UNIVERSITY OF TURKU
Turku School of Economics

DECEIVING USER INTERFACE ELEMENTS – USER STUDY ON DARK PATTERNS

Information Systems Science

Master's thesis

Author:
Anni Hallia

Supervisor:
D.Sc. Ville Harkke

2.11.2022

Turku

The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin Originality Check service.

Master's thesis

Subject: Information Systems Science
Author: Anni Hallia
Title: Deceiving user interface elements – user study on dark patterns
Supervisor: D.Sc. Ville Harkke
Number of pages: 66 pages + appendices 8 pages
Date: 2.11.2022

Large portion of websites and applications want to influence users' behaviour. Persuasive designs can guide users towards choices they desire but there are also designs that don't have the users' best interests in mind. These design choices are called dark patterns and they aim to manipulate users towards choices that don't serve the users' best interests. At the same time, many online service providers want to offer best user experience possible for their users. Since the purposes of these two concepts are somewhat contradictory it is worth examining how dark patterns affect user experience.

Previous research has studied users' perspective on dark patterns and it has been found that dark patterns can cause negative effects such as annoyance. However, no research has examined dark patterns' effects specifically to user experience. This research examines the effects of dark patterns trough user experience model.

This research was conducted as qualitative research. First, a literature review presents the findings of previous research on dark patterns and user experience. The used data collection method in this research was concurrent think-aloud technique. This specific technique has not been used before to study users' perceptions on dark patterns. The think-aloud technique was used in user studies where participants performed tasks and verbalized their thoughts at the same time. The participants performed five tasks that included different dark patterns.

The results of this research support the findings of previous research. It was found that that dark patterns can affect user experience negatively. This research indicates that dark patterns affect mostly the pragmatic quality of user experience. Especially the lack of autonomy reduces pragmatic quality. These effects cause negative consequences in emotional and behavioural level. However, the effects vary between dark pattern types and strategies. Also, individual differences on users' expectations and standards affect how dark patterns are perceived. This research suggests that prevalence of dark patterns can make users used to dark patterns and thus reduce the effects on user experience.

Key words: Dark pattern, deceptive design, user experience

Pro gradu -tutkielma

Oppiaine: Tietojärjestelmätiede
Tekijä: Anni Hallia
Otsikko: Petolliset käyttöliittymäelementit – käyttäjätutkimus tummista kuvioista
Ohjaaja(t): KTT Ville Harkke
Sivumäärä: 66 sivua + liitteet 8 sivua
Päivämäärä: 2.11.2022

Suuri osa nettisivuista ja sovelluksista haluaa vaikuttaa käyttäjien toimintaan. Suostuttelevat suunnittelumallit voivat ohjata käyttäjiä kohti heidän haluamia valintoja, mutta on olemassa myös malleja, jotka eivät ole käyttäjien etujen mukaisia. Näitä suunnittelumalleja kutsutaan tummiksi kuvioiksi ja ne pyrkivät manipuloimaan käyttäjiä kohti valintoja, jotka eivät ole heidän etujensa mukaisia. Samaan aikaan monet verkossa toimivat palveluntarjoajat haluavat tarjota käyttäjilleen parhaan mahdollisen käyttäjäkokemuksen. Koska näiden kahden konseptin tarkoitukset ovat hieman ristiriitaisia on syytä tarkastella miten tummat kuviot vaikuttavat käyttäjäkokemukseen.

Aikaisemmat tutkimukset ovat tutkineet tummia kuvioita käyttäjien näkökulmasta ja on löydetty, että tummat kuviot voivat aiheuttaa negatiivisia vaikutuksia kuten ärsytystä. Ei kuitenkaan ole tehty tutkimusta, joka tutkisi tummien kuvioiden vaikutuksia nimenomaan käyttäjäkokemukseen. Tämä tutkimus tutkii tummien kuvioiden vaikutuksia käyttäjäkokemusmallin läpi.

Tämä tutkimus toteutettiin laadullisena tutkimuksena. Aluksi, kirjallisuuskatsaus esittelee aikaisempien tutkimuksien löydöksiä tummista kuvioista ja käyttäjäkokemuksesta. Tämän tutkimuksen käytetty tiedonkeruumenetelmä oli samanaikaisen ääneen ajattelun tekniikka. Tätä tiettyä tekniikkaa ei ole aiemmin käytetty tutkittaessa käyttäjien käsityksiä tummista kuvioista. Ääneen ajattelun tekniikkaa käytettiin käyttäjätutkimuksissa, joissa osallistujat suorittivat tehtäviä ja samalla sanallistivat ajatuksiaan. Osallistujat suorittivat viisi tehtävää, jotka sisälsivät erilaisia tummia kuvioita.

Tämän tutkimuksen tulokset tukevat aikaisempia tutkimuksia. Tutkimuksessa todettiin, että tummat kuviot voivat vaikuttaa käyttäjäkokemukseen negatiivisesti. Tämä tutkimus osoittaa, että tummat kuviot vaikuttavat enimmäkseen käyttäjäkokemuksen pragmaattiseen laatuun. Erityisesti autonomian puute alentaa pragmaattista laatua. Nämä vaikutukset aiheuttavat negatiivisia seurauksia niin emotionaalisella kuin käyttäytymisenkin tasolla. Vaikutukset kuitenkin vaihtelevat tummien kuvioiden tyyppien ja strategioiden välillä. Myös käyttäjien yksilölliset eroavaisuudet odotuksissa ja standardeissa vaikuttavat siihen miten tummat kuviot koetaan. Tämä tutkimus ehdottaa, että tummien kuvioiden yleisyys voi saada käyttäjät tottumaan niihin ja näin vähentää kuvioiden vaikutusta käyttäjäkokemukseen.

Avainsanat: Tummat kuviot, petolliset suunnittelumallit, käyttäjäkokemus

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 Introduction

Imagine you have decided to cancel your streaming service subscription. You remember that starting the subscription was easy; just few clicks and you have access to all your favourite series and movies. Now the situation is different. You can't find a text anywhere that would talk about cancelling your subscription. You click on every icon on the website but can't find the information. You feel frustrated and annoyed. If you happen to find a button that lets you cancel the subscription, you are reminded of all the shows you can't see after the cancelling. You start regretting the cancelling and decide to continue your subscription. (Tolvanen 2022.)

It is no wonder if the example sounded familiar. Increasing amount of online service providers exploit human decision making heuristics and biases to manipulate people towards decisions they might not otherwise make (Mathur et al. 2019). This kind of websites try to manipulate people by limiting choices and information or coercing to certain decisions (Bongard-Blanchy et al. 2021). These design choices are called dark patterns or deceptive design (Brignull 2022). The example of cancelling a streaming service was an illustration of a dark pattern. This type of dark pattern that makes a process more difficult than it needs to be is called obstruction (Gray et al. 2018). The intention of dark patterns is to mainly benefit an online service provider by manipulating users to make unintended or possibly harmful decisions. The goal of the manipulation can be for example getting people to purchase more, spend more time on website or accept the use of personal data. (Mathur et al. 2019.)

Now let's consider how the example of cancelling the streaming service subscription made you feel. It created a certain experience for you. The experience that an online product or service creates for its users is called user experience. It is often the factor that separates a successful product from a failed one. (Garret 2010, p.3.) User experience is a central characteristic of online products and services that affects for example whether people want to make a purchase or keep using a mobile application. This is why companies want to offer good user experiences. (Philips 2018.) Hassenzahl (2003) has presented that user experience has four key elements that are product features, apparent product character, usage situation and consequences. Dark patterns are product features of user interfaces which makes them part of the user experience. If you consider the example presented in the beginning of this chapter, it is clear that the obstruction dark

pattern affected the user experience, and the effect is likely negative (Tolvanen 2022). As companies are striving to provide good user experiences but increasingly exploit dark patterns it is worth examining more closely how dark patterns influence user experience.

Research on dark patterns has increased in recent years. Previous research has for example tried to define dark patterns, examined dark patterns in specific context and their ethical implications (Bösch et al. 2016, Gray et al 2021, Mathur et al. 2019). Users' perspective on dark patterns has only recently been a growing area of research. Previous research has studied users' perceptions and feelings on dark patterns but they have not used user experience models or frameworks (Bhoot et al. 2020, Maier & Harr 2020). These studies are also mostly either quantitative studies or qualitative interview studies.

The purpose of this thesis is to find what effects dark patterns have on user experience. A user experience model by Hassenzahl (2003) is used to study the effects trough different user experience elements. Thus, this research provides a new theoretical approach to examine dark patterns. This research also uses a method for empirical data collection that has not been used before to examine the effects of dark patterns. This method is think-aloud technique. It is used to study users' own perception during the interaction with dark patterns.

The research question of this thesis is:

How dark patterns affect user experience?

First of all, to answer the research question a literature review has been conducted. The literature review defines dark patterns and present the used dark pattern strategy classification. The underlying factors of dark patterns functionality are also presented to help understand how dark patterns work. The last chapter combines dark patterns with user experience literature to present how previous research sees the effects of dark patterns on user experience.

The second part of this thesis discusses the user studies that were conducted to collect empirical data. The user studies used a specific think-aloud technique that is discussed more closely in the methodology chapter. The results chapter presents how the empirical data answers to the research question. Finally, the discussion and conclusions chapter combines the results with previous literature and presents the central findings of this research.

This research examines the effects of dark patterns on individual users so the effects from the perspective of society and law are excluded from this research. The literature review presents shortly that dark patterns are problematic also from the perspective of law and society but these perspectives are not the focus of this research. The results and findings of this research do not focus on the ethics of dark patterns' effects but dark patterns are inherently considered as unethical in this research.

2 Defining dark patterns

This chapter defines and describes dark patterns, presenting also how they differ from other designs that influence user behaviour. Next, different dark pattern classification are presented and the classification that is used in the theoretical framework of this research is discussed more closely.

2.1 Designs that influence user behaviour

The development of digital technologies has increased ways to influence users' behaviour and attitudes (Oinas-Kukkonen & Harjumaa 2008). Previous research has examined how computer systems and applications could enable user behaviour to be influenced for example for commercial or political purposes. Different constructs such as design with intent and embedded design have been developed to facilitate the designing process for behaviour change (Kaufman & Flanagan 2015, Lockton et al. 2009). One major and commonly used construct is persuasive technology (Maier & Harr 2020).

Persuasion is a commonly used term to describe attempts to influence people's behaviour and attitudes (Jones & Simons 2017, p. 33). Fogg (2003, p. 1-15) invented the term persuasive technology to describe interactive information technology that is designed to change people's behaviour and attitudes. The study of computers as persuasive technologies in turn is referred to as Captology. Growing number of computing products are used for persuasion because these products have the advantage of interactivity, scalability, ubiquity, persistency and anonymity. Persuasion is most effective when it is interactive and computer technology is able to adjust its activities based on user's inputs, needs and situations. (Fogg 2003, p. 6-7.)

The definition of persuasive technology is rather extensive under which can fit many subcategories. Digital nudging is closely related concept that can be seen complementary or as a subcategory of persuasion. (Meske and Amojo 2020.) According to a definition provided by Weinmann et al. (2016), digital nudging is described as the guiding of decision making with user interface elements by making use of people's heuristics and biases. Although the purpose of nudges is to affect people's behaviour, they do not limit any options or change economic incentives significantly. Hence nudges are designed to serve those being nudged. (Hansen 2016.)

There are different degrees on how much user can have control over product that is designed to affect behaviour. At one end of the spectrum the user has total control on the decisions and the product has just an informing role. At the other end, the product determines the user's behaviour. Figure 1 visualizes that between these extremes the spectrum includes various types of ways to influence users behaviour. The middle part of the range is considered as persuasion. (Zachrisson et al. 2012, p. 363.) Both persuasive technology and digital nudging can be considered to belong to this part of the range because they both are described to guide users (Oinas-Kukkonen & Harjumaa 2009, Weinmann et al. 2016).

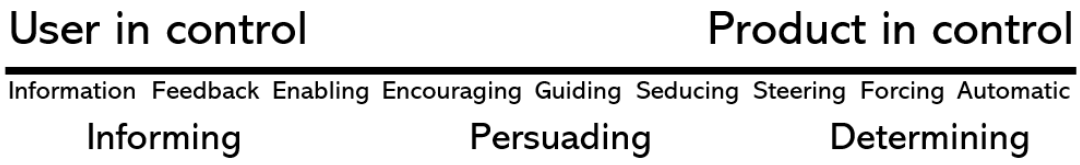


Figure 1 Control distribution between user and product (Zachrisson et al. 2012, p. 363)

The other end of the spectrum where the product determines user behavior can also be described as manipulative, coercive or deceptive. Purpose of manipulation is to change people's behavior towards someone else's than the user's interests. (Mathur et al. 2021.) Sometimes deception and coercion can be confused with persuasion although the definition of persuasion says that it affects behavior without coercion or deception. Persuasion differs from coercion and deception in the way in which they cause behavior change. Persuasion means that change of behavior is voluntary while coercion and deception force the change. (Fogg 2003, p. 15.)

2.2 The dark in dark patterns

User experience practitioners have been using the term dark pattern for manipulative design practices in digital platforms (Gray et al. 2021). Originally the term dark pattern was invented by user experience practitioner Harry Brignull in 2010. Brignull wanted to create terminology for deceptive user interfaces and bring attention to this topic. (Brignull 2011.) His definition for dark patterns was that they are "tricks used in websites and apps that make you do things you didn't mean to, like buying or signing up for something". Today dark patterns are also referred to as deceptive design patterns. (Brignull 2022.) Other practitioners and scholars have specified Brignull's definition and created their own

ones. One definition by Maier & Harr (2020) defines dark patterns as design choices that utilize psychological factors to push people towards decisions that are desired from someone else's than the user's perspective. Mathur et al. (2021) compared different definitions of dark patterns and noted that there is no unique definition or concern for dark patterns but it is a scholarship that combines thematically related considerations.

There are various types of dark patterns each of which affect users' decision-making in a slightly different way. However, one thing in common for all dark patterns is that they influence users' decisions by modifying users' choice architecture (Maier & Harr 2020). Mathur et al. (2021) recognized two main themes how dark patterns modify users' choice architecture. First theme is modifying the decision space. This can be done by for example eliminating certain choices or making them more difficult to choose. The second theme is manipulation of information flow. One way to manipulate information flow is to obscure or delay the disclosure of essential information to users.

One key element for dark patterns is that they are not designed to benefit the user (Gray et al. 2018). Dark patterns are intentionally designed to benefit the online service provider or even harm the user (Mathur et al. 2021). Businesses apply dark patterns often when they want to take control and increase sales and growth (Maier & Harr 2020). In some rare cases the revenue growth of the company can also benefit the user. An example is Uber's driver app that pushes drivers to continue working. This pattern is designed to make more money for Uber but also the driver benefits from taking more rides. However, also in the case of Uber the main goal is to benefit the company not the user. (Susser et al. 2019.) It is also possible that user interface design results in a bad experience or does harm to the user unintentionally. In such cases these patterns are anti-patterns not dark patterns. Anti-patterns can be design choices that once were good but in the light of current knowledge these patterns no longer meet the users' expectations. Anti-patterns can also be unintentional design failures that result from ignorance, bad trade-offs or lack of time and resources. Therefore, the key difference between dark patterns and anti-patterns is the designer's intentions. (Zagal et al. 2013.)

Mathur et al. (2021) have discussed the problematic of dark patterns and they proposed four normative perspectives why we should be concerned about dark patterns. The first and most highlighted perspective in the literature is individual welfare. From this perspective it is viewed whether dark patterns reduce users' individual welfare. Dark

patterns are seen as any interface that modifies the choice architecture against the user's best interest just to benefit the service provider. Three examples of individual welfare decrease by dark patterns are financial loss, invasion of privacy and cognitive burden. Dark patterns that make users spend unnecessary time, energy or attention cause cognitive burden to users.

