needs of visually impaired users is limited. As search by browsing is a major information search technique on websites, people with visual impairments face numerous problems when browsing the web, as it usually involves skimming the content to find the desired information. (Zhang et al, 2017.)

2.3.4 Online flow experience

Flow theory has been a topic of several studies in HCI and a framework to model enjoyment, user satisfaction, playfulness, engagement, and other related states of user involvement with interfaces (Pace, 2004). In flow state, the rewards or results of the activity are secondary. Flow is an *optimal experience*, a dynamic equilibrium of operating at full capacity and stretching one's existing skills, sometimes even disregarding discomfort during the activity. Main characteristics of flow are concentration, merging of action and awareness, loss of self-consciousness, sense of control, distortion of temporal experience (passing of time), and experience of intrinsic reward of the activity itself. In order to continue experiencing flow, one must engage progressively in more complex challenges. Experiencing not enough challenges in relation to skills results in boredom. On the other hand, experiencing too much challenges in relation to skills results in anxiety. Between

those states lies the happy medium where flow can be experienced. (Nakamura & Csikszentmihalyi, 2009.)

There are few essential conditions that facilitate flow state. First of all, the perceived challenges and opportunities need to stretch but not exceed existing skills (this could be compared to emotional UX, where user's pre-task confidence, problem-solving tendency, frustration tendency, and task performance affect the user experience). Secondly, having clear goals, as well as immediate feedback help to concentrate on the task and accomplish flow state, just like clear goals and immediate feedback are facilitators for good user experience. Flow also requires meta-skills, which are related to ability to be motivated by intrinsic rewards: persistence, general curiosity and interest in life, and low self-consciousness. Ability for intrinsic motivation often leads to task enjoyment, which is an essential part of flow. (Nakamura & Csikszentmihalyi, 2009.) Intrinsic motivation is related to emotional user experience.

Other HCI applications of flow had been done before, but Hoffman & Novak were the first to apply flow to web usage context in 1996. According to them, online flow occurs when seamless sequence of interaction is facilitated by the system and the interaction is enjoyable. Loss of self-consciousness is an important characteristic of online flow. User's perceived skills (their self-efficacy, the extent to which they believe in their capabilities to accomplish courses of actions) is a facilitator flow state. The perception of self-efficacy is believed to affect effort, persistence, and interest for the task, as well as the level of goal difficulty. Flow studies suggest that some outcomes of flow experience are increased exploratory behavior and perceived behavioral control. (Pace, 2004.) Searching and browsing behavior will be discussed more in next chapter.

The challenges for facilitating flow experiences (especially online) are the increased multi-tasking, which is a result of the accelerated pace of life and the pervasive technologies that disrupt our focus (Nakamura & Csikszentmihalyi, 2009). Flow experiences can be affected by distractions, but usually web users experiencing flow tend to ignore those distractions, due to focus on the task at hand. There are different types of distractions, such as environmental distractions (noises), physiological distractions (hunger), and computer-related distractions (error messages, lost Internet connection). If the distraction is intense or frequent enough, it can cause the user to shift their attention to the distraction. Also, poorly designed website can cause a disruption in flow experience, since attention is a limited resource and interface demanding too much of it means there are less resources available for the task at hand. (Pace, 2004.)

The ideal situation is where an interface requires minimal amount of attention, so the user has the maximum amount of resources to focus on the tasks. However, one of the results of experiencing a flow state is reduced awareness of irrelevant factors, so flow also helps to leave irrelevant thoughts outside of one's consciousness. (Pace, 2004.) With more understanding of online flow, developers, designers and marketers can develop better interfaces. The aim of UX design is to enhance usability and enjoyability of an interface from user perspective. An easy-to-learn and fun interface is also a facilitator for flow experiences.

2.3.5 Designing for trust

Perceived trust is a widely recognized theme in ecommerce research. It is a major factor for either completing a purchase or discontinuing the shopping process. Also, visitors are more likely to have a good user experience in situations where they have strong trust toward the website. (Dai et al., 2018; Seckler et al., 2014.) Trust is an abstract concept, often used interchangeably with credibility and reliability. Trust is essential for human interaction; it allows us to act under uncertainty. It is especially important in ecommerce, which is associated with high complexity and anonymity. Designing for trust and studying how trust affects UX has been a rising theme in HCI research. Optimizing website design can help to create trust, especially when exploring a website in early stage of customer journey – where design characteristics play a big role for UX. (Seckler et al., 2014.)

Seckler et al. (2014) suggest that the facets of trust are: *benevolence*, *honesty*, and *competence*. Benevolence means mutually beneficial relationship and trustee's interest in trustor's welfare (trustor is the one who is browsing a website, and trustee represents the website). Honesty is sincerity and fulfillment of promises, i.e. the accuracy of information. Competence indicates resources for a successful transaction and continuance of relationship. For long, research addressed trust and distrust as opposite ends of the same spectrum, but it seems that trust and distrust are actually two distinct, coexisting constructs. They are independent in their valence (like feelings of competence and frustration) and trust does not necessarily indicate low distrust, as well as absence of trust does not automatically indicate there is distrust. According to Seckler et al. (2014, p. 48), "users may trust a website because of good reviews and a good brand image, but at the same time experience distrust due to a bad visual design and privacy concerns". Trust is associated with high perceived honesty and competence, social factors (reviews, recommendations), and security signs – whereas distrust is associated with missing honesty and benevolence, graphical and structural problems, and privacy issues. (Seckler et al., 2014.)

Essentially, distrust could be described as unwillingness to be vulnerable and having negative expectations about the website's conduct, such as fear of harmful or incompetent behavior from the trustee. To avoid distrust, website operator should focus on graphic design, structure design, and content design. To gain trust, a website should provide social cues, security cues, and good usability. These factors also enhance the user experience on a website. (Seckler et al., 2014.) Seckler et al. (2014) also point out that websites should take into account considerations, such as knowing that there is no secondary use of user data and providing accurate information and sincere promises.

3 CREATING SATISFYING ONLINE CUSTOMER JOURNEYS

This chapter will explore online customer journeys and decision-making on ecommerce websites, and their relationship with UX. Traditionally customer journey mapping is long-term tracking of customer interactions. Here, the focus will be on what customer journey and decision-making are like on an ecommerce website, excluding all other journey touchpoints outside the website. Consumer decision-making process on ecommerce websites will be discussed from following aspects: cognitive load, perceived quality of the website, perceived irritation, non-buyer behavior, and website performance.

3.1 Online customer journey

Customer journey is a sequence of contacts between consumer and a company, each contact evoking either positive, negative, or neutral experiences in consumer (Micheaux & Bosio, 2019). Customer journeys are also referred to as *customer decision journeys* and *customer purchase journeys*, and they are studied mostly in marketing and service design research (Lemon & Verhoef, 2016). Digital technologies have created consumers "so expert in their use of tools and information that they can call the shots, hunting down what they want when they want it and getting it delivered to their doorsteps at a rock-bottom price", which creates a need to design *finely tuned online experiences*. Companies who succeed in facilitating outstanding, easy, flexible, and affordable experiences on their websites have the best shots to prosper. (Singer & Edelman, 2015, p. 90.) These *finely tuned online experiences* can also be interpreted as user experiences.

The purpose of customer journey mapping is to understand these customer-company interactions. Buyer personas are the basis of customer journey mapping. (Micheaux & Bosio, 2019.) Buyer persona is a representation of an ideal customer: typical customer describing demographic, behavioral and motivational features, as well as individual needs and goals (Kusinitz, 2014). Personas are also used in user-centered design, because they help to understand *for whom* exactly the interfaces are designed for. Design if often about constraints and trade-offs (every feature cannot be included), so personas help to set the focus on the most important features and touchpoints. (Pruitt & Adlin, 2006.) As personas are based on market research and data, they help to reveal customers' *frustrations*, a valuable insight for designing better user experiences and reducing usability problems (Micheaux & Bosio, 2019).

In addition to utilizing data, another approach to buyer personas is *jobs-to-be-done*. This approach describes more thoroughly the *circumstances* personas operate in and what *tasks* they have. The emphasis is on understanding the persona's *experience* and what are the key factors for their purchase intention.

(Lemon & Verhoef, 2016.) Jobs-to-be-done is also applied in usability testing, but it should be noted that personas for UX context are not always the same as personas for marketing context (Micheaux & Bosio, 2019). According to Kantner & Rosenbaum (1997), three topics to assess usability of an ecommerce website are the purpose of the website, profiles of intended users, and typical scenarios for users accessing the site. Hence, profiling the most likely visitors helps to focus the usability efforts for the *target user groups*. Usability is assessed not only by identifying problems and concerns, but also successful features: how user task support, presentation, and terminology on the website support the target user group's goals and needs. (Kantner & Rosenbaum, 1997.)

3.1.1 Journey stages and touchpoints

Contacts between customer and the brand at different stages of customer journey are called touchpoints (Lemon & Verhoef, 2016). They are consumer's indirect or direct contacts with the company. Just like for UX, emotions are important for customer journeys; they help to understand where customer is having difficulties and to explore solutions to those difficulties. At each stage of customer journey, there are one or several possible successful interactions between customer and the brand. (Micheaux & Bosio, 2019.) In FIGURE 4 (modified from Micheaux & Bosio 2019, p. 131), numbers from 0 to 4 represent successive touchpoints during a customer journey. Focus of this study is on *pre-purchase* and *purchase stages*, i.e. when consumer is already on a website, and how the UX will affect their customer journey.

| Previous experience (0) | Pre-purchase stage *Need recognition Consideration Search (1)* | Purchase stage *Choice (2a) Ordering (2b) Payment (2c)* | Post-purchase stage *Consumption (3a) Usage (3b) Engagement (3c) Service requests (3d)* | Future experience (4) |
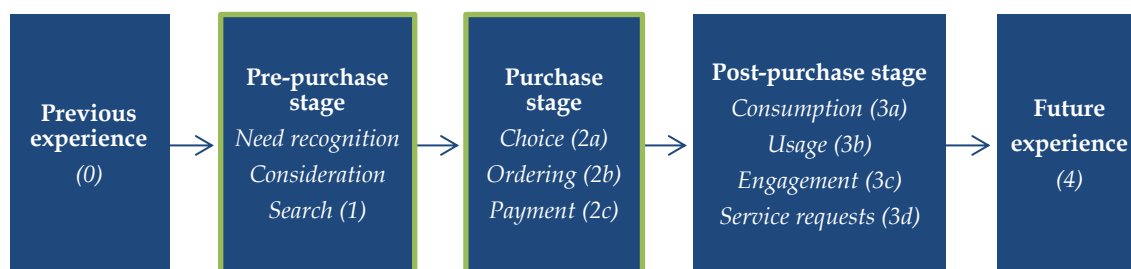
FIGURE 4 Customer journey touchpoints at an ecommerce website

Interestingly, purchase is the most temporal stage of customer journeys, yet the most studied (Lemon & Verhoef, 2016). The purpose of each stage and touchpoint is to make the journey "stickier", in other words more likely to keep customers interested. Four key features of effective customer journeys are *automation*, *proactive personalization*, *contextual interaction*, and *journey innovation*. Automation is digitalizing the steps that used to be done manually; e.g. buying a product is now a one-stop digital process. Proactive personalization is built on automation and by gathering information about past interactions, customizes customer's shopping experience (this includes e.g. recommendation engines on ecommerce websites). Contextual interaction uses the knowledge about where customer is

on the journey and guides them toward the next interaction. (Singer & Edelman, 2015.) Likewise, the purpose of UX design is to guide users into desired actions and to reduce the mental effort of usage (especially by using efficiently conventions and metaphors). In other words, to allow the user to *do things* on and *go places*. (Garrett, 2011.) Lastly, journey innovation contains spotting the opportunities to extend or enhance the customer journey. With ongoing analysis and experimentation, an ecommerce website can identify ways to create more value for customers and for themselves. (Singer & Edelman, 2015.)

Companies are increasingly investing in delivering effective customer journeys, instead of just trying to increase sales or reduce costs (Singer & Edelman, 2015). The main considerations for consumer decision journey driven strategy is that the decision journey can be understood by conducting research and asking questions about what consumers do, see, and say. Also, by defining the key touchpoints and how to interact with consumers in those touchpoints. Adopting this strategy helps to facilitate a coherent customer experience. (Edelman, 2010.) However, *planned customer journey* and *actual customer journey* can be (and often are) different. Planned customer journey – very much like the planned UX – is the process defined by the company, based on what they expect the customer to go through. The actual customer journeys is what customer goes through. (Haugstveit et al., 2016.) Usability testing can help to reveal if the planned customer journey and actual customer journey are close to one another.

3.1.2 Journey analysis for ecommerce websites

Analyzing customer journeys is important, because it helps to identify trigger points that nudge the customer into a decision (whether to continue or discontinue their journey) and to understand what choices and options consumer encounters during the journey. All journey stages are affected by customer's previous experiences – and will affect their future experiences. (Lemon & Verhoef, 2016.) This is very similar to the time span of user experience: *anticipated UX* (imagining the experience before usage) affects *momentary UX* (experience during usage), which affects e*pisodic UX* (reflecting on an experience after usage), and finally, *cumulative UX* (recollecting multiple periods of use over time), and then again to anticipated UX (Roto et al., 2011).

According to Wolny & Charoensuksai (2014), customer journey types can be segmented based on distinct user behavior patterns. The three customer journey types are: *impulsive journeys*, *balanced journeys*, and *considered journeys*. In impulsive customer journeys, consumer spends less time searching for information and instead relies on previous experience, recommendations, or product trials as the main sources of information. Characteristics of impulsive journeys are swift decisions or being affected by mood or exposure to brand. Balanced journeys are likely to be triggered by recommendations, whether from friends, influencers, or form traditional media channels. These are the journeys that include an extended search and evaluation stage; customer has *an intention* to buy and they go through a *cognitive evaluation*. Typically, in balanced journeys consumers check the reliability of the information they have found by comparing

it to other sources before making a purchase decision. Quite similarly to balanced journeys, considered journeys also include an extended pre-shopping phase, but in addition consumers go through orientation ('scanning the horizon') stage. This includes gathering information from different sources, which might not be relevant right away but can retrieved and evaluated when the want or need arises. (Wolny & Charoensuksai, 2014.) According to the case company, their customer base is generally looking for the specific product niche they represent, so most probably balanced and considered customer journey types are more represented in their website visitor behavior.

The overall goal of customer journey analysis and measurement is to gain actionable insights to reflect on the company objectives. Customer journey performance can be measured with multiple metrics, of which *conversion rate* is probably the most important for an ecommerce business. Conversion will be discussed more in chapter 3.2.5 Measuring ecommerce website performance. For example, individual level clickstreams can be used to make conversion rate and order size estimates to support journey analysis. However, it should be noted that website visitors can have different motives, e.g. depending on the traffic source. A visitor entering an ecommerce site via Google might not have the same purchase intentions as a visitor entering the website directly. (Lemon & Verhoef, 2016.)

3.1.3 Customer experience on ecommerce websites

According to Lemon & Verhoef (2016), customer experience has been listed as one of the most important research challenges for coming years by The Marketing Science Institute. The common consensus is that improving customer journey performance results in better customer experience and higher conversion rate. Customer experience is a multidimensional construct involving cognitive, emotional, behavioral, sensorial, and social components of the experience. It is the result of interactions in different touchpoints during the customer journey; basically, a broader concept of *customer satisfaction*. (Lemon & Verhoef, 2016.)

Bleier et al. (2018) argue that design shapes customer experience. Considerations, such as high-quality photos, videos, and copywriting require resources but are strategic for ecommerce websites' success – from both customer journey and UX perspective. Using design elements that not only convey information but also entertain can help to facilitate good customer experience, which hopefully turns ecommerce website's visitors into buyers, maximizing the website performance. Well-designed product pages including effective verbal and visual stimuli drive conversion. Verbal elements, such as linguistic style can affect the perceived effectiveness of the website, whereas visual elements, such as photos can simulate human interaction and connect the product to customer's life. Combined elements, including customer ratings, endorsements, recommendation agents, content filters, and comparison matrices can affect purchase decision. Content filters (i.e. user's control over what, when and how much will be shown on the page) are related to Ariely's theory of information control (see chapter 3.2.1 for more details about Cognitive load). In addition,

structural elements, such as navigation and menus, and the general organization of the website all affect UX. (Bleier et al., 2018.) Communicating the relationships between elements and allowing the user to get from one place to another are important for positive UX on a website (Garrett, 2011).

According to Bleier et al. (2018), the dimensions of customer experience are *informativeness* (cognitive dimension), *entertainment* (affective dimension), *social presence*, and *sensory appeal*. These dimensions are underlying factors for which web design elements support purchase intention best in a specific situation. The role of informative dimension is to provide resourceful and helpful information. It is the primary cognitive dimension of customer experience, including the functional aspect and value of the experience. (Bleier et al., 2018.) Very similarly, Coursaris & Van Osch (2016) address the cognitive and affective dimensions of usability, and their role in building user satisfaction. Entertainment is the affective dimension, which triggers enjoyment and arousal, and can help to reduce shopping cart abandonment. Social presence dimension is the 'feeling of human contact' on the website. It can activate feelings of pleasure, arousal, or flow – inducing purchase intentions and customer loyalty. Finally, the sensory dimension includes sensory-level stimulation and processing, which drives our preferences, and is mostly automatic. Aesthetics of the website is a powerful tool to stimulate sensory appeal. (Bleier et al., 2018.)

Accuracy and truthfulness of the information on an ecommerce site can reduce uncertainty and increase online trust, resulting in purchase decision (trust is also discussed earlier in chapter 2.3.5 Designing for trust). Using purposeful web design to create trustworthiness is especially important for selling *experience products* online (which the case company does), because the relevant attributes of those kind of products can be discovered only through physical contact. On the other hand, *search product* attributes can be assessed without physical contact, which is why providing factual information is usually enough for search products. Because experience products require physical experience to really understand what they are about, the information on a website should be supplemented with sensory dimensions and social presence of customer experience as well. More informative experiences work for search products; presenting information with bulleted features or in a matrix format and using recommendation agents. (Bleier et al., 2018.)

The reason why customer experience is an important construct for ecommerce websites is the increasing complexity of customer journeys: experiences are more social in nature and companies have less control over the journeys. Also, for example *information overload* and *choice overload* can affect consumers' purchase confidence and decision satisfaction. Depending on how much information and/or choice overload consumer is experiencing, in pre-purchase stage they either stop the shopping process or continue searching. If they are not too overwhelmed, they continue the shopping process and possibly get to the purchase stage, where they either complete or postpone the decision. (Lemon & Verhoef, 2016.) Hence, it is important to support the purchase decision with good customer experience, which on an ecommerce website is for the most part a result of good web design and user experience.

3.2 Consumer decision-making on ecommerce websites

Studying consumer decision-making on ecommerce sites helps to predict customer behavior patterns, which can be used to gain competitive advantage. (Karimi et al., 2015) Consumer decision-making is mostly researched in the fields of Marketing, Economics, Psychology, and Sociology (Hamilton et al., 2018). The difference between *customer journey* and *consumer decision-making* is that customer journey describes the consumer's *interactions* in different touchpoints (and the role of customer journey mapping is to examine customer engagement in these touchpoints), whereas consumer decision-making describes the *process* of going through the stages of reaching a purchase *decision*. Decision-making models take into account the cognitive aspect of the decision-making process, whereas customer journey reflects on cognitive, emotional, and behavioral aspects of the process. Descriptive to customer journeys is that compared to decision-making models, the interactions in different touchpoints do not have to follow a linear structure. (Wolny & Charoensuksai, 2014.)

