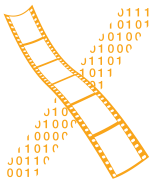

Chair for Computer Science 10 (Media Computing and Human-Computer Interaction)

RWTH AACHEN UNIVERSITY

Exploring the Effect of Bright Patterns on Dark Pattern Perception

Master's Thesis
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Abstract

Dark Patterns are manipulative design elements intended to deceive or coerce users into actions that benefit the website or application, often at the expense of the user's best interests. These patterns have become increasingly prevalent across the internet. There exist multiple attempts to counter Dark Patterns, for example by making users aware of their existence or taking legal action against their usage. Another approach are Bright Patterns, which manipulate users into choosing user-friendly options. The effects of Bright Patterns are not well known yet, and since users may encounter Dark Patterns frequently on websites, we investigated the following research question: *How do websites using Bright Patterns influence users, when these websites are in the minority?* In order to answer this question, a study was conducted in which 15 participants visited ten websites, nine of which contained Dark Patterns and one contained Bright Patterns. After that, a semi-structured interview was held. Interactions with the websites, questionnaire and interview data were analysed. A thematic analysis of the interviews revealed, that the website using Bright Patterns did not stand out to the majority of participants in hindsight. However, the results of the questionnaire analysis supported previous findings of users preferring Bright Patterns over Dark Patterns. They also showed, that websites containing Dark Patterns were less popular, when they were visited after a website using Bright Patterns. Furthermore, statements made by the participants supported the approach used in this study, as well as the findings from the quantitative data analysis. This thesis provides first valuable insights of Bright Patterns influencing user perception.

Überblick

Dark Patterns sind manipulative Designelemente, die Nutzer täuschen oder zu Aktionen verleiten, die der Website oder Anwendung zu gute kommen, aber oft den Nutzern schaden. Dark Patterns sind im Internet immer häufiger anzutreffen. Es gibt mehrere Ansätze, Dark Patterns zu bekämpfen, zum Beispiel indem Nutzer auf ihre Existenz aufmerksam gemacht werden, oder rechtliche Schritte gegen ihre Verwendung eingeleitet werden. Ein weiterer Ansatz sind Bright Patterns, die Nutzer dazu bringen, benutzerfreundliche Optionen zu wählen. Die Wirkung von Bright Patterns auf Nutzer ist noch nicht erforscht, und da Nutzer auf Websites häufig auf Dark Patterns stoßen können, wurde in dieser Arbeit die folgende Forschungsfrage untersucht: *Wie beeinflussen Websites, die Bright Patterns beinhalten, Nutzer, wenn diese Websites in der Minderheit sind?* Um diese Frage zu beantworten, wurde eine Studie durchgeführt, bei der 15 Teilnehmer zehn Websites besuchten, von denen in neun Websites Dark Patterns und in einer Website Bright Patterns implementiert wurden. Anschließend wurde ein Leitfadeninterview geführt. Die Interaktionen mit den Websites, Ergebnisse des Fragebogens, und die Interviewdaten wurden analysiert. Eine thematische Analyse der Interviews ergab, dass die Website mit den Bright Patterns für die Mehrheit der Teilnehmer im Nachhinein nicht hervorstach. Allerdings bestätigte die Analyse der quantitativen Daten frühere Erkenntnisse, wonach Nutzer Bright Patterns gegenüber Dark Patterns bevorzugen. Sie zeigten auch, dass Websites mit Dark Patterns weniger beliebt sind, wenn sie nach einer Website mit Bright Patterns besucht wurden. Weitere Aussagen der Teilnehmer unterstützten einerseits die Art und Weise, wie wir die Studie konzipiert haben, andererseits unterstützten sie die Ergebnisse der Analyse der quantitativen Daten. Diese Arbeit liefert erste wertvolle Erkenntnisse, dass Bright Patterns die Wahrnehmung von Nutzern beeinflussen können.

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A big thank you to my advisors Rene Schäfer and Sarah Sahabi for giving me the chance to work in this interesting field of research. Their supervision and valuable feedback throughout my master's thesis was invaluable. I have learned a lot during this time.

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Conventions

Throughout this thesis we use the following conventions.

Text conventions

Definitions of technical terms or short excursus are set off in coloured boxes.

EXCURSUS:
Excursus are detailed discussions of a particular point in a book, usually in an appendix, or digressions in a written text.

Definition:
Excursus

Source code and implementation symbols are written in typewriter-style text.

The whole thesis is written in British English.

The first person is written in the plural form and unidentified third persons are referred to neutrally or in the plural form.

Chapter 1

Introduction

In 2024, there are more than one billion websites for different areas such as games, social media, and e-commerce on the internet [Netcraft[1]]. User interface (UI) design plays a big part in the way users interact with these websites to accomplish their respective goals. Good UI design is supposed to support users in these tasks by placing them in control, reducing their memory load, and making interfaces consistent [Mandel, 1997]. One way to support users in their decision making process is to use nudging techniques.

User interface design is an important part of the modern internet

NUDGING:
"Nudges are interventions that steer people in particular directions but that also allow them to go their own way." [Thaler and Sunstein, 2008]

Definition: *Nudging*

While users may have multiple options on what to do or which option to select, the way a choice is presented influences what a user chooses [Johnson et al., 2012]. An example for that is highlighting one option over other alternatives and therefore increasing its visibility. Nudging techniques can influence users towards doing certain actions, that are beneficial for the provider, but detrimental to the user. Nudging techniques with these properties are some-

Users are being manipulated in the internet

[1] https://www.netcraft.com/blog/march-2024-web-server-survey/ Accessed: May 27, 2024

times also referred to as *Dark Patterns* [Hartzog, 2018].

1.1 Dark Patterns

Definition: *Dark Patterns*

DARK PATTERNS:
"[..]Dark patterns are tricks used in websites and apps that make you do things that you did not mean to, like buying or signing up for something." [Brignull et al., 2023]

Dark Patterns influence users toward making user-unfriendly choices

Dark Patterns exploit cognitive biases, subtly nudging users into actions they might otherwise avoid [Waldman, 2020]. In addition to nudging, Dark Patterns may also use "digital sludging", which describes methods to impede users' free choice and autonomy. This is achieved by constraining choices or artificially increasing the time needed for the user to complete his or her intended task [Kollmer and Eckhardt, 2023].

Dark Patterns are present in many different domains

Organisations implement Dark Patterns to increase their revenue, collect data, and steer users' attention [Kollmer and Eckhardt, 2023]. Some companies offer Dark Patterns as a service, making it easy to implement them on a website [Mathur et al., 2019]. Dark Patterns can be found in many different contexts, such as gaming [Zagal et al., 2013], robots [Lacey and Caudwell, 2019] or websites [Mathur et al., 2019]. The distribution of Dark Pattern types varies across modalities and can vary within the same service, depending on whether the service is accessed via mobile app or website [Gunawan et al., 2021]. The prevalence of Dark Patterns differs across domains, for instance they are more common in mobile applications than they are in websites [Mathur, 2021]. Especially in the context of consent management platforms (CMPs), Dark Patterns are used frequently [Nouwens et al., 2020]. Some users view Dark Patterns as so widely spread and common, that they have become a part of the normal interaction with UIs [Di Geronimo et al., 2020].

Since the term "Dark Pattern" was first defined by Brignull

[2010], different taxonomies have been developed in order to properly describe the problem of Dark Patterns [Gray et al., 2018, 2024]. Consequently, there exist multiple ways to define Dark Patterns in order to have a fitting description for specific contexts [Mathur et al., 2021]. For example, there are some Dark Patterns that are defined specifically for shopping contexts and may not be applicable elsewhere.

There are many different taxonomies and definitions for Dark Patterns

To what extent Dark Patterns influence users, depends on multiple factors, such as education of the user or the kind of Dark Pattern the user is exposed to [Luguri and Strahilevitz, 2021]. Based on the context, users expect and tolerate varying degrees of malicious design techniques [Conti and Sobiesk, 2010]. While some users do not mind Dark Patterns [Tiemessen et al., 2023], they may still have consequences, as recognising and identifying Dark Patterns does not imply that one may not be manipulated by them [Bongard-Blanchy et al., 2021].

The impact of Dark Patterns on users can vary

This makes it important to think about ways to counteract Dark Patterns. One approach to do that, is to visually indicate them to the user [Schäfer et al., 2024]. Another approach is to encourage the implementation of *Bright Patterns*, which should counteract Dark Patterns by providing a better user experience (UX) and therefore leading users to avoid websites using Dark Patterns [Truong and Dalbard, 2022].

Countermeasures against Dark Patterns exist

1.2 Bright Patterns

BRIGHT PATTERNS:
"Bright Patterns are benevolent design solutions prioritising user goals and well-being over companies' desires and business objectives." [Sandhaus, 2023a]

Definition: *Bright Patterns*

Bright Patterns are design elements that aim in the opposite direction of Dark Patterns. The focus with these patterns is to nudge users towards making user-friendly choices such as preselecting "decline all" in a cookie consent request, instead of an option that shares more private data. Apart

Bright Patterns influence users toward making user-friendly choices

from Bright Patterns, there also exist Fair Patterns, that display options without the usage of nudging techniques, such that they are presented in a neutral way [Potel-Saville and Francois, 2023]. In the example above, this means no option would be preselected and all options would have the same visibility and accessibility. Bright Patterns on the other hand are not designed in a neutral way, they try to manipulate the user.
In an isolated view of a single website, users prefer the website when Bright Patterns are implemented over a version of the website with implemented Dark Patterns [Calawen, 2022].

However, users may visit more than one website when browsing the internet. Therefore, it is also important to evaluate the impact of Bright Patterns in the context of visiting multiple websites. While users are likely to encounter Dark Patterns when browsing the web [NCC, 2022, Mathur et al., 2019, Moser et al., 2019], the prevalence of Bright Patterns in websites is not known. Since the concept of Bright Patterns is rather new, it is assumed that there exist very few websites that make use of Bright Patterns. This scenario led to the research question for this thesis:
How do websites using Bright Patterns influence users, when these websites are in the minority?

Websites using Bright Patterns are in the minority

1.3 Outline

This thesis aims to answer what impact Bright Patterns in a single website have on user perception of websites.

First, background information about previous work in the field of Dark Patterns and Bright Patterns is presented in Chapter 2.

The findings of the previous research give the basis for the study conducted in this thesis. The used materials and their creation for this study are discussed in Chapter 3. The study design including participant recruitment, methodology and measures, is presented. The chapter then concludes with the results of the quantitative and qualitative

data analysis.

In Chapter 4, the findings of this study are discussed. This includes discussing the implication of the results and comparing them to previous research, as well as to show limitations of the study design and the generalisability of the findings. The primary focus here is on the influence of Bright Patterns on user perception.

This thesis is then concluded with a summary of the work and suggestions for future work based on the findings of this research, in Chapter 5.

Chapter 2

Related work

In this chapter, an overview of the related work in the field of Dark Patterns and Bright Patterns is presented and discussed.

2.1 Background

2.1.1 How and Why Dark Patterns Work

Before the term "Dark Pattern" was first defined, there existed other ways of user manipulation, whether that was on the internet or in offline contexts. One example for this are statements like "Only 3 items left in stock" in deal advertisements. These type of statements can be classified under the Dark Pattern *Fake scarcity*. It has been shown, that restrictions increase the likelihood of a consumer to buy a product, because consumers use them as one aspect of assessing the value of a deal [Inman et al., 1997]. Since the available amount of an item does not influence the price a costumer has to pay, this is one example of users making decisions that are not completely rational. This type of design choice can be seen as a nudging technique.

Some of the mechanics Dark Patterns make use of, have been present for a long time.

When browsing the internet, users make choices constantly. These choices may come in the context of buying some-

thing in an online store, CMPs, or what article to read next. But it has been demonstrated by Weinmann et al. [2016], that choices made by users are not always rational. In fact, users' decisions may be determined or at least influenced by the way the choice is presented [Johnson et al., 2012]. For example, users choose to disclose more personal information than they would like to, because the option to disclose less information may be harder to access [Norberg et al., 2007].

Internet users make irrational choices.

Cognitive biases are one factor for irrational decision making.

However, Waldman [2020] states, that at least in the context of privacy decision making, the convenience of one option over another is not the only reason for this behaviour. In their work, they presented five cognitive biases, that act as a barrier for rational decision making.

The use of nudging techniques have raised ethical concern

There exists some ethical concern about nudging and whether it should be restricted or even forbidden in some cases [Kuyer and Gordijn, 2023]. However according to Sunstein [2015], nudging is natural and occurs in many different areas, such that forbidding it may not be helpful or even possible. This highlights the importance to find and establish ethical standards on how to use nudging techniques [Sunstein, 2015].

2.1.2 Positive Applications of Nudging

The ethical application of nudging techniques can be supported by looking at scenarios, in which they were implemented in a user-friendly manner.

There exists for example some research about nudges trying to strengthen passwords selected by users [Peer et al., 2020, Egelman et al., 2013]. An example for this is the study by Ur et al. [2012], where they found out that displaying password meters, which indicate the strength of a chosen password, lead to users choosing longer passwords that are harder to crack.

Ethical nudges can support users in their decision making

An offline example was presented by Johnson and Goldstein [2003]. They showed, that a preselection of an option can have a strong impact on the choice, by analysing organ donation statistics of multiple countries. They found

that countries, in which consent for organ donation is presumed, i.e. donation is the "preselected" option, have a significantly higher percentage of people who consent to donate their organs, compared to countries in which consent has to be given explicitly.

2.1.3 Conclusion

Nudge principles can be similar Dark Patterns

Weinmann et al. [2016] discussed the influence of nudging techniques in online contexts and summarized several nudge principles from Thaler et al. [2010]. Some of these nudge principles resemble Dark Patterns from different taxonomies, that will be presented in Section 2.2.1 "Taxonomies".

Dark Patterns exploit cognitive biases, use nudging and sludging techniques

Kollmer and Eckhardt [2023] argued, that Dark Patterns are more than nudging. According to them, Dark Patterns use nudging and digital sludging techniques. In addition to that, they found that Dark Patterns apply different kinds of manipulation and deception techniques. Manipulation techniques contain *composition* and *complication*, deception techniques are defined as the *fabrication of false information* and the *omission of relevant information or options* [Kollmer and Eckhardt, 2023].

2.2 Dark Patterns

There exist multiple definitions and taxonomies for Dark Patterns

To define what Dark Patterns are exactly, multiple attempts of describing them have been explored, resulting in multiple names for these design elements, such as *deceptive designs* [Brignull et al., 2023] or *malicious interface design* [Conti and Sobiesk, 2010]. In this thesis, we will use the term Dark Pattern, since most research done in the field refers to these designs as Dark Patterns.

Research in the topic of Dark Patterns has increased significantly in the last years [Mathur et al., 2021], and Narayanan et al. [2020] state, that Dark Patterns will be used in the fu-

ture as well. Therefore it is important to get an understanding of their prevalence, impact, and how they work.

2.2.1 Taxonomies

In order to understand the topic of Dark Patterns better, it is important to define them in a consistent way. Taxonomies for Dark Patterns have been developed in order to achieve that. These taxonomies can help to make research in the topic more consistent and comparable.

There exist multiple definitions and taxonomies for Dark Patterns

As well as there are multiple definitions for specific Dark Patterns, the existing taxonomies differ as well.