The second normative lens is collective welfare which sees dark patterns as any user interface that is designed to benefit the service provider at the expense of collective welfare. There are at least four kinds of collective welfare related to society and markets that dark patterns can diminish. Competition provides collective welfare by enabling innovation, keeping price levels reasonable and helping consumers find products matching their preferences. (Mathur et al. 2021.) Dark patterns can reduce competition by for example creating high switching costs for users. This kind of dark patterns are seen coercive because they limit choices for users. (Day & Stemler 2020.) Price transparency is another kind of collective welfare that can be diminished by dark patterns. This can be done by hiding true costs or preventing price comparison. Also trust in the market can be undermined by dark patterns. When users become more aware of dark patterns they might become sceptical and start to evade user interface elements that look like dark patterns. This can lead users to avoid also honest providers and damage business of these companies. The last way how dark patterns can reduce collective welfare is by causing unanticipated societal consequences. In addition to intended effects dark patterns can also have side effects or unintended effects that cause decline of collective welfare. (Mathur et al. 2021.)

Regulatory objectives is a normative perspective that views dark patterns through democratic rules and standards to examine when dark patterns are causing harm for individual and collective welfare. This perspective is more useful to create metrics for empirical studies than explain why we should care about the effects of dark patterns. There is no single standard to examine problematic practices so different dark patterns should be evaluated case-by-case. Various laws and regulations have been created to control the use of dark patterns. (Mathur et al. 2021.) GDPR is one of the most studied regulations against which dark patterns are examined. Many privacy consent interfaces use dark patterns that are inconsistent with GDPR which makes most of them unlawful. (Nouwens et al. 2020.)

The last normative lens is individual autonomy and it views dark patterns as any user interface that weakens individual decision making. This lens has a lot in common with the individual welfare perspective but the difference is that this one focuses on users' rights. (Mathur et al. 2021.) Autonomy means that users have the right to make decisions that are not controlled by anyone else (Cambridge Dictionary 2022). Dark patterns that interfere individual autonomy make users to choose options that they would not have selected without the displayed choice architecture. Some dark patterns also include elements that enable addiction. (Mathur et al. 2021.) Addiction to digital experiences can cause harm in different levels including physical, psychological, societal and economic (Berthon et al. 2019). Therefore, maximizing user engagement is highly contrary to user autonomy. Regarding this normative perspective it is also important to note that distinguishing acceptable interfere on autonomy and violation of autonomy is sometimes challenging. (Mathur et al. 2021.)

2.3 Dark pattern classification

Dark patterns are used all around different digital platforms including websites, mobile applications and video games (Mathur et al. 2019). Some dark patterns are context specific while others can be used more universally (Gray et al. 2018). Also dark pattern classifications have been created based on specific contexts as for example e-commerce and privacy but some classifications are more general (Bösch et al. 2016, Gray et al., Mathur et al. 2019).

The first classification of dark patterns was proposed by Brignull in 2010 (Brignull 2010). Today his classification consists of 12 dark pattern types that include both context specific dark patterns and more general ones. One part of Brignull's classification defines dark pattern types that are typical in e-commerce. These types of dark patterns are sneak into basket, roach motel, price comparison prevention, hidden costs and forced continuity. Few dark pattern types are more related to privacy theme and these patterns are privacy zuckering and friend spam. The rest of the dark pattern types are more general ones that can be used in any kind of digital platform. (Brignull 2022). More specific descriptions for the dark pattern types are presented in Table 1.

Table 1 Dark patterns classification by Brignull (2022)

Type of dark pattern	**Description**
Bait and switch	You set out to do one thing, but a different, undesirable thing happens instead.
Confirmshaming	The act of guilting the user into opting into something. The option to decline is worded in such a way as to shame the user into compliance.
Disguised ads	Adverts that are disguised as other kinds of content or navigation, in order to get you to click on them.
Forced continuity	When your free trial with a service comes to an end and your credit card silently starts getting charged without any warning. In some cases this is made even worse by making it difficult to cancel the membership.
Friend spam	The product asks for your email or social media permissions under the pretence it will be used for a desirable outcome (e.g. finding friends), but then spams all your contacts in a message that claims to be from you.
Hidden costs	You get to the last step of the checkout process, only to discover some unexpected charges have appeared, e.g. delivery charges, tax, etc.
Misdirection	The design purposefully focuses your attention on one thing in order to distract your attention from another.
Price comparison prevention	The retailer makes it hard for you to compare the price of an item with another item, so you cannot make an informed decision.
Privacy zuckering	You are tricked into publicly sharing more information about yourself than you really intended to.
Roach motel	You get into a situation very easily, but then you find it is hard to get out of it (e.g. a premium subscription).
Sneak into basket	You attempt to purchase something, but somewhere in the purchasing journey the site sneaks an additional item into your basket, often through the use of an opt-out radio button or checkbox on a prior page.
Trick questions	While filling in a form you respond to a question that tricks you into giving an answer you didn't intend. When glanced upon quickly the question appears to ask one thing, but when read carefully it asks another thing entirely.

Other classifications have been generated based on Brignull's classification. Bösch et al. (2016) created privacy related dark pattern classification that includes eight privacy dark strategies. These strategies provide categorization for different dark pattern types. Privacy related dark patterns aim to manipulate people to submit their personal data against their actual intention. Mathur et al. (2019) conducted a study of dark patterns in e-commerce in which they created classification for dark patterns that are mostly used in e-commerce. This classification has seven categories for different dark pattern types. Dark patterns in

e-commerce are used to manipulate people to make more purchases or disclose more information than they originally intended.

Gray et al. (2018) presented more general classification that is not content or context specific. It is applicable to different digital platforms which is why it is used as a framework in this thesis. This classification was created by collecting a corpus of dark patterns from popular online platforms which resulted in categorization of dark pattern strategies. The classification includes five categories which are nagging, obstruction, sneaking, interface interference and forced action. Each dark pattern strategy category is explained below and overview can be found in Table 2.

Table 2 Dark pattern strategies by (Gray et al. 2018)

Dark pattern strategy	**Description**	**Dark pattern types**
Nagging	Redirection of expected functionality that persists beyond one or more interactions.	
Obstruction	Making a process more difficult than it needs to be, with the intent of dissuading certain action(s).	Roach motel, Price comparison prevention, Intermediate currency
Sneaking	Attempting to hide, disguise or delay the divulging of information that is relevant to the user.	Forced continuity, Hidden costs, Sneak into basket, Bait and switch
Interface interference	Manipulation of the user interface that privileges certain actions over others.	Hidden information, Preselection, Aesthetic manipulation, Toying with emotion, False hierarchy, Disguised ad, Trick questions
Forced action	Requiring the user to perform a certain action to access (or continue to access) certain functionality.	Social pyramid, Privacy zuckering, Gamification

Nagging is described as encroachment during normal interaction. Expected functionality can be redirected over one or more interactions. The interruption is usually not directly related to the task the user is focusing on the instant. (Gray et al. 2018.) Nagging reduces user's individual welfare by increasing unnecessary cognitive load (Mathur et al. 2021). Typical nagging behaviour includes pop-ups, audio notices and other actions that distract

or obstruct the user's focus. There are differing levels of nagging behaviour of which some are more sinister than others. (Gray et al. 2018).

Obstruction is a dark pattern category that works by hindering a task flow. Interaction is made more difficult than it needs to be with the intention to talk the user out of an action. Obstruction usually relates to the task that the user wants to accomplish. Brignull's roach motel and price comparison prevention are examples of obstruction dark pattern types. Typical example of roach motel pattern is when subscribing a service is easy, but cancelling is difficult or almost impossible. Roach motel can raise also other dark pattern types to complicate user's task flow. (Gray et al. 2018.) This dark pattern can also diminish competition because difficult cancelling creates higher switching costs (Mathur et al. 2021). Price comparison prevention makes direct price comparisons difficult for example by preventing product information from being copied. One more subtype of obstruction is intermediate currency. In this dark pattern users buy virtual currency with real money and then spend it on a good or service. The use of virtual currency aims to make users spend more than they would spend fiat currency. This pattern is typical in mobile games that use in-app purchases. (Gray et al. 2018.)

The most referenced dark pattern category by user experience practitioners is sneaking. Gray et al. (2018) define sneaking as "an attempt to hide, disguise or delay the divulging of information that has relevance to the user". The goal of sneaking pattern is to get users perform an action they would likely refuse if they would be aware of it. Additional hidden costs or undesired effects of an action are typical for sneaking patterns. These dark patterns are an example of Mathur et al.'s (2021) mentioned way to influence users' choice architecture by manipulating the information flow. Brignull's Forced continuity, hidden costs, sneak into basket and bait and switch belong to sneaking category. Forced continuity exploits users' inability to follow up subscription expiration dates by continuing to charge users after the expiration. Hidden costs pattern hides certain costs as long as possible until it's difficult for the user to decline these costs. Sneak into basket aims to get the user to buy additional items by adding them to users online shopping cart without user's consent. Bait and switch misleads the user by making it look like certain action would lead to certain result, when in reality the result is different and likely undesired. (Gray et al. 2018).

Interface interference is a dark pattern strategy that confuses the user by manipulating the user interface to favour certain actions over others. These dark patterns can utilize both decision space modifying and information flow manipulation to influence users' choice architecture (Mathur et al. 2021). This category includes three subtypes that are hidden information, preselection and aesthetic manipulation. The purpose of hidden information is to cover relevant information as irrelevant. Hidden information pattern functions by hiding information in fine text, discoloured text or terms and conditions. Preselection selects an option by default and this choice is usually desired by the service provider but not the user. If the service provider gives the impression that it has the user's best interest in mind it is more likely that the user will agree to the default option. Preselection can occur together with other dark patterns such as hidden information. Aesthetic manipulation utilizes design choices that distracts users by modifying the form of presented information. This subtype has four more specific instances. Toying with emotion pattern seeks to arouse an emotion that is used to persuade the user to perform certain action. False hierarchy arranges options in a hierarchical way that certain ones have precedence even though the options should be presented parallel. Brignull's disguised ad and trick questions are also aesthetic manipulation. Disguised ad pattern covers ads as interactive games, download button or as other salient interaction. Trick questions pattern presents questions that are not what they appear to be or uses language to manipulate user interaction. (Gray et al. 2018).

The last category forced action includes dark patterns that force users to perform specific action to access specific functionality. Forced action can be a compulsory step for completing a process or it may be tricked to be an option desired by the user. (Gray et al. 2018.) This category modifies users' choice architecture by modifying the decision space. Social pyramid is a forced action dark pattern that obligates the user to recruit other users in order to use the service and then these other users are spammed or nudged to sign up. This is an example how dark patterns don't harm only individuals but also collective welfare. (Mathur et al. 2021.) Brignull's privacy zuckering is a dark pattern that deceives users to share more personal information than their intentions (Gray et al. 2018). Gamification is the last dark pattern type but this term is widely used also to describe application of game features to increase motivation and engagement (Alsawaier 2018). In this context gamification refers to situations in which user has to perform certain actions that might be even undesired to earn certain aspects of the service. It is a common dark

pattern in mobile games where higher levels are almost impossible to achieve without paying for extra lives or other additional features. (Gray et al. 2018).

3 Underlying factors of dark patterns' functionality

The purpose of this chapter is to explain where the functioning of dark patterns is based. Examples of dark patterns are used to illustrate the functioning. First, human decision making processes are explained which is followed by the factors of human behaviour. The last part of the chapter explains how dark patterns exploit known usability heuristics.

3.1 Decision making processes

As the target of dark patterns is to affect users' decision making it is important to understand the human decision making processes. Various psychology theorists have suggested that human cognition has two different systems (Stanovich & West 2000). These two systems are referred to as system 1 and system 2 (Kahneman 2012, p. 20). Describing the functioning of these two systems will help to understand the effectiveness of dark patterns (Bösch et al. 2016).

System 1 is in charge of our unconscious thinking and reasoning. It operates automatically and with little or no effort. Impressions, intuitions, intentions and feelings are suggestions continuously created by system 1 but more effortful processing requires system 2. Our conscious mental activities that need effort and attention belong to the system 2. System 1 and 2 interact in a way that minimizes effort and optimizes performance. System 2 minimizes effort by adopting suggestions of system 1 with little or no modification. Performance optimization is done by conscious system 2 when things get too difficult for system 1. Impulses and biases are characteristics of automatic thinking and can only be controlled by effortful activity of system 2. (Kahneman 2012, p. 20-26.)

The operation of System 1 and laziness of system 2 enables the use of dark patterns. (Bösch et al. 2016, Kahneman 2012, p. 46.) Two central reasons determine whether person relies on system 1 or 2 thinking. Lack of motivation or resources like knowledge, ability and time makes one lean on system 1. Example of lack of motivation in the privacy context is that people are usually not highly motivated to read terms and conditions and they are accepted automatically. This provides an opportunity to use dark patterns like pre-selection to get more personal information from users. (Bösch et al. 2016.) The laziness of system 2 is related to the lack of motivation and resources. The system 2 monitors and controls the suggestions of system 1 and accepts them if there is no motivation or resources for modification. Modifying intuitions requires cognitive effort

and system 2 naturally prefers to function with the least effort. The functioning of system 2 varies among individuals so some people control their intuitions more actively than others. (Kahneman 2012, p. 44-46.)

Cognitive ease is a range that also measures whether extra effort from system 2 is needed or not. On the one side of the range is the feeling of ease that signals there is no threats, no major news nor need for redirection of attention. Cognitive strain is on the other end which indicates a problem that needs mobilized effort of system 2. Repeated experience, clear display, priming and good mood are causes for cognitive ease. As a consequence of cognitive ease, the current situation will probably feel familiar, true, good and effortless. (Kahneman 2012, p. 59-60.) If the user trusts and likes the source of information a sense of cognitive ease is felt. This is one reason why dark patterns are likely to be found on popular websites. (Kahneman 2012, p. 46, Mathur et al. 2019.)

Humans are known to be boundedly rational. This means that decision making is affected by cognitive limitations. (Simon 2000.) One key characteristic of system 1 is susceptibility to heuristics and biases. Heuristics are simplifications that help people to make adequate decision in difficult issues. (Kahneman 2012, p. 98-105.) Relying on heuristics is most of the time quite useful but it exposes decisions to bias (Tversky & Kahneman 1974). The functionality of many dark patterns is based on exploiting these heuristics and biases (Mathur et al. 2021). Mathur et al. (2019) listed six types of cognitive biases that dark patterns commonly exploit. These biases are scarcity bias, sunk cost fallacy and anchoring, framing, default and bandwagon effects.

Comparing dark pattern categorization of Mathur et al. (2019) and Gray et al. (2018) indicates that interface interference dark patterns exploit most of these cognitive biases and most common ones are anchoring, framing, default and scarcity biases. Anchoring bias can be seen as priming effect that influences decisions. If certain value is considered before estimating an unknown quantity the estimation will likely be close to the considered value. (Kahneman 2012, p. 119-122.) Dark patterns that exploit anchoring bias occur for example in e-commerce to make users buy the more expensive options. User interface can be manipulated to favor more expensive options which anchors users estimate for the price to be higher. (Mathur et al. 2019.) Framing means that one option can be presented in different ways and the decision is dependent on the way of presentation (Kahneman & Tversky 1984). Especially aesthetic manipulation and trick

questions exploit framing bias. For example, using language to frame certain options to be better than others is a form of exploiting framing bias. (Gray et al. 2018, Mathur et al. 2019.) Default bias is based on same mechanism as framing. User's choice depends on the form of presentation. The exploitation of default bias is based on that people tend to stay with the default option. (Johnson et al. 2002.) Functionality of preselection dark pattern is based on default bias (Gray et al. 2018). Scarcity bias in turn means that people place more value on a good if it is scarce (Mittone & Savadori 2009). Countdown timers are form of toying with emotion dark patterns. They make the good to appear scarce although the scarcity is not real. After timeout the good is still available or the timer just resets. (Gray et al. 2018, Mathur et al. 2019.)

Another dark pattern category that takes advantage of cognitive biases is sneaking. Sneak into basket exploits default bias. Websites insert additional products to shopping cart in the hope that the user stays with the default option. Hidden costs dark pattern takes advantage of sunk cost fallacy. (Mathur et al. 2019). This bias means that people tend to continue an action if resources like money, effort or time has already been invested (Arkes & Ayton 1999). In the case of hidden costs online service providers trust that users will accept the hidden costs because they will feel so invested in the process and they don't want to waste their effort (Mathur et al. 2019).

3.2 Factors of human behaviour

In order to design persuasive technologies, it is important to understand factors driving the human behaviour. Fogg (2009) presented a model called Fogg Behaviour Model (FBM) for understanding factors that affect human behaviour. According to this model there are three influencing factors, which are motivation, ability and triggers. Figure 2 visualizes the factors of FBM. The model presents that high motivation and ease of task increases the possibility of successful behavior change. However, these two factors are not enough for behavior change but a trigger is needed to generate the desired behaviour. FBM is relevant model also for dark patterns because persuasive strategies and dark patterns have a lot of resemblance (Gray et al. 2018).