There are many consumer decision-making models, and probably the most well-known models is the five-stage consumer decision-making process: *need recognition*, *information search*, *alternative evaluation*, *purchase*, and *post-purchase*. These are the phases consumer will expectedly go through during the decision-making process. (Wolny & Charoensuksai, 2014.) However, many researchers, including Wolny & Charoensuksai (2014) and Edelman (2010), suggest that viewing decision-making process as a funnel should be abandoned, because customer journeys do not necessarily follow a chronological order: after need recognition, consumers gather information from search engines, websites and comparison websites, they might execute the purchase either on brand website, another retailer's website, or at the physical store. The reason consumers are applying these new decision-making strategies is that the web allows collecting, comparing, and assessing information quickly and easily. Also, the extended pre-shopping phase, the orientation stage, is not identified in most existing decision-making models. Orientation stage is when consumers are looking for inspiration, i.e. *scanning the horizon* – they think that they are not shopping yet and they might not even have an intention to buy, but they are on the lookout. Scanning the horizon usually happens e.g. via recommendations, blogs, vlogs, and product reviews, which demonstrates the importance of social networks and referrals in the pre-purchase stage. (Wolny & Charoensuksai, 2014.)

3.2.1 Cognitive load and user experience

Cognitive load is related to the limited capacity of working memory: people can only process few pieces of information at once. According to the cognitive load theory, when information processing limit is exceeded, people tend to feel overwhelmed, which affects their visual attention, behavior, and decision-making. (Wang et al., 2014.) To increase sales, customer satisfaction, and customer retention, an ecommerce site needs to consider usability of their

website, as the online environment is a very competitive marketplace (Schmutz et al., 2010). Wang et al. (2014) suggest that to understand user behavior, website designers and developers need to understand the cognitive processes users go through while they are browsing, because e.g. the information complexity of the website and task complexity of the task at hand affect the cognitive load of users.

The fundamental objective of ecommerce websites is to present information, on which consumers can base their decisions. It is especially important to select the *appropriate* information to be presented. (Ariely, 2000.) Excluding semi- or non-relevant pieces of information is important, because information overload during decision-making process can lead to e.g. highly selective information processing, decreased level of attention, incongruent responses, decreased decision-making performance, confusion, delaying or canceling decision, decreased satisfaction, or overconfidence (also known as preference-supporting bias). Although we are facing more and more information overload online, we have also become good at ignoring the overload. It seems that the cause of information overload is rather the *complexity* of information, than the *amount* of information. (Eppler & Mengis, 2004; Roetzel, 2018.) Lurie (2004) also suggests that *information structure* of a website is better predictor of information overload than the *amount of information*. Researchers have differing views of the connection of UX and website complexity. Some believe that simple websites are the most effective, and others argue that complex websites enhance the richness of information and user satisfaction, especially for experiential users. However, Wang et al. (2014) suggest that the higher the website complexity, the more likely users are to be distracted while completing tasks – even when the tasks are simple. Excessive cognitive load can be dealt with two coping mechanisms: perceptual selection mechanism (ignoring irrelevant and distracting stimuli) and more active mechanism of controlling the attention needed for dismissing distractions, which works in situations where perceptual load (website complexity) is low. If the load is too high, users are also likely to lose interest in exploring. Similarly, when the tasks are complex, but website has low complexity, users do not tend to engage in exploring. (Wang et al., 2014.) Users apply different coping strategies in their emotional UX responses as well: problem-solving centered approach (usually when control over situation is appraised high) and emotion-centered approach (usually when control is appraised low). User's feeling of competence is a result of *feeling in control* over the events, whereas frustration is a result of *feeling powerless*. (Jokinen, 2015.)

Ariely (2000) suggests that control over information flow allows consumers to be selective in their information search. This can be seen as an application of Nielsen's usability Heuristic no. 3, *User control and freedom*. Consumers who are able to control the information flow to match their preferences and select relevant information, tend to be more confident about decisions they make. Control over information flow means that user can affect what information will be presented, how it will be presented, and what information will follow. Interaction between consumer and an interface is a three-way process, including the *level of information control*, *cognitive load*, and *amount of experience* user has with that interface. The negative effect of information control is additional cognitive

resources required for managing the information flow. However, when a consumer engages in a task continuously, the cognitive effort required to control information flow will reduce – freeing resources for cognitive processing of the information itself. Thus, increased control over information flow seems to lead into increased *task performance*, because it improves the fit between actions and outcomes, and consumer's ability to explore. (Ariely, 2000.) As already mentioned earlier, user's task performance, as well as their pre-task confidence, problem-solving tendency, and frustration tendency affect UX (Jokinen, 2015).

The feeling of control and how it affects consumers' information processing has been studied much. The more control consumers feel they have over their environment (this group is referred to as *internals*, who believe that their personal actions drive experiences), the more confidence they show in their decisions. Also, internals tend to trust their initial preferences and show more preference-supporting bias. When they encounter a threat to their decision-making (e.g. product scarcity), they switch on an *accuracy goal* and process information more accurately – and interestingly feel less confidence in their preferences when doing so. On the other hand, in the same situation people with less feeling of control (*externals*, who believe environment controls their experiences) switch on a defense goal and show higher level of confidence in their preferences. Studies suggest that individuals with high feeling of internal control react to lack of external control during decision-making process with increased willingness to consider supplementary information and more careful processing. However, when feeling in full control, these individuals tend to express more overconfidence and information distortion. (Chaxel, 2016.)

Also, consumer's pre-existing motivation to process information might increase or decrease their *ability to focus on the task at hand*. Wolny & Charoensuksai (2014) found that during impulsive journeys, consumers are more likely to rely on heuristic processing (i.e. shortcuts, rules of thumb, or instincts). Sometimes affective responses, such as arousal, can inhibit thoughtful decision-making and lead to heuristic processing. For planning online customer journeys, this is important, as website design should support user goals, regardless of their level of motivation (Hamilton et al., 2018). The opposite of heuristic processing is rational decision-making; relying on cognition and elaborate thought, which usually is triggered when the decision is considered as important – and it is believed to increase decision performance. (del Campo et al., 2016.)

Another way to categorize decision-making styles is presented by Schwartz et al. (2002), who suggest that consumers can be categorized into *satisficers* who settle for a good enough choice that meets some of the criteria, and *maximizers* who seek for the best possible outcome. Although maximizing can yield in better *objective* outcomes, on subjective level maximizers seem to report less happiness, optimism, and self-esteem in life. (Schwartz et al., 2002.) Consumers can also be categorized by the *level of knowledge* they have of the subject or task at hand. Consumers with high level of knowledge tend to be more aware of their preferences, so they usually start with a smaller set of considered alternatives and have an idea of what evaluation criteria to use. This increases decision confidence and results in less overall time for making a decision. On the contrary, both

maximizers and satisficers with low level of knowledge tend to engage in more intense decision-making process with more cycles of evaluation and longer overall time. (Karimi et al., 2015.)

To avoid strain and to find out what they need to, users apply different strategies on websites. According to Harley (2018) here are two main strategies users rely on ecommerce sites: *search for a product* (searching for specific information) and *browse to discover* (experiential browsing). Homepage is usually the first point of entry to the website and its function is to tell the user what the website is about and what products or services are sold there. It is where brand can communicate who they are and what are their most important product offerings. Sometimes users arrive via search engine. In that case, they usually land on category pages or product listing pages, where the website introduces its whole product or service selection. The usability of landing pages, product category pages, and product listing pages is essential for creating a pleasant experience for the user. When users have a clear understanding of what the website is about, what is available to them, and they can find what they are interested in with ease, the positive experience supports conversion, which is the ultimate goal. (Harley, 2018.)

An important function in ecommerce websites is navigation. Products and services should be organized in a clear manner that makes sense to the user, so that they understand without much effort what each category is about and how they differ from each other. For visitors to find what they are looking for, the hierarchies and paths on the website should be designed to support understanding structures among different categories. Visual hierarchy can be used to indicate the relationships between categories. One recent trend has been to merge category and listing pages, in an attempt to reduce the amount of clicks user has to go through. In this case, if subcategories are highlighted clearly and separately from other filters, user can navigate easily to specific product categories. This also enables the user to control the number of items listed (information control), which helps to reduce choice overload. Another trend on ecommerce websites has been increased amount of information on product listing pages. This is a result of many reasons, one of which is the growing amount of mobile browser use, where every piece of information shown on product listing page might be critical for the user to differentiate the products from each other – and determine whether the product is worth the click or not. The key is to present well-curated and uncluttered information, to support informed decision making. (Harley, 2018.)

From cognitive load perspective, product listing pages are an important point of interest for an ecommerce website, because products and information about them is displayed there. Thus, product listing pages are where consumers make many of their decisions. Consumers can make comparisons and choices on product listing pages, which is an essential feature of ecommerce websites, especially if the features, quality, and the price of the products differ. Product listing pages contain usually information about products in a list or a matrix format; what are the features of the products, price of the product, availability, and so on. List presentation format presents one product per row, and matrix

presentation format presents two or more products per row. The advantages of list format are direct access to information, ease of comparing key features (because they are presented in the same column), and possibility for sorting, which increases user control. However, when comparison is not the intended task, users have been shown to perform better if products are presented in matrix format. The advantage of matrix format is that it separates different products from each other, and hence the format is suitable for users who have goal of choosing a specific brand or a product. (Schmutz et al., 2010.)

So why does the presentation format of products matter? What is the relationship between user's subjective cognitive load and the quality of their shopping decisions? It has been found that list format decreases the time used in product search and improves recalling product information, for example brand names. The phenomenon is explained by *proximity compatibility principle* (PCP), which suggests that the less spatial distance among elements there is, the less users move their eyes, and the less cognitive load is required for processing, as does Fitts' law. Eye tracking data from a study by Schmutz et al. (2010) demonstrated that users scan products generally from top to bottom in list format, and from left to right and top to bottom in matrix format (just like reading a book). The same study suggests that list format results in less mental workload for the user, which enables them to make more economic choices, resulting in lower value of shipping cart. For an ecommerce website, the takeout is preferring matrix format for product listing pages, to maximize the value of shopping carts. However, more research about product listing formats is required to identify what role cognitive load plays in situations where comparison is not the intended task. It should be noted also that customer needs are twofold: some are *searching*, some *browsing*, and the others will vary between search and browse strategies. The design should indicate what users can do on the website and how to accomplish their goals, and support both searching (goal-oriented) and browsing (exploratory) activities. (Schmutz et al., 2010.)

3.2.2 Perceived website quality on ecommerce websites

According to Lin (2007), website quality can predict customer satisfaction in B2C ecommerce context. Obadă (2014) suggests that website quality dimensions are *design quality*, *content quality*, *perceived ease-of-use*, *novelty*, and *perceived usefulness* – which are very similar to the dimensions of usability (ease-of-use, perceived usefulness, and satisfaction). Hence, customer satisfaction is a close concept to UX and usability on ecommerce sites. Although time (e.g. task completion time and speed of transactions) is an indicator of website quality, the *quality of user experience* seems to be more relevant for perceived website quality, as the time spent on a website might not be the best indicator of an experience. User might spend a short time on a website and experience enjoyment and flow, but they can also spend a long time on a website feeling anxious or bored, due to a need to complete a task (i.e. external motivation). Research on perceived quality at brand websites demonstrates that experiencing online flow has a positive effect on the perceived quality of that website. (Obadă, 2014.)

Falk et al. (2009) suggest that the less experienced customers are with the interface, the more important it is for them to have access to well-organized content, product information, guided tours, and website policies when they are shopping online. Experienced users have more hedonic needs than inexperienced users and are satisfied with more customizable content. (Falk et al., 2009) Ariely (2000) concluded as well that control over information flow has a positive effect on consumer's decision-making. This means that ecommerce site quality is evaluated very differently by experienced and inexperienced customers. Hence, websites should fill both *functional-utilitarian quality attributes* (for inexperienced users) and *hedonic quality attributes* (for experienced users). However, it is suggested that the traditional linear view of quality-satisfaction relationship does not hold true in online context, as the level of customers' expertise affects their expectations of the service quality. (Falk et al., 2009.)

There are many ways to improve website quality and user experience. These strategies include e.g. providing easy-to-use navigation and real-time communication, avoiding information overload, providing privacy protection policy, and adopting customer-oriented strategy. By providing customers a well-designed interface, customized content, information about products, and competitive prices, an online retailer has the possibility to increase *customer satisfaction*. (Lin, 2007; Bhattacherjee, 2001.)

3.2.3 Perceived irritation on ecommerce websites

Perceived irritation is "the degree to which an online shopping site appears messy and frustrating to its users" (Hasan, 2015, p. 225). Consumers seem to prefer shopping on websites with intuitive, simple navigation and visual structure that helps them to complete their tasks with the least possible effort, which is why websites need to deliver relevant, current, and easy-to-find information. If consumers encounter information that is not relevant for them or does not help them to perform the task they want to, they become dissatisfied and irritated, as they have spent valuable time and cognitive effort for information processing. As a result, customers tend to abandon their shopping cart and leave without making a purchase, if they feel irritated. Feeling of irritation has both immediate reactions (abandoning the shopping cart) and lingering effects, such as beliefs about the retailer's credibility, competence, or integrity. In other words, perceived irritation affects consumer's attitude, satisfaction, intention to return, and purchasing behavior. In online context the problem becomes even more important, as leaving a website is easy as it gets. (Hasan, 2015.)

Closely related concept to perceived irritation is frustration, which has been discussed earlier in User Experience chapter. Jokinen (2015) argues that competence and frustration are emotional components of UX and individual in their valence: when users face obstacles during the interaction and feel frustrated, they still might be able to successfully complete the task and feel competence as a result. However, according to Lemon & Verhoef (2016), good customer experience helps to reduce frustration and uncertainty related to the interaction.

Thus, it is better to aim for good UX and customer experience than to risk irritating or frustrating users of the website.

Visual design, navigation design, and information design offer the most visible cues on how to interact with an ecommerce website. Research implies that poorly designed websites have an increased possibility of irritating their users, which affects shopping behavior negatively. Visual design refers to the consistency, aesthetics, and attractiveness of the design. Navigation design includes the organization and structural layout of the pages and content. Information design (content organization and structures) impacts the amount of effort it takes to navigate the website. These design elements affect the *perceived ease-of-use*, *perceived usefulness*, *perceived enjoyment*, and *acceptance* of online shopping – and also have an effect on buying behavior. (Hasan, 2015.)

Website design characteristics can communicate either positive signals to enhance shopper's perceptions and attitudes, or negative signals. So, what are the factors that arouse negative emotions and reactions? How can those be identified to improve overall user experience? Hasan (2015) proposes that informative, visually appealing, easy to use, and easy to navigate websites seem to boost users' engagement with the website and are less likely to irritate users. By the same token, poorly designed websites are likely to strain users, as they require more effort and cognition to keep focused on the tasks at hand. Having trouble with navigating the website, finding products, or completing a purchase task can evoke negative feelings, such as irritation. It is important for ecommerce sites to understand which are the factors that stimulate positive feelings and reactions, and which are the factors that stimulate negative emotions and reactions, as research implies that website design characteristics have a key role in forming consumers' beliefs about the retailer and shaping their own purchase behavior. Thus, well-designed ecommerce websites support both increasing website traffic and conversion goals. (Hasan, 2015.)

3.2.4 Non-buyer behavior

Ecommerce has established its place during 21st century as an important part of marketing strategy and customer relations. This brings forth a need to understand online consumer behavior, especially *non-buyer behavior*. The most prominent theme in non-buyer behavior is shopping cart abandonment. The definition of cart abandonment is initiating a shopping process on a website and placing items into cart but failing to complete the purchase and leaving the website during the shopping session. Some possible explanations to shopping cart abandonment are other options (retailers and websites) and technical difficulties with the website. Also, consumer's perception of risks and benefits is a major factor for cart abandonment. (Ogilvie et al., 2016.) Interestingly, graphic design and structural design are often reported in distrust experiences on websites (Seckler et al., 2014).

Studies suggest that mobile devices have the highest shopping cart abandonment rate (86%) and desktop the lowest (73%), which indicates that the smaller the screen, the more likely customers are to abandon the cart when they

are shopping online. Solution to this problem is responsive design and mobile optimization. (Serrano, 2018.) According to Paytrail, Finnish consumers are most likely to abandon shopping cart because the total price including shipping costs is too high, or because their preferred payment method is not available. Other common reasons for cart abandonment are technical problems with the website, payment process that does not work, and uncertainty about the terms and conditions. (Paytrail, 2018) In comparison, in the US primary reasons customers reported for abandoning online shopping carts were unexpected shipping costs, having to create a new user account, and that they were conducting research to buy later (Serrano, 2018). Hence, if consumer encounters obstacles on their way, they are likely to abandon the transaction. On the other hand, keeping the total costs transparent and offering several payment methods are likely to reduce user frustration. (Paytrail, 2018,)

The growth of online shopping is to a great extent a result from increased time and money spent online among the consumers who *already* are shopping online. Hence, marketing and design efforts should be mostly targeted for existing online shoppers rather than new customer acquisition. Some effective techniques for targeting existing customers are e.g. cross-selling (selling additional products) and up-selling (increasing the total sum of shopping cart by suggesting more expensive alternatives). (Pogorelova et al., 2016.) Ecommerce cart targeting (ECT) is a tool for understanding better *when* to target consumers with marketing (with or without items in cart) and *how* to target them (with scarcity of products or with price promotions, for example). ECT refers to digitally tracking consumers' shopping carts who have shortlisted products but not finished the checkout process. According to Luo (2019), targeting consumers with product scarcity messages works better in early stage of shopping (it creates pressure for making the decision), whereas price promotion works better in late stage of shopping. In other words, promotions seem to boost those consumers' purchase intentions, who already have items in their cart. Consumers without items in cart need to establish shopping goals first, and research suggests that in this case, discounts in the beginning of the customer journey on the website can be interpreted as low-quality signals. (Luo, 2019)

So, how to combat non-buyer behavior (especially shopping cart abandonment) with improving UX? Ogilvie et al. (2016) suggest that the perceived risks can be tackled with *promotion-focused* and *prevention-focused* approaches. Promotion-focused consumers are concerned on maximizing gains from the purchase, whereas prevention-focused consumers are concerned on minimizing losses. Similarly, Karimi et al., 2015 talk about *maximizers* and *satisficers*. Online retailers should align their messages to fit these consumer orientations and goals (maximizing gains or minimizing losses) (Ogilvie et al., 2016). Promotion focused tactics include e.g. sending reminder emails with a promotional code if the customer has ended the session on the website with items in shopping cart, without making a purchase. A common tactic to promote product scarcity is stating "only one product left" next to the CTA button on ecommerce websites, or "two other people looking at this hotel right now" on online booking sites. This leads to why acknowledging hedonic aspects of

interaction is an important consideration in UX research (Hassenzahl & Tractinsky, 2006). Studies suggest that customers tend to make routinized decisions and stick to familiar, but extraordinary experiences and fear of missing out can affect our choices (Lemon & Verhoef, 2016).