Dark Patterns were first defined in 2010

There exist multiple taxonomies that try to define and group Dark Patterns in a general way such that these definitions are applicable in multiple contexts. The first taxonomy has been defined by Brignull [2010] and contained twelve unique Dark Patterns that were found on various websites on the internet. This taxonomy has since been re-evaluated and updated, such that there are currently 16 Dark Patterns defined on the website Deceptive Patterns[1]. Around the same time of this first taxonomy, Conti and Sobiesk [2010] defined a taxonomy on their own using the term "malicious interface design techniques" to describe designs that are aimed at harming users. This taxonomy features eleven categories and a total of 20 subcategories, that were found by analysing websites, desktop software and interfaces off the desktop.

Initial Dark Pattern taxonomies showed some overlaps

While the term "Dark Pattern" was not yet defined or at least not well known when Conti and Sobiesk [2010] published their work, some patterns found by them are similar to the Dark Patterns found by Brignull [2010]. For example, the technique named *Interruption* by Conti and Sobiesk [2010], corresponds to the Dark Pattern *Road Block* by Brignull [2010]. Both describe elements that interrupt, restrict or stop a user's task flow.

From the original taxonomy created by Brignull, Gray et al. [2018] created a refined taxonomy by performing content analysis. They refined Brignull's taxonomy in a way that

[1] https://www.deceptive.design/types Accessed: May 27, 2024

resulted in five primary categories of Dark Patterns, which are *Nagging, Obstruction, Sneaking, Interface Interference*, and *Forced Action*. These categories contained eight additional Dark Patterns, that were found in the process. One example for such a Pattern is *False Hierarchy*, which describes the hierarchical arrangement of options, that should be arranged in parallel. These taxonomies have been further developed by Gunawan et al. [2021], which resulted in a taxonomy that included a total of 50 unique Dark Patterns.

Newer taxonomies build on older ones and expand them

While these taxonomies are applicable in multiple areas, some have been defined for specific fields. Zagal et al. [2013] found and defined multiple Dark Patterns in the context of games and grouped them in "temporal", "monetary" and "social capital-based". Greenberg et al. [2014] found Dark Pattern in proxemic interactions and defined eight Dark Patterns for this context.
Because most research in the field is focussed on western contexts, Hidaka et al. [2023] investigated Dark Patterns occurring in Japanese mobile apps and defined new types of Dark Patterns for this context.
The taxonomy created by Bösch et al. [2016] focussed on privacy and introduces the term *Privacy Dark Pattern*. The Dark Patterns found in their work were specifically defined for contexts that are concerned with privacy.
Mathur et al. [2019] created a new set of Dark Pattern types, which appear specifically in shopping websites. These Patterns were then grouped in seven categories. They also defined five dimensions, in which Dark Patterns influence users. These dimensions are *Asymmetric*, *Covert*, *Deceptive*, *Hides Information*, and *Restrictive*.
Even though these different taxonomies introduce new terms for Dark Patterns, the descriptions for these patterns often resemble ones, that have been previously defined. For example the Dark Pattern *Low-Stock Messages* defined by Mathur et al. [2019] is described as a pattern, that shows fake limited quantities of a product. A similar description is given for the Dark Pattern *Fake Scarcity* in the taxonomy by Brignull et al. [2023].

There exist different taxonomies that depend on the areas they are used in

Gray et al. [2024] identified and grouped some of these taxonomies and definitions, which resulted in a new set of definitions containing low-level, meso-level and high-level

A new way to structure Dark Patterns has been developed by Gray et al. [2024]

patterns. This new arrangement therefore gives a hierarchical way of defining Dark Patterns which may influence future research, as specific Dark Patterns can be assigned to a higher level pattern. This can improve comparability of research concerning Dark Patterns in different areas.

2.2.2 Prevalence of Dark Patterns

As described in Section 2.2.1, Dark Patterns occur in multiple contexts. In this section, research about the prevalence of Dark Patterns is presented.

Users encounter Dark Patterns in their everyday lives

The Norwegian Consumer Council (NCC) released a report on the prevalence and costumer experience with deceptive design techniques [NCC, 2022]. They showed how often Norwegian citizens encounter different types of Dark Patterns in their everyday lives. While no general numbers on Dark Patterns are published, the Dark Pattern that is encountered the least is *Intermediate Currency*, which describes the method of users having to buy some kind of tokens that are used in a online shop, instead of paying for items directly with money. This Dark Pattern is encountered ”rarely”, ”sometimes”, or ”often” by more than 50% of the population. Other types of Dark Patterns were encountered at least ”rarely” by more than 80% of the population.

Dark Patterns occur frequently on mobile apps

Di Geronimo et al. [2020] investigated the prevalence of Dark Patterns in mobile apps. For that, they selected the top 30 most trending apps for eight categories in the Google Play Store, and analysed the occurrence of Dark Patterns in them. This analysis was done by recording an interaction with the app and later going through the recording and classifying Dark Patterns after the taxonomy created by Gray et al. [2018]. They found, that 95% of the analysed apps contained at least one Dark Pattern. On average, more than seven Dark Patterns were found per app. After comparing the app categories, they found that the prevalence of Dark Patterns differs across categories.

The prevalence of Dark Patterns in mobile apps was com-

pared with the prevalence in mobile and desktop websites by Gunawan et al. [2021]. They used the same recording methodology as Di Geronimo et al. [2020] and analysed 105 services, that are accessible via mobile app, mobile website and desktop website. The results of this analysis show, that the prevalence of Dark Patterns across these modalities can differ within the same service. Every service that was analysed contained at least one type of Dark Pattern across all modalities. In general, Dark Patterns occurred more often in apps than they do in their website counterpart. They also found, that more popular apps contain more unique Dark Patterns than less popular apps. While their findings of how many apps contain Dark Patterns are similar to the results found by Di Geronimo et al. [2020], they did show some discrepancies in terms of the distribution of Dark Pattern types across apps. These differences were explained by the difference of the apps that were analysed, as well as the fact, that different Dark Pattern taxonomies were used to classify design elements.

Dark Pattern prevalence differs across modalities

For a more specific context of shopping websites, Mathur et al. [2019] developed a webcrawler to determine the prevalence of Dark Patterns in 11.000 shopping websites. They found, that around 11.1% of the analysed websites contained at least one type of Dark Pattern. This result differs largely from the results in the previously presented research. The authors argue, that this resulted mainly from the way the Dark Patterns were identified. Instead of analysing the websites manually, they analysed the websites automatically. Consequently, only text-based interfaces were examined, which probably excluded some Dark Pattern occurrences. They also used their own taxonomy to classify Dark Patterns, which limits comparability of these studies.

In a large scale analysis, a lower bound of Dark Pattern occurrence was estimated to be 11.1%

Moser et al. [2019] also analysed shopping websites. They again used a manual approach and identified website elements, using a previously developed codebook. They specifically looked for features on websites, that encourage impulse buying. Even though they did not classify them as Dark Patterns, some of these features resemble previously defined Dark Patterns. For example, the authors talked about websites giving recommendations based on

Manipulative designs are common on shopping websites

what other users bought, without defining who "other" users are. This can be classified under the Dark Pattern *Fake Social Proof*.
In each of the 200 websites that were analysed, at least four features were detected. On average, more than 19 features occurred per website.

2.2.3 Effect of Dark Patterns on Users

Because users are likely to encounter Dark Pattens, especially when visiting shopping websites, it is important to know the effect they can have on users.

The first study concerned about user perception of Dark Patterns was conducted by Conti and Sobiesk [2010]

Conti and Sobiesk [2010] conducted the first study to assess user perception of malicious interface design, in which they found, that users were frustrated with all of the design techniques, that were defined in their taxonomy. They also found, that some techniques frustrate users more than others. Furthermore, their results showed, that users have a differing expectation and tolerance for these design techniques, depending on the context they occur in, such as weather, sport, or gaming.

Users detect Dark Patterns more often, when they are aware of their existence

Di Geronimo et al. [2020] introduced the term *Dark Pattern Blindness*, which describes whether a users is able to detect Dark Patterns. In an experiment, they tested for uninformed detection and primed detection. It showed, that primed users perceive Dark Patterns more often than they do when they are not made aware of these patterns being present.

Even if users detects a Dark Pattern, they may still be manipulated by them

Bongard-Blanchy et al. [2021] analysed whether users are aware of manipulative interfaces and whether they are able to detect them. In their study, only few participants were not able to detect any Dark Pattern. The age and education level of the participants was correlated with the ability to detect Dark Patterns, showing that younger and higher educated participants were able to detect more Dark Patterns. They further investigated the question whether users are influenced by these manipulative interfaces, even if they are able to identify them and concerned about their influ-

ence. They concluded, that users being aware of manipulation attempts does not make a significant difference on the likelihood for them to be influenced by these manipulations. This shows, that raising awareness about Dark Patterns alone is not enough to counteract them.

The severity of the effect of Dark Patterns can differ

NCC [2022] stated, that the most common consequence of Dark Patterns was, that users became annoyed with the website or app. In addition to that, some users stated, that they spent more money than planned or even bought something by mistake, due to a Dark Pattern. Similar results were found in the report by CPRC [2024]. From this, it can be concluded, that Dark Patterns have the potential to harm users financially.

Luguri and Strahilevitz [2021] found, that aggressive Dark Patterns are more effective than mild Dark Patterns

Luguri and Strahilevitz [2021] investigated the effect of different levels of aggressiveness of Dark Patterns. They conducted a study, in which participants were presented with a choice to accept or decline an offer for a data protection plan. This choice was presented in three conditions, a control, a mild and an aggressive one. The control condition contained no Dark Patterns, the mild condition contained multiple Dark Patterns and the aggressive Dark Pattern expanded on the mild condition by adding one extra step in order to decline the option. They found, that participants accepted the plan more often in the Dark Pattern conditions and that the aggressive condition was more effective than the mild condition. They also examined, whether the price of the data protection plan had an influence on this decision and found, that it had no significant effect across any of the conditions. The results also showed, that participants were significantly more upset in the aggressive condition.
In a second study, they also assessed the effects on acceptance rate of a presented choice for different kinds of Dark Patterns. They found that the rate at which participants accepted a certain choice or suggestion differed, depending on the kind of Dark Pattern.

The Dark Pattern *Fake Urgency* may not affect user behaviour, but can influence users in other ways

In a study specifically assessing the impact of deceptive countdown timers, which resemble the Dark Pattern *Fake Urgency*, Tiemessen et al. [2023] found that these deceptive timers do not increase the likelihood of purchasing a product more than discounts without timers. They do however

increase "fear of missing out" and perceived time pressure of the participants. This shows, that Dark Patterns may not always influence a user's choice, but can influence other aspects, such as psychological components.

2.2.4 Dark Patterns in Cookie Consent Requests

The area, in which Dark Patterns have been studied the most are CMPs.

Not all CMPs that are being used on the internet are legal

In a discussion about several styles of CMPs, Gray et al. [2021] summarized opinions from different perspectives. They argue, that some CMPs restrict users free choice, e.g. by restricting website functionality when not consenting to tracking. Depending on the Dark Patterns used, some CMPs, that were analysed, were non compliant to the *General Data Protection Regulation* (GDPR[2]) of the EU.

A majority of CMPs in the UK are illegal in the EU

The latter was also shown by Nouwens et al. [2020], who created a scraper to identify 680 unique CMPs in the United Kingdom. Only 11.8% of them were legal according to the GDPR, more than 50% used the Dark Pattern *Preselection*. They also conducted a study, in which participants browsed multiple websites, on which they were presented with different kinds of CMPs. They showed that the style of the cookie consent request (barrier or banner) did not affect the consent rate of participants. However, they found that removing the option to reject all trackers, increased consent by 22%.

Position and style of CMPs impact interaction and consent

The impact of CMP style was also investigated by Utz et al. [2019]. On a real website, the researchers placed a CMP, which users were confronted with, upon visiting the website. Especially the Dark Pattern *Preselection* had a strong impact on the consent rate. Interaction with the cookie banner and acceptance of the options was found to be higher in mobile than in desktop variants of the cookie banners. They also showed, that the position of a cookie banner has an impact on whether a user interacts with the banner or not.

[2]https://gdpr-info.eu/ Accessed: May 27, 2024

Machuletz and Böhme [2020] investigated the effect of the Dark Pattern *Visual Interference* on consent decisions. They conducted a study where participants were presented with a cookie banner on a mock-up website. They showed, that highlighting the option to accept all purposes of tracking, increased consent rate over a control group. At the same time, participants perceived the website as more deceptive than the control group.

Dark Patterns influence users choices in CMPs

Graßl et al. [2021] assessed the effect of the Dark Patterns *Preselection*, *Visual Interference* and *Obstruction*. They found that a majority of the participants accepted cookies, no matter if the CMP used Dark Patterns or not.
Because of this result, the researchers conducted a second experiment, in which they reversed the manipulations in the CMPs, such that they should manipulate the user towards making the user-friendly choice. They called these manipulations *Bright Patterns*. In this experiment, users accepted cookies significantly less often than before.

2.2.5 Countermeasures against Dark Patterns

As established by Bongard-Blanchy et al. [2021], awareness about Dark Patterns is not enough for users not to be manipulated by them. It is therefore important to think about ways to counteract Dark Patterns. A few approaches to do that, will be presented in this section.

First ideas for countermeasures were developed in 2010

Via a survey, Conti and Sobiesk [2010] evaluated seven types of countermeasures against malicious interface design in terms of "ease of use" and "effectiveness". As stated in Section 2.2.1 "Taxonomies", some of these malicious interface designs can be identified as Dark Patterns. None of the countermeasures that were evaluated received a high rating, meaning they are neither thought to be "easy to use" nor very effective in countering the effects of Dark Patterns. The results of their research lead to the conclusion, that more effective countermeasures need to be developed.

Schäfer et al. [2023] investigated multiple countermeasures, that aim to make users more aware of Dark Patterns. In a study, participants were presented with a screenshot of

The effectiveness of countermeasures depends on the kind of countermeasure that is employed

a shopping website, in which a Dark Pattern was implemented. There existed multiple different versions of the screenshot, as there were three different Dark Patterns used, and each of them was altered by one of six different countermeasures.
All countermeasures were rated higher in terms of *usability*, *clarity*, *efficiency*, *safety*, *helpfulness*, and *feeling*, than the Dark Pattern being presented without any modification. It was also shown, that some countermeasures, especially *Highlighting + Explanation of the Dark Pattern*, were significantly higher rated than others, and that the kind of countermeasure that is applied, should depend on the kind of Dark Pattern that is shown.
Schäfer et al. [2024] expanded these findings by applying three of the countermeasures on 13 different Dark Patterns. These studies showed, that indicating Dark Patterns to users can be an effective way to support users.

2.3 Bright Patterns

2.3.1 Novelty

The term Bright Pattern was introduced by Graßl et al. [2021]. Therefore it is still a new concept and little research exists in the field. In contrast to Dark Patterns, few definitions or taxonomies exist.

Bright Patterns are a relatively new concept

Sandhaus [2023b] attempted to define Bright Patterns. Similar to the website created by Brignull et al. [2023], a website[3] was set up, containing a first taxonomy for Bright Patterns [Sandhaus, 2023a]. There, multiple examples and definitions for such patterns are presented.