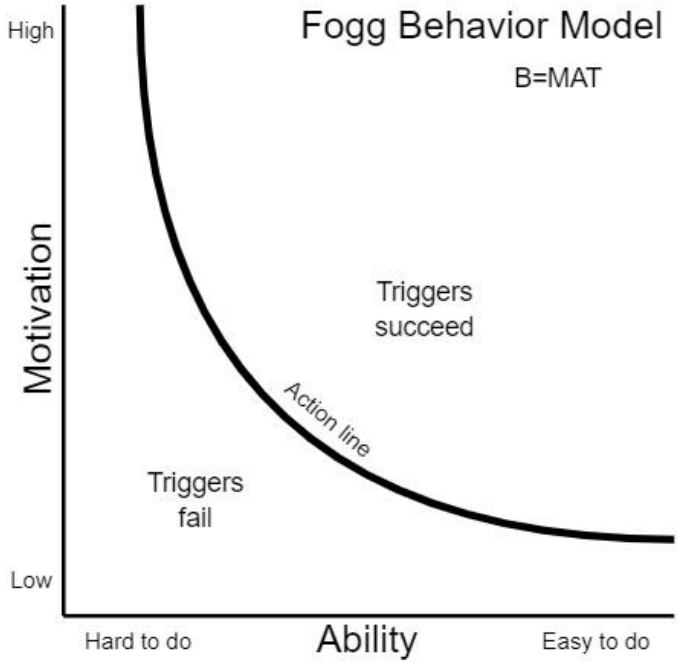


Figure 2 Fogg Behaviour Model (Adapted from Fogg 2009,2022)

Designers have most influence over ability and triggers (Maier & Harr 2020). The most effective way to increase users' ability is to add simplicity. Elements of simplicity are time, money, effort, cognitive load, social norms and routine. The less obvious element from this list is social norms. A simple task follows social norms and rules of society. If a target behaviour requires social deviance it is not simple. It is important to notice that simplicity can vary by individual and context. Triggers are the aspect of persuasive products that tell people to perform certain behaviour. There are different types of triggers such as sparks, facilitators and signals. Spark triggers are motivational and used when person lacks motivation. Facilitator suits for situations where user is motivated but lacks ability. This kind of trigger tells the user that the target behaviour is easy to perform. Signal trigger is a reminder for certain activity. It is effective for users that have both motivation and ability because a reminder is the only thing they need to perform the activity. (Fogg 2009.)

Motivation is a driver for certain behaviour. There are various types of motivation and it can be classified in different ways. One way to see motivation is to divide it into internal and external motivation. For example, own values or interest can evoke internal motivation can while external motivation can be evoked by external rewards or punishment. (Ryan & Deci 2000.) Fogg (2009) suggests that for persuasive design context

motivation should be divided in three core motivators. Each of the motivators are dimensions that have two sides. The first core motivator is dimension of pleasure and pain. This motivator is a primitive response that includes very little thinking or anticipation. The second dimension is between hope and fear. This motivator involves expectation of an outcome. Hope includes expectations of something good and fear anticipates something bad will happen. The last core motivator is a dimension of social acceptance and social rejection. This dimension determines large part of our social behaviour. People have a primitive need to be socially accepted.

From dark patterns point of view FBM can give useful insights on causing or preventing certain behaviour. In contrast to inducing target behaviour the model also helps to analyse ways to reduce motivation, take away ability or remove triggers to prevent certain behaviour. (Fogg 2009.) For example, obstruction dark patterns reduce simplicity by adding cognitive load to prevent certain behaviour such as cancelling subscription. For causing target behaviour dark patterns can use especially spark triggers. Target behaviour of dark patterns is not desired by the user so a trigger is needed to motivate the user towards targeted behaviour. Toying with emotion is an example of dark pattern that uses spark triggers to motivate user by certain emotion like fear of missing out. (Fogg 2009, Gray et al. 2018.)

3.3 Usability heuristics

Usability plays a central role in successful interactive systems. The concept of usability defines how successfully users perform assigned activities and accomplish their intended goals in interaction with technology. Usability heuristics are design principles that can be utilized in the usability evaluation process. There are various heuristic evaluation methods but the most common one was introduced by Nielsen. (Jimenez et al. 2016.) Nielsen's (1994) usability heuristics is a guideline that consists of ten general usability principles. Although these principles are intended to enhance usability, they can also be used to deceive users. Dark patterns exploit insights from human psychology and usability heuristics to manipulate users. By inverting Nielsen's usability heuristics, it is possible to describe the functionality of dark patterns. (Brignull 2013.)

Usability of a system intends to decrease cognitive effort by making the user interface easy to use (Eason 1984). By utilizing usability heuristics cognitive effort can be reduced in many ways. The first usability heuristic is visibility of system status. This means that

the system should always inform users about what is going on and this should happen through relevant feedback within reasonable time. (Nielsen 1994.) Dark patterns that follow obstruction strategy invert this heuristic to make certain actions more difficult to perform. System status can be hidden with untimely messages and unclear labels and navigation. (Brignull 2013.) Flexibility and efficiency of use heuristic suggests that the design should provide personalization and opportunity to customize for more flexible interaction. The purpose of aesthetic and minimalist design heuristic in turn is to decrease cognitive effort by focusing on essential information. (Nielsen 1994.) For example, hidden information dark pattern's functionality is based on inverting this heuristic. It hides relevant information making them appear irrelevant. (Gray et al. 2018.)

Match between the system and the world is a usability heuristic that means design should speak same language with users by using familiar words, phrases and concepts. Consistency and standards is closely related heuristic according to which design should follow industry and platform conventions so users don't have to wonder whether different words, actions or situations mean the same thing. (Nielsen 1994.) Bait and switch dark patterns exploit industry conventions. For example, red button with "x" would normally mean closing a popup window but as a dark pattern clicking this button leads to different result. (Gray et al. 2018.) This dark pattern also exploits recognition rather than recall heuristic. Recognition and recall are two different types of memory retrieval that have been identified in humans. In recognition memory retrieval cues activate related information in memory. (Budiu 2014.) Bait and switch exploits users' ability to recognize conventional actions and concepts (Gray et al. 2018).

Few heuristics are concentrated to users' potential to make errors. These are user control and freedom, error prevention and help to recognize, diagnose and recover from errors. Performing an action by mistake is common so users need clear instructions to exit a process or an action. Best designs prevent any kinds of errors from happening by eliminating error-prone conditions or double-checking user's commitment to an action. Another heuristic to prevent and solve users problems is help and documentation. In the case of an error, an error message should be displayed clearly in plain language indicating the problem precisely and suggesting helpful solution. (Nielsen 1994.) Dark patterns exploit users' capability to make mistakes to get them perform actions accidentally (Brignull 2013). For example, sneaking dark patterns operate against error prevention by adding additional items to shopping cart without user's confirmation (Mathur et al. 2019).

Preselecting options is also a way to prevent mistakes but in dark pattern context default options are used to benefit the online service provider (Brignull 2011).

4 Dark patterns and user experience

This chapter defines user experience and presents the used user experience model. Next the evaluation of user experience is discussed. The chapter ends with discussion of the dark patterns' effects on user experience that have been found from previous research.

4.1 Defining user experience

Human-computer interaction is research area that combines psychology and social sciences with computer science to better understand human interaction with and trough technology (Carroll 1997). User experience is widely used term for quality of interaction in the human-computer interaction field. However, it still doesn't have a common shared definition. (Berni & Borgianni 2021.) According to one definition user experience refers to user's perceptions and responses that are outcomes of using a product or service (ISO 2019). Another source defines user experience as a "momentary, primarily evaluative feeling (good-bad) while interacting with a product or service" (Hassenzahl 2008).

User experience and usability are closely related concepts and there are different views on their relationship. Sometimes user experience is used as a synonym for usability even though user experience is understood to cover more encompassing view on interaction quality. (Bargas-Avila & Hornbæk 2011.) According to some research usability is seen as one aspect of user experience (Hassenzahl & Tractinsky 2006, van Schaik & Ling 2008). Satisfaction is one characteristic of usability and it describes users' perceptions of product or service meeting users' goals (Bevan 2009). It is suggested that one way to understand user experience is that it is an elaborated form of satisfaction (Law & van Schaik 2010).

There have been various attempts to model user experience. Modelling of key constructs and their interplay is pivotal to design and study user experience. (Hassenzahl 2004.) One user experience framework by Borgi & Borgianni (2021) suggests that user experience has two aspects that are fundamental elements of interaction and typologies of experience. The elements of interaction which are user, system and context create a base for experience. Typology of experience in turn identifies three main experience categories that are ergonomic, cognitive and emotional.

One of the most referenced models is by Hassenzahl (2003). For example, Law & van Schaik (2010) and van Schaik & Ling (2008) have utilized Hassenzahl's (2003) model in their research. Hassenzahl's model is highly subjective which is well suited for this thesis as the purpose is to examine individual user experiences. The model is related to ideas that user experience goes beyond instrumental needs and it is affected by subjective and experiential facets. This means that user experience doesn't just focus on the task efficiency but it strives for more holistic view that pays attention also to aesthetic and hedonic aspects of interactive products. Furthermore, subjective factors like emotions and motivation with experiential aspects like situatedness and complexity are key factors influencing the user experience. (Hassenzahl and Tractinsky 2006.)

Hassenzahl's (2003) model presents that key elements of user experience from user perspective are product features, apparent product character, consequences and situation. This model is presented in Figure 3. First thing that users perceive when they encounter a product are product features. Designer chooses and combines certain features like content, presentation, functionality and interaction style to indicate intended product character. Based on the product features each individual user forms a personal view of the product character that in the model is called apparent product character. The apparent product character summarizes product attributes that are divided in to pragmatic and hedonic attributes. Consequences of the apparent product character are divided on judgments of the product's appeal, emotional consequences and behavioural consequences. These consequences may vary because they are always dependent on the usage situation. (Hassenzahl 2003.)

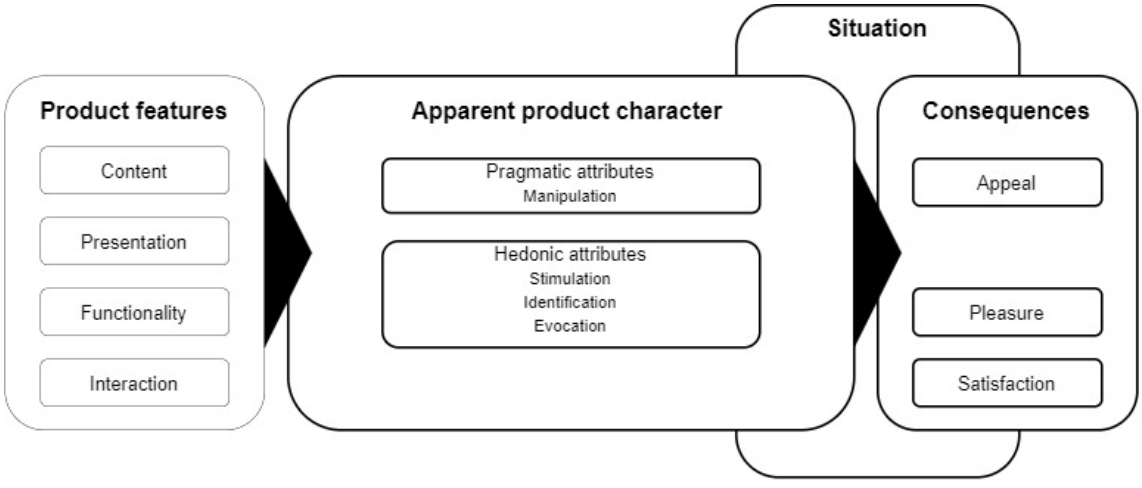


Figure 3 User experience model (Hassenzahl 2003)

The apparent product character is affected by product features and individual standards and expectations. Differing standards explain the variance of characters between individuals whereas experience with a product affects changes within a person. The product character is a personal perception that combines attributes from two main categories. These attributes address underlying human needs. Pragmatic attributes fulfil external or internal behavioural goals. Pragmatic products are instrumental as they are enablers of manipulating user's environment. Hedonic attributes address psychological well-being and pleasure. There are three subcategories for the hedonic product functions which are stimulation, identification and evocation. Stimulating products enable increasing knowledge and development of skills. Identification refers to human need to express their self to others with their possessions. Evocation as a function means that a product provokes memories. (Hassenzahl 2003.)

Consequences of experiencing product with certain character are momentary and dependent on the usage situation. Consequences can be emotions like satisfaction or pleasure, explicit evaluations or apparent behaviour. (Hassenzahl 2004.) Satisfaction can be felt when expectations of an outcome are confirmed. Pleasure in turn doesn't require expectations. It occurs when something desirable but unexpected is encountered in usage situation. Judgement of products appeal is an evaluation that combines the situation with user's experience with and feelings towards a product. (Hassenzahl 2003.) Other evaluative judgments are for example overall goodness and beauty. It has been found that evaluations of beauty are related with hedonic attributes and goodness relates to both hedonic and pragmatic attributes. (Schaik & Ling 2008.)

Usage situation combines the apparent product character with set of expectations like behavioural goals or psychological needs. Different combinations of product characters and consequences can vary depending on the usage situation. Usage mode is a term used to describe the mental state of user in specific situation. (Hassenzahl 2003.) Two usage modes are identified. In goal mode user is focused on completing a task and being efficient. In activity mode the action itself is more important and users are more experimental and spontaneous. (Hassenzahl et al. 2002.)

Hassenzahl's model of pragmatic and hedonic quality has also been combined with Herzberg's two-factor theory. Herzberg's theory suggests that two factors, hygienes and motivators affect job satisfaction. In user experience context hygienes are factors that

cause negative feelings if they go under certain limit. However, their presence is not alone enough to create positive feelings. Motivators are factors that create positive feelings but their absence doesn't create negative feelings. (Tuch & Hornbæk 2015.) Pragmatic quality is seen as hygiene factor and hedonic quality is seen as a motivator (Hassenzahl et al. 2010). For example, usability can be seen as hygiene factor as high level of usability is not source of positive user experience but if product doesn't work at all it creates a negative user experience. The psychological cause for positive or negative feelings in user experience is fulfilment of psychological needs or lack of it. For example, the feeling of autonomy is considered as hygiene factor and relaxation as motivator. (Tuch & Hornbæk 2015.)

4.2 User experience evaluation

The purpose of user experience evaluation is to explore users' experiences with interactive products whether they are positive or negative. There is a broad range of different qualitative and quantitative user experience evaluation methods. Quantitative methods include for example questionnaires while interview is an example of qualitative method. It has been found that it is common to combine both quantitative and qualitative data in user experience evaluation. (Vermeeren et al. 2010.) However, user experience research is mostly based on qualitative data as qualitative method being the only used method or as mixed with quantitative methods (Bargas-Avila & Hornbæk 2011).

There has been ongoing debate whether user experience can be measured quantitatively which is because user experience includes complex experiential and emotional concepts (Law et al. 2014.) Key concern is the reliability and validity of the measure. Validity comes from deep understanding of human aspects and reliability is built on consistent use of tools and protocols for data collection. (Law & van Schaik 2010.) Common argument against measurement is that emotional responses are so complex that they are difficult to quantify in numbers (Forlizzi & Battarbee 2004, Swallow et al. 2005). It is stated that it is not possible to reduce human experiences or feelings into numbers (Law & van Schaik 2010). Despite these arguments, different measures have been created to measure user experience constructs like emotions and satisfaction (Law et al. 2014).

Related to the debate between quantitative and qualitative there is also discussion whether user experience measures should be subjective or objective. One approach suggests that user experience measurement should be self-reported because of the subjective nature of

user experience. Traditional methods like questionnaire, interview and think-aloud are useful self-report methods. Another view suggests that objective approach is more suitable. (Law & van Schaik 2010). For example objective physiological measures have been getting support on measuring user experience because they can be used without interrupting user's experiential activity (Mandryk & Atkins 2007). Superiority of objective measures is justified by the fact that users might not be aware or able to recall some aspects of experience in subjective assessment (Wilson & Sasse 2004). Since both approaches have their own strengths and weaknesses the most appropriate solution could be to triangulate objective and subjective measures (Law & van Schaik 2010). It has been found that triangulation of different methods in user experience evaluation is very common (Pettersson et al. 2018).