3.2.5 Measuring ecommerce website performance

Different types of websites naturally have different key performance indicators (KPIs), chosen metrics that most accurately measure the website's performance. All website analytics packages include many metrics to measure performance, including basic metrics (e.g. pageviews, sessions, time on page), calculated metrics (pageviews per session, average session duration, bounce rate etc.), and manual metrics (visitor actions website admin wishes to measure). The focus of this thesis is on ecommerce-specific calculated and manual metrics, because these metrics usually tell if there's something wrong with the user experience. In ecommerce it is essential to understand customer needs, behavior, and buying patterns. Hence, general KPIs related to online retail are *conversion rate*, *average order value*, *revenue per session*, and *cart abandonment rate*. Conversion rate is probably the most important indicator of an ecommerce website's success. It tells the retailer, what percentage of visitors make a purchase. Average order value indicates how much consumers spend on the website on average. The end goal for an ecommerce website is to increase both average order value and the total amount of transactions. Revenue per session is a metric for defining the marketing budget; it tells if it is profitable to generate more traffic through advertising. (Larson & Draper, 2017.) Garrett (2011) argues that conversion rate is also a way to measure the effectiveness of user experience: empty or abandoned carts can be indicators of problematic UX, which is helpful information for conducting planned UX development.

Conversions can be divided into *primary* and *secondary conversions* (Larson & Draper, 2017), or in other words, *macro* and *micro conversions* (Google Analytics Academy, 2019). For an ecommerce website a macro conversion is commonly a purchase, and a micro conversion can be e.g. subscription to a newsletter or creating an account. Visitors who create accounts on ecommerce websites are more likely to return and make new purchases. Micro conversions are usually measured with *metrics* (KPIs), and macro conversions measure the *tactics* that are used to improve website's performance. Tactics support website's strategies, which are based on the general objective of the website. For example, generating sales (general objective) determines the strategies, then strategies determine the tactics, and then tactics determine the chosen KPIs to measure. Common methods for improving ecommerce website's success are conversion-rate optimization and A/B testing. (Google Analytics Academy, 2019.)

So, why are KPIs, especially conversion, so important? Business goals dictate *what is important for the success of the website*. Aligning business goals with user goals helps to facilitate a smooth customer journey and UX – which is important for an ecommerce website's success.

4   METHODOLOGY

This chapter discusses the chosen research method, data collection, data analysis, and key findings from pilot study, which was conducted to establish the study procedure. There are several usability testing methods and the chosen method for this study is Cognitive Walkthrough, which is helpful for observing *decisions* and *tasks* users are involved in, and to discover areas of potential difficulties users encounter (Pryor et al., 2017). The importance of usability testing for ecommerce websites arises from creating satisfactory, effective, and efficient interactions, which result in better UX and higher purchase intention (Goh et al., 2013).

4.1   Research strategy

This research uses a combination of qualitative and quantitative methods: cognitive walkthrough for qualitative usability testing, and user experience questionnaire (UEQ) for quantitative UX measurement. Because consumers use ecommerce websites to achieve specific tasks, the research measurements are *performance measures* (task completion in usability test) and *subjective measures* (UEQ answers). User performance is examined through cognitive walkthrough task analysis and subjective UX is examined through UEQ by Schrepp et al. (2019)

4.1.1 Cognitive Walkthrough as a research method

Cognitive Walkthrough (CW) is a method to study the usability of interactive systems, such as websites. Usually conducted by a usability expert, it creates a realistic task scenario (a sequence of tasks) to evaluate an interface's usability. It examines how easy it is for users to perform given tasks with little or no instructions, based on exploration and using cues the system provides to determine their next actions. (Jadhav et al., 2013.) CW is a theory-based user interface design evaluation method, adapted from several design walkthrough techniques, such as model of *learning by exploration* (Polson & Lewis) and *theory of action* (Norman). The need emerged from the realization that many systems and applications were (and still are) difficult to use. (Polson et al., 1992.)

CW provides a tool to find out the causes to usability problems early during the design process so that when the final design is launched, the most severe UPs have been found and fixed (Polson et al., 1992). The redesign process should target the UPs but avoid major changes, because in case of drastic modifications it might be difficult to determine which were the changes that made the difference (Loranger, 2015). CW helps to identify the touchpoints where users typically succeed or struggle, and the possible causes to their failures. It is based on a premise that if an interface provides a path of associative connections between user's goal and the representation of the action, the action is most likely sufficiently executed. Feedback from the system has a critical role in task

performance, because users interpret system feedback to determine whether they have accomplished their goals or need to undertake some error recovery actions. Often goals are achieved as a part of sequence; sub-goals need to be accomplished in a fixed order to achieve the main goal. (Polson et al., 1992.)

Most commonly used methods in usability testing are CW, Heuristic Evaluation (HE), and Think Aloud (TA). Methods can be divided to expert-based methods (CW and HE) and user-based methods (TA). Expert-based methods are recommended, because they are more cost-efficient and less time consuming. CWs allow collecting quick feedback from *user perspective* with low costs (see TABLE 7). HE is a method to determine interface's conformance to usability heuristics, it is also convenient when there are little resources and time. HE can be used as a pre-phase for identifying the focus for further usability testing, as it helps to catch the most visible usability problems. However, actual user data will not be obtained from HE, because the participants are expert evaluators. Hence, key audience groups and typical UPs might not be represented in HE, in addition to that the results are affected by the evaluator's expertise. Also, in TA, the results are affected by evaluator skills, as well as the user group and task list representativeness. On the other hand, TA gives detailed insight on the *reasons behind UPs*. (Jadhav et al., 2013; Jaspers, 2009; Kantner & Rosenbaum, 1997.)

TABLE 7 Characteristics of Cognitive Walkthrough method

Cognitive Walkthrough (Jaspers, 2009)		
When & how	Early design state	Experts simulate users walking through the interface, carrying out typical tasks
Input	List of action sequences to accomplish tasks	User background description (computer and domain knowledge)
Output	List of potential usability problems	
Benefits	Structured approach	Detailed analysis of potential usability problems
Limits	Discourages exploration	Results affected by task descriptions

Cognitive walkthroughs include preparation and evaluation stages. Preparation consists defining a representative sample of *tasks to complete* with the interface, identifying *anticipated users*, and *user goals* (Jadhav et al., 2013). Preparation helps to forecast what actions users will most probably find easy or hard to accomplish. If the probable user goals are different to the actual goals needed to complete the tasks, it will most likely result in users having problems accomplishing the tasks. (Polson et al., 1992.) In UX design practice, the path to complete the tasks at hand is referred to as *happy path* (InVision, 2020). In evaluation stage, the interaction between user and the interface is analyzed. First, the relationship between *goals needed to operate the system* and *goals users form as they go* (goal problems) are

evaluated. Then, *problems selecting an action* (action problems) are observed. Goal problem is user *trying to do a wrong thing*, whereas action problem is user *having problems doing the right thing*. The task for usability test evaluator is to define correct goal for each task (goals needed to operate the system) and to evaluate the mismatch between initial goals and the goals users form as they go. After this, action problems are evaluated (problems selecting the right actions), assuming that at this point users have the right goals. Finally, evaluation includes observing if users *modify their goals* after accomplishing an action and receiving feedback from the system (i.e. do users understand they are making progress and how they adapt their behavior according to the feedback from the system). Users should be able to estimate the right order of accomplishing sub-goals to reach the end goal. (Polson et al., 1992.) The stages of CW are listed in TABLE 8.

TABLE 8 Cognitive Walkthrough Procedure

Cognitive Walkthrough Procedure (Polson et al., 1992)	
Preparation	Evaluation
Step 1. Identifying tasks	Step 1. Goal problems
Step 2. Identifying users	Step 2. Action problems
Step 3. Identifying initial user goals	Step 3. Goal modifications

An advantage of conducting CWs is that the final interface does not need to be ready: wireframes are used often as well (Interaction Design Foundation, 2018). Although background in cognitive science is helpful, CWs can be performed by e.g. software developers who have been trained to detect usability problems. This approach helps to overcome some obstacles of designing for usability, such as limited understanding of usability or lack of resources to hire usability specialists. Essentially, detecting UPs identifying user's mental processes and cues to why they fail to perform certain actions. Usability testing takes usually 4-6 weeks and provides valuable, measurable data to support design decisions (Jadhav et al., 2013; Bruun & Stage, 2015; Kantner & Rosenbaum, 1997; Polson et al., 1992.)

4.1.2 UX evaluation in usability testing

Usability testing and UX evaluation can be combined to capture both usability and UX aspects of human-computer interaction. UX evaluations are often laboratory studies, online studies, or questionnaires. Some dimensions of UX can be addressed through usability testing, but usability testing methods are usually heavily focused on *task-performance* and not so much on the subjective experience of the user. (Quiñones et al., 2018.) Standardized user experience questionnaires are an efficient tool to quantitatively measure UX, and they supplement usability testing by collecting quantitative data about user impressions and providing information on *hedonic quality* aspects of UX, which some other methods to study

usability and UX do not measure. For example, cognitive walkthrough focuses on detecting usability issues and deviations from established principles but does not provide an overall impression of UX. (Schrepp et al., 2017.)

This study applies Use Experience Questionnaire (UEQ) by Schrepp et al. (2019), which measures UX with 26 items on six scales: *attractiveness*, *perspicuity*, *efficiency*, *dependability*, *stimulation*, and *novelty*. The scales can be categorized into *pragmatic quality* aspects (goal-directed), and *hedonic quality* aspects (not goal-directed). *Attractiveness* is a pure valence dimension. Assumed scale structure of UEQ is presented in FIGURE 5. *Attractiveness* refers to the overall impression of the interface (i.e. do users like or dislike it), *perspicuity* to how easy it is for the user to understand and learn how to use the interface, *efficiency* to how well and fast users can solve tasks without unnecessary effort, *dependability* to user's feel of control and predictability of the interaction, *stimulation* to excitement and motivation during the interaction, and *novelty* to innovativeness and creativity of the interface and its ability to catch user's attention. (Schrepp et al., 2019.)
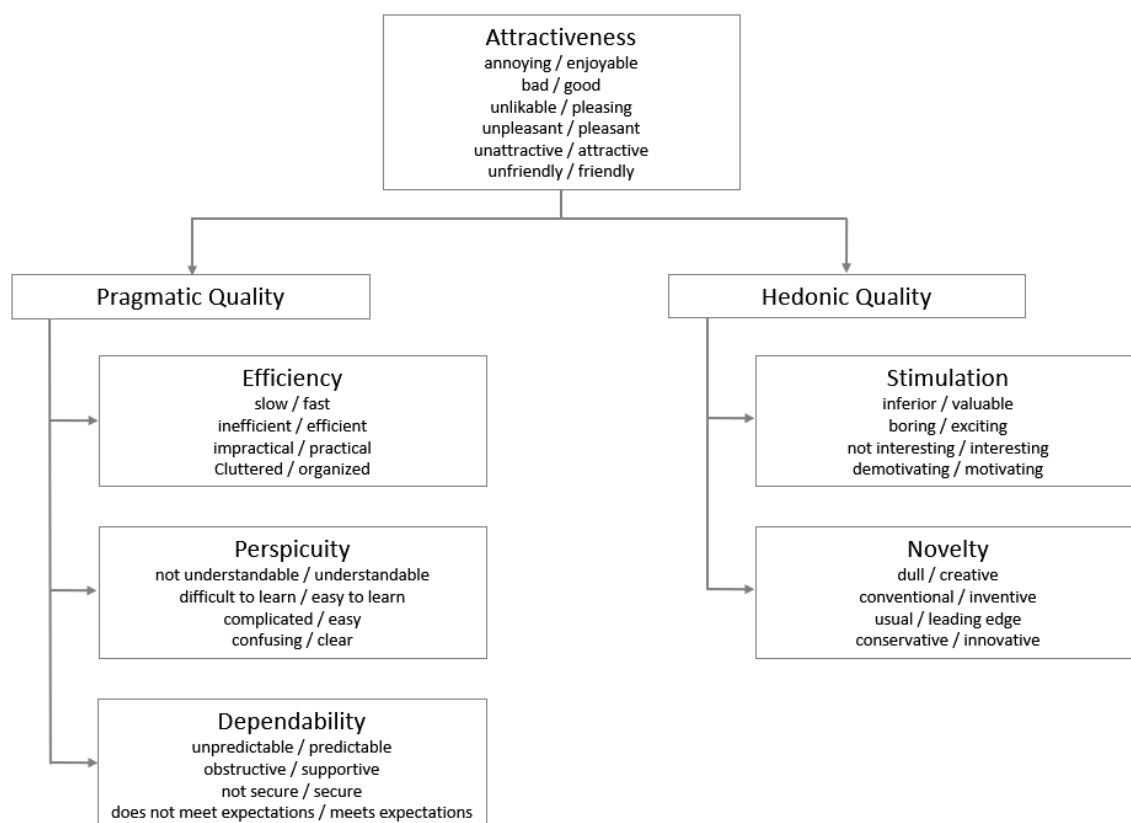
FIGURE 5 Assumed scale structure of UEQ (Schrepp et al., 2019, p. 3)

Combination of usability testing and UX evaluation in ecommerce domain is suggested (de Villiers & van Biljon, 2012). It is important to remember that cognitive walkthrough examines users' ability to *complete tasks* but not if they are *enjoying it*. I.e. users are not making judgements about the features of an interface; the goal is simply to identify problems in a task context. Hence, many aspects of UX are beyond the scope of cognitive walkthrough. (Polson et al., 1992.)

4.2   Research participants

According to Polson et al. (1992), when defining the target segment, it helps if the participants are from a relatively uniform population. It should also be considered, to what extent they need or are likely to have background experience with that specific or similar interfaces. (Polson et al., 1992) For the convenience of this research, participants are recruited through snowball sampling. They match the case company's website visitor demographics, i.e. they are a good fit to the brand and the products. Pilot study includes three respondents to establish the research procedure and the actual study includes six respondents (N= 6). Target segment and participant demographics will be presented in the Findings chapter, and Pilot study implications later in this chapter.

The reason to test case company's website with users is that usability testing allows improving the original design and eliminating problems users may have encountered otherwise – a fundamental goal of UX design. Even one round of testing can be critical for the success of the interface: research suggests that five users can unveil up to 85% of usability problems. (CareerFoundry, 2019.) Goh et al. (2014) and Sauro (2010) suggest that up 85-90% of usability problems can be discovered with six users (given that the problem occurrence is 30%), whereas de Villiers & van Biljon (2012) suggest that to identify 80% of usability problems, the number of participants could be up to 8–12.

4.3   Data collection

Website UX research is conducted to discover ways to improve the interface. UX research can be grouped into *generative research* (usually qualitative observations,) *evaluative research* (usually quantitative eye tracking/mouse tracking), and *insight-driven research* (looking into task succession rate and KPIs) (Nunnally & Farkas, 2016). Focus of this study is generative research. Qualitative approach can often give better insight on cognitive and emotional processes users go through (Law, 2011), which is why this study combines qualitative research (cognitive walkthrough) and quantitative UX measurement (user experience questionnaire), to supplement the usability test observations from *user perspective*.

4.3.1 Case company and website structure

The case company is a Finnish consumer brand, selling consumer electronics. For confidentiality reasons, the organization is not named. Their website was redesigned 2019 to enhance user experience, and this usability test is conducted to collect data about the UX on the new website. The company could be described as a lifestyle brand, so both visual aspect and providing information on the website is extremely important for conveying their message. Fixing possible usability problems is out of the scope of this research, as the purpose is to

examine UX through cognitive walkthrough and user experience questionnaire, and to provide improvement suggestions based on that. The primary goals the case company listed for their website were better conversion rate, more sales revenue, and better usability. Also, they stated that it is important for them to introduce the brand for interested consumers, provide manuals for product owners, and compatibility information for potential customers.

In the redesign process, all the content on the website was renewed and the WordPress theme was changed. Company reported that during the first eight months after going online with the new website and without any changes in promo budget, there has been more traffic on the website, conversion has gotten better, and their revenue has increased. They do not have official data about the nature of customer journeys, but they suspect that balanced and considered journeys are more represented on their website, as the consumers buying their products are usually looking for that specific product niche and quality.

Homepage includes a large hero slider. Below the hero slider is an element grid, each element linking to a promoted product category. This is followed by featured products element, featured articles form blog, newsletter subscription field, and trust symbols (partner logos). See Appendix 1. Website wireframes: homepage. Header contains company logo (link to homepage), main navigation (webshop, blog, about us, and customer support: these sections are not relevant for this study, so they are not described in detail), search bar, account login, shopping cart, and social media snippets. Footer includes information about payment methods, shipping and return terms, etc.

Product listing pages follow common ecommerce conventions: category navigation and recently viewed products are presented on the left, and products can be filtered by price. Products are presented in matrix format. In hover state, each product shows an overlay (quick view of details). See Appendix 2. Website wireframes: product category page. Product pages include product images, brief details, price, star reviews and CTA button above the fold. Below the fold are full description and details. See Appendix 3. Website wireframes: product page.

Shopping cart can be entered through icon in the header or through an overlay after adding products to cart, which includes two CTAs: *view the cart* and *proceed to checkout*. When a product is added to cart, there is also a confirmation message *product has been added to your cart* at the top of the current page. Shopping cart includes a list of products, shipping costs, and the total sum of the order. There is also a CTA to *continue shopping* and product suggestions based on the cart contents. *Proceed to checkout* CTA button is bright blue and has a hover state when it is active (see Appendix 4. Website wireframes: shopping cart).

4.3.2 Cognitive Walkthrough task list

The cognitive walkthrough task list includes a set of representative tasks based on case company's ecommerce goals and typical tasks users perform on their website. Task list is translated from English to Finnish, so that participants can choose which language they prefer. Then, the Finnish version is back translated to English, to check that the wordings are the same in both versions. Tasks are

identical for each participant. They are described so that a first-time user understands them. For more complex tasks, a task description is provided. The task flow is outlined in FIGURE 6.

FIGURE 6 Flow chart of tasks for each study participant
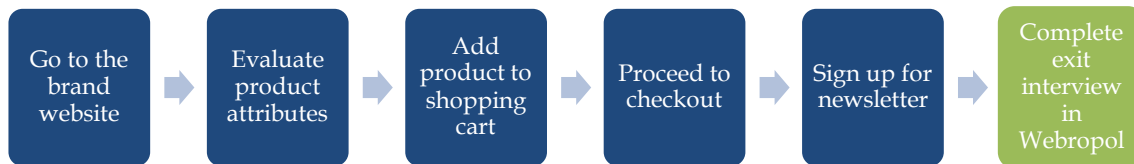
There are six main tasks: *go to the brand website*, *evaluate product attributes*, *add product to shopping cart*, *proceed to checkout*, *sign up for newsletter*, and *complete exit interview*. See Appendix 5. Cognitive walkthrough task list.