2.3.2 Criticism of Bright Patterns

There exists some scepticism about Bright Patterns

While Bright Patterns aim to support users in doing what they actually intent to do, there exists some scepticism in that approach.

[3] https://brightpatterns.org/

Sunstein [2015] state, that even well-motivated manipulation may not be ethical, if users do not consent to them.
Because Bright Patterns are, as well as Dark Patterns, manipulative design elements, Potel-Saville and Francois [2023] argued that there needs to be a different approach to counter Dark Patterns. They introduce the term *Fair Patterns*, which are described as design elements, that are designed in a neutral way. Instead of manipulation, they focus on providing users with information, such that they are in control and can make their own informed choices [Potel-Saville and Francois, 2023].

Fair Patterns design user interfaces without manipulations

However, in the taxonomy proposed by Potel-Saville and Francois [2023], some Fair Patterns resemble previously defined Bright Patterns and may therefore not describe neutrally designed interfaces. For example, they defined the Fair Pattern *Protective Default* in the following way: "*Privacy-protective options and consumer-friendly options are set as defaults. Positive consumer outcomes or positive society outcomes (for example climate friendly) and data protection by design are used to define 'protective' defaults.*"
This resembles the Bright Pattern *Honest Defaults*, presented by Sandhaus [2023a], which was defined as follows: "*This pattern involves setting default options that are in the best interest of the user, rather than the business. For example, a default option to unsubscribe from marketing emails may be provided, rather than requiring users to opt-out.*".
Fair Patterns may therefore not be free from manipulation. Weinmann et al. [2016] argued, that there may not exist a neutral way to present options.

Not all fair patterns proposed by Potel-Saville and Francois [2023] are free from manipulation

It is therefore important to investigate how these manipulations can be used in way that help users.

2.3.3 Studies on Bright Patterns in Websites

Expanding on the findings by Graßl et al. [2021], a study to investigate the effects of Dark and Bright Patterns on decisions made in the context of CMPs was conducted by Bielova et al. [2024]. In their study, participants visited three fictitious e-commerce websites, on each of them, a

Bright Patterns can help users making user-friendly choices in the context of CMPs

consent banner was placed. On the first two websites, participants were presented with a consent banner, that used one of six kinds of Dark and Bright Patterns. On the third website, the same control banner was shown for every participant. Participants refused tracking more often, when the cookie banner was designed using Bright Patterns compared to the cookie banner containing Dark Patterns.

Websites using Bright Patterns score higher in *transparency*, and *freedom of choice*

Truong and Dalbard [2022] studied the effect of Bright Patterns on designers and users. They created two prototypes of e-commerce websites, one using Bright Patterns, the other one using Dark Patterns. Participants were presented with both prototypes and were given some tasks to complete on them. Afterwards the participants were asked follow-up questions about the interaction. They assessed the decisions users made during the interactions and how ethical Dark and Bright Patterns were perceived.
No significant difference between Dark and Bright Patterns, in terms of what decision was made, was found. However, the prototype with the Bright Patterns was unanimously rated as the one with the higher transparency and the higher freedom of choice.

A website using Bright Patterns scores higher in the UEQ and SUS than the same website using Dark Patterns

A similar approach to compare user perception of Dark Patterns against Bright Patterns was used by Calawen [2022]. He created two versions of a mock-up airline website, one contained Dark Patterns, the other one contained Bright Patterns. In contrast to the experiment by Truong and Dalbard [2022], participants were only presented with either the ”bright” version or the ”dark” version. After completing a flightbooking task, they answered a survey which included the *User Experience Questionnaire* (UEQ) [Laugwitz et al., 2008], the *System Usability Scale* [Brooke, 1996], and some additional questions. After that, a semi-structured interview was held.
A significant difference between the two versions was found only for the *attractiveness* scale of the UEQ. While not significantly, the ”bright” version was rated higher than the ”dark” version in all scales of the UEQ.
After answering the survey, some participants were asked in an interview about the website they just visited. Here, the ”bright” version was perceived as less annoying and

overall received more positive responses.

Bright Patterns are preferred over Dark Patterns, but their impact on Dark Patterns is not yet well known

These studies show, that in a direct comparison, users do prefer Bright Patterns over Dark Patterns. In non of these studies however, was the Bright Pattern website placed in context with different websites that contain Dark Patterns. As shown in Section 2.2.2, users are likely to encounter Dark Patterns when browsing the internet. Therefore it is important to evaluate the effect of Bright Pattern in the context of a regular browsing experience, in order to get a better understanding of how well Bright Patterns are able to counteract Dark Patterns.
This work will therefore investigate the question of what impact Bright Patterns have on user perception, when these Patterns are in the minority.

Chapter 3

Own work

In this chapter, a detailed description of the methodology for our study, in which we investigated the influence of Bright Patterns on user perception, is provided. The chapter will be concluded with a presentation of the results.

3.1 Method

The methodology section provides a detailed description for the creation of the study design, the resulting study procedure, and its materials. Participant recruiting and demographics, and ethical considerations are presented. At last, we will discuss our measures and the way we analysed the gathered data.

3.1.1 Study Design Decisions

In order to answer the research question, a suitable study design had to be developed. As shown in Section 2.2, there exist multiple studies about Dark Patterns, but since there are multiple contexts in which Dark Patterns can occur and multiple perspectives from which they can be investigated, the methodology in these studies differs quite a bit. Since the research question of this thesis is rather exploratory in

Our study design is oriented on designs of previous research

nature, there is no exact precedent on how to conduct such a study in the field of Bright Patterns. Still, some aspects of previous studies can be adopted.
The decisions made and the reasoning behind them will be presented in this section.

Functional Website or Design Prototype

We decided to use functional websites for a more realistic setting

One design decision that was identified in previous studies is, that participants were often confronted with Dark Patterns either on functional mock websites or on website prototypes. This is mostly done to give context and to be able to create a more realistic user interaction with Dark Patterns. Due to our scenario trying to resemble a real world browsing experience, it was decided to create functional websites instead of prototypes.
We found the following advantages in using a functional website over a prototype in such a setting.
Websites can be accessed via a browser, which we assume gives participants a more realistic feeling of actually visiting a website, compared to using a prototype and accessing that via a specific tool or seeing it as a pdf, or as an image.

We found more suitable templates for the creation of functional websites than for Figma prototypes

A popular tool for prototype development is Figma[1]. However, the templates we found for prototypes created by Figma, often only consisted of one page for a website, e.g. the *Home* page. This meant, that other pages had to be created, that match the style of the template. The risk of the style not fitting and therefore making the websites less consistent and realistic was one of the reasons to use functional websites instead.
There exists a vast amount of HTML[2], CSS, and JavaScript[3] templates for creating websites, which also often contain multiple pages for each website. This ensures a consistent design across all pages of a website and allowed for a time-efficient creation of the websites.

[1] https://www.figma.com/ Accessed: May 27, 2024
[2] https://html.com/ Accessed: May 27, 2024
[3] https://www.javascript.com/ Accessed: May 27, 2024

Amount of Websites

In order to create the scenario given in the research question, that describes Bright Patterns as being in the minority, multiple websites had to be visited by the participants. A majority of these websites contained Dark Patterns, and a minority contained Bright Patterns. When deciding for the amount of websites, it should be noted, that choosing too few websites could lead to less valid results, as outliers would have a bigger impact on the results. Choosing too many websites could lead to participants rating websites in different ways, depending on their position, making results between websites less comparable.

Considering this, the amount of websites, participants were navigating through, was chosen to be ten. This figure is mainly based on the study conducted by Graßl et al. [2021]. In their experiment, users visited eight different websites, which was explained, would be creating a realistic setting for the presentation of cookie consent requests. They showed, that *Privacy Fatigue*, which is defined as "a sense of weariness toward privacy issues, in which individuals believe that there is no effective means of managing their personal information on the internet" [Choi et al., 2018], correlated with consent, but apart from that, there was no report that indicated that using eight websites was too many for this study.

We created ten websites for participants to navigate through

Because for our experiment, we wanted participants to have a high exposure to Dark Patterns, this number was increased by two, resulting in ten websites.

Out of these ten websites, nine contained Dark Patterns and one website contained Bright Patterns, which will from now on be called the *bright* website. This way, Bright Patterns were in the minority and the influence of Bright Patterns can be determined from users visiting this one *bright* website.

Website Category

The term website category refers to the classification of websites into distinct types, based on their purpose or content, such as shopping, news, or education.

For this study, it was decided to create websites from the same category. While having multiple categories may represent a more realistic browsing experience, it would make the websites less comparable.

All websites were from the same category (*Shopping*), in order to have higher comparability between websites

The website category was decided to be *Shopping*. This is in part due to the amount of websites that was chosen. It was easier to create ten different shopping websites than it would have been with other websites, because of the amount of templates available for the respective category. Another reason is the choice of Dark Patterns on the websites, as some of them were mainly applicable in a shopping context. The exact choice of Dark Patterns will be presented in Section 3.1.3.

Product Category

The ten websites could either all sell items from the same product category, have a unique product category for each website, or have some websites offer items from the same product category and other websites offer items from different product categories.

Every website offered different types of products

We decided for each website to have a unique product category. Although choosing one product category to be displayed on all website could make the results more comparable, it was decided against, because this may introduce other factors in the evaluation of a website for the participants. For example, participants may prefer one website over the other, because of the products that were presented on the websites.
On the other hand, having some, but not all websites with the same product category is assumed to decrease comparability between websites that offer items from different product categories.

Pattern Context

The chosen shopping websites consisted of multiple pages. The most important pages for this study are the *Home page*, the *Shop* and the *Checkout* page.

In all of these pages, different kinds of Dark Patterns can be implemented. Therefore it was decided to have at least one Dark Pattern on at least one page for every website. This way, there existed some variety for the occurrence of Dark Patterns, making it less obvious for the participant to identify a pattern for when they were manipulated.

Dark Patterns were implemented on at least one page for each website

Cookie Banners

We assumed that the sheer existence of a cookie banner already impacts the way users experience a website. Therefore, either all websites or no website had to show a cookie banner. It was decided to show cookie banners on each website, because it provided another type of interface to use Dark Patterns in. This is also a more realistic setting than presenting websites without cookie banners, as they are present on real websites as well.

Participants faced a cookie banner upon visiting each website

Positioning of the *bright* website

The last major decision for the study design, was the positioning of the *bright* website. One possibility would be to vary the position of the *bright* website, to investigate if Bright Patterns have a different influence on user perception when occurring in the beginning of a browsing session, rather than a user being confronted with them after seeing multiple websites containing Dark Patterns.
While this is an interesting question, it was decided to set a fixed position for the *bright* website for all participants. This was done due to the research question being rather exploratory and therefore, introducing the position of the *bright* website as an additional variable was determined to an interesting approach for future research. The exact position was decided to be the sixth position, as it provides a similar amount of Dark Pattern exposure to the participants before and after visiting the *bright* website.

The *bright* website was positioned as the sixth website, such that there is enough Dark Pattern exposure for analysis, before and after visiting the *bright* website

Website evaluation

A questionnaire was placed after each website, such that participants evaluated a website directly after visiting it. This way, a more direct impression of the website was captured, compared to an evaluation after visiting all websites. The creation of this questionnaire will be explained in more detail in Section 3.1.6 “Questionnaire”.

Conclusion

All these decisions led to the study having a within-subjects design. The exact procedure will be presented in Section 3.1.2.

A within-subjects design was used for our study

Because repeated measures designs usually introduce order effects, a mutually orthogonal Latin square of order four was used. This means, the four websites that come before, and the four websites positioned after the *bright* website are treated as one block each, such that websites were rotated within each block. The first overall website stayed the same for all participants and served as a way to get to know the procedure and structure of the websites. Before starting the study, it was tested once with a student from the institute in the presence of the advisors.

3.1.2 Study Procedure

The study was explained to the participants by information given on a starting page

The entire study was conducted in a single tab of one browser session. At the beginning, participants were presented with a starting page. The starting page introduced the participants to the study. Here, participants were told the study was about user perception of real shopping websites from the USA, because we wanted them not to suspect that websites were specifically created for this study. The general task given to the participants was to navigate through the websites, adding items to the shopping cart and leaving a website by clicking the ”checkout” button in the *Checkout* page.

Figure 3.1: Screenshot of a scenario description given to the participants.

We chose this approach over the experimenter giving an explanation to the participants, because it guarantees that the study is explained in the same way for every participant.
After reading through the instructions on the starting page, participants could click on a button that redirects them to the first website "Seat Serenity".
At this point, a screenrecording was started, that captured the entire interaction of the participants with the websites.
Before each website, a short scenario was given to the participant that contained a task description for the participants to complete, and provided some context for the upcoming website. An example scenario can be seen in Figure 3.1. When a participant read through the scenario given for a website, they pressed a button that redirected them to the *Home page* of the respective website. From there, participants were free to do what they want within the restrictions explained in Section 3.1.3 "General Website Design Considerations". This approach was adapted from the study conducted by Truong and Dalbard [2022].

Participants navigated through all ten websites, answering a questionnaire after each one

When navigating to the *Checkout* page and clicking the "checkout" button, the participant was redirected to an *intermediate* website on which a questionnaire about the visited website was placed. This questionnaire had to be answered in order to proceed to the next website. This cycle is then repeated until the participant visited all ten websites. After answering the questionnaire for the last website, the participant was redirected to a *demographics* page,

After the interaction with the websites, a semi-structured interview was held

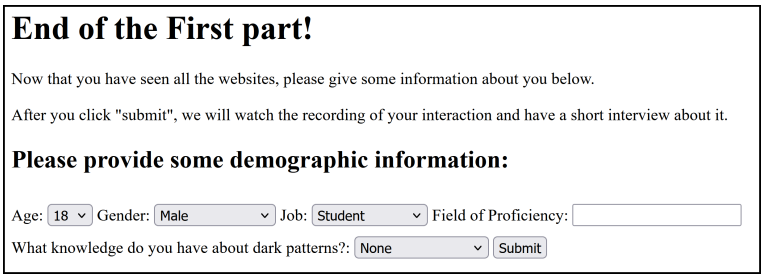


Figure 3.2: Screenshot of the *demographics* page.

on which participants were asked to provide some demographic information about themselves. Once all items were answered, the runthrough of the websites is finished and the participant is given the information, that this part of the study is over, as seen in Figure 3.2. The screenrecording gets stopped and is then watched together with the experimenter while a semi-structured interview is held.

Concrete Runthrough

To keep as many aspects of the study as constant as possible, every run of the study was conducted in the same room by the same experimenter. The room was prepared in the same way for every participant as well. This meant, all participants used the same peripherals like screen, keyboard, and mouse. A consent form was placed next to the keyboard, as well as snacks and water for the participants. The consent form can be seen in Appendix B. Upon arrival, participants were welcomed and guided to the place where the study setup was positioned.

As many factors as possible were held constant for this study, in order to minimise the risk of extraneous variables becoming confounding variables

The consent form was explained to the participant and some short information about the study was provided. During the runthrough of the websites, the experimenter sat opposite of the participant, with a laptop on which the websites were hosted and the browser was opened in which the participant visited the websites. The screen of the laptop was mirrored to the screen of the participant. Therefore, the experimenter saw what the participant was doing during the interaction. This was necessary for the experimenter to be able to take notes for the interview. Par-

ticipants were made aware of the experimenter observing their interaction.
The study was then conducted as described in Section 3.1.2 "Study Procedure".
For the interview, the experimenter sat down next to the participant and the recording was watched on the screen on which the participant was going through the websites. This way, there existed no variation in the way the websites were presented to the participants. This guaranteed that a website's appearance was not perceived differently by the participants during the interaction and during the interview.
After the interview was concluded, the participant was told about the actual research question and reason behind the study. They were thanked for their participation and shown out of the room.