As user experience and usability are related concepts it is no wonder that user experience measures and methods have been widely derived from usability (Law et al. 2014). Central issue of objective usability measures for user experience is that usability measures like number of errors are not able to tell whether user perceives the product as good or bad (Roto et al. 2011). Usability evaluation focuses on task efficiency while the purpose of user experience evaluation is to understand users' feelings and experiences. Although satisfaction is a component of both user experience and usability, user experience includes a wider variety of subjective emotional responses. Some usability measures can be included in user experience evaluation but they alone are not enough to evaluate user experience. (Vermeeren et al. 2010.)

There are different factors affecting the choice of evaluation method. For example, purpose of evaluation and available resources affect the choice. (Roto et al. 2011). Practicability of a method is important for it to be useful in product development. Issues like skills required, ease of use and data analysis and applicability of results should be considered. Methods such as field study and multi-method research require high level of resources while heuristics and checklists are considered as easy and fast methods. However, easiness and fastness can affect the reliability and validity of evaluation as these methods don't rely on statistical analyses. (Vermeeren et al. 2010.) Also the time span of user experience have to be considered as user experience can be evaluated before, during, after and over time. (Roto et al. 2011.) Most of user experience evaluation methods are used during or after interaction (Pettersson et al. 2018). There are remarkably less methods that can be used before interaction. This might be due to their low scientific

quality. (Vermeeren et al. 2010.) As expectations are believed to affect user experience it would be useful to create more methods to be used before interaction (Kujala & Miron-Shatz 2015).

4.3 The effects of dark patterns on user experience

Previous dark pattern research has also explored users' experiences on dark patterns. It should be noted that these studies have not used exclusively the concept of user experience but they have talked about users' perceptions and feelings. It has been found that emotions like distress, upset, hostile and irritable are combined to manipulative products. These emotions can arise from initial judgments or impressions before interaction or they can be experienced during or after interaction. (Gray et al. 2021.) One research discovered that many people first get annoyed about certain patterns but over time they get used to them. Acceptability of certain dark patterns is also dependent on visibility, freedom of choice, enjoyment of interaction and noticing of important information. (Maier & Harr 2020.) If the product or service provides enough motive to use it, the user will likely ignore manipulative attempts. However, the appearance of dark patterns is expected to decrease trustworthiness of the service provider. (Bhoot et al. 2020.) There are differences in the effects of dark pattern strategies so next the effects on user experience are reviewed by category.

Nagging strategy is considered to be annoying rather than dangerous. It is experienced over time so the feelings of irritation might arouse as a result of multiple interactions. Nagging is also perceived to be visible because it doesn't affect user's freedom of choice. For these reasons users consider nagging to be more acceptable than for example strategies that hide information. (Gray et al. 2021, Maier & Harr 2020.) Sometimes users may also feel manipulated due to the pressure created by constant notifications and pop-ups (Susser et al. 2019). Although nagging is seen to be acceptable to some extent users have certain tolerance for accepting annoyance. When the tolerance is exceeded users are likely to start searching for alternative service provider. (Conti & Sobiesk 2010.)

Obstruction can be experienced during or after the interaction and it can be felt as manipulative if user receives a negative result or the interaction is undesired or unnecessary. For example, roach motel dark pattern has been found to be manipulative when users receive a negative result after interacting with a product for some time. (Gray et al. 2021.) One study discovered that roach motel dark pattern makes users feel

frustrated because of its misleading behaviour. Frustration was found to be related to the attractiveness of website. If the website was found to be appealing the level of frustration was lower. (Bhoot et al. 2020.) From another perspective users don't consider obstruction to be too dangerous because complicating certain actions is not as bad as missing something very important (Maier & Harr 2020).

Sneaking strategy is perceived inexcusable and users suggest it could lead to loss of trust and credibility in the company. Nevertheless, users would likely continue to use the service if there was no alternative option. (Maier & Harr 2020.) In one research forced continuity was the most identified dark pattern. It is probably due to the visibility of sneaking strategy as users can visibly see the behaviour of these dark patterns. Users consider forced continuity to be misleading and the level of frustration is associated with the misleading behaviour. (Bhoot et al. 2020.) One study discovered that user felt upset and manipulated after realizing the sneaking behaviour. This user blamed the designers and other stakeholders responsible for the negative outcomes but also herself for not identifying this pattern in the first place. (Gray et al. 2021.)

In the case of interface interference strategy users often have a feeling that their behaviour is being influenced but have difficulties to precisely describe the factors behind these feelings (Gray et al. 2021). On the other hand toying with emotion and preselection dark patterns are highly recognised and considered to be predictable and quite obvious. For this reason they are also more acceptable. Information hiding in turn is seen to be dangerous because it is more difficult to detect. Positive findings about dark patterns are rare in previous research but one comment stated that pressuring with emotion can be good because it can help make faster decisions. (Maier & Harr 2020.)

Manipulative intentions of forced action can be experienced in long-term interaction. First impression of user interface with forced action strategy might not be manipulative but undesired interaction or negative results from interaction can evoke manipulative sensations. Specifically, privacy zuckering raises concerns about personal data collection and users would prefer to use an alternative option that doesn't apply privacy dark patterns. (Gray et al. 2021.) Privacy zuckering can also make user feel overwhelmed because of the complex privacy settings (Bösch et al. 2016). In the case of social pyramid users are questioning the ethics of the product but still feel social pressure to keep using

it (Zagal et al. 2013). However, users consider forced action to be just annoying and not harmful (Maier & Harr 2020).

Although similar effects have been found in dark pattern strategies it is important to remember that the effects on user experience are highly dependent on the user. Users' balance between values and manipulation affects desire to use the service that exploits dark patterns. Users' perceptions and emotions are influenced by previous experiences with dark patterns. In addition, ability to recognize dark patterns affects users' perceptions and feelings. (Maier & Harr 2020.) People of younger age and higher education have been identified to have better ability to recognize dark patterns (Bongard-Blanchy et al. 2021). It has been also stated that dark patterns are so ubiquitous that users consider many of them to be normal. However, users are concerned about dark patterns and awareness of dark patterns can help to resist them. Therefore, it would be important to raise awareness among more vulnerable user groups like older people and children. (Bongard-Blancy et al. 2021, Di Geronimo et al. 2020.)

5 Methodology

The purpose of methodology chapter in this thesis is to describe selected research approach and data collection and analysis methods. The procedures of data collection and analysis are also described. The last subchapter discusses the trustworthiness of this research.

5.1 Research approach

This thesis is conducted with qualitative research approach to explore users' experiences on dark patterns. Studying subjective experiences is characteristic of qualitative research (Puusa et al. 2020, p. 74). It is suitable approach for this research because user experience includes subjective experiential and emotional concepts (Law et al. 2014). Qualitative research focuses on getting deep and explanatory knowledge. It answers to questions like how and why which is opposite to quantitative research that focuses on numbers and quantities. (Eriksson & Kovalainen 2008, p. 4-6.) As user experience on dark patterns is rather new research topic it is useful to gather rich qualitative knowledge to get deeper understanding of the phenomenon.

The research process of qualitative research is flexible which means that the research steps can be overlapping and made choices can be changed throughout the research process. The purpose is not to test strict hypothesis but to make interpretations that generate deeper understanding leading again to new interpretations. Qualitative research has inductive nature which means that it generates conclusions from the empirical data. The collected data is highly in evidence in the research and theory is rather a tool than premise for the research. (Puusa et al. 2020, p. 10-11, 76-77.)

The research process of this thesis started from selecting and setting the limits for the topic. This was followed by design of the research problem. A literature review was conducted to gather deeper understanding of the research topic as it was completely new for the researcher. The selection of data collection and analysis method was overlapping with the literature review. As the researcher gathered more knowledge on the research topic it was more clear what kind of data would be suitable for answering the research problem. After the literature review and method choices data collection was executed followed by data analysis. More specific descriptions of data collection and analysis procedures are presented in the next subchapters.

5.2 Data collection

5.2.1 Think-aloud method

The chosen data collection method in this thesis is think-aloud technique. The purpose of think-aloud is to get verbalization of users' reasoning and perceptions while performing a task (Fonteyn et al. 1993). It is assumed that the verbalization of thoughts is a reflection of contents in participant's short term memory (Kuusela & Paul 2000). Think-aloud technique is used in fields of research such as psychology, education and computer science (Lundgrén-Laine & Salanterä 2010). In user studies it is used to evaluate both usability and user experience (Pike et al. 2014).

Think-aloud technique is also referred to as think-aloud protocol because the method is based on verbal protocol by Ericsson and Simon (Olmsted-Hawala et al. 2010). In the verbal protocol context the word protocol refers to the verbalized cognitive process that reveals the progress of person's problem solving process (Jones 1989). According to Ericsson and Simon (1980) there are three levels of verbalization. Levels one and two are considered to be accurate verbalization of cognitive processes in short term memory during the task. On these levels the researcher can use a probe like "Keep talking" that doesn't distract the focus of participant. (Olmsted-Hawala et al. 2010.) In usability testing context reading a text on screen would be level one verbalization and translating abstract graphs in words would be level two verbalization (Cooke 2010). On level three the participant can be probed with questions that might require information from long term memory to verbalize thoughts and this can affect the task performance. Probes like this might try to uncover person's motives for performing a specific action. (Olmsted-Hawala et al. 2010.)

In the original model of verbal protocol only level one and two verbalizations would be considered as accurate description of cognitive process because on level three the researcher can influence the thought process of participant. However, there are other versions of think-aloud protocol that accept probes that generate level three verbalization. If probes like "Why did you do X?" are accepted it is important to be aware of the possible influence of these probes on the task performance. (Olmsted-Hawala et al. 2010.) Especially in usability testing this is an important observation because level three probes can lead to improved task performance and biased test results (Wright & Converse 1992). In this research the focus is not on task performance but on feelings and perceptions of

user's experience. McDonald et al. (2016) presented on their research that interactive think-aloud technique provides more accurate verbalization of user experience. Especially interventions that seek opinion and ask for explanation raised more expressions about the user experience. Therefore, questions and interaction were accepted in the think-aloud user studies of this research.

One typical way to categorize types of think-aloud techniques is to divide them to retrospective and concurrent think-aloud technique. The concurrent think-aloud technique requires the participants to think aloud their thoughts during given tasks. In retrospective think-aloud technique participants first perform tasks silently and the verbalization of thoughts is done afterwards usually with the help of video recording of the task performance. (van den Haak et al. 2003.) Both techniques have their own advantages and disadvantages. Verbalization during the task can interfere information processing and influence the task performance. Thinking aloud makes thoughts public so participants might also behave in a different manner than they would privately. However, compared to retrospective technique the verbalization with concurrent technique can be more accurate. This is because in retrospective thinking participants' memory can be influenced by time and past experiences can be mixed with present. (Kuusela & Paul 2000.) One advantage of concurrent technique is that it requires less resources and time to conduct than retrospective technique (van den Haak et al. 2003). Concurrent think-aloud technique is also suggested to be better choice if the goal is to get insight on user experience rather than usability problems (Olmsted-Hawala & Bergstrom 2012). These are the key reasons why concurrent think-aloud was the chosen method in this thesis.

5.2.2 Data collection procedure

Before conducting the think-aloud user studies examples of dark patterns was gathered and tasks based on these were developed. The purpose of each task was to represent one dark pattern strategy by Grey et al. (2018). Previous research suggests that different dark patterns often appear together (Grey et al. 2018). This was noticed during the gathering of examples which resulted in one task that includes three dark patterns from different strategies. This task includes roach motel dark pattern from obstruction strategy, hidden information from interface interference strategy and nagging. Other tasks included only one dark pattern per task and these dark patterns were hidden costs from sneaking strategy, forced action, nagging and trick question from interface interference.

Descriptions of the tasks can be found from Table 3 and visualization of the tasks from appendices.

Table 3 User study task descriptions

	Task description	**Dark pattern type**
Task A	Find information how to cancel subscription.	Roach motel, Hidden information, Nagging
Task B	Order a pizza. Proceed until the payment step.	Hidden costs
Task C	Enter and browse this website.	Forced action
Task D	You are browsing your feed and this pop-up appears. Explain how you experience this.	Nagging
Task E	Fill in this form to proceed to check out.	Trick question

Sample sizes in think-aloud studies are normally quite small because as in general qualitative research focuses on in-depth data that can be gathered from a small set of participants. (Lundgrén-Laine & Salanterä 2010.) Data gathered with think-aloud technique can also be analyzed quantitatively in which case sample size can be bigger (Eveland Jr. & Dunwoody 2000). In this study the sample size is six. However, more important than the sample size is to choose representative group of participants that has skills to verbalize their thoughts aloud (Lundgrén-Laine & Salanterä 2010). Participants in this study were selected from convenient subset of population. Convenience sampling means that participants present a sample of population that were available and accessible in that moment (Baxter et al. 2015, p. 108). It has some disadvantages that are discussed in chapter 5.4. The main requirement for participant was familiarity with digital systems and ability to verbalize thoughts aloud. Participants were aged between 24 and 27. This is a representative age group because according to Pew Research Center (2021) young adults aged between 18 to 29 are the biggest age group using the internet. This means they are also most prone to encounter dark patterns in daily life and thus are likely able to provide verbalization of experiences with dark patterns.

The user studies were conducted in Finnish because that was the native language of each participant. Native language was used to get as rich verbalization as possible. For example, Maier and Harr (2020) suggested that using some other language than the native language of participants could limit their verbalization. The user studies started with an

introduction video of think-aloud technique. After this, participants were asked to perform tasks and think thoughts aloud focusing on how the experience with the product was felt. The tasks were presented in different order to each participant to avoid order bias (Onwuegbuzie & Leech 2007). Participants were allowed to ask clarifying questions and the researcher could ask questions to specify certain sentences. The researcher also made notes during the tasks to complete the verbal data. The duration of user study sessions were around 20 minutes. The time spent on task varied between tasks and participants but each task had a maximum time limit of five minutes to prevent fatigue. All user study sessions were audio recorded and the recording started from the first task performance. All collected data was anonymized to protect participants' privacy.

5.3 Data analysis

The purpose of data analysis in qualitative research is to organize the collected data in to a clear and coherent set. It is important to make interpretations of the data not just descriptions. With successful interpretations the results of research can be taken to a higher abstraction level. It means that the results can be generalized into a wider context. (Puusa et al. 2020, p. 143.) The reasoning logic of interpretations can be inductive, deductive or abductive. Inductive means that conclusions are drawn from individual perceptions into generalized understanding. Deductive reasoning logic in turn works the opposite way. Abductive reasoning has features from both inductive and deductive reasoning. The reasoning process combines conclusions drawn from data and theory. At first the analysis process proceeds based on the data but later the theory guides the organization of data. (Tuomi & Sarajärvi 2018, p. 80-82.) In this research the reasoning process was abductive. The data collection and start of data analysis proceeded freely but the final categorization was guided by dark pattern categories by Gray et al. (2018) and user experience model presented by Hassenzahl (2003).

The most used data analysis method in qualitative research is content analysis. It is rather seen as a framework than as a strict method that guides the analysis process step by step. (Puusa et al. 2020, p. 144-145.) Qualitative content analysis was used also in this research. Content analysis aims to transform the collected data into summarized and general description. The problem of content analysis is that it only organizes the collected data although that is not enough to answer to research questions. After the organization of data it is important to make meaningful conclusions. (Tuomi & Sarajärvi 2018, p. 87-88.)

Although there is no one right way to do qualitative content analysis there are general descriptions about the analysis process (Tuomi & Sarajärvi 2018, p. 78). To start the analysis process interviews and other audio recordings are recommended to be transcribed in written form. This provides an opportunity for the researcher to closely examine the collected data and make observations. (Kallio 2022.) In the first phase of qualitative content analysis the transcribed data is reduced in a way that only statements relevant for the research question are compiled in simplified form (Tuomi & Sarajärvi 2018, p. 92). In this research the audio recordings from think-aloud user studies were transcribed to start the qualitative content analysis. The reduction phase started with underlining expressions relevant for answering the research question. These expressions were moved to a separate file where the original expressions were reduced to more concise form.