4.3.3 Data capture process

Research setting includes the *location* of the tests, *device* participants use, cognitive walkthrough *task list* (Appendix 5. Cognitive walkthrough task list *exit interview* (see Appendix 6. Exit interview, and *data capture*. For the purpose of this study, participants are observed individually interacting with the website at their homes. This setting best simulates an online shopping environment for the participants. Before starting the walkthrough, each participant is briefed about the process and how the test will proceed. Privacy policy will be given to them at this point, to give their permission to record computer screen, mouse movement, and audio (see Appendix 7. Privacy policy). Participants use their own laptop, as it is ideal that they use a familiar device with familiar operating system, keyboard, browser, and commands. Briefing participants includes emphasizing that the *usability of the website* is being evaluated, not their IT skills. Norman (2013) suggests that usually when people blame themselves for not being able to use something, the design is actually the one to be blamed. It is bad design – not user error – in many cases that causes failed attempts.

Data capture is executed as computer screen recording with QuickTime Player, including audio. Participants' actions, comments, and other notes about the walkthroughs are transcribed into written documents, so that individual participants cannot be recognized. During the walkthrough, participants are encouraged to ask questions and think aloud while performing the tasks. Post-test interview is used to gather demographic background information about participants and their impressions about the UX. Exit interview is in English, but Finnish translations of the UEQ measurement items are included, as some of them are specific, scientific attributes (see Appendix 6. Exit interview).

4.3.4 Pilot study

One pilot study with three participants was conducted to establish the study procedure. Minor changes were made to the exit interview after piloting, but

cognitive walkthrough task list remained the same. Participants were recruited through snowball sampling (see Appendix 8. Pilot study demographics). Key findings from the pilot study indicated that the task about finding product compatibility information was even more important than suspected, as it turned out to be challenging for the participants (see Appendix 9. Pilot study findings). Having this information easily available on the website for potential customers is one of the case company's goals. Feedback from pilot study also suggested that it would be valuable to add Finnish translations of UEQ attributes to the exit interview and use the full version of UEQ instead of the short version. Also, task list was translated to Finnish after the pilot study so participants could choose which language they prefer (see Appendix 5. Cognitive walkthrough task list), as one pilot participant mentioned that language preference for the instructions can depends on e.g. which language one is *used to* when shopping online.

Measuring task completion rate turned out to be useful during the pilot. It is a commonly used indicator of *effectiveness* in usability testing and it helped to identify where users encountered problems in their task sequence. However, task completion time – a commonly used indicator of *efficiency* in usability testing – turned out to be not so relevant for this study. (Sonderegger et al., 2016.) Although task completion time can be an indicator of website quality (e.g. speed of transactions), it does not describe *the quality of the user experience*: time spent on a website might be short but include flow and enjoyment, or it could be long and include anxiety and boredom (Obadă, 2014). Hence, task completion rate per participant was calculated but task completion time was not used as an indicator of usability or UX at the company's website. For some participants, it took longer to finish the walkthrough, because they struggled completing a task (i.e. they had an *action problem*), other participants simply spent a long time just browsing the website and different products out of interest.

4.4 Cognitive walkthrough and UEQ data analysis

Analyzing observations is an important stage in usability testing, in order to define the identified usability problems. Analysis includes turning observations into coherent, prioritized descriptions of usability problems and providing possible solutions to them. However, analysis should be kept lightweight, fast, and effective. For this reason, e.g. heuristic guidelines and design principles are valuable resources for analysis. (Følstad et al., 2012; Hvannberg & Law, 2017.) The results of this study are compared against *usability heuristics* by Quiñones et al. (2014), an updated version of Nielsen's heuristics, specific for ecommerce context. Also, design principles (such as Norman's *Seven Fundamental Principles of Design*, *Fitts' law*, and *Gestalt Principles*) are included in the analysis, as they address usability and design. Additionally, Chrome DevTools audit will be performed to observe the level of website's accessibility.

Evaluation stage of this study includes examining *goal problems*, *action problems*, and *goal modification* users engage in during cognitive walkthrough

(Polson et al., 1992). Most importantly, task analysis is conducted using Interaction Design Foundation's (2018) adaptation of *four questions for cognitive walkthrough* on websites (see TABLE 9 for the questions). Questions are based on four questions for CW Blackmon et al. (2002), which are originally based on questions by Wharton et al. (1994). For the purpose of this research, questions by Interaction Design Foundation (2018) are used instead of questions by Blackmon et al. (2002), as they are more practical for the analyzing process.

TABLE 9 Four questions for cognitive walkthrough

Four Questions for Cognitive Walkthrough (Interaction Design Foundation, 2018)	Cognitive Walkthrough for the Web (Blackmon et al. 2002)
Q1) Will the user try to achieve the right outcome?	*Q1) Will the correct action be made sufficiently evident to the user?*
Q2) Will the user notice that the correct action is available to them?	*Q2a) Will the user connect the correct subregion of the page with the goal using heading information and her understanding of the sites page layout conventions?*
Q3) Will the user associate the correct action with the outcome they expect to achieve?	*Q2b) Will the user connect the goal with the correct widget in the attended to subregion of the page using link labels and other kinds of descriptive information?*
Q4) If the correct action is performed, will the user see that progress is being made towards their intended outcome?	*Q3) Will the user interpret the system's response to the chosen action correctly?*

Answers to these questions are designed to identify problems in usability, e.g. user not receiving a confirmation message or ineffective search functionality (Jadhav et al., 2013). A cognitive walkthrough template (Dalrymple, 2018) will be used to document the task analysis. In addition to the four questions, a fifth question – *were you able to complete the task* – by Dalrymple (2018) will also be included in tasks analysis, to calculate the task completion rate.

Cognitive walkthrough task analysis is based on transcribed screen and audio recordings of the walkthroughs, and user experience questionnaire results will be analyzed with UEQ Data Analysis tool. UX questions are included in the exit interview (see Appendix 6. Exit interview) participants fill out after the test, as the best time to capture immediate impressions concerning UX is shortly after finishing tasks. (Schrepp et al., 2019.) It should be noted, however, that the results of UEQ in this study are indicative, as the qualitative sample size is rather small for this kind of scale. Also, one challenge in UX research is that some things are more measurable than others (Law, 2011). Thus, data collection and qualitative data analysis of this research is planned to match the sample size and the type of feedback acquired from the UX study, so that the collected data is meaningful and meet the objectives of this research.

5   FINDINGS

Research findings are discussed in this chapter. Sample and target segment characteristics are presented first, and research results after that. Results describe the findings from the cognitive walkthrough the user experience questionnaire.

5.1   Target segment and participant demographics

Six participants were recruited, in addition to three pilot participants. They were recruited based on the case company's website visitor demographics. Primary demographic factor was age; participants needed to fit the target age group of the case company's website. Both female and male participants were included in the sample. In addition, computer operating system was taken into account: equal amount of Microsoft and Macintosh users were recruited. Basic IT skills and some experience of using Internet was required, but advanced skills or online shopping experience were not necessary. Participant demographics are presented in Appendix 10. Participant demographics

According to company's website analytics software, website's largest user group is 25-34-year-olds (47.6%), followed by 18-24-year-olds (21.2%), and 35-44-year-olds (19.8%). King et al. (2016) argue that *millennials* (18–34-year-old consumers) represent the main demographic group in online shopping – despite of the fact that they have lower income level than older adults. As it can be seen, millennials dominate visitor demographics: 68.8% of the visitors are 18-34-year-old (see FIGURE 7). Note that these visitors account for only about a half of total visitors. Approximately two thirds of the visitors are male, one third female. Audit time was set to May 1 to December 31, because the new website was published in May 2019 and analysis was conducted at the end of December 2019.
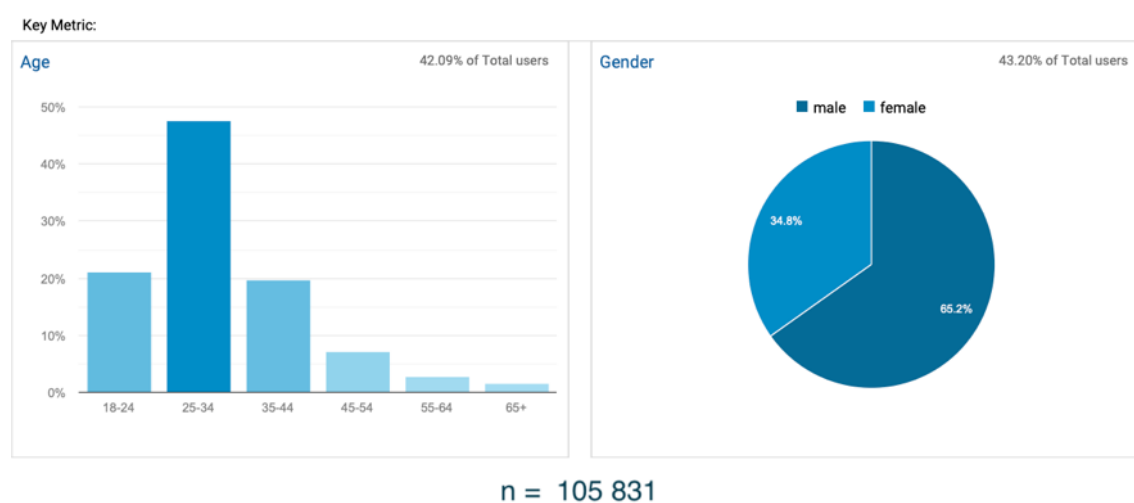

FIGURE 7 Company website visitor demographics

Popular operating systems among visitors are Microsoft (33.6%) and Mac (23.5%), accounting for more than half of the users. The dominant browser is Chrome (75.9%), followed by Safari (16.5%), other browsers accounting for less than 3% each. Although the company is Finnish, their visitor base is very international: most traffic comes from the US (16.09%), followed Australia (9.77%), Canada (7.07%), Italy (6.86%), Spain (6.57%), UK (6.29%), Netherlands (5.81%), Germany (5.31%), Finland (4.59%), and France (2.85%).

5.2   Cognitive walkthrough task analysis

The following analysis is based on filling out the results of the usability tests on cognitive walkthrough templates, which include four plus one questions for CW (see Appendix 11. Cognitive walkthrough task analysis), in addition to examining possible *goal problems*, *action problems*, and *goal modification* users encountered (Polson et al., 1992). Participants had no goals problems, i.e. problems related to *goals needed to operate the system* and *goals users form as they go* while performing tasks. An action problem related to one task (second task) was very common: participants were *trying to do the right thing* but did not succeed, at least not on the first try. TABLE 10 presents the task analysis of the second task (numbers 1-6 represent participants).

TABLE 10 Cognitive walkthrough task analysis excerpt

Evaluate product attributes: Make sure the product is compatible with your device(s)	1	2	3	4	5	6
Will the user try to achieve the right outcome?	Yes	Yes	Yes	Yes	Yes	Yes
Will the user notice that the correct action is available to them?	No	Yes	No	No	No	Yes
Will the user associate the correct action with the outcome they expect to achieve?	No	Yes	No	No	No	Yes
If the correct action is performed, will the user see that progress is being made towards their intended outcome?	No	No	Yes	Yes	Yes	Yes
Were you able to complete the task?	No	No	Yes	Yes	Yes	Yes

Eventually, most participants found the information, but many remained unsure if they had actually found it; they were looking for something *more specific* (e.g. a list of compatible devices) than what the information element on the website actually states. Participants who encountered this action problem started to look into different places trying to find the information and modified their goals on the go. Some even got frustrated or irritated after searching for a while. Some

comments from participants when they were trying to locate the information on product pages include:

> *"I was expecting to see a list on the product page."*

> *"It is probably here… no… now I'm a little irritated."*

> *"Is it not here? I would put it here, at least I would start looking from here."*

> *"So, where is the information…? It is not very intuitively here…"*

> *"This makes me feel stupid."*

Although participants struggled completing the second task, the average task completion was 93% (calculated with 12 sub-tasks, excluding 'complete exit interview'). Five out of six had problems finding compatibility information, of which four had an *action problem* finding it and one found it but was not convinced that the information was sufficient enough: *"It says here that it is compatible [with my device], but it would be nice to see that it actually does – that is important for me. The product is not cheap, and I wouldn't want to go through the trouble of returning it. Next, I would Google if the product actually is compatible with my device, because I want to be sure before ordering."* Only one user found the information without struggle and was satisfied with it (she was not familiar with the brand nor the website beforehand).

Most common identified usability problem was finding compatibility information. Other identified usability problems did not interfere as much with task performance – but affected the perceived UX. Other usability problems included low contrast, small fonts, and unobtrusive secondary navigation. Finding compatibility information was the only usability problem causing difficulties to perform a task, whereas other problems are more of suggestions for improving UX, especially conversion rate. See TABLE 11 on the next page for the list of found usability problems in the usability test. P2–P4 are included in the table, although they are not severe problems. However, they could affect the level of usability for some users (e.g. visitors with vision impairment) and improving them would probably result in better UX for all visitors. One participant, who is a web designer, commented: "In general, the site is very black and white, and nothing pops out. The text is small at times... I wonder if this would pass an accessibility test.", which indicates that some UX development for the website could be made.

TABLE 11 Identified usability problems based on cognitive walkthroughs

	Problem definition
P1	**FINDING COMPATIBILITY INFORMATION** Almost everyone had problems finding compatibility info or were not sure although finding it and kept looking for a list of compatible phones/devices.
P2	**LOW CONTRAST** CTA buttons, CTA links, and subheading texts should stand out more from the background: both color and size could be used for contrast.
P3	**SMALL FONTS** Font size is small in many places, which affects accessibility and readability. Participants commented that they have to concentrate while reading, because of the small font. However, they reported that the prices are easy to see.
P4	**UNOBTRUSIVE SECONDARY NAVIGATION** Breadcrumb trail could be more visible for intuitive navigation, so users know where they are and how to go back (especially on product pages).

Related to P4, one participant commented: *"This is a little unintuitive in the sense that when I enter the product page... what would be the most convenient way to go back? These days, there usually is a breadcrumb trail that you can follow back."* However, he noticed the link to homepage and product category page but did not get an impression at first that it is the secondary navigation (breadcrumb trail).

On the other hand, there were many successful features on the website and participants were overall satisfied with the interaction. On product category pages, other participants seemed to be pleased with comparing possibilities and filtering options, while others felt that there should be more options, e.g. side by side comparison. In addition, product reviews turned out to be a successful feature. Some participants looked at the reviews on product category pages and product pages to get inspired: *"This product has also gotten good reviews, so I will choose this. I would not trust [reviews] if they were only stars, so it is good that the comments are also shown – I like to read the reviews when I'm shopping."* Especially the checkout process was liked; one participant commented that the pop up after adding a product to shopping cart is convenient, and one participant pointed out the in the shopping cart: *"CTA is clear and the whole process works well. For an ecommerce site, this is a must!"*

5.2.1 Usability heuristics and design principles

Usability heuristics are both principles for good design and a tool for evaluating usability. Although this study will not contain Heuristic Evaluation, results are briefly compared against *Transactional Web Applications Heuristics* by Quiñones et al. (2014) The website meets most heuristics, e.g. *Aesthetics and minimalist design*

(F8) and *Standardized Symbology* (F7). Also, *Visibility and clarity of system status* (F2) and *Feedback on the final state of transaction* (F4) are clear and users are informed about what is going on (e.g. when a product is added to cart, a pop-up on shows contents of the cart and CTAs *view cart* or *proceed to checkout*). In addition, product page shows a confirmation message (*product has been added to your cart*).

Found usability problems suggest that few heuristics are not clear enough on the website. They are compared against usability heuristics in TABLE 12. Participants explored many places looking for compatibility information, trying to remember which places they had already checked when continuing the search. Thus, their workflow of accomplishing task list got interrupted (F10) as product pages did not offer the functionality where they expected it to be found (F13), increasing their memory load as a result (F14). Also, visibility of CTAs, text, and secondary navigation was commented, indicating that *Visibility and clarity of system elements* (F1) could be improved. (Quiñones et al., 2014.)

TABLE 12 Found usability problems compared to usability heuristics

Found usability problems		Usability heuristics (Quiñones et al., 2014)	
P1	Finding compatibility information	F10	*Appropriate flexibility and efficiency of use* Accomplishing tasks effectively, without disturbances to workflow
		F13	*Correct and expected functionality* Functionalities that are correct and offer what users expect of them to provide
		F14	*Minimize user's memory load* Providing information, which is easy to remember when moving forward
P2	Low contrast in CTAs/buttons	F1	*Visibility and clarity of systems elements* Most important elements should be clearly visible
P3	Small fonts		
P4	Unobtrusive secondary navigation (breadcrumb trail)		

CTA buttons are an important UX consideration for ecommerce sites. They are both *affordances* (button affords clicking it), and *signifiers* (button signifies it can be clicked) (Norman, 2013). Also, for example Fitts' law and Gestalt principles (especially Law of Proximity) can be used to evaluate CTAs. Fitts' law suggests that the larger the *signifier* of an *affordance* (possible interaction) is, the more effective the CTA will be (Johnson, 2013). *Law of proximity* describes the tendency to perceive elements as related to each other if they are close (Interaction Design Foundation, 2019c). On the website, CTA buttons are close to the texts they are

supposed to, indicating which call-to-action is related to which piece of information. On product pages and in shopping cart, CTA buttons are colored and stand out from the monochrome color scheme. However, on homepage, CTAs to enter the webshop do not stand out from the background and some buttons (including *accept cookie policy* and *subscribe to newsletter*) do not have a hover state to indicate that cursor is on an interactive element. One participant pointed this out: "*There is no visual feedback when the buttons are active.*"

Other observations include large amount of information on homepage and product pages, which increases risk of information overload. Also, there is repetitive content on homepage, e.g. blog posts and newsletter subscription field come up twice (see Appendix 1. Website wireframes: homepage).

5.3   User Experience Questionnaire results

Before presenting the User Experience Questionnaire results, it is important to remember that the results are only indicative, as the qualitative sample is small for quantitative evaluation. UEQ by Schrepp et al. (2019) is used to evaluate, whether the interface has sufficient UX, and to determine areas of improvement. See TABLE 13 for UEQ scale descriptions.

TABLE 13 UEQ Scale descriptions

UEQ Scales explained (Schrepp et al., 2019, p. 2)		
Attractiveness	*Overall impression of the product. Do users like or dislike the product?*	
Perspicuity	*Is it easy to get familiar with the product? Is it easy to learn how to use the product?*	Pragmatic quality
Efficiency	*Can users solve their tasks without unnecessary effort?*	Pragmatic quality
Dependability	*Does the user feel in control of the interaction?*	Pragmatic quality
Stimulation	*Is it exciting and motivating to use the product?*	Hedonic quality
Novelty	*Is the product innovative and creative? Does the product catch the interest of users?*	Hedonic quality

Participants' evaluation of the website was positive for pragmatic quality, neutral for hedonic quality, and neutral for attractiveness. Pragmatic quality had the highest mean (0,81), attractiveness was in the middle (0,44), and hedonic quality scored lowest (-0,06). Values between -0,8 and 0,8 represent neutral, values over

0,8 represent positive, and values less than -0,8 represent negative evaluation. (Schrepp et al., 2019.) Mean per scale is presented in TABLE 14.