3.1.3 Website Design

General Website Design Considerations

Websites were created with the help of templates that were structured similarly

All websites used for this study were adaptations of website templates. All of the templates used for this study are licensed under the Creative Commons Attribution 3.0[4], and were "free to use for personal and commercial use". The sources of all templates used in this study can be viewed in Appendix C. All websites have a similar structure that include a *Home*, *Shop* and *Checkout* page. The templates were adjusted in the following ways in order for them to suit the study design.

Links to external websites were removed

Functional: The website templates originally contained multiple pages, that were not relevant for the study. In addition to that, there were elements that would link to several social media accounts of the respective websites, or other external websites. We decided to keep the buttons that redirect participants because they make websites look more realistic. However, the hyperlinks of these buttons

[4]https://creativecommons.org/licenses/by/3.0/
Accessed: May 27, 2024

were deleted. This way, the navigation through the websites was more streamlined. Participants were told about these restrictions on the starting page of the study and by the experimenter.

The names of products and websites, as well as the prices for the products, were made up

Semantic: All products presented on the websites were made up. This way, it is avoided to let brand preference or previous knowledge about products have an impact on a purchase decision. Therefore, fake product names were selected and prices were chosen somewhat arbitrarily for the products. All websites offered multiple products. The website "Party Pals" presented the least amount of products (7), and the most products (12) being offered by the websites "Peak Venture", "Timepiece Trove", and "Fit Finds".
In addition to the products, the website names were adjusted to fit the according product category and to not be recognisable by the participants. Website names were selected with the help of ChatGPT[5]. The website names and the corresponding product categories can be seen in Table 3.1.

Website name	Offered Products
Seat Serenity	Seating furniture
Peak Venture	Outdoor and Camping equipment
Pet Paw Paradise	Accessories for cats and dogs
She Treasures	Gifts targeted at female persons
Timepiece Trove	Watches for male and female persons
Pure Roots	Hand crafted cosmetic products
Fit Finds	Fitness equipment
Gent's Treasure	Gifts targeted at male persons
Party Pals	Party accessories
Sonic Sensation	Wireless over-ear, and in-ear headphones

Table 3.1: An overview of the names of the websites and the kind of products they offered.

Contact information on the websites was changed to be fake information

Every website had a footer, in which navigation elements, contact and other information was placed. All of these elements were kept because they contribute to a more realistic

[5]https://chatgpt.com/ Accessed: May 27, 2024

feeling of the websites. However, the contact information was adjusted to make sure no real information is portrayed on these websites. This was done using Fakexy[6], which is a website that generates fake addresses, phone numbers, and other contact information. The contact email for each websites was set to be "contact@<websitename>.com", where <websitename> would be the name of the website, e.g. contact@partypals.com.

Aesthetic: The website templates contained several images for products, background, etc. These images were all replaced by AI generated images. We used DALL-E 3[7] by Open AI[8] for all websites. This way, it was impossible for participants to recognise a product, which may influence purchase decisions, because previous knowledge about a product could be factored into the decision making process. The prompt given to the AI, that described the way an image should be created, was the same for all images within one website. This ensured a similar style for all images within one website, which is intended to further decrease the influence of the product appearance on the purchase decision. An example for generated product images can be seen in Figure 3.3.

Images for products, backgrounds, etc. were created with the help of AI

After the websites were adjusted as described above, cookie consent banners and checkout windows were added to all websites. For the *bright* website, Bright Patterns were implemented and for all other websites, Dark Patterns were added.

Bright Patterns

There exist multiple ways an interface can be designed in, such that it manipulates the user towards making a user-friendly choice. In order to choose which Bright Patterns to use for the *bright* website, we considered two different ways to design Bright Patterns.

[6]https://www.fakexy.com/ Accessed: May 27, 2024
[7]https://openai.com/index/dall-e-3/ Accessed: May 27, 2024
[8]https://openai.com/ Accessed: May 27, 2024

Figure 3.3: The top two product images are from the website "She Treasures". The bottom two product images are from the website "Peak Venture".

There exist multiple approaches to designing Bright Patterns

Semantic Approach: This approach is used by Sandhaus [2023a]. They defined concrete Bright Patterns for specific contexts, such as the Bright Pattern *Usage Limits*, which describes an interface that restricts the usage time of a service to a healthy level.

Flipping Dark Patterns: This is the way, the term Bright Pattern was first defined. The direction of the manipulation is switched from harming the user to being user-friendly. For example, instead of highlighting the option that harms the user, the user-friendly option is highlighted.

We chose the latter approach, because it offered another way to directly compare specific Dark Patterns with Bright Patterns by defining one website in each of the two blocks of websites, that come before and after the *bright* website, to

be a *check* website. These *check* websites were chosen to be the websites "She Treasures", which will be called *pre-check* website, and "Party Pals", which will be called *post-check* website. These *check* websites were designed with the Dark Pattern versions of the Bright Patterns used in the *bright* website. We chose to implement three different kinds of Patterns on each of these websites.

We chose to use the Bright Pattern versions of the Dark Patterns *visual interference*, *preselection*, *false hierarchy* for the *bright* website

As stated by Truong and Dalbard [2022], some Dark Patterns can be converted to a Bright Pattern more easily than others, which is why we selected the Dark Patterns *Visual Interference* [Brignull et al., 2023], *Preselection* [Brignull et al., 2023], and *False Hierarchy* [Gray et al., 2018] to convert into Bright Patterns.

For these Dark Patterns, the manipulation can directly be flipped from being a Dark Pattern to become a Bright Pattern in the following ways.

As a Bright Pattern, *Visual Interference* makes the user-friendly option more visible, while the Dark Pattern version of this makes the user-hostile option more visible.

The Bright Pattern *False Hierarchy* creates a hierarchical alignment that puts the user-friendly option at the top, as a Dark Pattern, the user-hostile option is positioned at the top.

Finally, *Preselection* shows a user-friendly option to be selected by default in the Bright Pattern case, while as a Dark Pattern, the user-hostile option is selected by default.

Every page of the *bright* website contained all three Bright Patterns

All of these patterns were implemented on all pages of the websites, i.e. *Home*, *Shop* and *Checkout* page, as well as on the cookie banner that was shown on the website. The implementation of these Patterns for the *Checkout* pages of the *check* and *bright* websites can be seen in Figure 3.4.

Dark Patterns

We mainly used Dark Patterns from Brignull et al. [2023], but added two more Dark Patterns from Gray et al. [2018] and Conti and Sobiesk [2010]

For the other seven websites, the type of Dark Patterns that needed to be implemented had to be decided. This process started with choosing a taxonomy of Dark Patterns. For that, we considered taxonomies by Brignull et al. [2023], Gray et al. [2018], Conti and Sobiesk [2010] and Mathur et al. [2019]. These taxonomies were considered because all of them contain Dark Pattern types that can be applied

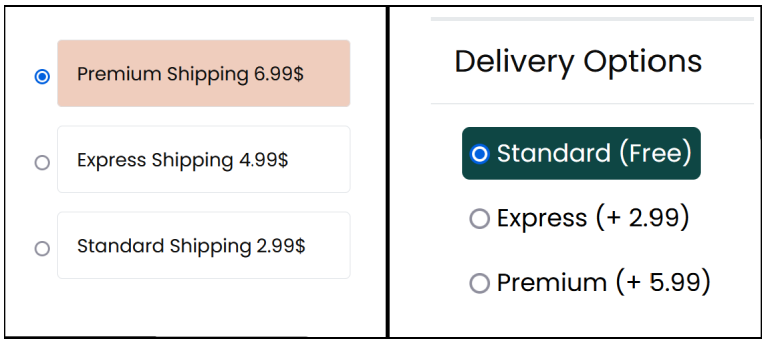


Figure 3.4: Screenshot of *Checkout* page from a *check* website (left) and the *bright* website (right). On the *bright* website, the user-friendly delivery option "standard" is preselected (*Preselection*), positioned at the top (*False Hierarchy)* and highlighted (*Visual Interference*). For the *check* website, these manipulations are all towards the user-hostile direction.

in the context of a shopping website.
As stated in Section 2.2.1, different terms of Dark Patterns in different taxonomies often describe a similar type of manipulation. Therefore, the different Dark Patterns from these taxonomies were compared with each other. We found that most of the Dark Patterns, that were suitable to use in our study, could be defined according to the taxonomy by Brignull et al. [2023]. These Dark Patterns were defined by Brignull et al. [2023] as follows.

Comparison Prevention: "The user struggles to compare products because features and prices are combined in a complex manner, or because essential information is hard to find."

Confirmshaming: "The user is emotionally manipulated into doing something that they would not otherwise have done."

Fake Scarcity: "The user is pressured into completing an action because they are presented with a fake indication of limited supply or popularity."

Fake Social Proof: "The user is misled into believing a product is more popular or credible than it really is, because they were shown fake reviews, testimonials, or activity messages."

Forced Action: "The user wants to do something, but they are required to do something else undesirable in return."

Hidden Costs: "The user is enticed with a low advertised price. After investing time and effort, they discover unexpected fees and charges when they reach the checkout."

Nagging: "The user tries to do something, but they are persistently interrupted by requests to do something else that may not be in their best interests."

Obstruction: "The user is faced with barriers or hurdles, making it hard for them to complete their task or access information."

Sneaking: "The user is drawn into a transaction on false pretences, because pertinent information is hidden or delayed from being presented to them."

Trick Wording: "The user is misled into taking an action, due to the presentation of confusing or misleading language."

The Dark Pattern *Distraction* was used from the taxonomy by Conti and Sobiesk [2010], and was defined as follows:

Distraction: "Attracting the user's attention away from their current task by exploiting perception, particularly preattentive processing."

Across all websites, each Dark Pattern has been implemented exactly once

Each of these Dark Patterns were used exactly once, such that participants would not be able to identify a previously seen Dark Pattern and therefore find out the actual research question. However, some of these Dark Patterns were combined with the Dark Pattern variants of the patterns introduced in Section 3.1.3. An example of this can be seen in Figure 3.5, where in addition to *Confirmshaming*, *Visual Interference* is used to make the user-friendly option less vis-

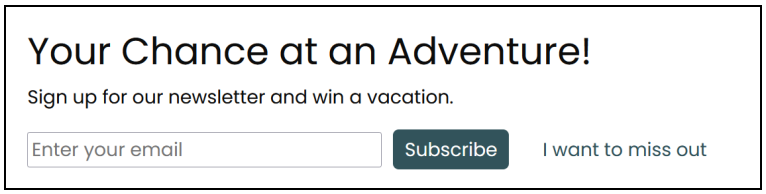


Figure 3.5: Screenshot of the Dark Pattern *Confirmshaming* in combination with *Visual Interference* used in one of the websites in the study.

ible. The exact Dark Patterns used on the websites can be seen in Table 3.2.

Website	Dark Patterns
Seat Serenity	Fake Social Proof
Pet Paw Paradise	Hidden Costs
Peak Venture	Distraction, Confirmshaming
Timepiece Trove	Comparison Prevention, Sneaking
Fit Finds	Obstruction, Trick Wording, Nagging
Gent's Treasure	Forced Action
Sonic Sensation	Fake Scarcity

Table 3.2: An overview of the Dark Patterns used in the different websites.

For the *bright* and the *check* websites, the elements, in which the patterns were applied, were given different contents on the *Shop* page. This was done in order to keep the websites realistic and avoid participants from recognising a theme of them being manipulated in a certain way. A screenshot of these elements can be seen in Figure 3.6. On both *check* websites, an additional item was offered (care package or insurance), while the *bright* website offered a way to directly select multiple items.

For the *Checkout* page, the element on which the Patterns were applied, was the selection of delivery options. This was the same for the *bright* and the *check* websites, as shown in Figure 3.4.

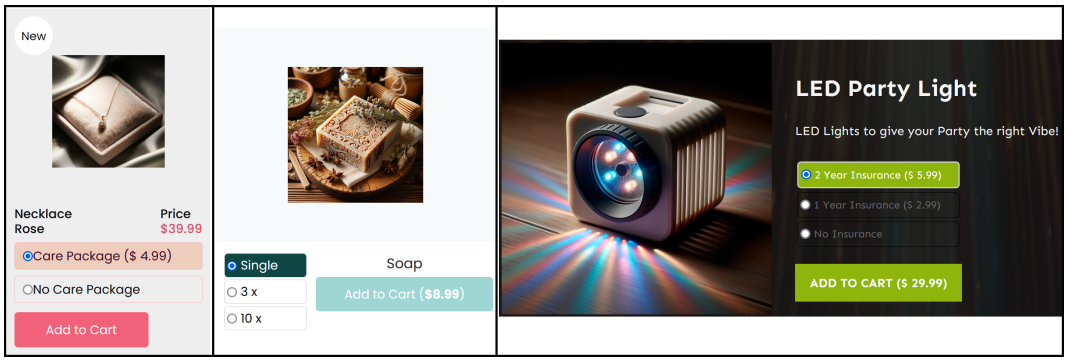


Figure 3.6: Juxtaposition of the elements containing Dark and Bright Patterns on the *Shop* pages of the *bright* (middle) and *check* (left and right) websites.

Cookie Banners

Since the website templates originally did not contain cookie banners, they had to be added separately. For the creation of most cookie banners, the tools Cookie Banner Generator[9] and da-software[10] were used. One cookie banner was created by hand and one cookie banner was included as a template, taken from codeply[11]. The tools used, to create the cookie banners, offered some customization of colour choice, usable elements or positioning of the banner, but in general, the cookie banners had similar styles. Using more than one tool therefore helped to diversify the designs, making it less obvious to participants that the websites and the cookie banners were created specifically for the purpose of this study. While not every cookie banner allowed for a granular choice of which types of cookies to consent to, as shown on the right side in Figure 3.7, the cookie banners that did allow to select specific types were all presenting the same options, which were ”marketing”, ”preferences”, and ”analytics”.

Cookie banners had to be implemented separately and were created with the help of specialized tools and templates

All cookie banners were designed in a way that they contain at least one Dark Pattern. We decided to use *Preselection*, *Visual Interference*, *False Hierarchy* and *Obstruction* as a

We selected four types of Dark Patterns to be implemented on cookie banners

[9] https://cookiebannergenerator.com/ Accessed: May 27, 2024

[10] https://da-software.net/cookiebannergenerator/ Accessed: May 27, 2024

[11] https://www.codeply.com/p/azCmarhM9X Accessed: May 27, 2024

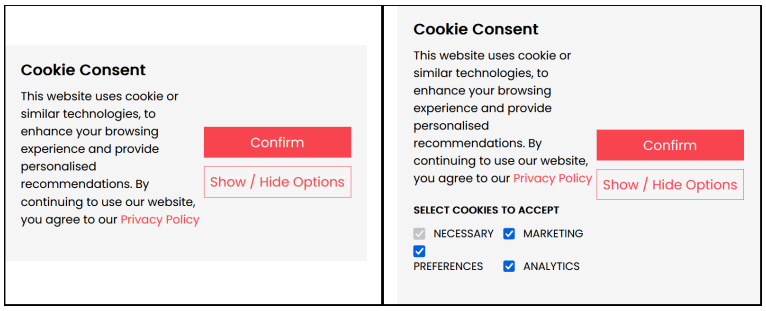


Figure 3.7: Screenshot of a cookie banner using all four Dark Patterns. On the left side, the cookie banner is shown as is appears on the website. The right side shows the cookie banner after pressing the "show / hide options" button.

pool to select Dark Patterns from for the cookie banners. A similar collection of Dark Patterns were used in the study conducted by Graßl et al. [2021]. An example of a cookie banner is shown in Figure 3.7. The exact Dark Patterns used on each cookie banner can be seen in Table 3.3.