The next phase of the analysis is to group the expressions by looking for similarities or differences and then abstraction of concepts (Tuomi & Sarajärvi 2018, p.92). Usually in qualitative research coding is used to organize and categorize the collected data. Coding means that passages with similarities are grouped under same categories. Because of the rich nature of qualitative data there are multiple perspectives to code the same data. Categories can be driven by the collected data, theoretical framework or as a combination of these approaches. (Juhila 2022.) In this research the categories were guided by theory. This means that the initial codes were based on collected expressions but upper level categories and abstraction were guided by theoretical framework. At first the expressions on user experiences were divided by the dark pattern strategies by Gray et al (2018). After that the effects of each dark pattern strategy were examined through the different user experience elements that are presented in Hassenzahl's (2003) user experience model. The categorization is visualized in Figure 4.

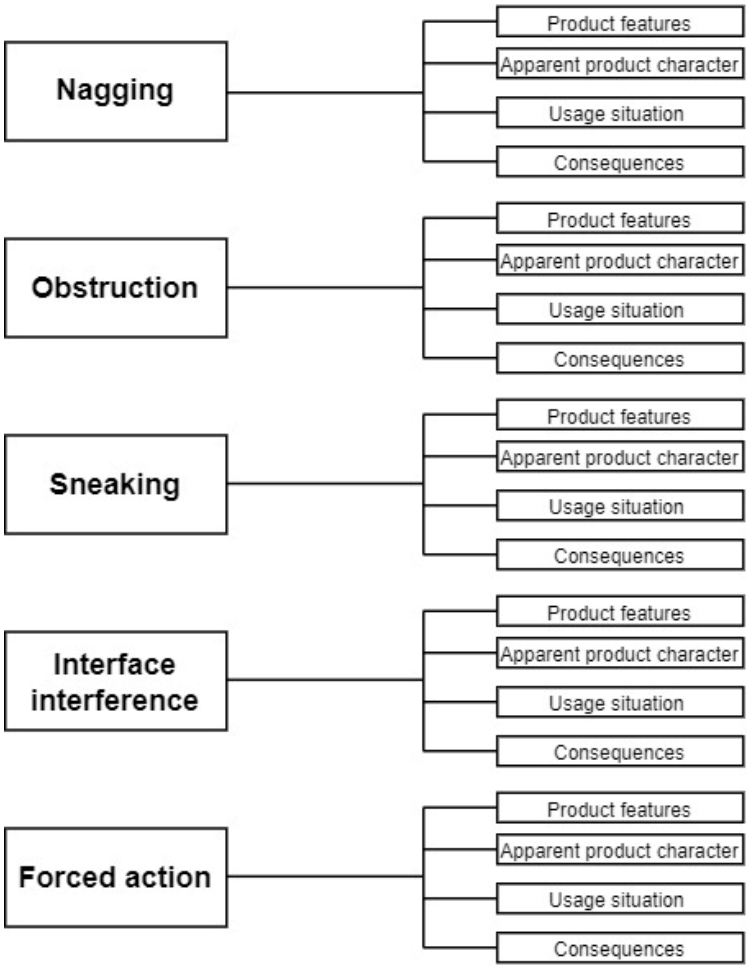


Figure 4 Categorization of collected data

After the coding process it is time to make interpretations and conclusions. This is a very important part of research as the researcher's conclusions are the end result of the research. Interpretations always present the researcher's point of view because people perceive things in different ways. To make convincing interpretations the researcher must justify them logically. Quotations from collected data and connections to previous research are ways to support the conclusions. (Puusa et al. 2020, p. 151-.) In this research results and interpretations from the analysis process are presented in chapter 6. Conclusions that include limitations and implications for future work are presented in chapter 7.

5.4 Trustworthiness of the research

Addressing the trustworthiness of research is important for transparency and quality of research (Eriksson & Kovalainen 2008, p. 290). Reliability and validity are the most used concepts when the trustworthiness of research is addressed. However, the concepts of

reliability and validity are originally developed for the purposes of quantitative research and as such they are not suitable for assessing trustworthiness of qualitative research. Although there is a large variety of concepts used to discuss the trustworthiness of qualitative research these different concepts have very similar contents. (Tuomi & Sarajärvi 2018, p. 119-121.) In this research the trustworthiness of research is discussed using aspects of credibility, transferability, dependability and confirmability (Eriksson & Kovalainen 2008, p. 294-295).

Key aspect to consider when evaluating credibility of research is that other researchers can agree with your claims or make similar interpretations. This means that the data must be sufficient to reason the results. (Eriksson & Kovalainen 2008, p. 294.) Lincoln and Guba (1985, p. 219, 290) suggest that the concept of credibility can be used to replace internal validity which refers to causality of variables. One way to increase credibility in qualitative research is to illustrate how conclusions were made (Puusa et al. 2020, p. 172). The description of data analysis and participant quotations clarify the chain of reasoning in this research.

Transferability of research means that there is some form of similarity between your research and prior results (Eriksson & Kovalainen 2008, p. 294). Transferability is similar to the concept of external validity which means that the results of research can be generalized to other contexts (Puusa et al. 2020, p. 171). Convenience sampling can be a threat to external validity as the sample might not be a representation of the population. However, practicality of research must be considered in which case convenient sample can be acceptable although the sample still must be as representative as possible. (Baxter et al. 2015, p. 108-109.) In this research representativeness was considered by the age of participants.

Dependability can used in place of the concept of reliability (Lincoln & Guba 1985, p. 219). The basic concept of reliability refers to repeatability. In qualitative research reliability means that the choices and steps are explained and reasoned (Puusa et al. 2020, p. 171-172.) The research process and methodological choices have been explained and reasoned in this thesis to increase the reliability. Many think-aloud studies have a reliability problem that practitioners have not documented the specific think-aloud method they have used. This is problematic as different think-aloud methods can produce

very different data. (Olmsted-Hawala et al. 2010.) To avoid this problem in this research the used think-aloud method was described as accurately as possible.

Confirmability means that the interpretations and findings are reasoned with research data (Eriksson & Kovalainen 2008, p. 294). Lincoln and Guba (1985, p. 219) present that confirmability is also related to the concept of objectivity. Objectivity of research means that the researcher's own presumptions and actions shouldn't affect the results or subject of the research. However, complete objectivity in qualitative research is impossible. (Puusa et al. 2020, p. 181-182.) Detailed reasoning with participant quotations is a way to increase objectivity in this research. The researcher ensured that all conclusions were justified with research data and not with researcher's assumptions.

Ethics is also important for the trustworthiness of research. Ethics of research means that the researcher has followed ethical principles in each step of research and participants have not been harmed in any way. Examples of the ethical principles are integrity, openness and carefulness (Puusa et al. 2020, p. 167-168, 253.) In this research following measures were performed to ensure ethics of research. The researcher acted in honest and careful manner towards the participants and collected data. Before conducting the user studies voluntariness was confirmed from each participant. All the participants were treated anonymously during the whole process of research to protect their privacy. After the research process was complete the collected data was deleted.

6 Results

This chapter presents results from the think-aloud user studies. The results are divided into five subchapters based on the dark pattern strategy categorization. Each dark pattern strategy is reviewed trough the user experience elements presented in the theoretical framework of this research.

6.1 Nagging

Nagging dark pattern appeared in task A and task D. The product features that included nagging were different in both tasks. In task A several pop-ups appeared in the bottom corner of the website which distracted participants' attention. However, these pop-ups didn't require any action and participants were able to continue their activities. In task D a pop-up window appeared interrupting the activities. This pop-up required the participants to decide whether they want to put notifications of the application on by choosing "OK" or "Not now". Only after the decision participants were able to continue their activities.

In task A participants didn't pay much attention to the content of the nagging pop-ups and just quickly checked that the pop-ups didn't include any relevant information. After realising that the pop-ups were advertisements most participants wanted to get rid of them. "Oh my god, how do I get it off!", one participant commented. Participants focused mostly on the presentation and functionality of the pop-ups. The participants described that the pop-ups are jumping and bouncing to the screen.

More attention was paid to the content of pop-up in task D. The participants carefully read what the pop-up was about. Also, the presentation was more carefully examined and participants made observations about the layout of the choices. The "OK" button appeared to be more attractive because it was placed on the right side of the screen. One participant commented that because she uses her right hand and thumb to scroll the screen she could choose "OK" because it is easier even though "Not now" would be the preferred option for her.

In task D the nagging dark pattern didn't affect the apparent product character but in task A attribute "confusing" was used to describe the website. Because the distractive nagging behaviour was not the only dark pattern that appeared on the website it was not the only

influencing factor but one of them. The interrupting pop-ups affected the failure to meet participants' expectations. As the task was to find information on how to cancel subscription this was the goal and expectation for the participants. When the distractive pop-ups appeared, they interrupted participants' goal oriented activity. Participants commented that such behaviour is very distractive and affects the website's complexity. One participant described her experience in the following way:

> *"Some pop-ups are bouncing to the screen…this is very distracting, I can't focus at all. This is a very confusing website."*

The participants described that the nagging dark pattern affects their experience when they are exposed to it several times. Repetition was central influencing factor in both tasks but the repetition in task A appeared during the same usage situation and in task D during several situations. In task A comments on the distractive behaviour increased the more often the pop-ups appeared but already the first appearance evoked feelings for some participants. In task D the first interaction with nagging doesn't necessarily evoke any feelings but repeated interruption during several usage situations has consequences.

In both tasks the central emotional consequence of interaction with nagging was annoyance. The interruption of activities was the main reason for this. "It's just in the way, now it's annoying", one participant explained. Many participants had encountered similar behaviour before and described that they were annoyed also in previous experiences. In task D some participants were also annoyed that they were pushed to do something they didn't want to do. The preferred choice for all participants was not to put the notifications on so they were annoyed by the question of putting the notifications on. For one participant this was also a reason for potential behavioural consequence. The participant commented that as a result of interruption in several usage situations she could choose to put the notifications on just to get rid of the pop-up. This would be a decision against her original intention. On the other hand, one participant commented that the nagging behaviour doesn't affect his desire to use the application because he has a need to use it. When the researcher asked him if the nagging evokes some feelings the participant answered as follows:

> *"It doesn't really affect whether I want to use the application or not. I just prefer to click something and continue the usage because if I use the application then I have some need for it."*

6.2 Obstruction

Obstruction dark pattern was part of task A where participants had to find information on how to cancel a subscription. The obstruction strategy used roach motel dark pattern that made the cancellation of subscription difficult with hiding information and cancellation by phone only. The information was hidden in the website's frequently asked questions section behind several clicks. The hiding of information is a form of interface interference strategy but in this case it was used to serve the obstruction strategy. Therefore, it is considered here also as part of the obstruction strategy context.

Participants commented a lot about the presentation of information on the website. The headlines were not informative and the layout was perceived to be confusing. This was mostly caused by the hidden information dark pattern. In the front page of the frequently asked questions there was a search box that could have been used to search information. However, only few participants noticed and used it. These participants found the information they were looking for. Only one participant that searched the information behind the headlines was able to find the same information.

The attributes "confusing" and "difficult" were given to the apparent product character of the website. As described before the nagging dark pattern was one influencing factor but the obstruction strategy largely affected the difficulty of the website. The presentation and layout of information were confusing which made completing the task difficult. "Very difficult website and there were no clear headlines", one participant commented. As a result, the website didn't meet the expectations and part of the participants didn't even reach the goal of finding information. The participants who completed the task and found out that the cancellation could be done by phone only commented that it doesn't correspond to the standards of today. According to one participant such cancellation functions should be available online. For one other participant the difficulty of the cancellation was normal. Before starting the task, she commented her previous experiences that cancellations are always so difficult.

Emotional consequences of obstruction strategy were annoyance and frustration. The difficulty made participants feel frustrated as they didn't find the information they were looking for. Also cancellation by phone only was central reason for participants' annoyance. Even the participant for whom the difficulty was normal commented that she was annoyed. The researcher asked how she felt about not finding the information and

she answered: “Annoying and difficult”. Few participants judged the appealingness of the website. They commented that the website is bad. This was partly due to the difficulty of finding the right information but also the usage situation influenced the judgment. This usage situation was the first time participants encountered the website and their activity was very goal oriented. Participants also described a behavioural outcome from their interaction. This consequence was that participants wouldn’t use such service again. One participant commented the emotional and behavioural consequences in the following way:

> *“At least I wouldn’t order again… because if cancellation is made this difficult it is very annoying.”*

6.3 Sneaking

Task B included hidden costs dark pattern which is part of sneaking dark pattern strategy. The task was to order a pizza using a food ordering mobile application. Participants used their own mobile phones to perform the task. In the last phase of the order there appeared a cost that was not mentioned before. The cost was called service fee and it was always 40 cents.

Compared to other contents on the last phase participants paid quite little attention to the service fee. When participants noticed or when the researcher asked about the service fee participants commented that the amount of the cost is small in relation to the total cost of the order. For most participants the total cost was around 15 euros. However, participants noted that there was no description of the service fee so it was unclear what the expense consisted of. “It doesn’t say what it is or where it comes from”, one participant commented. Participants on the one hand wondered why the cost was not part of the delivery fee but on the other hand they wished there would have been a clearer description of it.

It turned out that hidden costs didn’t have influence on the apparent product character of the mobile application. This was mostly due to the small amount of the service fee. The influence of usage situation was seen in the fact that mobile application was already familiar to all participants, so they had formed some kind of image of the application before. Participants had a clear expectation of the ordering steps and the service fee didn’t affect the fulfilment of their expectations. “The service fee is always that much”, one participant commented. In task B participants even used positive attributes to describe the

application which didn't happen in any other task. Participants described some functionalities of the application as "easy" and "nice to have".

The hidden costs dark pattern didn't either have any consequences in task B. Participants considered the service fee as a standard element of the mobile application, so it didn't cause emotional or behavioural consequences nor affected the evaluative judgment of the application. As the participants had used the mobile application before, few participants described that they had been little surprised about the service fee when it appeared for the first time. However, they had already made the decision to order food by using that specific food ordering application so participants accepted the service fee. "Well, you can't buy or order without it", one participant explained. The smallness of the cost also affected that the cost didn't cause emotional or behavioural consequences. One participant commented her view in the following way:

> *"As it is so small, I don't pay attention to it per se because it doesn't make me cancel this order."*

6.4 Interface interference

Interface interference was part of task A and task E. In task A there was a hidden information dark pattern to serve the purpose of obstruction strategy. The functioning of hidden information is described together with the obstruction strategy. Task E included a trick questions dark pattern. The task was to fill in a form to proceed to checkout of an online store. The form included two checkboxes that participants could check or not based on the sentences next to the boxes. These sentences included the trick questions dark pattern. The first checkbox was an "opt-out" box that had to be checked if you didn't want to receive offers from the service provider. The second one was an "opt-in" checkbox that meant you want to receive offers from third party organizations if you check the box.

Participants paid attention to the language of the sentences in the trick questions dark pattern. All participants had to read the sentences more than once to really understand what the sentences were about. One thing that participants wondered was the mention about third party organizations. However, what drew the most attention was that the first sentence read "please do not send me" and the second one "please send me". One participant commented that such wording as "please send me" is not usually used. Other participant commented that the sentences used reverse psychology to trick people. She described her thoughts as follows:

> *"Well in a way it is maybe done by using reverse psychology because in the other one you have to choose the "do not send me" and in the other one "please send me"."*

The hidden information dark pattern was quite successful as part of the participants were not able to find information on how to cancel the subscription. By making the task more difficult to complete it influenced the apparent product character in task A. The trick questions dark pattern in task E instead had no effect on the apparent product character. Participants commented that the sentences were confusing but it didn't affect their perception of the website. Central reason for this was that the trick questions dark pattern didn't affect placing of the order. Like obstruction strategy or hidden information dark pattern the trick questions dark pattern didn't make the ordering process more difficult.

Also the consequences of trick questions dark pattern differed from the hidden information dark pattern. The hidden information dark pattern evoked annoyance in all participants while the trick questions dark pattern aroused only a little confusion. The confusion was followed by understanding that the purpose of the sentences was to trick them. Participants commented that it requires precision to check the right boxes so by being negligent it is possible to choose an option that leads to unwanted spam messages. However, in this usage context all participants noticed the confusing language of the sentences and were able to choose pleasing options. The fact that participants noticed they were tried to be tricked didn't affect their desire to order from the website. One participant described that the urge to order something makes her ignore the tricking. Other participant made a point that this type of tricking behaviour is so common that it doesn't arouse any feelings or behaviour. "It doesn't trigger me in a way that it would annoy me or cause me to leave the website", he explained.