TABLE 14 UEQ results per scale

UEQ Scale	Mean (n = 6)	Variance	UEQ Scale	Mean	Variance
Perspicuity	0,750	1,05	Attractiveness	0,444	2,64
Efficiency	0,792	1,21	Stimulation	0,375	0,77
Dependability	0,875	0,67	Novelty	-0,458	3,66

Answering a question *what should be changed in order to improve the user experience* cannot be inferred directly from quantitative UX measurement, but it gives insight on general areas of improvement (Schrepp et al., 2019). As it can be seen, participants' evaluation of their experience on the website scored highest in *dependability* (user feels in control of the interaction). That scale also had the least variance in answers. Website scored worst in *novelty* (catching user's interest; innovativeness and creativeness of the interface), which was also the scale with the highest variance in answers. The scales range between -3 (extremely bad) and +3 (extremely good), but values above +2 or below -2 are unlikely, because extreme answers are usually avoided in questionnaires.

When it comes down to individual items, the website scored highest in following; *easy to learn* (1,7), *efficient* (1,5), and *predictable* (1,3), all of which describe the pragmatic quality of the UX. In this context, predictability can be interpreted as good, because an ecommerce website can benefit from conventions, such as using commonly known iconography and navigation structures. According to Interaction Design Foundation (2019b) and Nielsen's usability heuristics (following general platform conventions for consistency), using common web design conventions adequately is a sign of effective UI design. The website scored lowest in *inventive* (-1,0), *leading edge* (-0,5), *innovative* (-0,2), and *creative* (-0,2). This means that the participants assessed the website more as *conventional*, *usual*, *conservative*, and *dull* – which all include in *novelty* scale, describing the innovativeness of the interface. All UEQ items and mean value per item are presented in FIGURE 8.
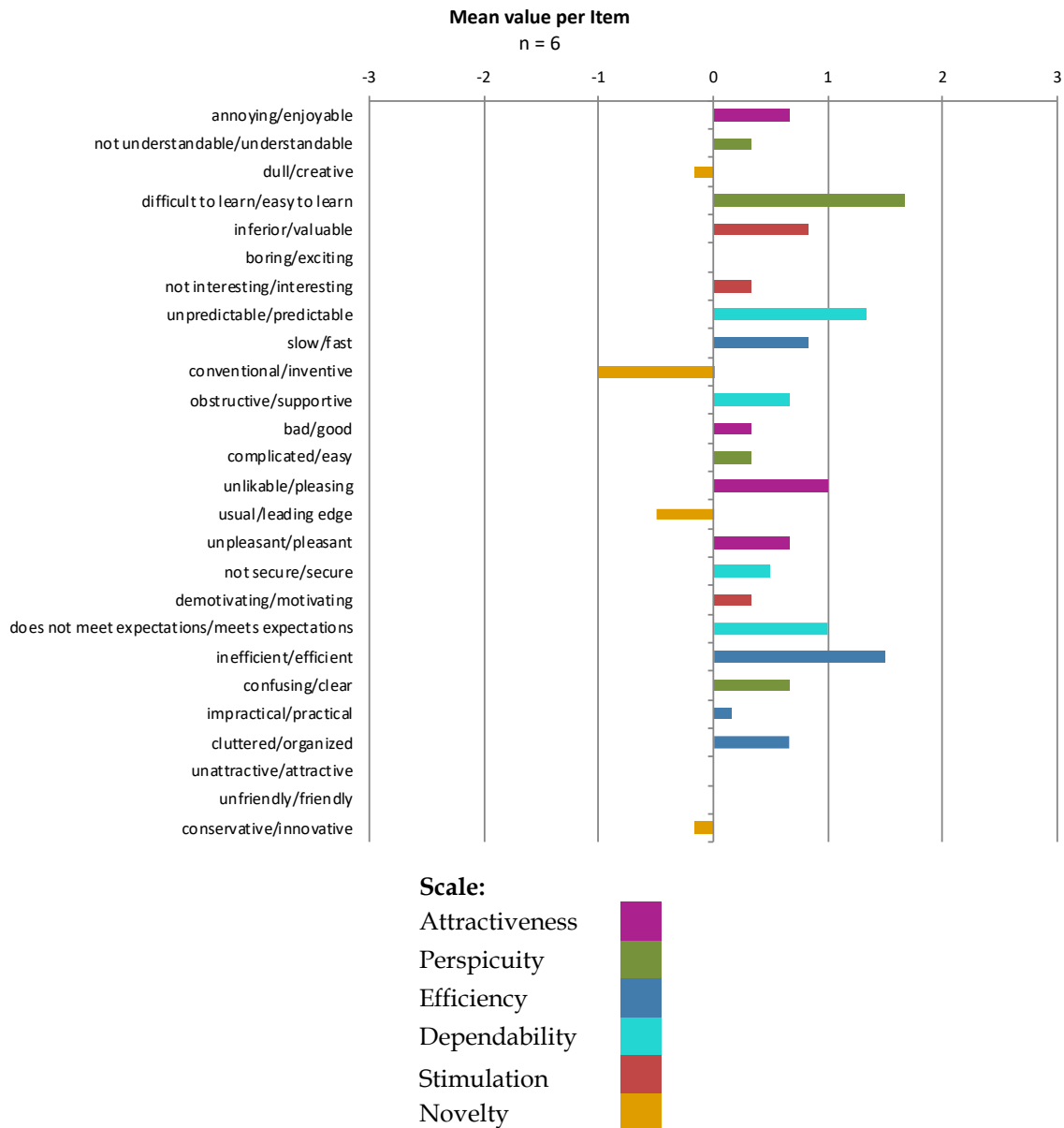
FIGURE 8 Results per item

When an item shows big deviations to other items of the same scale, it can be an indication that the item is misinterpreted. In this study, *novelty* scale had the biggest standard deviation, which indicates that some participants might interpret *conventional* e.g. as a sign of reliability, others e.g. as a sign of not being up to date. Hence, context of the study might shape the answers and the results are not unambiguous. (Schrepp et al., 2019.)

In conclusion, the UEQ results suggest that the pragmatic quality of the case company's website is good: it is easy to learn, efficient, and predictable. On the other hand, the hedonic quality of UX (the innovativeness and catching users' interest) could have scored better. Discussion about contribution to scientific research and managerial implications will be discussed next.

6 DISCUSSION

This chapter includes discussion about the usability test and user experience questionnaire results. Theoretical contribution to scientific research is followed by managerial implications. The theoretical contribution is categorized into UX research and online customer journey research. Research limitations and future research suggestions are presented after that.

6.1 Theoretical contribution

6.1.1 UX friendly website design

According to Roto et al. (2011), examining UX through its core factors – system, user, and context – helps to understand, why a *particular user* experiences a *particular experience*, and possible reasons behind that experience. Sulaiman et al. (2015) emphasize user's role in UX and how their personality (traits and attitude) affect their behavior during interaction and judgements they make about the interaction. This is why the participants of this study were asked about their decision-making style when they are shopping online (see Appendix 6. Exit interview), to help analyze their task performance. Having an idea of their *maximizing tendency* (seeking for the best possible outcome) or *satisficing tendency* (settling for good enough choices that meet some criteria) helped to evaluate why some participants took more time to finish the task list: some were thorough with their research and purchase decision (maximizing tendency), others took more time because they had troubles finishing a task. Accordingly, Obadă (2014) suggests that time might not be the best indicator of an experience on a website, because even a short experience can include experiencing enjoyment and flow, and on the other hand, long session can be a result of external motivation (need to complete a task) and include e.g. anxiety or boredom.

Frustration is one criterion for classifying usability problems and their severity (Bruun et al., 2016). In addition to frustration tendency, user's *subjective emotional experience* and *coping* while performing tasks also depends on e.g. user's technological problem-solving tendency, pre-task self-confidence, and task performance. Feeling of frustration is a result of not being able to accomplish tasks, whereas feeling of competence is a result of being able to accomplish tasks (Jokinen, 2015). Some of the participants showed signs of frustration when they were not able to find the compatibility information (task two) and commented that they felt irritated as a result. This was the most severe usability problem found in this usability test. Although not everyone had problems accomplishing this task goal, majority of the participants struggled with it, suggesting it is an issue the company should address when they are redesigning their website the next time, as providing this information is one of their goals for the website. This

usability problem is specific to the case company's, but the frustration of not being able to accomplish tasks (*"This makes me feel stupid."*) is generalizable to all websites and should be prevented with mindful UX design.

Research suggests that *task performance* and *user satisfaction* are positively correlated; according to Jokinen (2015), feelings of competence or frustration resulting from task performance affect the judgement made about the interaction and the whole experience (primary appraisal), resulting either in satisfaction or dissatisfaction (successful interactions are usually appraised as pleasant). Secondary appraisal is user's evaluation of their ability to *cope with the event*. Again, the feeling of competence is linked to the feeling of control, and the feeling of frustration is linked to feeling powerless. Of the two common coping strategies (*problem-solving centered approach* and *emotion-centered approach*), participants of this study employed more problem-solving centered approach when they encountered difficulties: they looked into different places and systematically searched for the compatibility information. This suggests that they appraised their feeling of control high: many even said out loud that they *know what they are looking for*, they just cannot find it. An important aspect of Competence-Frustration theory is that feelings of frustration and competence are not exclusive. Even when facing obstacles, user can be able to complete tasks and feel competence as a result. (Jokinen, 2015.) Despite of this one prominent usability problem, most of the participants still felt rather competent and were able to complete the general objective of the task list (purchase a product).

According to the usability heuristics for transactional websites (Quiñones et al., 2014), the first usability problem falls under heuristics 10 *Appropriate flexibility and efficiency of use* (no disturbances to workflow), 13 *Correct and expected functionality* (offers what users expect), and 14 *Minimize user's memory load* (providing information, which is easy to remember when proceeding in workflow). Similarly, usability problem categorization by Goh et al. (2013) suggests that the first and the most severe usability problem found in this study (finding compatibility information) falls under *User guidance and support* and *Functionality* and rest of the usability problems (low contrast, small fonts, unobtrusive secondary navigation) fall under *Visual Clarity*. Other usability problems found in this study (low contrast, small fonts, and unobtrusive secondary navigation) are generalizable to all website design, and to the usability, readability, and accessibility of websites.

Design principles and conventions are important for UX. The website was evaluated as *predictable* and *conventional* by the participants. Although this may seem like a negative evaluation, according to Johnson (2012), websites should follow common conventions and be predictable – for consistency. Similarly, Garrett (2011) argues that UX design aims to *reduce the mental effort* of using an interface and *guide users* by utilizing conventions and metaphors efficiently. Results of this study suggest that design principles, such as Law of Proximity (Gestalt principles) and Fitts' law are efficiently used on the company's website; e.g. CTAs are located strategically. However, according to Norman's seven design principles (2013), the *signifiers* of possible interactions (*affordances*) could be communicated more clearly: some CTAs do not stand out from background

(e.g. "shop now"), and some buttons do not have a hover state to let the user know when the cursor is on an interactive element (e.g. "subscribe"). On the other hand, the *conceptual model* – which, according to Norman, leads to understanding and feeling of control – seems to be clear on the website, as the website scored best in dependability scale in the UEQ, which measures if user is feeling in control of the interaction.

Because user needs are two-fold – on an ecommerce website, users are engaged either in *searching* (goal-oriented behavior) or *browsing* (exploratory behavior) – website design should support both strategies. UX goals and usability goals differ slightly as well, although the concepts are interconnected. Usability goals are more objective and pragmatic, usually referring to the *ease-of-use* – whereas UX goals are more subjective and hedonic in nature, measuring e.g. *engagement* and *stimulation* of the interaction. (Schmutz et al., 2010; de Villiers & van Biljon, 2012.) According to the UEQ results, the website scored highest in pragmatic quality (especially in ease-of-learning and efficiency) but did not excel in hedonic quality (novelty and stimulation). Hence, it could be inferred that the usability of the website is good, and the UX could be improved. Accordingly, Hassenzahl et al. (2010) suggest that *need fulfilment* is linked to perceived hedonic quality of the experience and describe need fulfilment as a source for positive experiences, but also suggest that need fulfilment does not seems to be as closely linked to perceived usability (pragmatic quality of the experience). A powerful tool for communicating the intended message and improving UX on ecommerce websites is visual attractiveness: it increases the fulfilment of higher order desires, such as enjoyment and online flow. (Djamasbi et al., 2010.) Visual appeal also affects user's evaluation of the website and the interaction, ideally resulting in *trust* and *satisfaction* (King et al., 2016; Krauss & Hoffmann, 2004). Although in the UEQ, *attractiveness* of the website scored as neutral and feedback from the walkthroughs suggested that it looks *clear* and *nice* (participant comments), it also got feedback about looking *conservative* and *missing contrast* in many places.

6.1.2 Satisfying online customer journeys

When it comes to customer journey analysis, in an initial interview, the case company reported that their customer base usually knows what kind of product they are looking for, and that balanced and considered customer journeys are probably the most represented in their website visitor behavior. In both balanced and considered journeys, customers have an *intention to buy* and go through a *cognitive evaluation*. (Wolny & Charoensuksai, 2014.) The customer experience can be enhanced with providing accurate and truthful information on the website, to decrease uncertainty and increase trust, which can predict purchase decision (Bleier et al., 2018). According to Bleier et al. (2018), trustworthiness of experiences on websites is especially important for selling *experience products*, which require supplementary sensory information and social presence to understand what they are about. Accordingly, the case company showcases the benefits of their products on the website extensively, including e.g. featured

articles, how-to videos, and a variety of pictures to demonstrate what their products are about and how they can supplement the target audience's lifestyle.

Interaction between user and website is a three-way process, including the *level of information control*, *cognitive load*, and the *amount of experience* user has with that specific interface. Bleier et al. (2018) suggest that in order to drive conversion, efficient tools to improve customer experience include e.g. recommendation agents, product rating, and content filers. The reason these elements are useful on ecommerce websites is related to Ariely's (2000) theory of control over information flow, which suggests that feeling of control increases consumer's confidence in decision-making. Control over information flow also results in increased *task performance*, as it improves fit between *actions* and *outcomes*, and user's ability to explore. Ariely (2000) In this study, participants utilized the possibility to control information flow on product category pages by using product filtering options. These findings are in line with Ariely's argument that the possibility to control information flow will help consumers in their decision-making. However, information-packed product pages decreased participants' task performance in the second task (finding specific information). Harley (2018) suggests that to support informed decision-making on ecommerce websites, it is important to present well-curated, uncluttered information and communicate clearly what is the *visual hierarchy* of the elements and content.

Experiencing information overload can result in decreased decision-making performance, as well as *perceived irritation* on websites. According to e.g. Hasan (2015) and Harley (2018), intuitive navigation and clear visual structure help users to complete their tasks effortlessly and understand without much effort what each category is about. *Informative*, *visually appealing*, *easy to use*, and *easy to navigate* websites are less likely to irritate users. This is especially important for ecommerce websites, because the design can shape consumers' beliefs about the retailer, as well as their purchasing behavior. (Hasan, 2015.) Findings of this study suggest that the time and cognitive effort spent for task two irritated most of the participants. However, as Jokinen (2015) presents, competence and frustration are individual in their valence and despite of facing obstacles, user might be able to complete the tasks and feel competence. This seemed to be the case in this study: five out of six participants had problems completing task two, but three of them were able to complete the task to the point they felt they had sufficient information. Perceived irritation during shopping process has both immediate consequences (e.g. shopping cart abandonment) and lasting effects, such as beliefs about the retailer and their credibility (Hasan, 2015). Two participants mentioned during the test that they would normally avoid the risk of having to return a product and not place an order if they felt they did not have sufficient information to make an informed purchase decision. However, the smoothness of the checkout process on the website was appreciated by the participants, which is important for ecommerce websites if they wish to decrease shopping cart abandonment and increase conversion rate. Conversion rate is one way to measure how good the UX on a website is, as empty or abandoned carts can indicate that there are problems with the user experience. (Garrett, 2011.)

Customer satisfaction is consumer's cognitive evaluation of their experience (Lemon & Verhoef, 2016), and ne predictor for customer satisfaction in ecommerce is *website quality* (Lin, 2007). One indicator of website quality is *perceived quality of user experience*, which in some contexts is a more relevant indicator of experience and satisfaction than e.g. task completion time (Obadă, 2014), as already mentioned earlier. Falk et al. (2009) suggest that website quality is experienced differently by experienced and inexperienced customers, which explains the relevance of *perceived UX*; experienced users have more hedonic needs, whereas inexperienced users have more pragmatic needs for the interaction. Participants in this study were inexperienced with the studied website, in order to capture impressions from first-time users. In the UEQ, the website scored best in pragmatic quality, but did not perform that well in hedonic quality measurements. This can either mean that the website could be redesigned to support hedonic user needs more, or that the participants happened to be more focused on the pragmatic aspects of interaction, as they were inexperienced with this particular website and focused on the cognitive walkthrough task list.

6.2   Managerial implications

When it comes to measuring website performance, key performance indicators are widely used for assessing the effectiveness of customer journeys on websites. One of the most important online retail KPIs is *conversion rate*. In this study, primary conversion was buying a product, but it should be noted that participants were *asked to finish* the tasks. Case company's website performance has improved last year after publishing the redesigned website. During audit time period (May-December 2019), *conversion rate*, *revenue*, *number of transactions*, and *average order value* have increased in comparison to the preceding eight-month period. There has been a 60.99% increase in revenue, 39.02% increase in the number of transactions, and 15.80% increase in average order value. Conversion rate has improved modestly, from 0.56% to 0.63%. Hence, there are areas of improvement, as it is often suggested that ecommerce conversion rate should be approximately 1-2%. Also, one good sign is decreased *cart abandonment rate*, which has reduced by 9.72% (from 66.83% to 60.34%). *Bounce rate* of the website has increased (16.67%) but at the same time, *average time on page* has increased 25.31%. Visual attractiveness can be used to reduce the bounce rate on websites, and research findings could explain the increased bounce rate, as the attractiveness and hedonic aspect of the website did not score as well as the pragmatic quality of the UX; visitors may not be engaged from first impression (they exit the website) but if they stay, the website allows them to explore, perform tasks, and accomplish their goals.

An interesting question is if the results of cognitive walkthroughs and user experience questionnaire are congruent. In the UEQ, case company's website scored highest in pragmatic quality, especially as *easy to learn*, *efficient*, and *predictable*. The path to products should be thoughtfully designed to convey

hierarchies among categories and to helps users locate the product that best suits their needs. Navigating to category pages and product pages was easy for participants, supporting the UEQ results. Also, smoothness of the checkout process was commented positively by many participants, which indicates that users felt in control of the interaction on the website. The website scored lowest in hedonic quality in the UEQ, especially in *novelty* scale, which measures the innovativeness and creativeness of the interface. This is in line with observations from the walkthroughs. Some participants commented that the website is very black-and-white and missing contrast in many places, some described it as conservative, one even said that the WordPress theme seems *"a bit old-fashioned"*. Running Chrome DevTools audit supports these observations and indicates that the accessibility of the website could be improved: current background and foreground colors do not have a sufficient contrast ratio: low-contrast text makes the website difficult to read for many users. Web Content Accessibility Guidelines and EU directive on web accessibility include worthwhile guidelines for increasing website's accessibility.