Website	Preselection	Visual Interference	False Hierarchy	Obstruction
Seat Serenity		•	•	
Pet Paw Paradise		•		
Peak Venture	•	•		
Timepiece Trove		•		
Fit Finds	•	•	•	•
Gent's Treasure	•			•
Sonic Sensation	•	•		
Bright / Check	•	•	•	

Table 3.3: An overview of the Dark Patterns used in the cookie banners.

Participants had to make a choice on the cookie banner in order to proceed with navigating through the website

Participants were confronted with the cookie banners when they were redirected to the *Home* page of the website. The rest of the website was dimmed and participants were not able to interact with the website before making a choice on the cookie banner. While this may not be realistic, because real websites do sometimes allow users to ignore the cookie banner, it was necessary in order to assure that participants

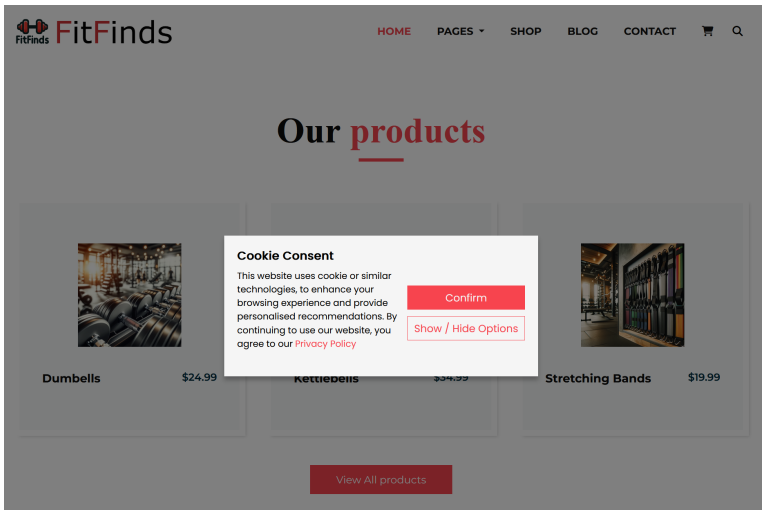


Figure 3.8: Screenshot of the website "Fit Finds". The colour of the clickable elements on the cookie banner are the same as the detail colours of the website (logo, "View All products" button, and current tab).

would interact with the cookie banner. Forcing an interaction also allowed for different placements of the cookie banners, because whether a user interacts with a cookie banner may depend on the positioning of it [Utz et al., 2019]. Different positions for the cookie banners introduced more variation in the design of the cookie banners, making it less obvious that some of them were designed using the same tool.

To make the cookie banners seem integrated in the website and therefore make the website more believable, colours were adjusted to fit the colour scheme of the website. An example of this can be seen in Figure 3.8.

Colours of the cookie banners were adjusted to the colours used on the corresponding website

Checkout Windows

Most of the templates contained an item in the navigation bar, that would redirect a user to the *Checkout* page. This item was some variation of a shopping cart icon. For websites, that did not contain such an item in the navigation

bar, we added similar icons using Fontawesome[12].

Checkout windows were added with the help of templates

The checkout windows within the *Checkout* pages, needed to be created as well, because none of the templates included them. For this, templates were used. The sources for these templates can be seen in Appendix C.
These templates were adjusted, such that all checkout windows provided the same core functionality. This included increasing or decreasing the amount of an item, and deleting an item from the cart. For each checkout window, items were displayed with at least an image of the item and the item's name. On some websites, additional information about some item was displayed, e.g. a dumbbell on the website "Fit Finds" always displayed that it's weight would be ten kilograms.

Study Procedure Related Websites

Additional websites were created, that guided the users through the study

Since the entire study was conducted on a computer, multiple websites needed to be created to guide the participants through the websites. All of these websites used the same font, no images or colours, such that had a neutral appearance, because they are not supposed to distract participants in any way. Their sole purpose was to give, or ask for information.

3.1.4 Participants and Recruitment

Participants were friends and students from the institute

For this study, a schedule planner on the website DFN terminplaner[13] was set up, on which participants could book a timeslot for the study. There was not a fixed amount of participants, but rather an effort made to find as many participants as possible. Participants for this study were recruited in two ways. The first one was asking for any students, that were either working for the institute, or on their bachelor's or master's thesis to participate in the study. The exact recruiting message sent to the institute's slack[14] channel was

[12] https://fontawesome.com/ Accessed: May 27, 2024
[13] https://terminplaner6.dfn.de/de Accessed: May 27, 2024
[14] https://slack.com/ Accessed: May 27, 2024

the following:

Hey everyone! I am starting the user study for my master's thesis next week and am looking for participants. You will navigate through a set of websites and give feedback to them. The interaction will be screenrecorded and afterwards, it will be discussed in a short interview. If you are interested, please choose a time slot to participate here: [URL to a schedule planner]. The study will take place in the media space. Thank you in advance!

This way, five participants could be recruited.

The other participants were friends and family of the author, that have not been told about the topic of this master's thesis. They were either asked in person or via text message, if they would participate. An example for such a message is the following:

I am currently working on my master's thesis and I am still looking for participants. If you have about an hour of time in the next two weeks, i would greatly appreciate if you would sign up for a slot here: [URL to a schedule planner]

In total, 15 participants were recruited for this study, aged 20 to 58 (M=28.8 years, SD=11.61, five women, nine men, and one divers). Twelve of them were students, while the other three were employees. Nine participants reported "Computer Science" to be their field of proficiency. The others included "Engineering", "Medicine", and "Pedagogy". The previous Dark Pattern knowledge was self-reported on a scale from 1 ("none") to 5 ("expert") and was rated rather low (M=1.93, SD=1.12). Eight participants reported no previous knowledge about Dark Patterns, and seven participants had at least heard of them before.

We successfully recruited 15 participants

3.1.5 Ethical Considerations

The study was designed in a way that it was supposed to comply with the ACM Code of Ethics and Professional Conduct[15]. This code of conduct includes seven principles,

The "Code of Ethics and Professional Conduct" served as a guide to creating an ethical study design

[15]https://www.acm.org/code-of-ethics Accessed: May 27, 2024

which we tried to follow.

In order to guarantee, that recorded data can not be traced back to the participants, names were not stored. Instead, participants were assigned a number under which their data was stored.

Participants were given all the necessary information about the study trough a consent form

As described in Section 3.1.2 “Concrete Runthrough”, participants were handed a consent form. The content of this form was explained to the participants. On this form, the (fake) purpose of the study, the procedure, potential risks, information about confidentiality, and costs and compensation was given. This way, the scope of the study and any potential harm was transparently disclosed to the participants. They were also told, that they could pause or cancel their participation any time. Participants were asked to agree on recording the audio of the interview, but did not have to consent to it. The consent form can be seen in Appendix B.

3.1.6 Measurements

We used interactions, a questionnaire and an interview as measurements

When analysing the studies presented in Chapter 2, the kind of measurements that were used to gather data, can roughly be divided into three groups.
There are quantitative measurements, for example measuring the consent choice of a user in a cookie banner. To assess user perception of websites, questionnaires and interviews were used. We decided to use all three of these measures for our study in order to get a broad overview of the entire subject matter.

Website Interaction Data

Website interaction data was stored automatically during the runthrough in *.json*-files. It consisted of time information, cookie consent decisions, and interaction with Dark or Bright Patterns.

Time: The amount of time a user spent on each page of the websites was measured automatically, which eliminates human error. The duration information was included as an indication for the ease of use of a website. An example for such an entry looks like this:

{"websiteName":"Party Pals",
"duration-cookie":"5125",
"duration-index":"9365",
"duration-shop":"47721",
"duration-checkout":"5183"}.

Interaction data included durations, cookie decisions and interaction with Dark or Bright Patterns

Cookie decisions: Whether cookies were accepted, as well as the types of cookies that were accepted was also stored automatically. An example for an entry of a participant accepting all cookies looks like this:

{"WebsiteName": "Gents Treasure",
"cookieConsent": "true",
"cookieConsentPrefs": "[\"preferences\",
\"marketing\", \"analytics\"]"}.

Pattern interaction: If a participant interacted with a Dark or Bright Pattern, or a website element that is linked to a Dark or Bright Pattern, the interaction was stored by giving the element, the pattern is linked to, as well as the decision made. The following is an example of such a stored interaction:

{"Website":"PartyPals",
"ShippingOption":"standardOption",
"Context":"Checkout"}.

Questionnaire

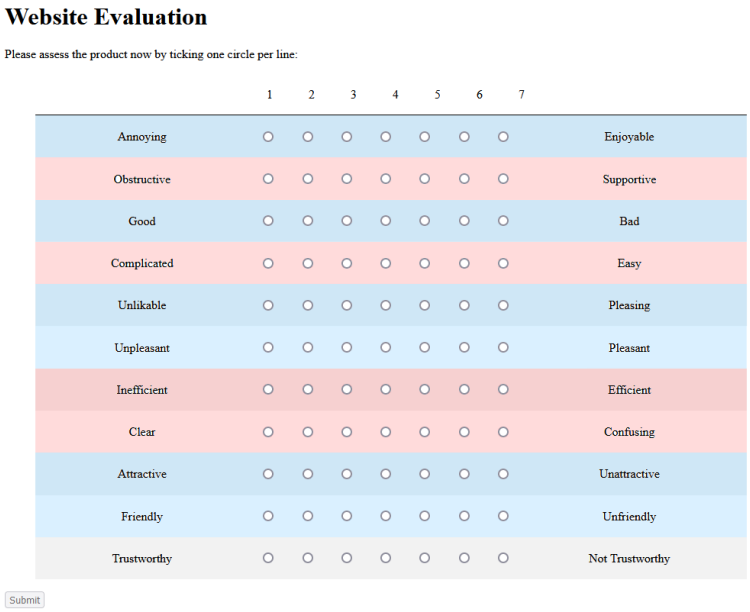
There exist multiple questionnaires that try to assess user perception, e.g. the UEQ, the SUS and others. We decided to adapt the approach from the study conducted by Calawen [2022], since his work is most closely aligned to this thesis. The questionnaires he used were the UEQ and the SUS.

We adapted the UEQ and UEQ-short to create our questionnaire

The use of similar questionnaires allowed for a more direct comparison of results. The questionnaire used in this study and which was placed after every website, was an adjusted version of the UEQ.
The UEQ consists of 26 items and a total of six scales. There also exists a shortened version of the UEQ, which is called UEQ-s [Schrepp et al., 2017]. This version regroups some of the items of the UEQ to introduce two new scales, which are called *pragmatic* and *hedonic*, and consist of four items each. In the handbook for the UEQ, it is explicitly stated, that it is possible to include only a subset of the scales in a questionnaire, as long as no individual items from one scale are removed. This allowed us to construct the questionnaire more freely, as otherwise, we would have been limited to using wither the full UEQ or the UEQ-s. It is also stated, that using the UEQ-s is recommended for studies where participants would have to judge multiple products, because the full UEQ would be too time consuming.

We used the *attractiveness* and *pragmatic* scale of the UEQ and added another item *trust* to our questionnaire

We decided to use the *attractiveness* scale from the UEQ, consisting of six items, and the *pragmatic* scale from the UEQ-s. The *attractiveness* scale estimates the overall impression of a product, which is why we decided to use it. It was also the only scale that yielded significant effects in the study by Calawen [2022], and was therefore an interesting aspect for a comparison. The *pragmatic* scale was chosen, because it summarizes *efficiency*, *perspicuity* and *dependability* scales from the UEQ. Thus, this scale gave us a good estimate of how users perceived the functionality of a website.
In addition to these two scales, we added an additional item *trust*. This was included, because we wanted to see, whether results from the UEQ scales could be explained with this item. This meant, that participants had to answer eleven items per website. All items were answered on seven point Likert scales. The final questionnaire can be seen in Figure 3.9.



Website Evaluation

Please assess the product now by ticking one circle per line:

	1	2	3	4	5	6	7	
Annoying	○	○	○	○	○	○	○	Enjoyable
Obstructive	○	○	○	○	○	○	○	Supportive
Good	○	○	○	○	○	○	○	Bad
Complicated	○	○	○	○	○	○	○	Easy
Unlikable	○	○	○	○	○	○	○	Pleasing
Unpleasant	○	○	○	○	○	○	○	Pleasant
Inefficient	○	○	○	○	○	○	○	Efficient
Clear	○	○	○	○	○	○	○	Confusing
Attractive	○	○	○	○	○	○	○	Unattractive
Friendly	○	○	○	○	○	○	○	Unfriendly
Trustworthy	○	○	○	○	○	○	○	Not Trustworthy

Submit

Figure 3.9: Screenshot of the questionnaire as it was placed on the website. The scales have been coloured for this image (red = *pragmatic*, blue = *attractiveness*, gray = *trust*).

Interview

We recorded the interaction and watched it together with the participants during a semi-structured interview

As described in Section 3.1.2, participants' interaction with the websites was screenrecorded. This recording was watched together with the experimenter after the participant navigated through all websites to the *demographics* page. It was chosen to record the interaction, because it allows the participant and researcher to see the websites afterwards in the same way, they were visited by the participant. While watching the recording, a semi-structured interview was held. Compared to a structured interview, this allowed for spontaneous questions about specific interactions and gave room for new ideas and themes, that may not have been thought of prior to the study. An open interview was decided not to be suitable, because the study itself had a rather fixed structure and an open interview could lead to results that are hardly comparable, which could make it difficult to identify themes afterwards.
The entire interview was voicerecorded and later tran-

scribed for further analysis.

Partcipants were asked the same two questions before the screenrecording was watched

Before playing the recording, participants were asked the following two questions.

1. Question: "What do you think, the study was about?"
   This was a quick check that was supposed to find out whether participants identified specific themes in the websites or even found out the actual research question.

2. Question: "Are there any websites that you remember as being particularly good or bad?"
   This question was asked to find out, if a specific website stood out.

Participants were asked about their general reasoning for cookie decisions, if the experimenter identified a theme during the interaction

If during the interaction, the experimenter identified a common pattern about accepting or rejecting cookies, the reasoning for this decision was asked beforehand, such that the interview would not be too repetitive, asking about cookie decisions on every website. At last, whenever the recording showed the *Home* page of a new website, the participants were asked about their first impressions of that website.