6.5 Forced action

The forced action strategy was part of task C. The task was to enter a website and start browsing it. When participants opened the website a cookie policy pop-up appeared and participants were forced to accept the cookies in order to proceed to the website. There was no option to close the pop-up or decline the cookies.

The central content in task C was the cookie policy text inside the pop-up. Most of the participant didn't read the text. Participants recognized that the pop-up was about cookie policy and noticed their only option was to accept the cookies. Only one participant read

the whole text inside the pop-up. One other participant read about the cookie policy after the researcher asked him about his interest on the cookie policy. He had already agreed on the cookies and started to browse the website but after the question he opened a tab about the cookie policy and started reading it. He found out that there was a possibility to manage cookie preferences.

For most of the participants accepting the cookies without reading them was standard behaviour. Therefore, forced action dark pattern didn't affect the apparent product character of the website. Participants commented that they accept the cookies because they are too lazy to read them, they have a need to enter the website or they just feel like they have no other choice. One participant explained that because the coercion to accept cookie policies is so universal it doesn't trigger emotional or behavioural consequences. However, other participant made a point that usually there is an option to accept only some part of the cookies. "And here is only one option which is a bit weird", she commented. Despite this she accepted the cookies and entered the website.

In one participant the website evoked suspicion. After reading the cookie policy text she commented:

> *"I don't know what I am accepting myself into…I can't access their website if I don't select agree and enter which I think is suspicious."*

Unclear cookie policy text and coercion to accept the cookies aroused the participant's suspicion. She noted that there was no close button or link to additional information of the cookie policy. The reason behind these feelings was that the website was unknown for her. She explained that if the website is unknow for her and there is no option to decline the cookies she doesn't want to enter the website. The only situation where she would accept the cookies would be if she had a necessary need to access the website. As a result of the participant's feelings she refused to accept the cookies and didn't enter the website.

7 Discussion and conclusions

This chapter starts with discussion that presents interpretations of the results and connects them to previous research. Discussion is followed by conclusions that summarize the findings of the research. Finally, limitations of the research and implications for theory and practice will be discussed.

7.1 Discussion

The purpose of this research was to examine how dark patterns affect user experience. Previous research has shown that dark patterns evoke feelings and influence users' perceptions of products (Maier & Harr 2020). In this research a user experience model was used to clarify the effects of dark patterns trough different user experience elements. The results of this research strongly support previous research. It was show that dark patterns have negative effects on user experience but the effects vary a lot depending on the dark pattern strategy and type. However, there are also common factors that explain the effects.

This research supports the Hassenzahl et al.'s (2010) consideration of pragmatic qualities as hygiene factors as the negative feelings of participants were mostly related to pragmatic attributes such as "confusing" and "difficult". This finding shows that dark patterns affect the pragmatic quality of a product. Tuch & Hornbæk (2015) presented that psychological cause for negative feelings is lack of need fulfilment and especially lack of autonomy is related to negative user experiences. The results of this research support this finding. The effects in task A were largely due to the fact that users were not able to reach their goal of finding the information on how to cancel the subscription. Hence the website restricted users' autonomy which caused negative user experience. Also, the forced action dark pattern example showed for one participant that if user feels her autonomy is restricted it causes negative consequences.

Gray et al. (2021) described that nagging dark pattern creates negative consequences over time. The results of this research are aligned with this finding as nagging caused annoyance when it occurred repeatedly during one usage situation and multiple situations. Participants' felt annoyance is also in line with results from previous studies. For example, in the research of Maier & Harr (2020) the interviewees considered nagging to be always annoying. Perception that was not found in previous research was that the

nagging behaviour made the website feel confusing. This may be partly due to that nagging examples in most studies are encountered over multiple usage situations. In such case the nagging pattern is very small part of the interaction and doesn't necessarily affect the feeling of autonomy. In the case of task A in this research nagging appeared repeatedly during one usage situation, making it a significant part of the interaction. Therefore, it had a greater impact on the need fulfilment of participants. On the other hand, the fact that the website used roach motel and hidden information dark patterns also affected the apparent product character. Therefore, it is hard to tell whether this kind of nagging pattern would affect the apparent product character alone.

In the user studies of this research the obstruction strategy had the most impact on user experience. It influenced the apparent product character of the website and caused strong emotional and behavioural consequences. Participants felt annoyed and frustrated and some participants criticized the appealigness of the website. This finding confirms result from Bhoot et al.'s (2020) research that roach motel dark pattern causes more frustration the less appealing the website is evaluated. Maier & Harr (2020) presented that people would stop using a product because of excessive frustration. Participants in this research also told that they would not use the service again because they were so frustrated and annoyed by the obstruction strategy. The strong impact of obstruction strategy could be partly due to the fact that the website used three different dark patterns in which case the combined effect was greater than of a single dark pattern. Therefore, it can be argued that dark patterns have greater impact on user experience when several dark patterns occur together.

The results of sneaking dark pattern strategy in this research are not completely in line with previous research. Maier & Harr (2020) presented that people consider sneaking dark pattern as not acceptable and it affects the perception of the website. In this research the hidden costs dark pattern didn't affect the apparent product character and there were no consequences. This was largely due to the small amount of the hidden cost. For example, in the research of Maeir & Harr (2020) it was mentioned that a hidden fee of "50 bucks" is not acceptable. Therefore, it can be reasoned that a hidden cost needs to be more significant compared to the total cost of purchase than it was in this research. Also, the lack of negative feelings in this task suggests that participants didn't feel their autonomy was interfered by the sneaking dark pattern.

Previous research has presented that users are highly capable to detect dark patterns (Bongard-Blanchy et al. 2021). The interface interference dark pattern examples in this research supported this finding as participants detected both information hiding and confusing language of trick questions. It has been suggested that visibility decreases the influence of dark patterns and thus users would be more likely to accept dark patterns if they can detect them (Maier & Harr 2020). This research suggests that the visibility decreases the effect if by detecting the dark pattern users are able to act in a desirable way and thus avoid unpleasant consequences. In other words, visibility of dark patterns increases the feeling of autonomy. In task E where participants detected the trick questions dark pattern they were able to choose options that avoided unpleasant consequences. In the case of hidden information dark pattern participants detected that the website was hiding information but there was nothing they could do about it. Hence the hidden information was perceived to be annoying and frustrating.

Gray et al. (2021) suggested that forced action dark pattern in privacy context gets users worried about their privacy and they would prefer to use an alternative website. In this research the forced action dark pattern raised suspicious in only one participant. This may be due to differences in personal expectations and standards. Previous research also highlights the influence of individual differences (Maier & Harr 2020). It can be assumed that the participant who was influenced by the forced action dark pattern had a different standard for the feeling of autonomy because she wished she had an option to decline the cookies. The forced action example in this research also showed that coercion to accept cookie policies is so common for many users that it doesn't evoke feelings. It can be reasoned that the prevalence of dark patterns can modify users' expectations and standards as frequent exposing to dark patterns gets users used to them and thus decreases the effects on user experience. Maier & Harr (2020) presented similar finding in their research. For example, coercion to accept cookies and hidden cost in food ordering application are encountered often in daily life which can explain why these dark patterns didn't effect the user experience. Difficulties in cancelling of subscription in turn doesn't presumably happen daily so that may explain why users are not so used to it and it has greater influence on user experience.

Maier & Harr (2020) presented that the individual differences on users' acceptability of dark patterns also depends on how much they value the benefits of a product compared to the disadvantages. The results of this research support this finding. In the forced action

dark pattern context it was shown that most of the participants didn't see the coercion to accept cookies as a significant disadvantage as they were ready to accept the cookies without even reading them. In task B users valued ordering food that much that the hidden cost didn't have any influence. Task D showed that if a user has a specific need for the usage of the application the harm caused by the nagging dark pattern is not enough for a user to stop using the application.

7.2 Conclusions

This research was conducted to study the influence of dark patterns on user experience. The research question of this research was "How dark patterns affect user experience?". Previous research has studied end users' perspective on dark patterns but no user experience model has been used to examine the effects on end users'. This research presents that Hassenzahl's (2003) user experience model can be used to examine the influence of dark patterns on user experience. The empirical data of this research was collected by think-aloud user studies.

The user studies in this research included dark patterns from each of Gray et al.'s (2018) dark pattern strategy category. The results showed that the effects vary significantly between dark pattern strategies and types. However, common for all effects was that they were negative. Nagging caused annoyance in all participants as it repeatedly interrupted participants' activities. Roach motel and hidden information made users feel annoyed and frustrated because they made the task significantly more difficult. All of these dark patterns appeared on a same website and the strong effects indicated that the combined effect of multiple dark patterns is greater than the effect of a single dark pattern.

A central finding from this research was that dark patterns affect the pragmatic quality of a product. Pragmatic attributes "confusing" and "difficult" were the most used attributes to describe participants' perceptions of websites that affected user experience. This finding also supports the consideration of pragmatic quality as hygiene factor which means that poor pragmatic quality can lead to negative user experience. In this research especially lack of autonomy was a source for the negative feelings of participants.

Part of the dark patterns didn't have effect on the user experience. Trick questions and hidden costs dark patterns didn't affect the user experience because participants' autonomy was not restricted. Forced action dark pattern was neutral for most of the

participants as they were so used to it. This research suggests that users' expectations and standards can be modified by dark patterns if users are exposed to them frequently. The more accustomed users are to dark patterns the more neutral users perceive them to be. However, individual differences of users make it difficult to generalize how users perceive dark patterns.

7.3 Limitations and conclusions for theory and practice

A few limitations should be considered when evaluating the results and findings of this research. Tuch & Hornbæk (2015) have presented that examining user experience when users perform predefined tasks is problematic because the user experience might not be as authentic as it would be without the research situation. This limitation applies to this research as the think-aloud user studies included predefined tasks.

It should also be noted that the used think-aloud technique in this research brought up effects on user experience that occurred during the interaction. Hence later effects could not be examined using this method. For example, if users would not have detected the trick questions dark pattern in task E and as a result would have received spam emails, the consequences of this could not have been detected in this research. Also, it is not possible to know whether forced action dark pattern will later cause consequences due to the acceptance of cookies.

In addition, the sample of this research sets some limitations on the generalizability of the results. As all the participants were aged between 24 and 27 the results can only be generalized to young adults. With older users the results could be very different. Other background factors were not collected from participants in this research but it is possible that they affect the results.

As an implication for theory this research provided a theoretical basis for the effects of dark patterns on user experience. However, future research should be conducted to get more wider understanding of the effects. Based on the findings of this research future research can be conducted with different methodology and perspective. Future research could use another methodology to examine longer-term effects on user experience or what the effects would be without the predefined tasks. It would also be meaningful to study whether dark patterns have effects on hedonic quality of user experience.

Understanding the effects of dark patterns on user experience provides useful insights also for user experience designers and other practitioners. Online service providers that use or think of using dark patterns can consider based on these results whether it is worth it to use dark patterns. For example, if a company wants to provide positive user experience the effects of dark patterns should be considered as the results of this research show that dark patterns can affect user experience negatively. This research also raises users' awareness on dark patterns and their effects.

References

Alsawaier, R. S. (2018) The effect of gamification on motivation and engagement. The International Journal of Information and Learning Technology, Vol. 35 (1), 56-79.

Arkes, H. R. & Ayton, P. (1999) The sunk cost and Concorde effects: Are humans less rational than lower animals? Psychological Bulletin, Vol. 125(5), 591–600.

Bargas-Avila, J. & Hornbæk, K. (2011) Old wine in new bottles or novel challenges: a critical analysis of empirical studies of user experience. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, p. 2689–2698.

Baxter, Courage, C. & Caine, K. (2015) Understanding your users: a practical guide to user research methods (Second edition.). Morgan Kaufmann.

Berni, A. & Borgianni, Y. (2021) From the definition of user experience to a framework to classify its applications in design. Proceedings of the Design Society, p. 1627-1636.

Berthon, P., Pitt, L. & Campbell, C. (2019) Addictive de-vices: A public policy analysis of sources and solutions to digital addiction. Journal of Public Policy & Marketing, Vol. 38(4), 451-468.

Bevan, N. (2009) Extending Quality in Use to Provide a Framework for Usability Measurement. In: Kurosu, M. (eds) Human Centered Design. HCD 2009. Lecture Notes in Computer Science, Vol. 5619, 13-22.

Bhoot A., Shinde M., and Mishra W. (2020) Towards the Identification of Dark Patterns: An Analysis Based on End-User Reactions. Proceedings of the 11th Indian Conference on Human-Computer Interaction. Association for Computing Machinery, New York. p. 24–33.

Bongard-Blanchy, K., Rossi, A., Rivas, S., Doublet, S., Koenig, V., & Lenzini, G. (2021) ”I am Definitely Manipulated, Even When I am Aware of it. It’s Ridiculous!”-Dark Patterns from the End-User Perspective. ACM DIS Conference on Designing Interactive Systems 2021 (pp. 763-776).

Brignull, H. (2022) Deceptive design. <https://www.deceptive.design>, retrieved 22.4.2022.

Brignull, H. (2013) Dark Patterns: inside the interfaces designed to trick you. <https://www.theverge.com/2013/8/29/4640308/dark-patterns-inside-the-interfaces-designed-to-trick-you>, retrieved 3.6.2022.

Brignull, H. (2011) Dark Patterns: Deception vs. Honesty in UI Design. <https://alistapart.com/article/dark-patterns-deception-vs-honesty-in-ui-design/>, retrieved 4.5.2022.

Brignull, H. (2010) Dark Patterns: User Interfaces Designed to Trick People. UX Brighton 2010.

Budiu R. (2014) Memory Recognition and Recall in User Interfaces, <https://www.nngroup.com/articles/recognition-and-recall/>, retrieved 3.6.2022.

Bösch, C., Erb, B., Kargl, F., Kopp, H. & Pfattheicher, S. (2016) Tales from the Dark Side: Privacy Dark Strategies and Privacy Dark Patterns. Proceedings on Privacy Enhancing Technologies, 2016(4), 237-254.

Cambridge Dictionary (2022) Autonomy. <https://dictionary.cambridge.org/dictionary/english/autonomy>, retrieved 9.5.2022.

Carroll, J. M. (1997) Human–computer interaction: Psychology as a science of design. International journal of human-computer studies, Vol. 46(4), 501-522.

Conti, G., & Sobiesk, E. (2010) Malicious interface design: exploiting the user. In Proceedings of the 19th international conference on World wide web. (pp. 271-280).

Cooke, L. (2010) Assessing Concurrent Think-Aloud Protocol as a Usability Test Method: A Technical Communication Approach. IEEE Transactions on Professional Communication, Vol. 53 (3), 202-215.

Day, G., & Stemler, A. (2020) Are dark patterns anticompetitive? Alabama Law Review, Vol. 72(1), 1-46.

Di Geronimo, L., Braz, L., Fregnan, E., Palomba, F. & Bacchelli, A. (2020) UI dark patterns and where to find them: a study on mobile applications and user perception. In Proceedings of the 2020 CHI conference on human factors in computing systems (pp. 1-14).

Eason K. D. (1984) Towards the experimental study of usability. Behaviour & Information Technology, Vol. 3(2), 133-143.

Ericsson, K. A., & Simon, H. A. (1980) Verbal reports as data. Psychological review, Vol. 87(3), 215.

Eriksson, P., & Kovalainen, A. (2008) Qualitative methods in business research. SAGE Publications Ltd.

Eveland Jr, W. P., & Dunwoody, S. (2000) Examining information processing on the World Wide Web using think aloud protocols. Media Psychology, Vol. 2(3), 219-244.

Fogg, B.J. (2022) Fogg Behavior Model. <https://behaviormodel.org/>, retrieved 23.5.2022.

Fogg, B.J. (2009) A behavior model for persuasive design. In Proceedings of the 4th International Conference on Persuasive Technology (Persuasive '09). Association for Computing Machinery, New York, NY, USA, Article 40, 1–7

Fogg, B.J. (2003) Persuasive technology: using computers to change what we think and do. Morgan Kaufmann Publishers.

Fonteyn, M. E., Kuipers, B. & Grobe, S. J. (1993) A description of think aloud method and protocol analysis. Qualitative health research, Vol. 3(4), 430-441.