The first step of website design is to think through the *user journey*: find out customers' expectations, and design navigation and information architecture to support the user journey. Second step is *visual hierarchy*. There is a difference between a website that looks nice and a website that guides users to the desired actions with effective layout. Visual hierarchy is necessary, because users are often scanning websites and the most important information needs to stand out, otherwise there is a risk of all content seeming equally important. Using grid-based layout and visually prioritizing key elements helps to convey the visual hierarchy of information, which is one of the key considerations for UX design, in addition to *consistent color scheme* and *efficient typography*. Both cognitive walkthrough and UEQ results suggest that these considerations should be addressed next time when the company's website is redesigned. Third step of designing websites is call-to-action buttons, which some argue to be the most important element on ecommerce sites. Strategically located and well-designed buttons can drive conversion. This includes making sure that the buttons look clickable (by using shape, shadows, and highlights), labeling them clearly to guide users to the next action (e.g. *add to cart*), and highlighting most important CTAs with color, contrast, and location. Case company's homepage is one area of improvement: in addition to CTAs not standing out, the homepage is very long and there is repetitive content. For ecommerce websites, homepages are for introducing the brand and most important product offerings, i.e. communicating who you are and how you differ from competitors. Cluttered homepages usually fail to communicate this, which results in lower perceived quality. Hence, simplifying homepage by removing repetition and semi-relevant information could increase the *perceived value* of the website from user perspective.

One consideration for website's success is competition: good UX can be used to gain competitive advantage by improving customer trust and loyalty. Exceling in online service and providing high-quality products is an effective way to compete with international ecommerce stores. However, for the case

company, e.g. Amazon entering the Nordic markets is an opportunity to increase sales, because they sell their products on Amazon in addition their own website.

6.3   Research limitations

Cognitive walkthrough is a widely used method in usability testing, because uncovering design errors that might affect or interfere with user's exploration is crucial for the usability of the interface. Despite of being generally cost-efficient tool for finding out possible causes to usability problems, cognitive walkthrough method also has its drawbacks. First of all, if usability studies are performed late in the design process (like in this case with the redesigned website), solving usability problems may require larger redesigns, delays, and extra costs. Another limitation of using cognitive walkthrough method is that the results are affected by task descriptions, which might discourage exploration. Moreover, cognitive walkthroughs focus on user's cognitive activities while they perform tasks, so using the method requires knowledge of cognitive science and more expertise than most other usability evaluation methods, and analyzing the results is dependent on the practitioner's expertise. (Polson et al., 1992; Andre et al., 2004; Jaspers, 2009; Følstad et al., 2012.)

Participants who took part in this study are from relatively uniform population: they all have same cultural background and many years' experience of online shopping. According to Polson et al. (1992), uniform participant population can be good for conducting cognitive walkthroughs, as anticipated users of the interface should match the target segment. On the other hand, if there were more participants in this study and the sample was more divergent, research results could be more generalizable. Hence, the sample of this qualitative study is not fully representative of all visitors of the case company's website. In addition, the results might not be generalizable to other ecommerce websites, because the sample was tested with one website only. Also, there is no comparison to another version of the website and the UX was assessed based on cognitive walkthrough task performance and participants' own assessment about their experience. The research sample, the usability test task list, and the exit interview were based on case company's needs, website characteristics, and visitor demographics. Although this study was conducted for one ecommerce website only, there are many useful key takeaways for web designers.

6.4   Future research suggestions

The richness of online shopping environments is approaching physical retail. To address the challenge of providing unique online shopping experiences, future research should examine how brand and product characteristics can be effectively communicated on ecommerce websites. Online retailers should work

strategically to maximize their website performance, especially on product pages. Research could address for example how design elements on product pages influence consumer's decision-making (Bleier et al., 2018), to investigate how this affects conversion rate and other business goals. Also, an important theme is to continue integrating UX research and UX design practice. Følstad et al. (2012) suggest that this gap between usability evaluation in scientific research and in design practice should be addressed with developing methods and tools, which support analysis in both contexts. This includes focusing on task-scenario development and problem identification, for example. (Følstad et al., 2012)

For the case company, future UX studies should be conducted with all buyer personas, to collect data from different personas and their customer journey on the website. In this study, data was collected only from the target segment (the largest user group on the website) with existing interface. In future, testing could be executed with prototypes or wireframes, remembering that the challenge of measuring UX is to present prototypes that are *rigid enough* (they already have the key characteristics), but also *flexible enough* so that there is room for feedback and modifications (Law, 2011). Also, Ecommerce cart targeting (ECT) could be studied to further decrease cart abandonment rate and examine if users are more likely to exit the website with or without items in cart, and in what stages price promotions and scarcity promotions would be effective (Luo, 2019).

7   CONCLUSIONS

In UX research and design practice, usability testing is conducted to find out which features are successful from user perspective – and which are not. Similarly, customer journey mapping is conducted to discover successful and unsuccessful touchpoints. The idea that user needs are the baseline for design emerge from user-centered design (Norman & Draper, 1986), which calls for more *efficient* interaction: helping users to work faster, make fewer mistakes, with minimal effort (Garrett, 2011). Many UX researchers have come to a conclusion that good usability predicts good UX – and good UX predicts adoption. Good UX is also a predictor for trustful relationship between consumer and service provider, which is a predictor for purchase intention. Understanding UX, online customer journey, and consumer decision-making process on a website helps to understand what are the pain points and problems that prevent users from performing tasks or accomplishing their goals.

The objective of this study was to examine how website design affects the perceived usability and user experience, as well as the online customer journey on that website. The first research question was: *Does the new design facilitate good user experience on the website?* The case company was looking for someone with UX expertise to evaluate their website and how well the redesigned version supports business objectives, most importantly conversion. Their main goals include also providing information for potential customers and manuals for product owners. The findings suggest that the pragmatic quality (i.e. the usability) of the website is good, but there are some areas of improvement for increasing the hedonic quality of the interaction (i.e. user experience). The answer to the first research question is not a certain yes or no: website scored as neutral in user experience questionnaire, so the results indicate that the website's ability to facilitate good UX is not bad – but it could be better.

The second research question addressed the business objective: *Does the new design of the website support conversion, i.e. lead intuitively to purchase?* Answering the second research question with certainty is challenging as well. Although shopping process on the website is straightforward and received compliments from participants, the most severe usability problem is something that in a real-life setting probably would prevent some users from making a purchase decision. Many participants reported that if they were actually shopping for a product and felt uncertain about the details of the product (such as product's compatibility with other devices), they would probably discontinue shopping or search additional information via search engines. One way to measure the effectiveness of user experience on ecommerce websites is conversion rate (Garrett, 2011), which indicates that the UX on this website could be improved in the light of the findings. On the other hand, company's website analytics data shows that their redesigned website has performed better than the previous version in many metrics, including *conversion rate*, *revenue*, *transactions*, and *average order value*.

It is important to remember that "a design is not usable or unusable *per se*" (Interaction Design Foundation, 2019a). The system features, user, and the context of use all determine the level of usability: UX is a result of *user* interacting with a *system* in a *context* (ISO, 2019). From user perspective, most important outcome of usable interfaces is that the interface is easy to become familiar with and learn how to use, including that user goals are easy to accomplish. To improve UX, websites need to address *usability* (user's ability to use a website and to complete desired tasks), *useful content* (providing relevant information for informed decision-making), *desirable content* (moving beyond usable and increasing emotional bonding), *credibility* (trust plays a part in UX), and *accessibility* (reducing frustration and barriers of usage, and assisting users with disabilities). (Interaction Design Foundation, 2019a.) The EU directive on accessibility (European Union, 2016) and Web Content Accessibility Guidelines (WCAG) 2.1 include useful guidelines for web accessibility considerations.

Future agenda for UX research is to broaden the scope from a *single user interface* to *multiple touchpoint customer experience* and *customer journey design*, addressing both utilitarian and emotional user needs (Roto et al., 2016). The duality of user needs can be seen e.g. between inexperienced and experienced users: the less experienced users are with an interface, the more important it is to provide well-organized content and product information, whereas experienced users have more hedonic needs and expectations for the interaction. Website quality is also perceived differently by inexperienced and experienced users, as user's expertise affects their expectations of the service quality. In either case, both *functional-utilitarian needs* and *hedonic needs* need to be addressed with the design to serve all users. (Falk et al., 2009.)

Usability testing is essential for planned UX development, especially during the design (or redesign) process of a website (Loranger, 2015). However, usability testing alone does not equal thoughtful, informed UX design process – but it is a good tool for understanding *user needs* (Garrett, 2011). The objective of this study was to understand if the case company's redesigned website facilitates good user experience and customer journey. The case company found research results helpful in continuing their process of improving the website, especially from UX perspective. Now they can perform more informed decisions and make the next redesign process more thoughtful from UX perspective, based on the research findings.

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APPENDICES

Appendix 1. Website wireframes: homepage
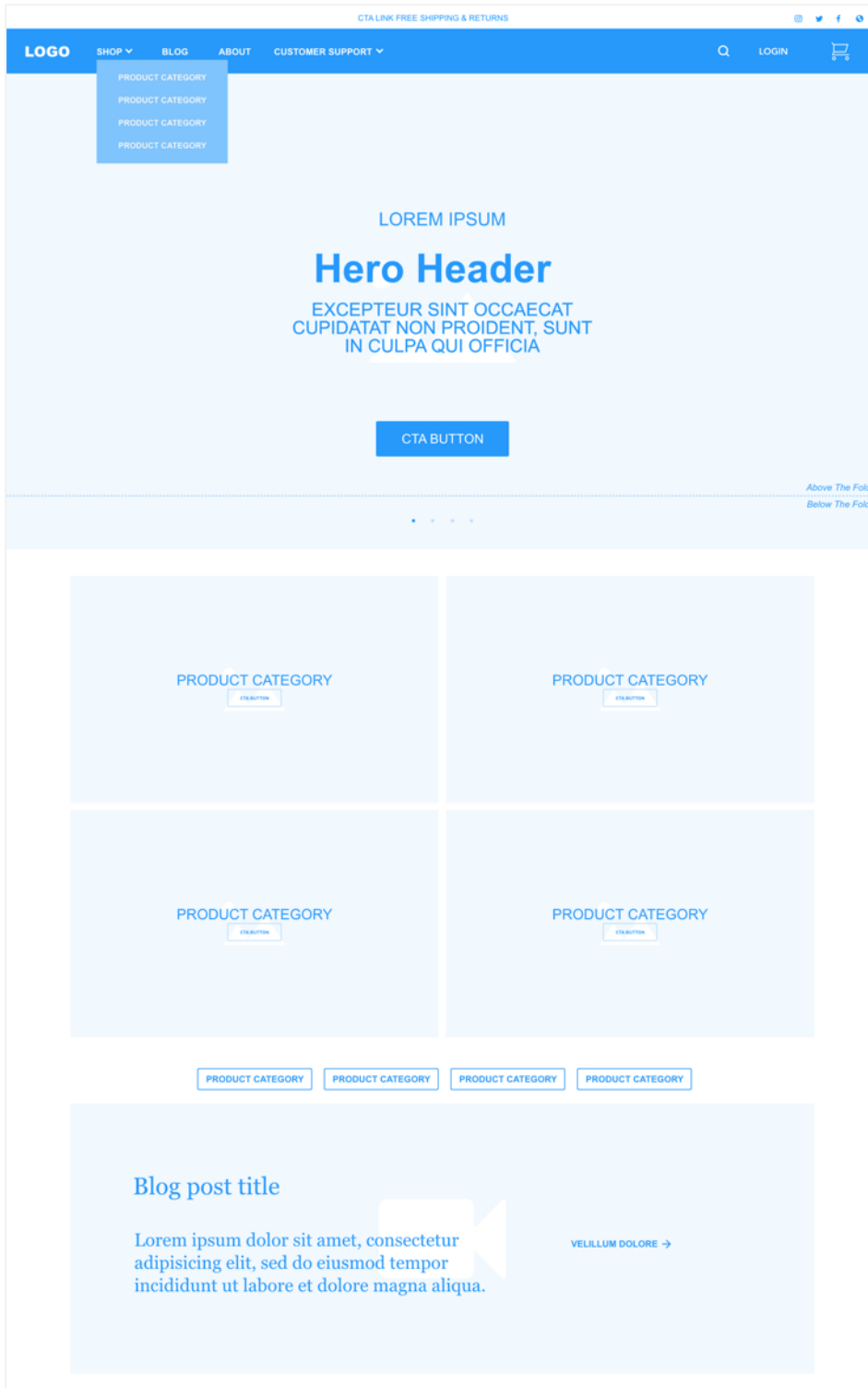
(Continues on next page)

PROMO OF THE MONTH

PRODUCT NAME
PRICE
ADD TO CART
★★★★☆

PRODUCT NAME
PRICE
ADD TO CART
★★★★☆

PRODUCT NAME
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Blog post title

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READ MORE

NEWSLETTER SUBSCRIPTION

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SUBSCRIBE

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TRUST SYMBOLS

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PAYMENT METHODS
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SHIPPING & RETURNS
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TERMS & CONDITIONS
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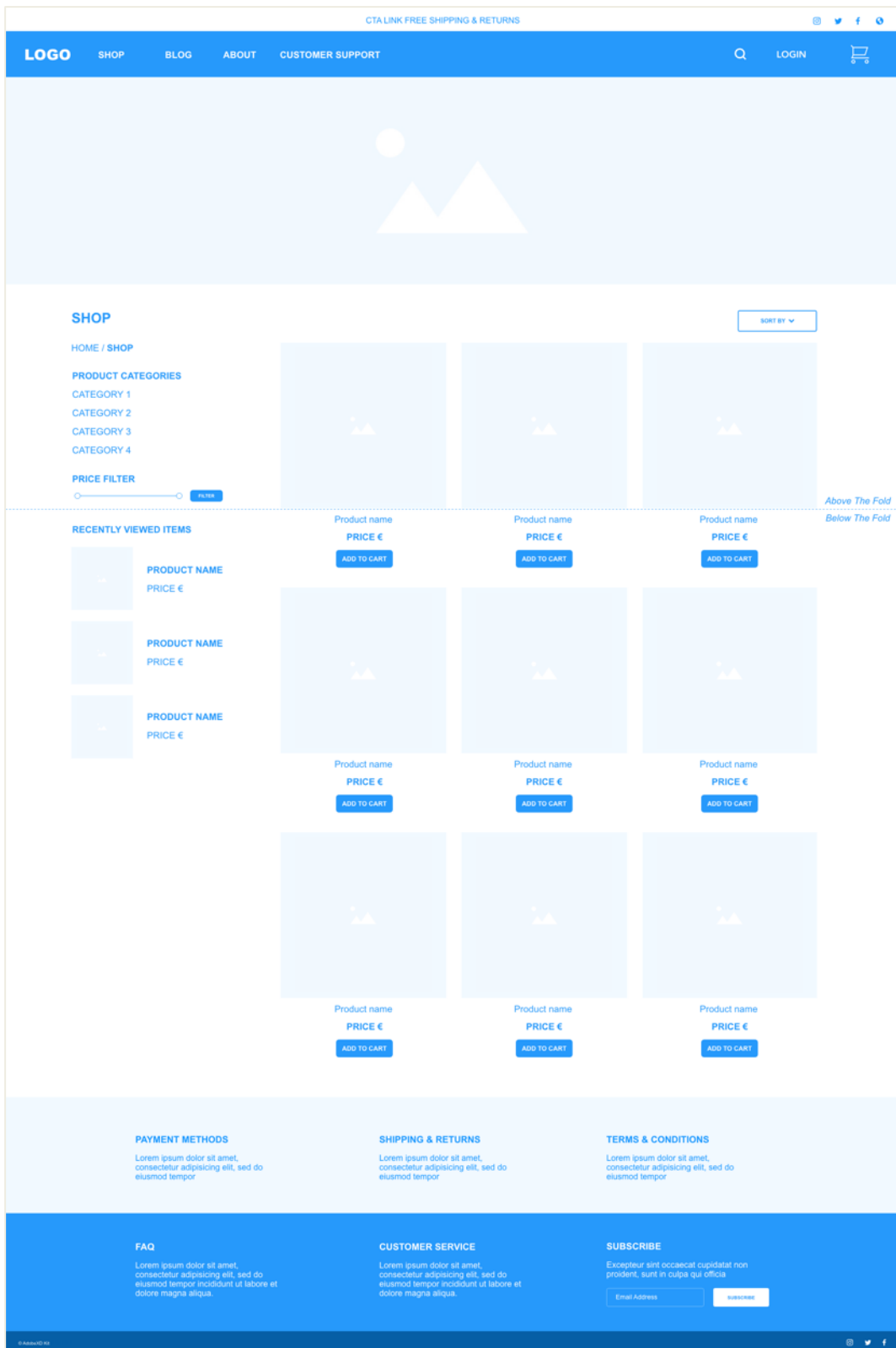
FAQ
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CUSTOMER SERVICE
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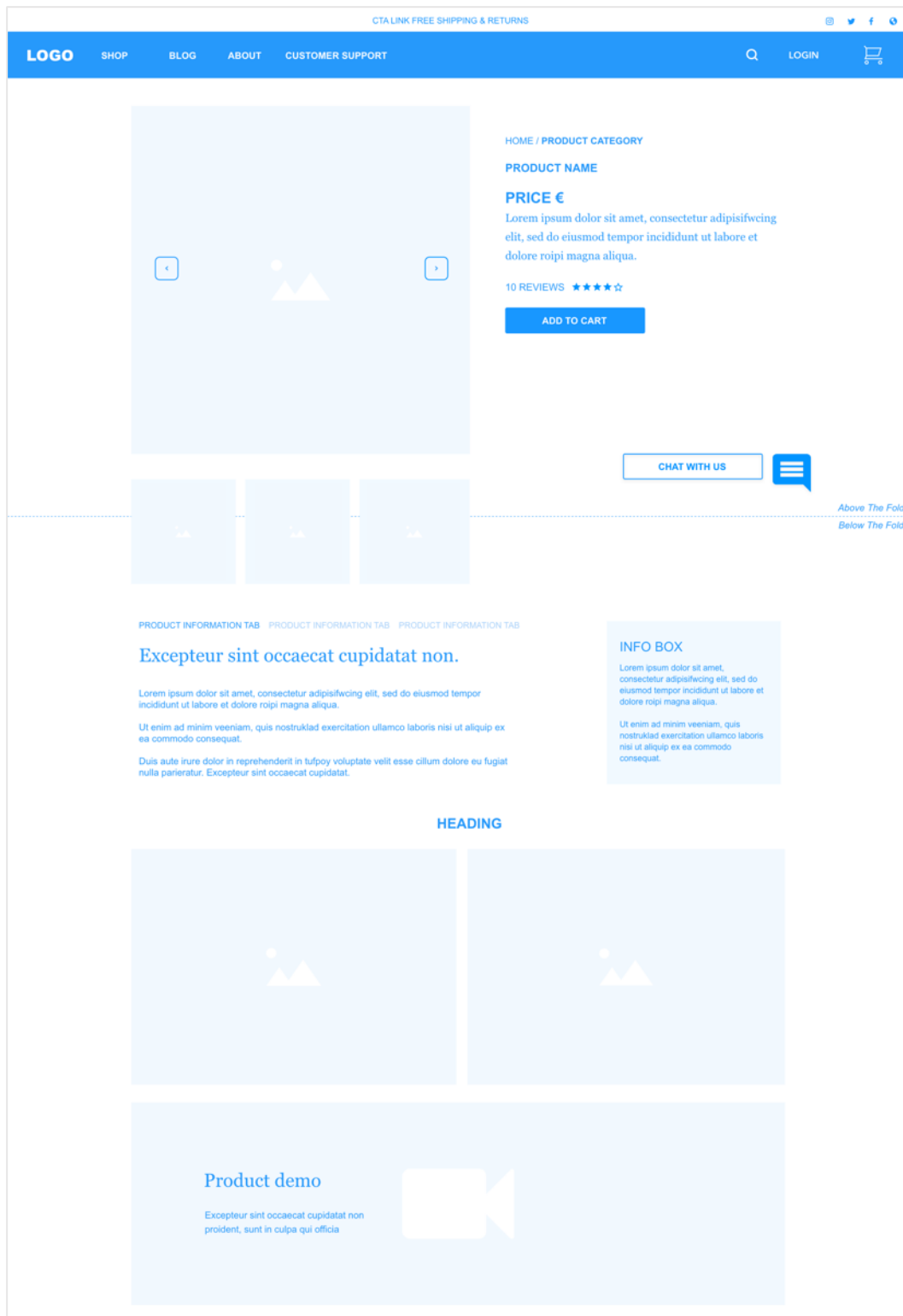
SUBSCRIBE
Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia

Email Address SUBSCRIBE

Appendix 2. Website wireframes: product category page

Appendix 3. Website wireframes: product page

(Continues on next page)

Product details

Excepteur sint occaecat cupidatat non
proident, sunt in culpa qui officia

Compatibility information

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proident, sunt in culpa qui officia

CHECK

Endorsement

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enim ad minim veniam.