Reactive Questions were asked, whenever participants interacted with specific website elements

Apart from these fixed questions, a pattern for reactive questions was defined. These questions were concerned with different types of interactions on the website, which were relevant to the study. The first one is about the time a participant spent on certain website parts or elements. For example, a participant looking significantly longer at one *Checkout* page than at *Checkout* pages from other websites. In such a case, participants were asked what they were looking for or looking at, and why they were taking more time. This way, influences of Dark Patterns or influences of other design elements could be determined. If participants selected a specific option, that is linked to a Dark or Bright Pattern, the participants were asked about their reasoning behind the choice they made. This way, the thoughts participants had, when encountering a Dark or Bright Pattern, could be collected.

3.1.7 Data Analysis

In order to analyse the gathered data, quantitative and qualitative methods were used.

Quantitative Data Analysis

For the demographics data, Microsoft Excel[16] was used. Other quantitative data was analysed using Python[17].
While for demographics, duration, pattern interaction, and cookie selection data, no framework for the analysis was needed, because the data was simply descriptive, the analysis of the questionnaire answers was done with the help of some frameworks to assist with the inferential statistics.
The analysis of the participants' interaction with Dark or Bright Patterns was done manually. This is because there may not always be a conclusive way to define whether a participant was influenced by a Dark or Bright Pattern or not. Participants may not see the element containing a Dark Pattern or, in the case of the Dark Pattern *Nagging*, the element linked to the Dark Pattern may not have been shown, because a user directly chose the option that was desired by the website. Another problem with analysing this interaction, is the fact that different patterns needed to be interacted with differently. This made comparing participants' choices in different Patterns difficult.
The comparison of Pattern interaction has therefore been limited to the *bright* and *check* websites, where the same Patterns in the same contexts were used.

Dark and Bright Pattern interaction was only analysed for the *bright* and *check* websites

The website of the UEQ[18] offers Excel-files in which the recorded data can be inserted. In these files, it is also described how the data needs to be analysed. In our study, a total of 1500 UEQ items were answered, which is why we adopted the data analysis from the Excel-files to Python code to save time and avoid errors by manually typing in the values. Another reason to use Python code instead of

The analysis of the questionnaire data was done using Python

[16] https://www.microsoft.com/en-us/microsoft-365/excel Accessed: May 27, 2024
[17] https://www.python.org/ Accessed: May 27, 2024
[18] https://www.ueq-online.org/ Accessed: May 27, 2024

the provided Excel-files is the amount of websites that were analysed and the way the websites needed to be compared. The Excel-files only provide a comparison of two websites, making it necessary to use other ways to analyse the data, when comparing more than two websites.

The recorded data was first restructured for further analysis

In order to adapt the analysis correctly, the collected data needed to be transformed into the correct shape first. The UEQ requires values to be in the interval [-3, 3]. Since the collected data was stored in a range from one to seven, it needed to be adjusted. The original data was given on the scale of one to seven, because this was the official labelling provided by the UEQ. After the values were adjusted, items were assigned to their respective scale. For the analysis of the scales, Pingouin[19] was used. Pingouin is a Python framework for statistical analysis. It provides functions for statistical tests such as ANOVA, t-tests, and others. These functions are usually taking Pandas[20] dataframes as an input. Therefore the data needed to be transformed into fitting dataframes.

We compared the *bright* and the *check* websites, as well as the blocks of websites before and after the *bright* website

We defined two main ways to compare websites:
The first comparison is a comparison of the *check* websites and the *bright* website. The second comparison is between the two blocks of websites, that were placed before and after the *bright* website. The block of websites that were placed before the *bright* website, was called *pre-block*, and the block of websites that were placed after the *bright* website, was called *post-block*.
In order to find out which tests are suitable for the collected data, we tested for normality, using the *Shapiro-Wilk test*. This test for normality showed, that the data is in fact normal distributed, which means that the parametric tests *paired t-test* and *repeated-measures ANOVA* could be used.

We used two-tailed paired t-tests for the comparison of websites

The comparison of the *check* websites and the *bright* website was done using two-tailed paired t-tests with the following hypothesis:
H_0**:** $\mu_1 = \mu_2$ (the two population means μ_1 and μ_2 are equal)
H_1**:** $\mu_1 \neq \mu_2$ (the two population means μ_1 and μ_2 are not

[19] https://pingouin-stats.org/build/html/index.html Accessed: May 27, 2024
[20] https://pandas.pydata.org/ Accessed: May 27, 2024

equal)

The comparison between the two blocks before and after the *bright* website, needed some more testing first. This is due to the fact, that the websites within one block might not be similar, such that combining them into a single block may not be valid. Therefore, repeated-measures ANOVA tests were conducted for the two UEQ scales on both blocks. Only after passing this test, stating that no significant difference could be found between the websites of one block, the websites could be combined to blocks and the blocks themselves could be compared the same way as the *bright* and *check* websites, using a two-tailed paired t-test.

Websites were combined to blocks that were placed before and after the *bright* website

Qualitative Data Analysis

The data gathered from the interviews needed to by analysed using qualitative methods. We chose to use *Thematic Analysis* and followed the approach suggested by Braun and Clarke [2006]. Thematic Analysis aims to identify patterns or themes inside a given dataset. Since no coding framework for our research question existed, an inductive thematic analysis was used.
The following six phases are involved in the approach proposed by Braun and Clarke [2006]:

We used thematic analysis to analyse the data gathered during the interviews

1. ***Familiarisation with the data:*** This phase involves the transcription of the audio and reading through the transcriptions to get an idea of what was said and how the data is structured.

2. ***Generating initial codes:*** The first codes are generated.

3. ***Searching for themes:*** Sorting initial codes into potential themes.

4. ***Reviewing themes:*** Deleting, combining, and adding themes.

5. ***Defining and naming themes:*** Interpreting the findings found in the themes such that a suitable name for a theme is found.

6. ***Producing the report:*** Presenting the findings including themes and text extracts.

For the process of coding and identifying themes, we used MAXQDA[21], which is a software specifically designed for qualitative data analysis.

3.2 Results

This section presents findings across three areas: descriptive statistics, questionnaire responses, and thematic analysis. These results are based on the data gathered using the analysis methods presented in Section 3.1.7.

3.2.1 Descriptive Statistics

Descriptive statistics include duration data, and decisions made by the participants concerning cookie banners and Dark or Bright Patterns. For all diagrams, that will be presented in this section, the order of the websites represents a sample order that one of the participants visited the websites in. This means, the first website is "Seat Serenity", which was visited first by all participants. After that, the four websites from the *pre-block* were shown, followed by the *bright* website "Pure Roots". The last four websites are the websites that made up the *post-block*.

Durations

The average time spent by participants on the different pages of the websites can be seen in Figure 3.10. It shows,

[21] https://www.maxqda.com/de/ Accessed: May 27, 2024

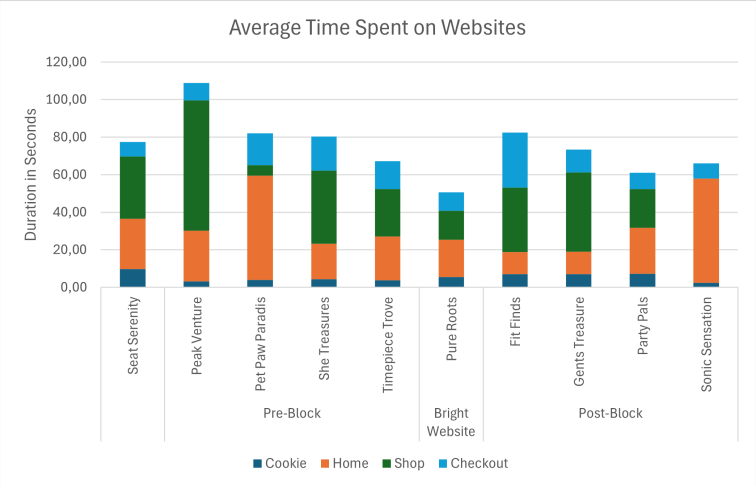


Figure 3.10: Stacked bar chart of the mean duration, participants spent on the different websites.

that participants spent different amounts of time on the different websites. When comparing the two blocks, participants spent on average 84.59 seconds on websites from the *pre-block* and 70.73 seconds on websites from the *post-block*. Notable is that on average, participants spent the least amount of time on the *bright* website "Pure Roots". The average time spent on the *bright* website was 50.56 seconds. The website "Sonic Sensation" does not have an entry for the page *Shop*, because the website did not have a dedicated *Shop* page, the items selected by the participants were all portrayed on the *Home* page.

Participants spent the least amount of time on the *bright* website

Cookie Decisions

In Figure 3.11, the decisions participants made in cookie banners are shown. A cookie consent request was defined as "accepted", if a participant consented to at least one cookie category, which were marketing, preferences, or analytics. For every website, at least two participants accepted cookies. Most participants accepted cookies for the website "Pet Paw Paradise", where four participants agreed to the cookie request.

Decisions made on cookie consent requests were similar on all websites

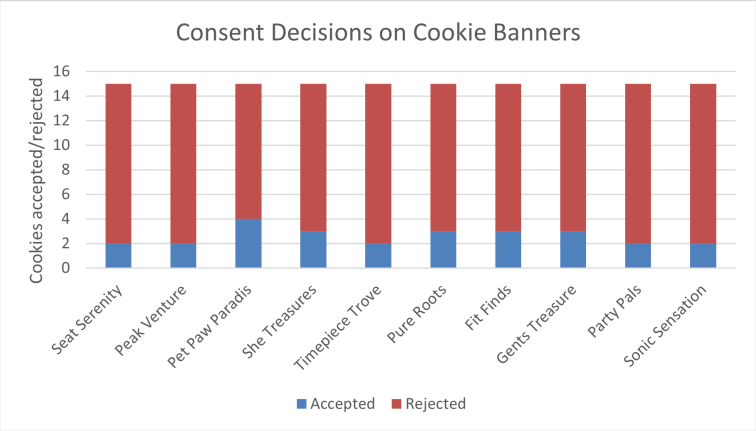


Figure 3.11: Stacked bar chart, showing the distribution of participants accepting or rejecting cookies.

Pattern Interactions

Participants choices on the *bright* and *check* websites differed for Patterns placed on the *Shop* page

Looking at the interactions of participants when visiting the *bright* and the two *check* websites, showed that participants chose the user-friendly option most often on the *bright* website. In addition to that, the user-friendly option was chosen more often in the *post-check* website than in the *pre-check* website. Figure 3.12 shows the distribution of user-friendly and user-hostile choices for the three websites in the shopping context, as well as in the checkout context.

3.2.2 Questionnaire

Due to the relatively low amount of participants, accuracy of the measurements for the questionnaire is rather low

Figure 3.13 shows the mean scores for two UEQ scales *attractiveness* and *pragmatic*, and the *trust* item. Error bars represent the 95% confidence interval for each scale. The calculation of the confidence depends on the standard deviation and sample size. Because of the relatively low sample size, the confidence intervals are rather large, meaning that measurements may not be perfectly accurate.

The standard deviation of the scores indicate, that participants had low agreement in the judgement of websites

A similar chart is shown in Figure 3.14, here the error bars represent the standard deviation, which show the level of agreement among the participants. According to the hand-

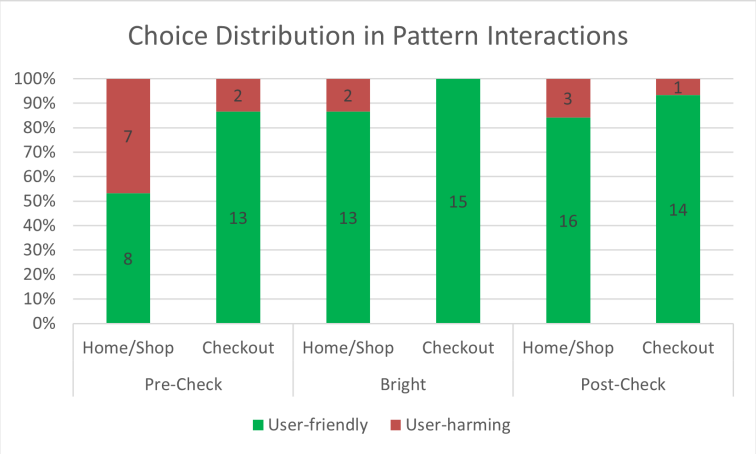


Figure 3.12: Stacked bar chart that shows the distribution of participants choices across the two *check* websites and the *bright* website.

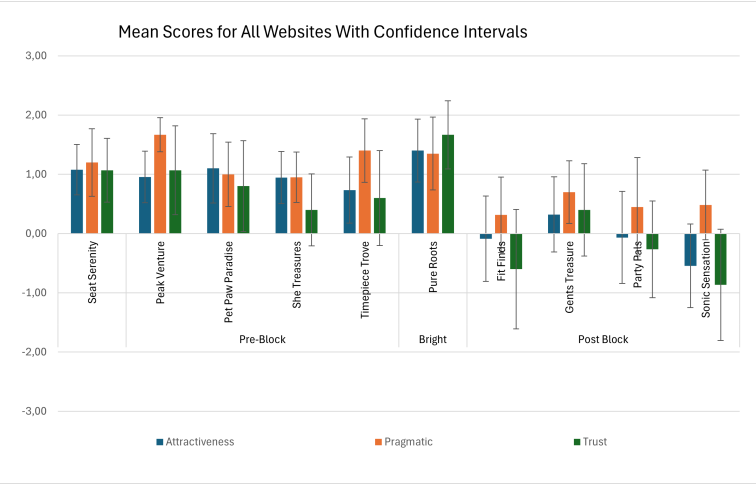


Figure 3.13: Clustered bar chart, displaying mean scores for the two UEQ scales and the trust item for all websites. Error bars represent the confidence.

book provided for the UEQ, standard deviations smaller than 0.83 are considered as *high agreement*, between 0.83 and 1.01 there exists *medium agreement* and *low agreement* is reached when standard deviations exceed a value of 1.01. On the *attractiveness* scale, agreement was low for seven websites and medium for three websites. Agreement was

Figure 3.14: Clustered bar chart, displaying mean scores for the two UEQ scales and the trust item for all websites. Error bars represent the standard deviation.

high once for the *pragmatic* scale ("Peak Venture"), and medium once ("She Treasures"), the other eight websites had low agreement.

The *Shapiro-Wilk test* for normality was conducted for all scales on every website. The exact values for each website can be seen in Table 3.4.

All websites passed the test for normality, allowing us to use parametric tests for the comparison of websites

The results showed test statistic values from 0.885 to 0.972, and p-values from 0.057 to 0.880. Assuming a significance level of 0.05, the hypothesis of a distribution being normal could therefore not be rejected for any scale on any website. This allowed us to use parametric tests for further analysis, because they assume that the distribution of the population is normal.