Forlizzi, J., & Battarbee, K. (2004) Understanding experience in interactive systems. In Proceedings of the 5th conference on Designing interactive systems: processes, practices, methods, and techniques (pp. 261-268).

Garrett, J. J. (2010) Elements of user experience, the: user-centered design for the web and beyond. Pearson Education.

Gray C., Chen J., Chivukula S., & Qu L. (2021) End User Accounts of Dark Patterns as Felt Manipulation. Proceedings of ACM Hum.-Comput. Interact. 5, CSCW2, Article 372.

Gray C., Kou Y., Battles B., Hoggatt J. & Toombs A. (2018) The Dark (Patterns) Side of UX Design. Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems.

Hansen, P. (2016) The Definition of Nudge and Libertarian Paternalism: Does the Hand Fit the Glove? European Journal of Risk Regulation, Vol. 7(1), 155-174.

Hassenzahl M., Diefenbach S. & Göritz A. (2010) Needs, affect, and interactive products – Facets of user experience. Interacting with Computers, Vol. 22(5), 353–362.

Hassenzahl, M. (2008) User experience (UX) towards an experiential perspective on product quality. In Proceedings of the 20th Conference on l'Interaction Homme-Machine (pp. 11-15).

Hassenzahl M. & Tractinsky N. (2006) User experience - a research agenda. Behaviour & Information Technology, Vol. 25(2), 91-97.

Hassenzahl, M. (2004) The interplay of beauty, goodness, and usability in interactive products. Human–Computer Interaction, Vol. 19(4), 319-349.

Hassenzahl, M. (2003) The Thing and I: Understanding the Relationship Between User and Product. In Funology. Springer Netherlands, pp. 31–42.

Hassenzahl, M., Kekez, R. & Burmester, M. (2002) The importance of a software's pragmatic quality depends on usage modes. In Proceedings of the 6th international conference on Work With Display Units (WWDU 2002) (pp. 275-276).

International Organization for Standardization (2019) ISO 9241-210 Ergonomics of Human–System Interaction – Part 210: Human-centred Design for Interactive Systems.

Jimenez C., Lozada P. & Rosas P. (2016) Usability heuristics: A systematic review. IEEE 11th Colombian Computing Conference (CCC), pp. 1-8.

Johnson, E.J., Bellman, S. & Lohse, G.L. (2002) Defaults, Framing and Privacy: Why Opting In-Opting Out. Marketing Letters. Vol. 13, 5–15.

Jones, J.G. & Simons, H.W. (2017) Persuasion in Society (3rd ed.). Routledge.

Jones, J. A. (1989) The verbal protocol: a research technique for nursing. Journal of Advanced Nursing, Vol. 14(12), 1062–1070.

Juhila, K. (2022) Koodaaminen. In Laadullisen tutkimuksen verkkokäsikirja. Yhteiskuntatieteellinen tietoarkisto. Tampere. <https://www.fsd.tuni.fi/fi/palvelut/menetelmaopetus/kvali/analyysitavan-valinta-ja-yleiset-analyysitavat/koodaaminen/>, retrieved 5.9.2022.

Kahneman D. (2012) Thinking, Fast and Slow. Penguin Books.

Kahneman, D. & Tversky, A. (1984) Choices, values, and frames. American Psychologist. Vol. 39(4).

Kallio, A. (2022) Litterointi. In Laadullisen tutkimuksen verkkokäsikirja. Yhteiskuntatieteellinen tietoarkisto. Tampere. <https://www.fsd.tuni.fi/fi/palvelut/menetelmaopetus/kvali/laadullisen-tutkimuksen-prosessi/litterointi/>, retrieved 1.9.2022.

Kaufman, G. & Flanagan, M. (2015) A psychologically "embedded" approach to designing games for prosocial causes. Cyberpsychology: Journal of Psychosocial Research on Cyberspace, Vol. 9(3), Article 5.

Kujala, S. & Miron-Shatz, T. (2015) The evolving role of expectations in long-term user experience. In Proceedings of the 19th International Academic Mindtrek Conference (pp. 167-174).

Kuusela, H., & Paul, P. (2000) A Comparison of Concurrent and Retrospective Verbal Protocol Analysis. The American Journal of Psychology, Vol. 113(3), 387–404.

Law, E. L. C., Van Schaik, P. & Roto, V. (2014) Attitudes towards user experience (UX) measurement. International Journal of Human-Computer Studies, Vol. 72(6), 526-541.

Law, E. & van Schaik, P. (2010) Modelling user experience – An agenda for research and practice, Interacting with Computers, Vol. 22(5), 313–322.

Lincoln, Y. S. & Guba, E. G. (1985) Naturalistic inquiry. Sage.

Lockton D., Harrison D., Holley T. & Stanton N. (2009) Influencing interaction: development of the design with intent method. In Proceedings of the 4th International Conference on Persuasive Technology. Association for Computing Machinery, New York, USA. Article 5.

Lundgrén-Laine H & Salanterä S. (2010) Think-Aloud Technique and Protocol Analysis in Clinical Decision-Making Research. Qualitative Health Research, Vol. 20(4), 565-575.

Maier, M. & Harr, R. (2020) Dark Design Patterns: An End-User Perspective. Human Technology, Vol. 16(2), 170-199.

Mandryk, R. L. & Atkins, M. S. (2007) A fuzzy physiological approach for continuously modeling emotion during interaction with play technologies. International journal of human-computer studies, Vol. 65(4), 329-347.

Mathur, A., Acar, G., Friedman, M. J., Lucherini, E., Mayer, J., Chetty, M. & Narayanan, A. (2019) Dark patterns at scale: Findings from a crawl of 11K shopping websites. Proceedings of the ACM on Human-Computer Interaction, Vol. 3(CSCW), (pp. 1-32).

McDonald, S., Zhao, T. & Edwards, H. M. (2016) Look who's talking: Evaluating the utility of interventions during an interactive think-aloud. Interacting with computers, Vol. 28(3), 387-403.

Meske, C. & Amojo, I. (2020) Status Quo, Critical Reflection, and the Road Ahead of Digital Nudging in Information Systems Research: A Discussion with Markus Weinmann and Alexey Voinov. Communications of the Association for Information Systems. Vol 46(1), 402-420.

Mittone, L. & Savadori, L. (2009) The scarcity bias. Applied Psychology, Vol. 58(3), 453-468.

Nielsen, J. (1994) 10 Usability Heuristics for User Interface Design. <https://www.nngroup.com/articles/ten-usability-heuristics/>, retrieved 3.6.2022.

Nouwens, M., Liccardi, I., Veale, M., Karger, D. & Kagal, L. (2020) Dark patterns after the GDPR: Scraping consent pop-ups and demonstrating their influence. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (pp. 1-13).

Oinas-Kukkonen, H. & Harjumaa, M. (2009) Persuasive Systems Design: Key Issues, Process Model, and System Features. Communications of the Association for Information Systems: Vol 24(1), 485-500.

Oinas-Kukkonen H. & Harjumaa, M. (2008) Towards Deeper Understanding of Persuasion in Software and Information Systems. First International Conference on Advances in Computer-Human Interaction. (pp. 200-205).

Olmsted-Hawala, E. & Bergstrom, J. R. (2012) Think-aloud protocols: Does age make a difference. Proceedings of Society for Technical Communication (STC) Summit, Chicago, IL.

Olmsted-Hawala, E. L., Murphy, E. D., Hawala, S. & Ashenfelter, K. T. (2010) Think-aloud protocols: a comparison of three think-aloud protocols for use in testing data-dissemination web sites for usability. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 2381-2390).

Onwuegbuzie, A. J. & Leech, N. L. (2007) Validity and qualitative research: An oxymoron? Quality & quantity. Vol. 41(2), 233-249.

Pettersson, I., Lachner, F., Frison, A. K., Riener, A. & Butz, A. (2018) A Bermuda triangle? A Review of method application and triangulation in user experience evaluation. In Proceedings of the 2018 CHI conference on human factors in computing systems (pp. 1-16).

Pew Research Center. (2021) Share of adults in the United States who use the internet in 2021, by age group. <https://www.statista.com/statistics/266587/percentage-of-internet-users-by-age-groups-in-the-us/>, retrieved 16.8.2022.

Philips, M. (2018) Know Your User – UX Statistics and Insights (with Infographic). Toptal. <https://www.toptal.com/designers/ux/ux-statistics-insights-infographic>, retrieved 6.10.2022.

Pike, M. F., Maior, H. A., Porcheron, M., Sharples, S. C. & Wilson, M. L. (2014) Measuring the effect of think aloud protocols on workload using fNIRS. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 3807-3816).

Puusa, Juuti, P., & Aaltio, I. (2020) Laadullisen tutkimuksen näkökulmat ja menetelmät. Gaudeamus.

Roto, V., Law, E., Vermeeren, A. & Hoonhout, J. (2011) User experience white paper - bringing clarity to the concept of user experience. Result from Dagstuhl seminar on demarcating user experience, September 15-18, 2010.

Ryan R. & Deci E. (2000) Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist. Vol. 55(1), 68-78.

Schneider, C., Weinmann, M. & Vom Brocke, J. (2018) Digital nudging: guiding online user choices through interface design. Communications of the ACM. Vol. 61(7), 67-73.

Simon, H.A. (2000) Bounded rationality in social science: Today and tomorrow. Mind & Society. Vol 1(1), 25–39.

Stanovich K. & West R. (2000) Individual differences in reasoning: Implications for the rationality debate? Behavioral and Brain Sciences. Vol. 23(5), 645-665.

Susser D., Roessler B. & Nissenbaum H. F. (2019) Online Manipulation: Hidden Influences in a Digital World. 4 Georgetown Law Technology Review 1.

Swallow, D., Blythe, M. & Wright, P. (2005) Grounding experience: relating theory and method to evaluate the user experience of smartphones. In ACM International Conference Proceeding Series Vol. 132, 91-98.

Tolvanen, P. (2022) Mitä ovat ”dark patternit” – ja miksi niitä käytetään? Vierityspalkki.fi. <https://vierityspalkki.fi/2022/03/23/mita-ovat-dark-patternit-ja-miksi-niita-kaytetaan/ >, retrieved 6.10.2022.

Tuch, A. N. & Hornbæk, K. (2015) Does Herzberg's notion of hygienes and motivators apply to user experience? ACM Transactions on Computer-Human Interaction (TOCHI), Vol. 22(4), 1–24.

Tuomi, J. & Sarajärvi, A. (2018) Laadullinen tutkimus ja sisällönanalyysi. Tammi.

Tversky, A. & Kahneman, D. (1974) Judgment under Uncertainty: Heuristics and Biases: Biases in judgments reveal some heuristics of thinking under uncertainty. Science. Vol. 185(4157), 1124-1131.

van den Haak, M., De Jong, M. & Schellens, P. J. (2003) Retrospective vs. concurrent think-aloud protocols: Testing the usability of an online library catalogue, Behaviour & Information Technology, Vol. 22(5), 339-351.

van Schaik, P. & Ling J. (2008) Modelling user experience with web sites: Usability, hedonic value, beauty and goodness, Interacting with Computers. Vol. 20(3), 419–432.

Vermeeren, A. P., Law, E. L. C., Roto, V., Obrist, M., Hoonhout, J. & Väänänen-Vainio-Mattila, K. (2010) User experience evaluation methods: current state and development needs. In Proceedings of the 6th Nordic conference on human-computer interaction: Extending boundaries (pp. 521-530).

Weinmann, M., Schneider, C. & Brocke, J.v. (2016) Digital Nudging. Bus Inf Syst Eng Vol. 58, 433–436.

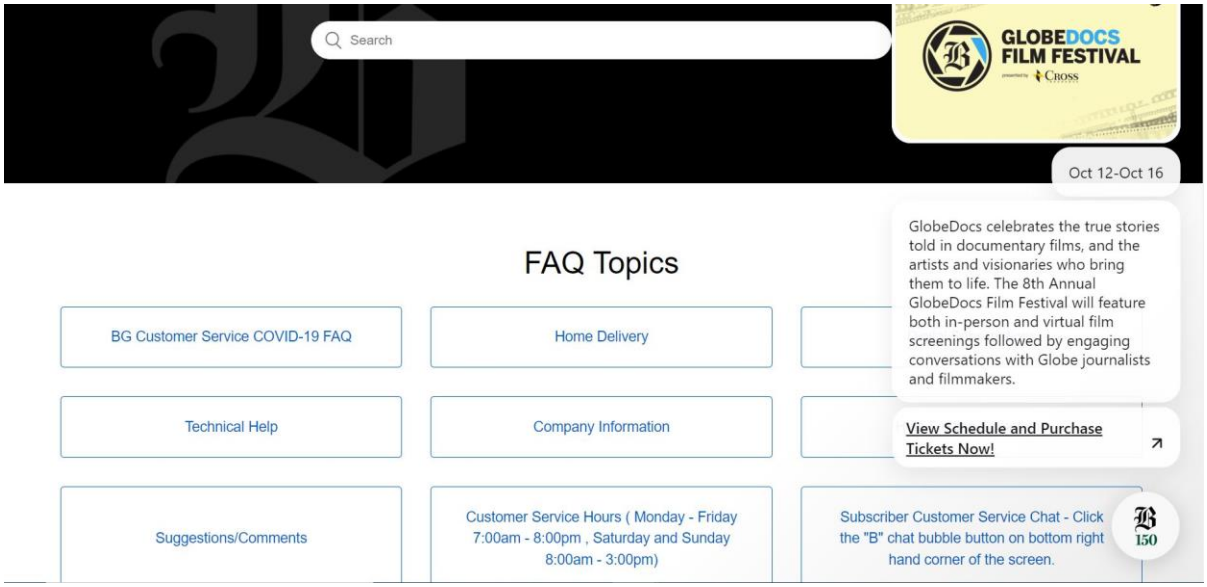
Wilson, G. M. & Angela Sasse, M. (2004) From doing to being: getting closer to the user experience. Interacting with Computers, Vol. 16(4), 697-705.

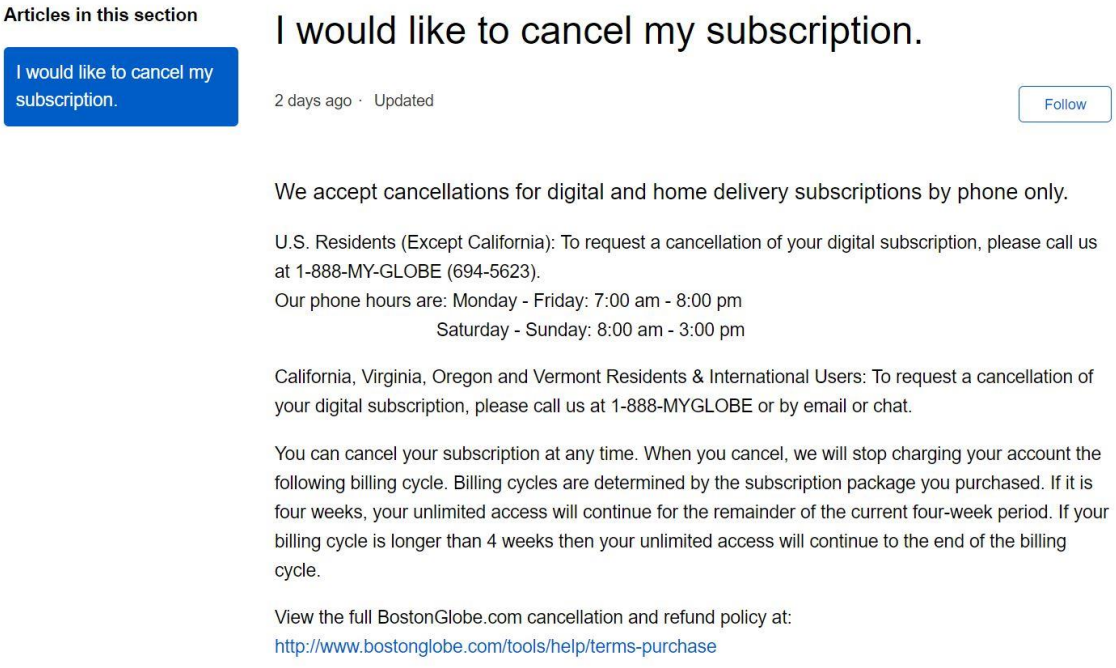
Wright, R. B. & Converse, S. A. (1992) Method bias and concurrent verbal protocol in software usability testing. In Proceedings of the Human Factors Society Annual Meeting. Vol. 36(16), 1220-1224.