👤 **Endorsing authority**

YOU MIGHT ALSO LIKE

Product name	Product name	Product name
PRICE €	**PRICE €**	**PRICE €**
ADD TO CART	ADD TO CART	ADD TO CART

PAYMENT METHODS

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eiusmod tempor

SHIPPING & RETURNS

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TERMS & CONDITIONS

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FAQ

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CUSTOMER SERVICE

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SUBSCRIBE

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proident, sunt in culpa qui officia

Email Address	SUBSCRIBE

© AdobeXD Kit

◎ 🐦 f

Appendix 4. Website wireframes: shopping cart
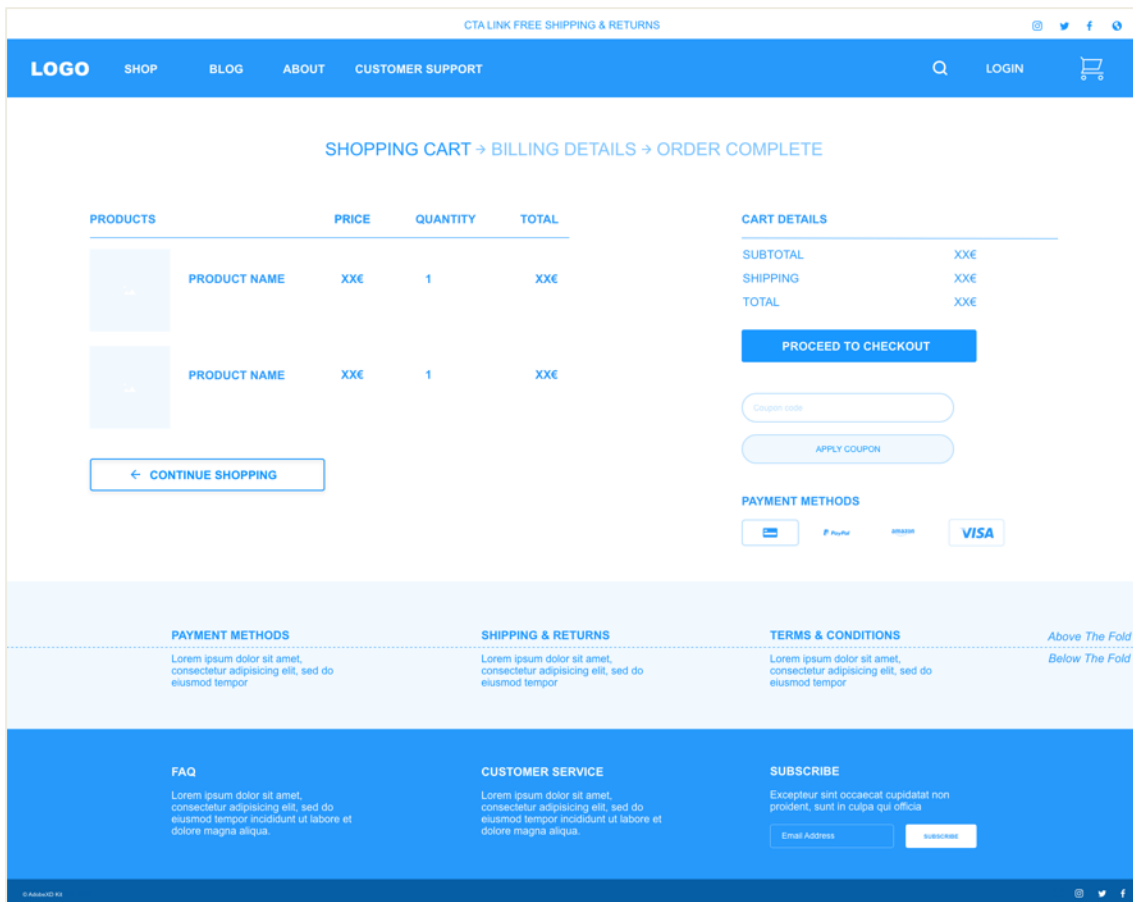
Appendix 5. Cognitive walkthrough task list

English version:

Thank you for participating in this website usability test. Here, you will be given instructions (task list below) on what to do on the website. Please perform the following tasks next. At any point, you can ask questions and think aloud if something is puzzling you. After this, you will fill out a short interview of your experience.

MAIN TASK: FIND A PRODUCT YOU WISH TO BUY

TASK 1. Go to the brand website

Enter the homepage

Navigate to product listing pages

Examine the product offering

TASK 2. Evaluate product attributes

Compare products

Settle for one you wish to buy

Make sure it is compatible with your device(s)

TASK 3. Add product to shopping cart

Click the 'add to cart' button

Go to shopping cart

TASK 4. Proceed to checkout

Follow the steps of placing an order

Cancel the transaction when required to provide personal/financial information

TASK 5. Sign up for newsletter

Find where to sign up for newsletter

Click subscription field (no need to enter email)

TASK 6. Complete exit interview

Answer the questions

(Finnish version on next page)

Finnish version:

Kiitos osallistumisesta tähän nettisivujen käyttökokemus-testiin. Alla näet ohjeet, kuinka toimia ja mitä tehtäviä sinun tulee tehdä. Seuraavaksi voit suorittaa tehtävät. Voit kysyä kysymyksiä missä tahansa kohtaa ja ajatella ääneen, mikäli joku asia askarruttaa sinua. Testin jälkeen saat täyttää lyhyen kyselyn kokemuksestasi.

PÄÄTEHTÄVÄ: ETSI MIELEINEN TUOTE, JONKA HALUAT OSTAA

TEHTÄVÄ 1. Mene brändin sivuille

Mene brändin kotisivuille

Navigoi tuotesivuille

Tarkastele valikoimaa

TEHTÄVÄ 2. Arvioi tuotteiden ominaisuuksia

Vertaile tuotteita

Valitse yksi tuote/tuotepaketti, jonka haluat ostaa

Varmista, että se on yhteensopiva laitteesi kanssa

TEHTÄVÄ 3. Lisää tuote ostoskoriin

Klikkaa 'add to cart' nappia

Mene ostoskoriin

TEHTÄVÄ 4. Mene kassalle

Etene, kunnes sinua pyydetään täyttämään laskutustiedot

Laskutustietoihin päästyäsi voit poistua

TEHTÄVÄ 5. Tilaa uutiskirje

Etsi, mistä voit tilata uutiskirjeen

Klikkaa kenttää (sinun ei tarvitse tilata uutiskirjettä)

TEHTÄVÄ 6. Täytä loppuhaastattelu

Vastaa kysymyksiin

Appendix 6. Exit interview

Usability Test Interview

Thank you for agreeing to participate in my website usability study. These following questions about you as a consumer and about your experience with the website help me in analyzing the results better. All information you give me today is treated with confidentiality, and no individual respondent can be identified.

The focus of this study is website design: how the various design features contribute to usability and what users think of them. When answering the questions, please think of YOUR experience of the website you just used.

1. Privacy Notice (Tietosuojalomake) describes the processing of personal data in this study. Privacy Notice is given to the participant at the beginning of the study.

◯ I accept the privacy notice

2. When you buy items from a website, how would you describe yourself as a decision-maker?

For the assessment of the website, here are some pairs of contrasting attributes that may apply to the website. You can express what most closely reflects your impression. Please decide spontaneously to make sure you convey your original impression.

Sometimes you may find that the attribute does not apply completely to the website. Nevertheless, please tick a circle in every line. It is your personal opinion that counts: there is no wrong or right answer!

3. Please assess the website now by ticking one circle per line

	1	2	3	4	5	6	7	
annoying (ärsyttävä)	◯	◯	◯	◯	◯	◯	◯	enjoyable (nautinnollinen)
not understandable (epäselvä)	◯	◯	◯	◯	◯	◯	◯	understandable (ymmärrettävä)
creative (luova)	◯	◯	◯	◯	◯	◯	◯	dull (tylsä)

(Continues on next page)

	1	2	3	4	5	6	7	
easy to learn (helppo oppia)	○	○	○	○	○	○	○	difficult to learn (vaikea oppia)
valuable (hyödyllinen)	○	○	○	○	○	○	○	inferior (huono)
boring (tylsä)	○	○	○	○	○	○	○	exciting (jännittävä)
not interesting (pitkästyttävä)	○	○	○	○	○	○	○	interesting (kiinnostava)
unpredictable (arvaamaton)	○	○	○	○	○	○	○	predictable (ennalta arvattava)
fast (nopea)	○	○	○	○	○	○	○	slow (hidas)
inventive (kekseliäs)	○	○	○	○	○	○	○	conventional (tavanomainen)
obstructive (estävä)	○	○	○	○	○	○	○	supportive (kannustava)
good (hyvä)	○	○	○	○	○	○	○	bad (huono)
complicated (monimutkainen)	○	○	○	○	○	○	○	easy (helppo)
unlikable (ikävä)	○	○	○	○	○	○	○	pleasing (mieluisa)
usual (tavallinen)	○	○	○	○	○	○	○	leading edge (moderni)
unpleasant (epämiellyttävä)	○	○	○	○	○	○	○	pleasant (miellyttävä)
secure (suojattu)	○	○	○	○	○	○	○	not secure (suojaamaton)
motivating (kannustava)	○	○	○	○	○	○	○	demotivating (lannistava)
meets expectations (vastaa odotuksia)	○	○	○	○	○	○	○	does not meet expectations (ei vastaa odotuksia)
inefficient (tehoton)	○	○	○	○	○	○	○	efficient (tehokas)
clear (selkeä)	○	○	○	○	○	○	○	confusing (hämmentävä)
impractical (epäkäytännöllinen)	○	○	○	○	○	○	○	practical (käytännöllinen)
organized (järjestelmällinen)	○	○	○	○	○	○	○	cluttered (sotkuinen)
attractive (viehättävä)	○	○	○	○	○	○	○	unattractive (ei-houkutteleva)
friendly (ystävällinen)	○	○	○	○	○	○	○	unfriendly (epäystävällinen)
conservative (perinteinen)	○	○	○	○	○	○	○	innovative (innovatiivinen)

Almost done! Here are the final background questions.

4. Age

○ < 20

○ 20-25

○ 26-35

○ > 35

5. Education

○ Secondary

○ Bachelor's

○ Master's

○ Doctorate

○ Other, please specify [   ]

6. Monthly income

○ < 1000€

○ 1000-2000€

○ > 2000€

○ I'd rather not say

7. Internet experience (in years)

○ 1-5

○ 6-10

○ > 10

8. Online shopping experience (in years)

○ 1-5

○ 6-10

○ > 10

9. How often do you buy online

○ Weekly

○ Monthly

○ Several times a year

○ About once a year

○ Less than yearly

10. Finally, if you wish to give some feedback about the website used in this study, and your experience of interacting with it, you can leave a comment below.

[   ]

Thank you for participating in this study!

Appendix 7. Privacy policy

Tietosuojailmoitus

TIETOSUOJAILMOITUS TUTKIMUKSEEN OSALLISTUVALLE

4.12.2019

Tutkimukseen osallistuminen on vapaaehtoista, tutkittavan ei ole pakko toimittaa mitään tietoja ja tutkimukseen osallistumisen voi keskeyttää missä vaiheessa tahansa.

1. Tutkimuksen luonne ja kesto

Tämä on pro gradu -tutkimus nettisivujen käytettävyydestä ja käyttökokemuksesta. Tutkimus on kertaluontoinen ja tulokset valmistuvat 2019-2020 vaihteessa. Tutkimukseen osallistuminen kestää noin 10-15 minuuttia.

2. Tutkimuksessa käsiteltävät henkilötiedot

Tutkimuksessa Sinusta kerätään seuraavia henkilötietoja: äänitällenne ja kyselyvastaukset.

3. Henkilötietojen käsittely perustuu

Tutkittavan suostumukseen (EU 679/2016 6.1a).

4. Henkilötietojen siirto EU/ETA ulkopuolelle

Tutkimuksessa tietojasi ei siirretä EU/ETA -alueen ulkopuolelle.

5. Henkilötietojen suojaaminen

Tutkimuksessa kerättyjä tietoja ja tutkimustuloksia käsitellään luottamuksellisesti tietosuojalainsäädännön edellyttämällä tavalla. Tietojasi ei voida tunnistaa tutkimukseen liittyvistä tutkimustuloksista, selvityksistä tai julkaisuista. Henkilötiedot suojataan tutkimuksen aikana, eikä tietoja luovuteta ulkopuolisille. Tutkimusaineistoa säilytetään Jyväskylän yliopisto tutkimusaineiston käsittelyä koskevien tietoturvakäytänteiden mukaisesti.

6. Tunnistettavuuden poistaminen

Suorat tunnistetiedot poistetaan suojatoimena aineiston perustamisvaiheessa. Puhe litteroidaan tekstiksi, jotta se ei ole tunnistettavissa.

7. Tutkimuksessa käsiteltävien henkilötietojen suojaus

Rekisteriä säilytetään käyttäjätunnuksella ja salasanalla suojattuna.

8. Henkilötietojen käsittely tutkimuksen *päättymisen jälkeen*

Tutkimusrekisteri säilytetään kunnes tuktimuksen tulokset on todennettu, jonka jälkeen aineisto hävitetään 06/2020 mennessä.

Tutkimuksen rekisterinpitäjä on Jyväskylän yliopisto.

9. Rekisteröidyn oikeudet

Oikeus siirtää tiedot järjestelmästä toiseen (tietosuoja-asetuksen 20 artikla)
Sinulla on oikeus saada toimittamasi henkilötiedot jäsennellyssä, yleisesti käytetyssä ja koneellisesti luettavassa muodossa, ja oikeus siirtää kyseiset tiedot toiselle rekisterinpitäjälle, jos se on mahdollista ja käsittely suoritetaan automaattisesti.

Rekisteröidyn oikeuksien toteuttaminen
Tutkittavalla on oikeus peruuttaa antamansa suostumus, kun henkilötietojen käsittely perustuu suostumukseen. Jos tutkittava peruuttaa suostumuksensa, hänen tietojaan ei käytetä enää tutkimuksessa. Tutkittavalla on oikeus tehdä valitus Tietosuojavaltuutetun toimistoon, mikäli tutkittava katsoo, että häntä koskevien henkilötietojen käsittelyssä on rikottu voimassa olevaa tietosuojalainsäädäntöä. (lue lisää: http://www.tietosuoja.fi). Tutkimuksessa ei poiketa muista tietosuojalainsäädännön mukaisista tutkittavan oikeuksista.

Jos sinulla on kysyttävää rekisteröidyn oikeuksista, voit olla yhteydessä yliopiston tietosuojavastaavaan. Kaikki oikeuksien toteuttamista koskevat pyynnöt toimitetaan Jyväskylän yliopiston kirjaamoon. Kirjaamo ja arkisto, PL 35 (C), 40014 Jyväskylän yliopisto, puh. 040 805 3472, e-mail: kirjaamo(at)jyu.fi. Käyntiosoite: Seminaarinkatu 15 C-rakennus (Yliopiston päärakennus, 1. krs), huone C 140.

Tietoturvaloukkauksesta tai sen epäilystä ilmoittaminen Jyväskylän yliopistolle
https://www.jyu.fi/fi/yliopisto/tietosuojailmoitus/ilmoita-tietoturvaloukkauksesta

Sinulla on oikeus tehdä valitus erityisesti vakinaisen asuin- tai työpaikkasi sijainnin mukaiselle valvontaviranomaiselle, mikäli katsot, että henkilötietojen käsittelyssä rikotaan EU:n yleistä tietosuoja-asetusta (EU) 2016/679. Suomessa valvontaviranomainen on tietosuojavaltuutettu.

Tietosuojavaltuutetun toimisto
Ratapihantie 9, 6. krs, 00520 Helsinki, PL 800, 00521 Helsinki
Puhelinvaihde: 029 566 6700
Sähköposti (kirjaamo): tietosuoja@om.fi

Appendix 8. Pilot study demographics

TABLE 15 Pilot study demographics

		n = 3
Age	< 20	
	20-25	
	26-35	3
	> 35	
Gender	Female	2
	Male	1
	Other	
	Prefer not to say	
Education	Secondary	1
	Bachelor's	2
	Master's	
	Doctorate	
	Other	
Monthly income	< 1000€	
	1000-2000€	
	> 2000€	3
Internet experience (in years)	1-5	
	6-10	
	> 10	3
Online shopping experience (in years)	1-5	
	6-10	
	> 10	3
How often buys online	Weekly	2
	Monthly	
	Several times a year	1
	About once a year	
	Less than yearly	

Appendix 9. Pilot study findings

Pilot participant 1

Enters product category pages through hero slider. Did not have any problems with tasks, found compatibility info pretty quickly and was confident it was enough information for him. Task completion time was 4 minutes 11 seconds, task completion rate 100%. Continued comparing products after adding one to shopping cart, going there and looking at recommendations ('products you may be interested in') shown below the items in cart.