Scores for the *trust* item were similar to the scores from the *attractiveness* scale

Because the reason for including the *trust* item was to have an additional score that could possibly explain outliers, we compared scores from the *attractiveness* and *pragmatic* scales with the scores of the *trust* item. Since the average difference between *trust* and *attractiveness* was rather low at 0.248, with a maximum difference of 0.544, we did not further investigate any influence of the scores for the *trust* item

Website	Scale	Test Statistic W	p-Value
Seat Serenity	Attractiveness	0.972	0.880
	Pragmatic	0.949	0.512
	Trust	0.924	0.218
Peak Venture	Attractiveness	0.916	0.168
	Pragmatic	0.936	0.335
	Trust	0.916	0.170
Pet Paw Paradise	Attractiveness	0.959	0.677
	Pragmatic	0.956	0.623
	Trust	0.930	0.273
She Treasures	Attractiveness	0.958	0.656
	Pragmatic	0.934	0.316
	Trust	0.896	0.082
Timepiece Trove	Attractiveness	0.948	0.500
	Pragmatic	0.949	0.502
	Trust	0.941	0.393
Pure Roots	Attractiveness	0.941	0.397
	Pragmatic	0.887	0.061
	Trust	0.891	0.069
Fit Finds	Attractiveness	0.972	0.880
	Pragmatic	0.912	0.144
	Trust	0.895	0.081
Gent's Treasure	Attractiveness	0.963	0.744
	Pragmatic	0.962	0.721
	Trust	0.933	0.304
Party Pals	Attractiveness	0.948	0.494
	Pragmatic	0.950	0.522
	Trust	0.941	0.393
Sonic Sensation	Attractiveness	0.896	0.084
	Pragmatic	0.948	0.497
	Trust	0.885	0.057

Table 3.4: An overview of the results from the *Shapiro-Wilk tests*.

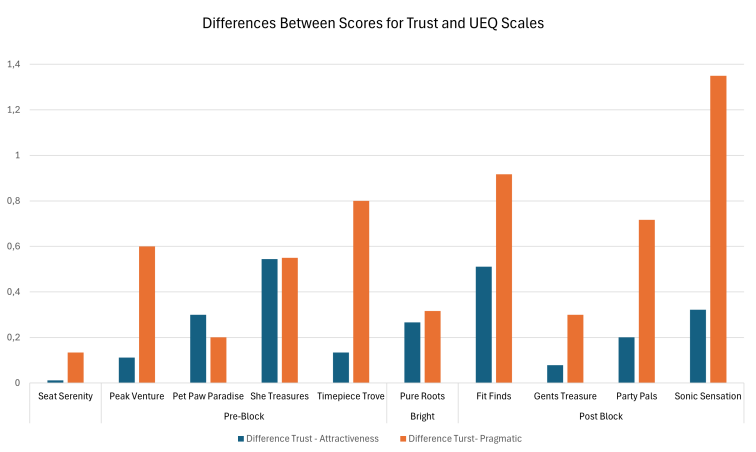


Figure 3.15: Clustered bar chart of the differences of the three scales that were used in the questionnaire

on the scores of any of the UEQ scales. In Figure 3.15, the differences between the scores for the *trust* item and the UEQ scales can be seen.
While the *trust* item is not part of the UEQ, it was treated the same way as the two UEQ scales in this analysis.

Check vs Bright Websites

Significance levels for statistical tests are assumed to be 0.05. P-values were corrected using ”Holm-correction”[Holm, 1979]. Effect sizes are indicated by ”Cohen’s d”.
The results of the two-tailed paired t-tests yielded the following results:

Attractiveness:
”Pure Roots” (*bright*, M=1.400, SD=1.052) and ”She Treasures” (*pre-check*, M=0.944 , SD=0.873);
`t(14)= 1.998, p=0.066, effect size=0.455.`
”Pure Roots” (*bright*, M=1.400, SD=1.052) and ”Party Pals” (*post-check*, M=-0.067 , SD=1.533);
`t(14)= 3.737, p=0.007, effect size=1.078`
”She Treasures” (*pre-check*, M=0.944, SD=0.873) and ”Party Pals” (*post-check*, M=-0.067 , SD=1.533);

t(14)= 2.709, p=0.034, effect size=0.783.
This shows that for the *attractiveness* scale, the *bright* and *pre-check* websites were rated significantly higher than the *post-check* website. There was no significant difference found between the scale means of the *bright* and *pre-check websites*.

Pragmatic:
"Pure Roots" (*bright*, M=1.350, SD=1.214) and "She Treasures" (*pre-check*, M=0.950 , SD=0.837);
t(14)= 1.428, p=0.350, effect size=0.371.
"Pure Roots" (*bright*, M=1.350, SD=1.214) and "Party Pals" (*post-check*, M=0.450 , SD=1.641);
t(14)= 2.059, p=0.176, effect size=0.602.
"She Treasures" (*pre-check*, M=0.950, SD=0.837) and "Party Pals" (*post-check*, M=0.450, SD=1.641);
t(14)= 1.243, p=0.350, effect size=0.371.
This shows that for the *pragmatic* scale, there existed no significant differences between the means for any of the three websites.

Trust:
"Pure Roots" (*bright*, M=1.667, SD=1.135) and "She Treasures" (*pre-check*, M=0.400 , SD=1.200);
t(14)= 3.676, p=0.005, effect size=1.048.
"Pure Roots" (*bright*, M=1.667, SD=1.135) and "Party Pals" (*post-check*, M=-0.267 , SD=1.611);
t(14)= 4.276, p=0.002, effect size=1.340.
"She Treasures" (*pre-check*, M=0.400, SD=1.200) and "Party Pals" (*post-check*, M=-0.267 , SD=1.611);
t(14)= 1.435, p=0.173, effect size=0.453.
These results indicate a significant difference between the *bright* website and the *check* websites. However, no significant difference was found between the two *check* websites.

Pre- vs Post-Block

Before conducting two-tailed paired t-tests for the two blocks, repeated-measures ANOVA tests were conducted for each block, as described in Section 3.1.7 "Quantitative Data Analysis".

ANOVA tests were conducted in order to validate combining websites into blocks

We calculated the average of the scores of the websites that made up one block, such that the sample size was not artificially increased. Cohen's d is used to indicate effect sizes of the t-tests, for ANOVA results, the effect size is indicated using partial eta-squared.
The results of these tests will be presented in the following.

Attractiveness:
Pre-Block: `F(3, 42) = 0.659, p=0.581`
Post-Block: `F(3, 42) = 3.101, p=0.060`
Since the post-block did not pass Mauchly's test for sphericity, the Greenhouse-Geiger corrected p-value was calculated .
The results show, that for both blocks, the hypothesis

$$H_0 : \text{All scale means are the same for all websites}$$

could not be rejected, which let us combine the websites to the *pre-block*(M=0.933, SD=0.837) and the *post-block*(M=-0.094, SD=1.289), and compare these blocks in a two-tailed paired t-test, which yielded the following result:
`t(14)= 4.452, p=0.001, effect size=0.946`

Pragmatic:
Pre-Block: `F(3, 42) = 3.521, p=0.023`
Post-Block: `F(3, 42) = 0.543, p=0.655`
For the *pragmatic* scale, both blocks passed Mauchly's test for sphericity. The ANOVA test for the *pre-block* however, yielded a p-value below 0.05, which means that the Null-hypothesis was rejected. We therefore could not combine the websites, that were placed before the *bright* website, to one block.

For the *pragmatic* scale, the ANOVA test returned significant results. We therefore removed an outlier website from the block

To still be able to compare two blocks, we conducted post-hoc tests to see whether there existed just one outlier website in the set of websites that would make out the *pre-block*.
We therefore conducted two-tailed paired t-tests for each pair of websites from the *pre-block*. The two-tailed paired t-test for "Peak Venture"(M=1.667, SD=0.568) and "Pet Paw Paradise"(M=1.000, SD=1.076) yielded the following result:
`t(14)= 2.823, p=0.014.`
For "Peak Venture"(M=1.667, SD=0.568) and "She Treasures"(M=0.950, SD=0.837) it yielded the result

t(14)= 3.208, p=0.006.
The other tests all yielded p-values above 0.136, and therefore showed no significant difference between the means of website pairs. We concluded, that "Peak Venture" might be an outlier and conducted a repeated measures ANOVA test again for the *pre-block*, but without the website "Peak Venture".
This test yielded the following result:
F(2, 28) = 1.548, p=0.230.
We therefore decided to define the *pre-block* without the website "Peak Venture".
The result of the two-tailed paired t-test between the *pre-block*(M=1.117, SD=1.017) and the *post-block*(M=0.488, SD=1.303) was
t(14)= 2.793, p=0.014, effect size=0.638.
We also conducted the t-test with the website "Gent's Treasure" being removed from the *post-block*. This way, for both blocks, the scores of three website were considered. The test yielded the following results:
t(14)= 2.794, p=0.014, effect size=0.685.
Performing a paired t-test without removing any websites from either of the two blocks resulted significant differences as well:
t(14)= 3.388, p=0.004, effect size=0.811.

Trust:
Pre-Block: F(3, 42) = 1.324, p=0.279
Post-Block: F(3, 42) = 3.089, p=0.060
The *post-block* did not pass Mauchly's test for sphericity, therefore the Greenhouse-Geiger corrected p-value was calculated.
After combining the websites to the two blocks, the two-tailed paired t-test between the *pre-block*(M=0.717, SD=1.253) and the *post-block*(M=-0.333, SD=1.493) yielded the following result:
t(14)= 3.348, p=0.005, effect size=0.762

3.2.3 Thematic Analysis

Themes found in the thematic analysis are divided in "study related" and "additional comments"

In general, two overlying themes could be identified in the data. The first one contained themes that were related to the study itself, such as decisions made in different contexts, such as cookie banner, purchase decisions, and others. The second one was made of themes that were classified as "additional comments made by participants".
We will start this section with themes that were identified from the reoccurring questions, that were related to the study itself. Afterwards, more study related themes will be presented and at last, we will give an overview of the themes that were identified as "additional comments".
Every interview was conducted in German, therefore any statement that is given in this section is a translation of the original statement made by the participant.
When a participant is referenced, they are referred to by the convention *PXX*, where "XX" indicates the number of a participant under which the data was stored.
An overview of all codes and categories can be seen in the codebook in Appendix A.

Reoccurring Questions

Purpose of the study: The responses to the question of what participants thought the purpose of the study was, were categorised into three groups.

The purpose of the study was thought to be investigating Dark Patterns, website perception, or user behaviour

Participants who reported to have previous Dark Pattern knowledge all reported, that they thought the study had something to do with Dark Patterns ("I think the study was about Dark Patterns.", P16). Participants who reported to not have any knowledge about Dark Patterns either thought the study was about website perception ("To see which websites are better or worse, and what one perceives as bad or good.", P13) or user behaviour on websites ("I thought it was about clicking behaviour, where i looked at first, and the path from entering a website to the shopping cart.", P11).

Remembering good or bad websites: We found that participants either remembered the exact website ("I especially

liked the Party Website.", P13) or they described a website ("I don't know which one it was, but it said 'Do you really don't want this?'.", P15).
When participants gave descriptions of websites they did not like, they mainly described websites from the *post-block*, especially the website "Fit Finds", because it contained an element that asked users to add another item to the cart in order to get free shipping ("I don't like it, when websites want you to order more to get free shipping.", P07).
Concrete positive memories included the websites "Party Pals" and "Peak Venture", while descriptions of websites that were liked, included a variety of websites.

Participants rather remembered websites they did not like

Cookie Decisions: Three main themes for participants making decision in the context of cookie banners could be identified. The first one described users explaining that they declined cookie banners because of data privacy reasons ("I do not want to provide any data.", P08). Some participants stated, that they accepted cookies for convenience reasons ("Sometimes i don't feel like it and click 'accept' because it is easier.", P02), which forms the second theme. The third theme, that was found in the responses, was about participants explaining their decision with it being a habit ("Because I always do this.", P07).
One participant chose to accept a specific selection of cookies. The consented to the use of functional cookies, and explained this decision by stating "Sometimes, things do not work when 'functional' is unselected."

Cookie decisions were mostly reasoned with the choice being the usual behaviour of the participant

First impressions: First impressions were divided in three themes. Impressions were either negative, which was mostly reasoned with the cookie banner design ("I mean, when the cookies are that stupid, I also dislike the website", P14) or the website design itself ("Ugly colours, where I thought 'this looks cheap'.", P03).
The second theme were first impressions that are rather neutral ("I did not have a strong opinion here.", P02).
The third theme described participants having positive first impressions of a website ("I thought this one was cool. It looked nice and inviting.", P06).
While it is not intended to report quantities in thematic analysis, they may be reported in some cases [Braun and Clarke, 2006]. In the case of initial website perception in

A majority of first impressions was positive, other first impressions were negative or neutral

our study, it provides a rough idea of the distribution of how participants first perceived websites. In total, 124 responses about first impressions were coded, some participants did not respond to the question. Out of these responses, 65 ($\sim$ 52.4%) were coded as "positive impressions", 26 ($\sim$ 20.9%) responses were coded as "neutral impressions", and 33 ($\sim$ 26.6%) responses were coded as "negative impressions".

Study Related Themes

Products were chosen because of their appearance, function, price, or randomly

Purchase Decisions: We identified four themes in the responses of participants explaining why they added an item to the shopping cart.
Some responses were coded as "Random product choice" ("I just picked based on my gut feeling.", P12). Participants also chose objects for price reasons ("When the price is that outrageously cheap, I will take that.", P07). Another theme that was found was participants choosing an item because of its looks ("I thought this one looked the best.", P01). The last theme, after which participants made purchase decisions, was "Decision based on function" ("Because [the watch] was waterproof.", P04).

Participants decided for standard delivery because of the price and them not having any time pressure

Delivery Options: Four websites showed delivery options in the *Checkout* page. Participants were asked to explain their reasons for choosing a specific delivery option, based on the way they interacted with the element displaying the delivery options. Two themes could be identified in their responses. The first one is participants choosing the "standard" delivery option, because there is no time pressure and it is cheaper than the other options ("There was no specific date when I would have needed it, so I do not pay extra for [delivery].", P06).
The second theme is participants choosing the "express" delivery option because of time reasons ("If it comes too late for mother's day, it would be stupid.", P06). These were mostly associated with the participant interpreting the scenario for the website in their own way.

Pattern Decisions: Responses were coded in order to have

another kind of data, that represents the pattern interaction. Participants either "Decided for a pattern" (69 times, 42.6%) ("Still decided for the headphones that were on sale.", P12), or "Decided against a pattern" (93 times, 57.4%) ("Chose to take no insurance.", P02).
These numbers correspond approximately to the ratio found in the quantitative analysis of pattern interaction (38.6% acted according to a pattern, 61.4% decided against a pattern).

Interaction with Dark or Bright Patterns was similar to the numbers yielded in our quantitative analysis

Pattern Perception: When participants were asked about how they felt about a Dark or Bright Pattern, they were asked about their feelings on how an option was presented, rather than specifically about Bright or Dark Patterns. Four themes could be identified in the responses.
The first theme was participants perceiving a Dark Pattern as "negative" (97 times)("It annoyed me, that it is worded like that.", P14).
Another theme was participants feeling neutral about a Dark Pattern (21 times) ("I did not care, because I directly removed the checkmark there.", P11).
The only website for which participants stated, that they liked the way a choice is presented was on the *bright* website "Pure Roots" (17 times) (" 'Standard' was selected as delivery option, which I found super friendly for the costumer.", P03). This shows, that participants preferred Bright Patterns, rather that Dark Patterns.
At last, 25 statements were coded under the theme "pattern was not noticed" ("Oh no, I did not see that.", P12).

Participants had mostly negative associations with Dark Patterns

Some participants did not mind Dark Patterns, Bright Patterns were the only ones that were perceived as being positive

Additional Comments

Additional comments are statements made by participants without being asked about something.