Zagal, J. P., Björk, S. & Lewis, C. (2013) Dark Patterns in the Design of Games. Presented at the Foundations of Digital Games 2013.

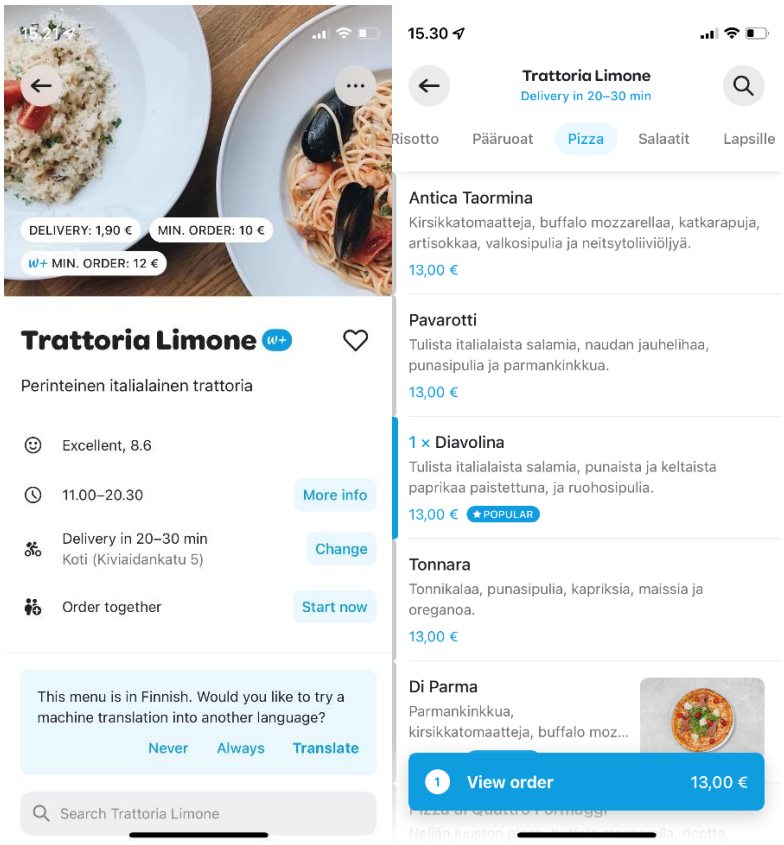
Appendices

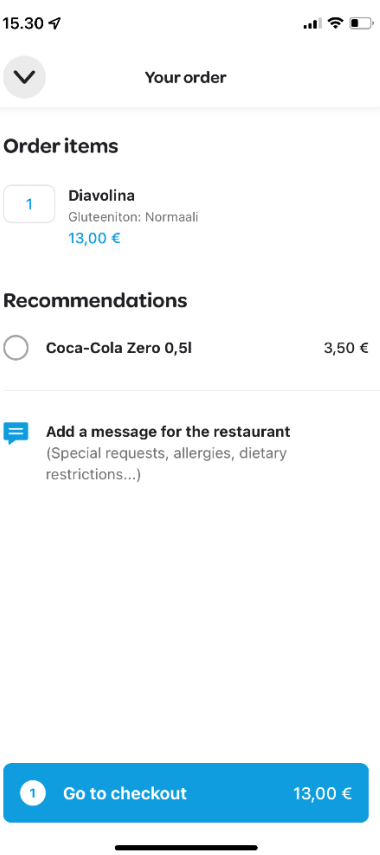
Appendix 1 User study task A

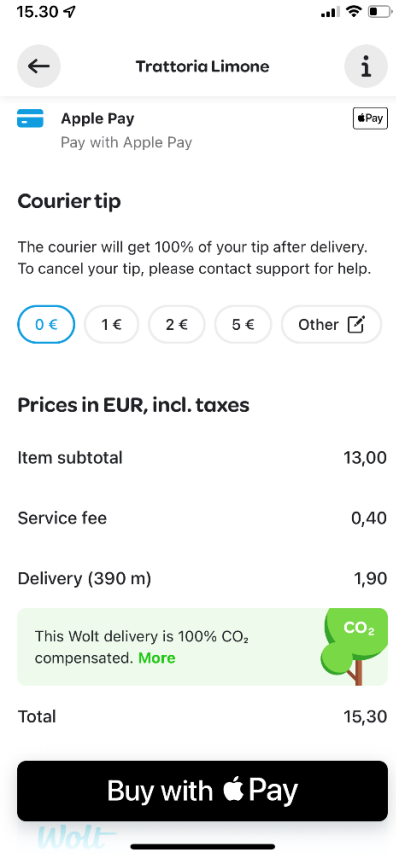




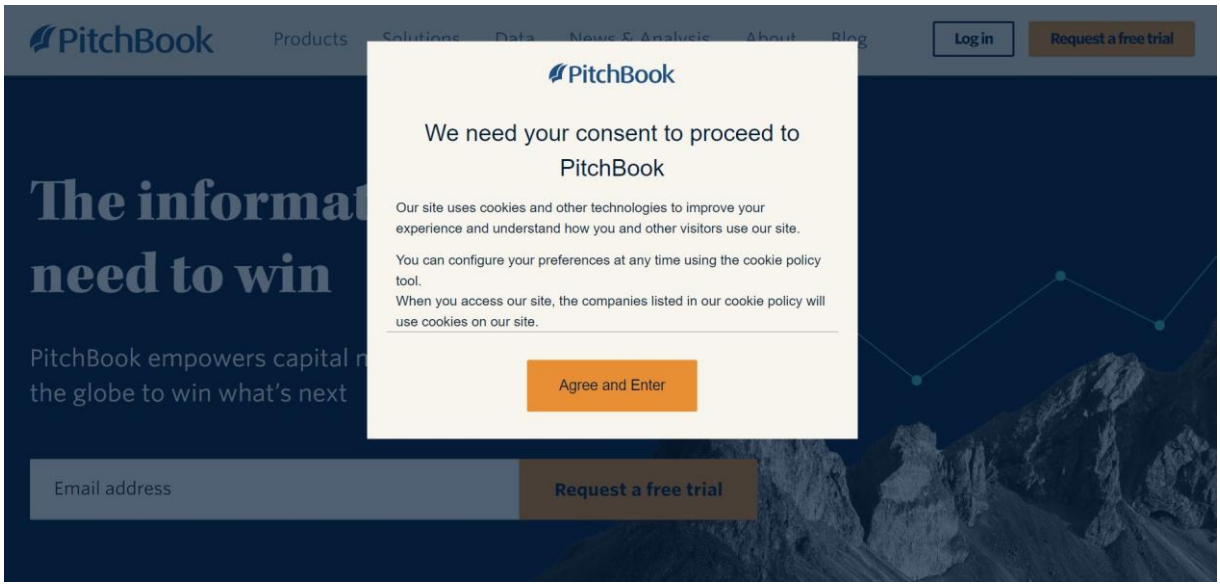
Appendix 2 User study task B



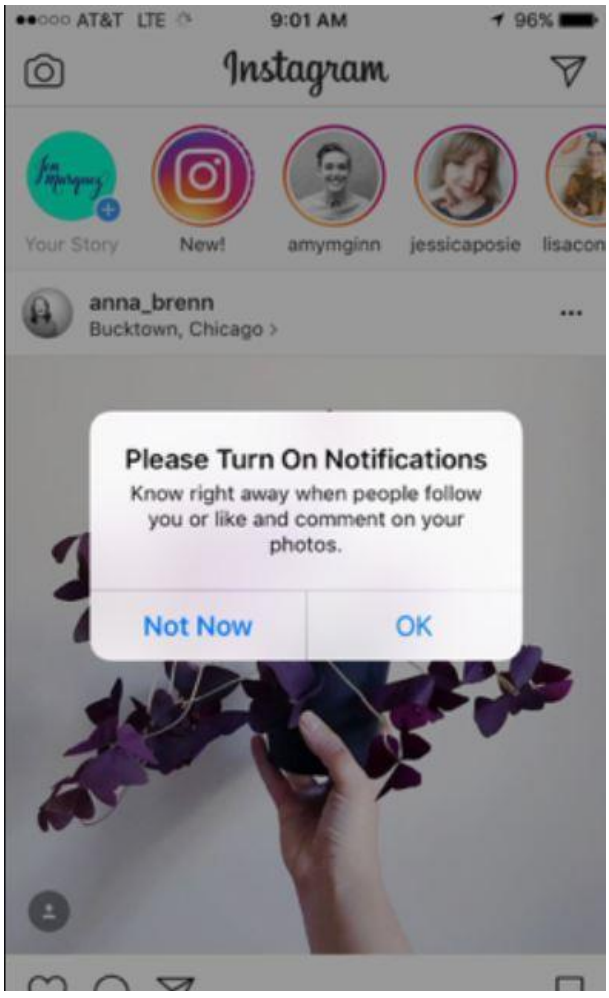




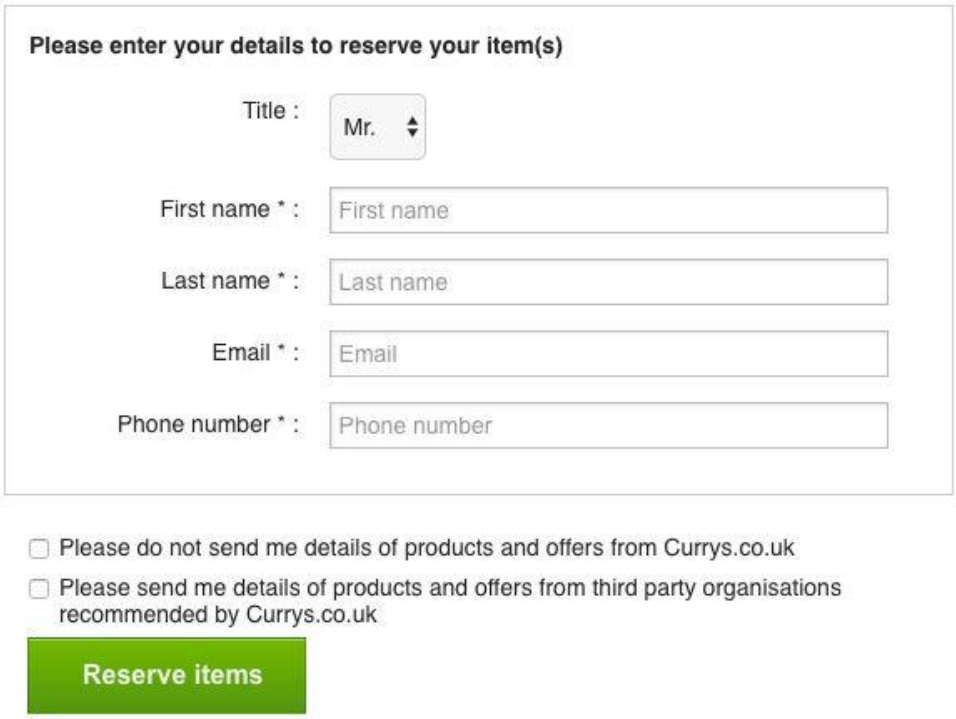
Appendix 3 User study task C



Appendix 4 User study task D



Appendix 5 User study task E



Appendix 6 Research data management plan

Research data management plan for students

This document will help you plan how to manage your research data. More detailed instructions for each section are available online in the Research Data Management Guide for Students.

1. Research data

Research data refers to all the material with which the analysis and results of the research can be verified and reproduced. It may be, for example, various measurement results, data from surveys or interviews, recordings or videos, notes, software, source codes, biological samples, text samples, or collection data.

In the table below, list all the research data you use in your research. Note that the data may consist of several different types of data, so please remember to list all the different data types. List both digital and physical research data.

Research data type	Contains personal details/information*	I will gather/produce the data myself	Someone else has gathered/produced the data	Other notes
User study recording		x		
Picture samples			x	

* Personal details/information are all information based on which a person can be identified directly or indirectly, for example by connecting a specific piece of data to another, which makes identification possible. For more information about what data is considered personal go to the Office of the Finnish Data Protection Ombudsman's website

2. Processing personal data in research

If your data contains personal details/information, you are obliged to comply with the EU's General Data Protection Regulation (GDPR) and the Finnish Data Protection Act. For data that contains personal details, you must prepare a Data Protection Notice for your research participants and determine who is the controller for the research data.

I will prepare a Data Protection Notice** and give it to the research participants before collecting data ☐

The controller** for the personal details is the student themself ☐ the university ☐

My data does not contain any personal data ☒

** More information at the university's intranet page, Data Protection Guideline for Thesis Research

3. Permissions and rights related to the use of data

Find out what permissions and rights are involved in the use of the data. Consult your thesis supervisor, if necessary. Describe the use permissions and rights for each data type. You can add more data types to the list, if necessary.

3.1. Self-collected data

You may need separate permissions to use the data you collect or produce, both in research and in publishing the results. If you are archiving your data, remember to ask the research participants for the necessary permissions for archiving and further use of the data. Also, find out if the repository/archive you have selected requires written permissions from the participants.

Necessary permissions and how they are acquired

Data type 1: Recordings

- I will ask permission from the participants to use collected data

3.2 Data collected by someone else

Do you have the necessary permissions to use the data in your research and to publish the results? Are there copyright or licencing issues involved in the use of the data? Note, for example, that you may need permission to use the images or graphs you have found in publications.

Rights and licences related to the data

Data type 2: Picture samples

- No copyright issues, pictures are allowed to be used if cited properly

4. Storing the data during the research process

Where will you store your data during the research process?

In the university's network drive ☐
In the university-provided Seafile Cloud Service ☐
Other location, please specify: ☒ Personal OneDrive

The university's data storage services will take care of data security and backup files automatically. If you choose to store your data somewhere other than in the services provided by the university, please specify how you will ensure data security and file backups. Remember to make sure you know every time where you are saving the edited/modified data.

If you are using a smartphone to record anything, please check in advance where the audio or video will be saved. If you are using commercial cloud services (iCloud, Dropbox, Google Drive, etc.) and your data contains personal data, make sure the information you provide in the Data

Protection Notice about data migration matches your device settings. The use of commercial cloud services means the data will be transferred to third countries outside the EU.

5. Documenting the data and metadata

How would you describe your research data so that even an outsider or a person unfamiliar with it will understand what the data is? How would you help yourself recall years later what your data consists of?

5.1 Data documentation

Can you describe what has happened to your research data during the research process? Data documentation is essential when you try to track any changes made to the data.

To document the data, I will use:

A field/research journal ☐
A separate document where I will record the main points of the data, such as changes made, phases of analysis, and significance of variables ☒
A readme file linked to the data that describes the main points of the data ☐
Other, please specify: ☐

5.2 Data arrangement and integrity

How will you keep your data in order and intact, as well as prevent any accidental changes to it?

I will keep the original data files separate from the data I am using in the research process, so that I can always revert back to the original, if need be. ☒

Version control: I will plan before starting the research how I will name the different data versions and I will adhere to the plan consistently. ☒

I recognise the life span of the data from the beginning of the research and am already prepared for situations, where the data can alter unnoticed, for example while recording, transcribing, downloading, or in data conversions from one file format to another, etc. ☒

5.3 Metadata

Metadata is a description of you research data. Based on metadata someone unfamiliar with your data will understand what it consists of. Metadata should include, among others, the file name, location, file size, and information about the producer of the data. Will you require metadata?

I will save my data into an archive or a repository that will take care of the metadata for me. ☐

I will have to create the metadata myself, because the archive/repository where I am uploading the data requires it. ☐

I will not store my data into a public archive/repository, and therefore I will not need to create any metadata. ☒

6. Data after completing the research

You are responsible for the data even after the research process has ended. Make sure you will handle the data according to the agreements you have made. The university recommends a general retention period of five (5) years, with an exception for medical research data, where the retention period is 15 years. Personal data can only be stored as long as it is necessary. If you have agreed to destroy the data after a set time period, you are responsible for destroying the data, even if you no longer are a student at the university. Likewise, when using the university's online storage services, destroying the data is your responsibility.

What happens to your research data, when the research is completed?

I will destroy all data immediately after completion, because I don't need it after completing the research.