Task analysis:

Four Questions for Cognitive Walkthrough (Interaction Design Foundation, 2018)	Will the user try to achieve the right outcome?	Will the user notice that the correct action is available to them?	Will the user associate the correct action with the outcome they expect to achieve?	If the correct action is performed, will the user see that progress is being made towards their intended outcome?	Were you able to complete the task? (Dalrymple, 2018)
TASK 1. Go to the brand website					
Enter the homepage	Yes	Yes	Yes	Yes	Yes
Navigate to product listing pages	Yes	Yes	Yes	Yes	Yes
Examine the product offering	Yes	Yes	Yes	Yes	Yes
TASK 2. Evaluate product attributes					
Compare products	Yes	Yes	Yes	Yes	Yes
Settle for one you wish to buy	Yes	Yes	Yes	Yes	Yes
Make sure it is compatible with your device(s)	Yes	Yes	Yes	Yes	Yes
TASK 3. Add product to shopping cart					
Click the 'add to cart button'	Yes	Yes	Yes	Yes	Yes
Go to shopping cart	Yes	Yes	Yes	Yes	Yes
TASK 4. Proceed to checkout					
Follow the steps of placing an order	Yes	Yes	Yes	Yes	Yes
Cancel the transaction when required to provide personal/financial information	Yes	Yes	Yes	Yes	Yes
TASK 5. Sign up for newsletter					
Find where to sign up for newsletter	Yes	Yes	Yes	Yes	Yes
Click subscription field (no need to enter email)	Yes	Yes	Yes	Yes	Yes
TASK 6. Complete exit interview					
Answer the questions	Yes	Yes	Yes	Yes	Yes

UEQ Short answers							
Obstructive						x	Supportive
Complicated						x	Easy
Inefficient							Efficient
Confusing				x			Clear
Boring						x	Exciting
Not interesting						x	Interesting
Conventional						x	Inventive
Usual					x		Leading edge

Pilot participant 2

The only task participant struggled with was finding compatibility info. She searched for it for quite a long time: looked into many different places and links on product page (description, product specifications, technical details), but found it eventually and was satisfied with the information. Commented that the form for billing information was clear and easy. Task completion time was 4 minutes and 4 seconds, task completion rate 92%.

Task analysis:

Four Questions for Cognitive Walkthrough (Interaction Design Foundation, 2018)	Will the user try to achieve the right outcome?	Will the user notice that the correct action is available to them?	Will the user associate the correct action with the outcome they expect to achieve?	If the correct action is performed, will the user see that progress is being made towards their intended outcome?	Were you able to complete the task? (Dalrymple, 2018)
TASK 1. Go to the brand website					
Enter the homepage	Yes	Yes	Yes	Yes	Yes
Navigate to product listing pages	Yes	Yes	Yes	Yes	Yes
Examine the product offering	Yes	Yes	Yes	Yes	Yes
TASK 2. Evaluate product attributes					
Compare products	Yes	Yes	Yes	Yes	Yes
Settle for one you wish to buy	Yes	Yes	Yes	Yes	Yes
Make sure it is compatible with your device(s)	Yes	No	No	No	Yes
TASK 3. Add product to shopping cart					
Click the 'add to cart button'	Yes	Yes	Yes	Yes	Yes
Go to shopping cart	Yes	Yes	Yes	Yes	Yes
TASK 4. Proceed to checkout					
Follow the steps of placing an order	Yes	Yes	Yes	Yes	Yes
Cancel the transaction when required to provide personal/financial information	Yes	Yes	Yes	Yes	Yes
TASK 5. Sign up for newsletter					
Find where to sign up for newsletter	Yes	Yes	Yes	Yes	Yes
Click subscription field (no need to enter email)	Yes	Yes	Yes	Yes	Yes

UEQ Short answers								
Obstructive						x		Supportive
Complicated						x		Easy
Inefficient						x		Efficient
Confusing						x		Clear
Boring						x		Exciting
Not interesting							x	Interesting
Conventional							x	Inventive
Usual					x			Leading edge

Pilot participant 3

This participant was more thorough and was browsing more products, because the brand was not familiar to her. Looked into different places to find compatibility info (reviews, product specifications, description), but found it eventually and was satisfied with the information. During this walkthrough, it was noticed that there is an additional information box about compatibility info on one product page, but not on the others. Task completion time was 7 minutes and 35 seconds, task completion rate 92%.

Task analysis:

Four Questions for Cognitive Walkthrough (Interaction Design Foundation, 2018)	Will the user try to achieve the right outcome?	Will the user notice that the correct action is available to them?	Will the user associate the correct action with the outcome they expect to achieve?	If the correct action is performed, will the user see that progress is being made towards their intended outcome?	Were you able to complete the task? (Dalrymple, 2018)
TASK 1. Go to the brand website					
Enter the homepage	Yes	Yes	Yes	Yes	Yes
Navigate to product listing pages	Yes	Yes	Yes	Yes	Yes
Examine the product offering	Yes	Yes	Yes	Yes	Yes
TASK 2. Evaluate product attributes					
Compare products	Yes	Yes	Yes	Yes	Yes
Settle for one you wish to buy	Yes	Yes	Yes	Yes	Yes
Make sure it is compatible with your device(s)	Yes	No	No	Yes	Yes
TASK 3. Add product to shopping cart					
Click the 'add to cart button'	Yes	Yes	Yes	Yes	Yes
Go to shopping cart	Yes	Yes	Yes	Yes	Yes
TASK 4. Proceed to checkout					
Follow the steps of placing an order	Yes	Yes	Yes	Yes	Yes
Cancel the transaction when required to provide personal/financial information	Yes	Yes	Yes	Yes	Yes
TASK 5. Sign up for newsletter					
Find where to sign up for newsletter	Yes	Yes	Yes	Yes	Yes
Click subscription field (no need to enter email)	Yes	Yes	Yes	Yes	Yes
TASK 6. Complete exit interview					
Answer the questions	Yes	Yes	Yes	Yes	Yes

UEQ Short answers								
Obstructive						x		Supportive
Complicated							x	Easy
Inefficient							x	Efficient
Confusing							x	Clear
Boring				x				Exciting
Not interesting						x		Interesting
Conventional							x	Inventive
Usual					x			Leading edge

Appendix 10. Participant demographics

TABLE 16 Participant demographics

		n = 6
Age	< 20	
	20-25	
	26-35	6
	> 35	
Gender	Female	3
	Male	3
	Other	
	Prefer not to say	
Education	Secondary	1
	Bachelor's	3
	Master's	2
	Doctorate	
	Other	
Monthly income	< 1000€	
	1000-2000€	
	> 2000€	5
	Rather not say	1
Internet experience (in years)	1-5	
	6-10	
	> 10	6
Online shopping experience (in years)	1-5	
	6-10	2
	> 10	4
How often buys online	Weekly	
	Monthly	2
	Several times a year	4
	About once a year	

Appendix 11. Cognitive walkthrough task analysis

Participant 1

Task analysis:

Four Questions for Cognitive Walkthrough (Interaction Design Foundation, 2018)	Will the user try to achieve the right outcome?	Will the user notice that the correct action is available to them?	Will the user associate the correct action with the outcome they expect to achieve?	If the correct action is performed, will the user see that progress is being made towards their intended outcome?	Were you able to complete the task? (Dalrymple, 2018)
TASK 1. Go to the brand website					
Enter the homepage	Yes	Yes	Yes	Yes	Yes
Navigate to product listing pages	Yes	Yes	Yes	Yes	Yes
Examine the product offering	Yes	Yes	Yes	Yes	Yes
TASK 2. Evaluate product attributes					
Compare products	Yes	Yes	Yes	Yes	Yes
Settle for one you wish to buy	Yes	Yes	Yes	Yes	Yes
Make sure it is compatible with your device(s)	Yes	No	No	No	No
TASK 3. Add product to shopping cart					
Click the 'add to cart button'	Yes	Yes	Yes	Yes	Yes
Go to shopping cart	Yes	Yes	Yes	Yes	Yes
TASK 4. Proceed to checkout					
Follow the steps of placing an order	Yes	Yes	Yes	Yes	Yes
Cancel the transaction when required to provide personal/financial information	Yes	Yes	Yes	Yes	Yes
TASK 5. Sign up for newsletter					
Find where to sign up for newsletter	Yes	Yes	Yes	Yes	Yes
Click subscription field (no need to enter email)	Yes	Yes	Yes	Yes	Yes
TASK 6. Complete exit interview					
Answer the questions	Yes	Yes	Yes	Yes	Yes

Walkthrough summary:

- Checked the product reviews on category pages, used *filter by price* feature

- On product page, commented that there is surprisingly much text about one product – same comment in shopping cart

- Had troubles finding compatibility information, and was not completely convinced even after finding and reading it

- Took some time to go through shopping cart, but had no problems with the process and liked the billing details page

Decision-making style:

"I make decisions based on affection, feeling, or maybe even gut feeling."

Comment in exit interview:

"I was surprised about the extent of the product selection and how much information there is about one product. However, I still wish there was more essential information, such as compatible device brands and models."

Participant 2

Task analysis (*this participant is a web designer*):

Four Questions for Cognitive Walkthrough (Interaction Design Foundation, 2018)	Will the user try to achieve the right outcome?	Will the user notice that the correct action is available to them?	Will the user associate the correct action with the outcome they expect to achieve?	If the correct action is performed, will the user see that progress is being made towards their intended outcome?	Were you able to complete the task? (Dalrymple, 2018)
TASK 1. Go to the brand website					
Enter the homepage	Yes	Yes	Yes	Yes	Yes
Navigate to product listing pages	Yes	Yes	Yes	Yes	Yes
Examine the product offering	Yes	Yes	Yes	Yes	Yes
TASK 2. Evaluate product attributes					
Compare products	Yes	Yes	Yes	Yes	Yes
Settle for one you wish to buy	Yes	Yes	Yes	Yes	Yes
Make sure it is compatible with your device(s)	Yes	Yes	Yes	No	No
TASK 3. Add product to shopping cart					
Click the 'add to cart button'	Yes	Yes	Yes	Yes	Yes
Go to shopping cart	Yes	Yes	Yes	Yes	Yes
TASK 4. Proceed to checkout					
Follow the steps of placing an order	Yes	Yes	Yes	Yes	Yes
Cancel the transaction when required to provide personal/financial information	Yes	Yes	Yes	Yes	Yes
TASK 5. Sign up for newsletter					
Find where to sign up for newsletter	Yes	Yes	Yes	Yes	Yes
Click subscription field (no need to enter email)	Yes	Yes	Yes	Yes	Yes
TASK 6. Complete exit interview					
Answer the questions	Yes	Yes	Yes	Yes	Yes

Walkthrough summary:

- Noticed that CTAs on homepage do not stand out from background, and that text is small in many places (homepage, product category pages etc.)

- Changing product categories was smooth and he liked it

- Found compatibility info quickly but was not 100% convinced and started to look for additional information (said that he would Google next)

- In shopping cart commented that CTA is clear the whole process works well: "for an ecommerce site, this is a must!"

Decision-making style:

"I will do extensive research on all the purchases I make and probably watch some YouTube videos and reviews of the product before making the final decision for the purchase."

Comment in exit interview:

"Readability of the website is quite bad. Missing contrast in many places, especially in typography. Website seemed slow. Layout was very traditional WordPress theme, bit outdated in late 2019. Would have loved to get more examples and comparisons of the lenses and so on."

Participant 3

Task analysis:

Four Questions for Cognitive Walkthrough (Interaction Design Foundation, 2018)	Will the user try to achieve the right outcome?	Will the user notice that the correct action is available to them?	Will the user associate the correct action with the outcome they expect to achieve?	If the correct action is performed, will the user see that progress is being made towards their intended outcome?	Were you able to complete the task? (Dalrymple, 2018)
TASK 1. Go to the brand website					
Enter the homepage	Yes	Yes	Yes	Yes	Yes
Navigate to product listing pages	Yes	Yes	Yes	Yes	Yes
Examine the product offering	Yes	Yes	Yes	Yes	Yes
TASK 2. Evaluate product attributes					
Compare products	Yes	Yes	Yes	Yes	Yes
Settle for one you wish to buy	Yes	Yes	Yes	Yes	Yes
Make sure it is compatible with your device(s)	Yes	No	No	Yes	Yes
TASK 3. Add product to shopping cart					
Click the 'add to cart button'	Yes	Yes	Yes	Yes	Yes
Go to shopping cart	Yes	Yes	Yes	Yes	Yes
TASK 4. Proceed to checkout					
Follow the steps of placing an order	Yes	Yes	Yes	Yes	Yes
Cancel the transaction when required to provide personal/financial information	Yes	Yes	Yes	Yes	Yes
TASK 5. Sign up for newsletter					
Find where to sign up for newsletter	Yes	Yes	Yes	Yes	Yes
Click subscription field (no need to enter email)	Yes	Yes	Yes	Yes	Yes
TASK 6. Complete exit interview					
Answer the questions	Yes	Yes	Yes	Yes	Yes

Walkthrough summary:

- Commented on product category page that the text is small
- Was hoping for more intuitive navigation, on product page he was looking for a breadcrumb trail (secondary navigation scheme): there is one above product name, and he eventually spotted that
- Wished there was a way to compare products side by side
- Found compatibility info after looking for a while, got frustrated while trying to find it and said he is irritated

Decision-making style:

"Usually I know in advance what I am going to buy online; I have possibly familiarized myself with the product in advance. I compare products quite a lot before purchase decision, and this comparison [after visiting a physical store] might continue on a website. I do not make impulsive purchase decisions often."

Comment in exit interview:

"Some things could have been presented more clearly on the website, especially the ones that the customers are interested in. For example: which devices are compatible with the products? The design of the website was rather conservative,

and I was hoping for more intuitiveness in navigation. Also, comparing products side by side could be a useful feature."

Participant 4

Task analysis:

Four Questions for Cognitive Walkthrough (Interaction Design Foundation, 2018)	Will the user try to achieve the right outcome?	Will the user notice that the correct action is available to them?	Will the user associate the correct action with the outcome they expect to achieve?	If the correct action is performed, will the user see that progress is being made towards their intended outcome?	Were you able to complete the task? (Dalrymple, 2018)
TASK 1. Go to the brand website					
Enter the homepage	Yes	Yes	Yes	Yes	Yes
Navigate to product listing pages	Yes	Yes	Yes	Yes	Yes
Examine the product offering	Yes	Yes	Yes	Yes	Yes
TASK 2. Evaluate product attributes					
Compare products	Yes	Yes	Yes	Yes	Yes
Settle for one you wish to buy	Yes	Yes	Yes	Yes	Yes
Make sure it is compatible with your device(s)	Yes	No	No	Yes	Yes
TASK 3. Add product to shopping cart					
Click the 'add to cart button'	Yes	Yes	Yes	Yes	Yes
Go to shopping cart	Yes	Yes	Yes	Yes	Yes
TASK 4. Proceed to checkout					
Follow the steps of placing an order	Yes	Yes	Yes	Yes	Yes
Cancel the transaction when required to provide personal/financial information	Yes	Yes	Yes	Yes	Yes
TASK 5. Sign up for newsletter					
Find where to sign up for newsletter	Yes	Yes	Yes	Yes	Yes
Click subscription field (no need to enter email)	Yes	Yes	Yes	Yes	Yes

Walkthrough summary:

- Said that the task for checking compatibility information is good, because he does not like to return products
- Took him a while to find compatibility information and he got frustrated looking for it – however, after finding it he was sure about it but commented that the information should be more visible and easier to spot

Decision-making style:

"Well normally I already know what I need, so I am looking for the best solution for my needs. I mean I do not randomly shop online and order stuff what looks nice and I might use it."

Comment in exit interview:

"The info about which product fits my device or not could be easier to find but otherwise it was very easy to use and looks nice."

Participant 5

Task analysis:

Four Questions for Cognitive Walkthrough (Interaction Design Foundation, 2018)	Will the user try to achieve the right outcome?	Will the user notice that the correct action is available to them?	Will the user associate the correct action with the outcome they expect to achieve?	If the correct action is performed, will the user see that progress is being made towards their intended outcome?	Were you able to complete the task? (Dalrymple, 2018)
TASK 1. Go to the brand website					
Enter the homepage	Yes	Yes	Yes	Yes	Yes
Navigate to product listing pages	Yes	Yes	Yes	Yes	Yes
Examine the product offering	Yes	Yes	Yes	Yes	Yes
TASK 2. Evaluate product attributes					
Compare products	Yes	Yes	Yes	Yes	Yes
Settle for one you wish to buy	Yes	Yes	Yes	Yes	Yes
Make sure it is compatible with your device(s)	Yes	No	No	Yes	Yes
TASK 3. Add product to shopping cart					
Click the 'add to cart button'	Yes	Yes	Yes	Yes	Yes
Go to shopping cart	Yes	Yes	Yes	Yes	Yes
TASK 4. Proceed to checkout					
Follow the steps of placing an order	Yes	Yes	Yes	Yes	Yes
Cancel the transaction when required to provide personal/financial information	Yes	Yes	Yes	Yes	Yes
TASK 5. Sign up for newsletter					
Find where to sign up for newsletter	Yes	Yes	Yes	Yes	Yes
Click subscription field (no need to enter email)	Yes	Yes	Yes	Yes	Yes
TASK 6. Complete exit interview					
Answer the questions	Yes	Yes	Yes	Yes	Yes

Walkthrough summary:

- Uses usually a laptop with small screen, so does not scroll down much (for this reason, the most important information should be above the fold!)
- Looked at reviews and read the review comments
- It took a while for her to find compatibility information, but she was sure about compatibility after finding it – however, she commented that it was not very intuitive to find

Decision-making style:

"I am very considerate; I usually visit a website many times before making a purchase decision."

Comment in exit interview:

"The connection was a bit slow, but maybe it was just my computer (work laptop). A very fine website!"

Participant 6

Task analysis:

Four Questions for Cognitive Walkthrough (Interaction Design Foundation, 2018)	Will the user try to achieve the right outcome?	Will the user notice that the correct action is available to them?	Will the user associate the correct action with the outcome they expect to achieve?	If the correct action is performed, will the user see that progress is being made towards their intended outcome?	Were you able to complete the task? (Dalrymple, 2018)
TASK 1. Go to the brand website					
Enter the homepage	Yes	Yes	Yes	Yes	Yes
Navigate to product listing pages	Yes	Yes	Yes	Yes	Yes
Examine the product offering	Yes	Yes	Yes	Yes	Yes
TASK 2. Evaluate product attributes					
Compare products	Yes	Yes	Yes	Yes	Yes
Settle for one you wish to buy	Yes	Yes	Yes	Yes	Yes
Make sure it is compatible with your device(s)	Yes	Yes	Yes	Yes	Yes
TASK 3. Add product to shopping cart					
Click the 'add to cart button'	Yes	Yes	Yes	Yes	Yes
Go to shopping cart	Yes	Yes	Yes	Yes	Yes
TASK 4. Proceed to checkout					
Follow the steps of placing an order	Yes	Yes	Yes	Yes	Yes
Cancel the transaction when required to provide personal/financial information	Yes	Yes	Yes	Yes	Yes
TASK 5. Sign up for newsletter					
Find where to sign up for newsletter	Yes	Yes	Yes	Yes	Yes
Click subscription field (no need to enter email)	Yes	Yes	Yes	Yes	Yes
TASK 6. Complete exit interview					
Answer the questions	Yes	Yes	Yes	Yes	Yes

Walkthrough summary:

- Liked 'filter by price' feature on product category page
- Found compatibility information
- Skipped 'go to shopping cart' task, which simulates the stage where customer is reviewing their order before ordering (in exit interview this she said that she is a quick decision-maker), and was the only participant who skipped a task (however, she proceeded to the checkout, so the outcome was the same)

Decision-making style:

"I usually make relatively quick decisions, based on comparison: I try to find out what kind of similar products the brand and other brands have, and I compare the features of the products. I make a decision based on whether I find a product that fits my needs and my budget. The speed of the decision-making process is mostly dictated by the price of the product: the bigger the investment, the longer I consider."

Comment in exit interview:

"A very nice website, looks clear and fresh."