Study-related comments: Study-related comments are comments that are directly linked to the way the study was designed.
The theme "Initial troubles" describes participants acting in a certain way because of the situation being new to them ("I had a few problems with the ratings, because I did not

There were some statements that addressed the design or procedure of the study itself

have anything to compare it to.", P02). This was reported by one participant.
Statements from two participants were coded under the theme "Illegal cookie banner" ("[..] also illegal in the EU, I think.", P10).
Especially when participants did not notice Dark Patterns and were made aware of their existence during the interview, some participants made statements that were defined as "Act differently in hindsight" ("In hindsight, one should have declined it.", P01).
Two participants made comments about the price of an item, stating that it was too high ("Because this one is rather expensive for 100€.", P03).
At last, there were some comments that fit into the theme "Different behaviour because of the study situation" ("If it would have been my own money, I would have left the website.", P03).

Design-related comments: Comments made by participants about the way the websites were designed were identified under the theme "Design-related comments".
One participant gave descriptions for desired cookie banner design ("I like it, when I can directly decline on the pop-up.", P03).
There were also statements, that gave general proposals for better, or more user-friendly design ("The minimal price should always be preselected.", P12). These statements were usually made after encountering a Dark Pattern and therefore described a way, an element, on which a Dark Pattern was used, could be designed in a more user-friendly way.

Some statements made by the participants were concerned with the way the websites were designed

A specific kind of proposal was made by two participants, who wanted to see the price of an item update when selecting a specific option ("The price was not adjusted, I thought that was misleading.", P13). For example, on the website "She Treasures", a care package could be bought in addition to an item. The displayed price for the item stayed the same whether the care package was selected or not.
One participant even stated, that the design of a website led to a bad rating in the questionnaire ("Because it was so pink.", P09).
The last theme that was identified as a design-related comment was "unclear website element". This theme described

statements of participants that did not completely understand or were confused by certain website elements (" 'Premium, Express, Standard'. It is not even explained what the difference is.", P08).

Pattern Influence: Some participants made clear, that a Dark Pattern led to them giving a website bad scores in the questionnaire ("I thought the website was very good, but in the end, I rated it a bit worse because of the pop-up.", P11).

Familiar from everyday life: Especially when participants did not feel surprised by the way an element is presented, or them being manipulated, they made statements that were coded as "Familiar from everyday life" ("For shipping options, I am used to the 'premium' option being preselected.", P09).

The feeling of upselling: Some participants made statements about them feeling that a website tried to make them spend more money or buy more things than they intended to ("They want to sell me more of every single product.", P04). These statements were identified under the theme "Feeling of upselling".

Chapter 4

Discussion

Our research was aimed at showing the influence of Bright Patterns on Dark Pattern perception, when these Bright Patterns are in the minority. In the study, conducted to answer this question, we found differences in the way users interacted with, and perceived Dark Patterns, before and after being exposed to Bright Patterns.

In this chapter, the results found in the conducted study, that was presented in Chapter 3, are discussed. These findings are then compared to previous work in the field of Dark and Bright Patterns, and we will present some of the implications these results have on the usage of Bright Patterns. Finally, limitations of this study will be discussed.

4.1 Interpretation of the results

Descriptive Statistics

As shown in Figure 3.10, the smallest amount of time spent on a website was on the *bright* website. This allows for the conclusion, that Bright Patterns can help users make user-friendly decisions, because the path to the intended choice is shorter when using Bright Patterns than using Dark Patterns.

When looking at the decisions, participants made on cookie banners, the results were similar across all websites, even though different kinds and combinations of Dark Patterns were used on the cookie banners. Therefore, in the context of cookie banners, Bright Patterns did not have an effect on the decision making of the participants.

Positive influences of Bright Patterns were found for duration data and amount of user-friendly choices made in a shopping context

In the context of shopping however, there were different choices made by the participants depending on the website. The fact that the most user-friendly choices were made on the *bright* website again shows, that Bright Patterns do influence users in their decision making. Adding to that, users choosing user-friendly options more often after visiting the *bright* website leads to the suspicion, that Bright Patterns also have an impact on Dark Pattern perception.

Questionnaire Results

Bright vs Check websites: For both UEQ scales and the *trust* item, scores were highest for the *bright* website. This shows, that there exists at least a tendency, that users prefer Bright Patterns over Dark Patterns.

In addition to that, the *pre-check* website received higher scores than the *post-check* website on all scales, indicating a negative effect of the *bright* website on Dark Pattern perception.

On all scales, the *bright* website received the highest scores

The conducted t-tests for comparing the scale means of the websites showed different results for the different scales. Assuming a significance level of 0.05, results of the t-tests were only significant for the *attractiveness* scale and the *trust* item, not for the *pragmatic* scale.

The handbook for the UEQ contains a table to classify websites scores for the different scales. A website can score "excellent", "good", "above average", "below average", or "bad". For the *attractiveness* scale, a website is classified as "good", when it reaches a score of 1.41, "above average" with a score of at least 0.96, "below average" for scores of at least 0.45, and "bad" for scores under 0.45. Considering this, the *bright* website, with a score of 1.40 can nearly be classified as a "good" website, while the *pre-check* website can be classified as "below average", but nearly as "above

The *bright* websites can be classified as "above average" on the *attractiveness* scale, while both *check* websites are "below average"

average" with a score of 0.944. The *post-check* website however, can clearly be classified as "bad" with a score of -0.067. For the *pragmatic* scale, there exists no entry in the table and therefore, the scores can not be classified.

Pre- vs post-block: The comparison between the two blocks showed, that the *pre-block* was rated significantly higher than the *post-block* on all three scales. This result can again be linked to the participants visiting the *bright* website between both blocks, indicating that Bright Patterns affect the way users perceive Dark Patterns.
The comparison for the *pragmatic* scale however needs to be interpreted carefully, because of the *pre-block* not passing the ANOVA test and therefore, it needed to be adjusted by leaving out the website "Peak Venture". However, after adjusting the *post-block* as well, by removing the website "Gent's Treasure", as well as without adjusting either the *pre-* or the *post-block*, the conducted paired t-tests showed significant differences in the means of the blocks as well.

Websites before the *bright* website were rated higher than the website after the *bright* website, indicating an effect of the Bright Patterns on Dark Pattern perception

Thematic Analysis

The interview allowed us to find out the reasons why participants made certain choices and how exactly they perceived certain website elements. These explanations were identified as themes using thematic analysis.

Participants mainly remembered websites as being "bad". Mentions of positive memories were associated for different websites, such that there is no single website that stood out as being "good". The latter is in contrast to the questionnaire data, where the *bright* website was rated significantly higher than other websites.
It seams, that while users may prefer the *bright* website over the other websites, it does not necessarily lead to the website standing out in retrospect.

Bright Patterns do not seem to make a website stand out

When looking at the responses of participants about their first impressions of a website, over 50% of the responses were positive, but only few websites were remembered positively. It can therefore be assumed, that Dark Patterns

Dark Patterns are likely to be the reason why websites got low scores in the questionnaire

are in fact the reason for participants to give lower ratings to websites using Dark Patterns. This is backed up by multiple participants stating that a Dark Pattern led to them giving a website a bad score in the questionnaire, as well as most responses to the perception of Dark Patterns being negative. Participants not noticing manipulations would sometimes make statements from the theme "Act differently in hindsight". This further shows the impact Dark Patterns can have on user interaction.
This impact of Dark Patterns supports the internal validity of the study, which is also underlined by responses that state, that certain designs, e.g. Dark Patterns, were already known to the participants from their everyday life.

Dark and Bright Patterns did not seem to influence participants choices in the context of cookie banners

The consent decisions participants made in the context of cookie banners was mainly explained by habit, data privacy, and convenience. All of these things do not take design elements of the cookie banners into consideration, explaining the relatively equal distribution of accepted or rejected cookies across all websites.
A similar structure of reasoning could be found in the participants statements about choosing a delivery option.

Reasons given for purchase decisions can be linked to Dark Patterns

A different pattern could be observed in the answers given by the participants about their decision making in a shopping context. Here, participants chose items primarily because of their price, function, or appearance. The first two reasons may be linked to Dark Patterns, which would suggest, that Dark Patterns had an influence on the purchase decision of the participants.

Participants comments could be valuable input for design of future work

We also identified some themes, that can help researchers design future studies. These themes were categorised under "Study related comments" and "Design related comments".
The themes "Initial troubles", and "Different behaviour because of the study situation" showed, that some of these results need to be interpreted carefully. Especially the theme "Initial troubles" confirms our decision of leaving out the first website in the questionnaire analysis.
Because some participants behave differently in a study situation than they would in real life, it is important to create

realistic scenarios, such that the study behaviour may still be close to the actual real world behaviour. The themes "Desired price update", "Price too high", and "Unclear website element" showed, that there were design details in shopping websites, that could influence the way a participant perceived a website. If the implementation of these details differed across websites, they could become confounding variables as shown by one statement that led to the theme "Design leads to bad score".
Comments that were coded as "Suggestions for better (cookie) design" can be helpful for future research as well. Because they are mostly made from a user perspective, they may be helpful for designing user-friendly interfaces.

4.2 Comparing the Results with previous Research

The results of our UEQ analysis are similar to the results found by Calawen [2022]. Even though both studies used different categories of websites, flight booking and shopping, and different kinds of Dark Patterns, both studies found that users rate a website using Bright Patterns significantly higher on the *attractiveness* scale of the UEQ than a website using Dark Patterns. In their study, no other scale yielded significant effects, but the bright version of their website did score higher in all other scales. The same holds for the evaluation of the *pragmatic* scale in the comparison of the *check* and *bright* websites. Therefore, their findings for Bright Pattern perception can not only be confirmed, they can be expanded to a setting, where Bright Patterns are in the minority.

Our results for website perception are similar to findings from previous research

Truong and Dalbard [2022] also showed that participants preferred a website using Bright Patterns over a website using Dark Patterns. However, they did not find an effect of the Bright Patterns on the decisions made by the participants. While this is also the case in our comparison of the *bright* and *post-check* website, the comparison of the *bright* and *pre-check* website showed, that there existed differences in the decisions made. The finding of Bright Patterns having no effect on decision making could therefore be based

on order effects, because some participants in their study were first shown the website using Bright Patterns, and then visited the website using Dark Patterns. Other reasons for this could be the kind of Dark and Bright Patterns that were chosen for the website, as well as the content of the elements on which they were implemented.

When having an isolated look at participants interaction with cookie banners and their consent choices, the findings in our research differ from other findings. In the study conducted by Machuletz and Böhme [2020], consent was higher in general and they did find an effect for *Visual Interference* on consent decision. Utz et al. [2019] found, that the Dark Pattern *Preselection* also leads to users being more likely to accept cookies. Graßl et al. [2021] showed that Bright Patterns help users make user-friendly choices in the context of cookie banners, which was also the case in study conducted by Bielova et al. [2024]. These findings stand in contrast to our results, where consent decisions were similar across all websites, which contained cookie banners with different combinations of Dark Patterns, or Bright Patterns on the *bright* website. While there are several factors that can be responsible for this difference, one explanation could be that users have become accustomed to cookie banners being designed with Dark Patterns and therefore learned how to choose user-friendly options regardless of the design. This explanation is supported by statements made by participants in the interview from our study ("Maybe it really has become a habit by now.", P10).

Compared to previous research, participants were not influenced by Dark and Bright Patterns in the context of cookie consent requests

In the thematic analysis, we found the theme "Neutral feeling" when talking about Dark Pattern perception, which encompassed participants' statements such as "It did not bother me, it was either taking it or changing it." (P11). This result of participants not having strong negative feelings about Dark Patterns and rather do not care about them, was also found by Tiemessen et al. [2023], Bongard-Blanchy et al. [2021], CPRC [2024], and NCC [2022].

As well as previous research, we found that some participants do not mind Dark Patterns

NCC [2022] showed, that some users bought something by mistake or spent more money than they wanted, because of Dark Patterns. This effect of Dark Patterns could also be

Our results support the statement, that Dark Patterns may affect users financially

found in our results, by participants stating that they did not notice a Dark Pattern, that for example made them buy an insurance that they did not want to buy ("I overlooked that, therefore I took the insurance. Otherwise I would have deselected it.", P07).

We did not find any negative comments towards the usage of Bright Patterns

The concept of Bright Patterns has been criticised by Potel-Saville and Francois [2023], because they are manipulative interfaces. Interestingly, the analysis of the interview did not show participants' desire for neutral design. For example, they rather stated, that a preselection of user-friendly choices is welcomed ("If there is a free one, I feel like this option should always be preselected." P03).

4.3 Implications

For profit-driven companies, Bright Patterns are not beneficial

Since our findings support previous research in the conclusion, that users prefer websites using Bright Patterns over websites using Dark Patterns, companies that care about how users perceive their website should consider using Bright Patterns for the design of website elements. Apart from that, we found no real incentive for companies to use Bright Patterns, since even when being surrounded by websites using Dark Patterns, the *bright* website did not stand out among websites that were remembered by the participants as being good. Because the primary goal, companies have, may not be user satisfaction, but rather maximising profits, there exist different objectives in the way websites are designed. As previous reports and our study have shown, Dark Patterns can manipulate users into buying things they did not want, which is why Dark Patterns can help companies generate bigger profits at the expense of their costumers.

Our findings may support legal interventions in the usage of Dark Patterns

Buying things one does not want has been shown in multiple studies and therefore, this practise may need to be looked at from a legal perspective. This includes mainly the Dark Patterns *Preselection*, *Sneaking*, and *Hidden Costs*. Some design practices in CMPs have been forbidden by the GDPR, therefore it may be possible to adapt some of these laws to a broader context.

Websites implementing Bright Patterns may not help themselves, but may help users visiting other websites that use Dark Patterns

For websites, that are not looking to sell anything or drain users' wallets in other ways, the implementation of Bright Patterns could help users when visiting other websites after the one using Bright Patterns, as we have shown, that decisions before and after the *bright* website differed, as well as the perception of the websites.

4.4 Limitations

The interpretation of our findings and their implications needs to take limitations of our research into account. In this section, the main limitations of this work are presented.

Study Design

Limitations for the way the study of this thesis was designed, include the amount of participants that have been recruited, the order in which websites were placed, and the fact, that there exists no baseline to compare the websites to.

Questionnaire scores are rather inaccurate due to the limited amount of participants

The amount of participants being 15, led to the measurements of the questionnaire being rather inaccurate. This is indicated by the error bars in Figure 3.13. The significant results found in our analysis of the questionnaire could therefore be attributed to the sample population and may not be well generalisable.

Participants' behaviour could have been influenced by the experimenter observing their interaction with the websites

The study being carried out in person made sure, that websites are presented the same way for each participant. There are however two main issues that come with this approach. The first one is the *Hawthorne Effect*, which states that participants may alter their behaviour because of the fact that they are being observed. Therefore, the behaviour shown in the study, i.e. selections made on the websites, may differ from the actual selections a participant would make in a real life situation.

The second issue is about participants using a computer

which is not their own. This way, there exists no real risk of giving away personal data, when accepting cookies in cookie consent requests. In previous research about Dark Patterns in CMPs, studies were sometimes conducted as an online experiment, where participants visited websites on their own device, e.g. by Utz et al. [2019]. This approach may yield more realistic results for decisions made by participants in the context of cookie banners.
However, in our study, cookies were accepted only a minority of the time, which may indicate, that participants did act according to the way they would interact with websites in their everyday lives. This would also be supported by themes, that were identified during our thematic analysis of the interviews, such as "Cookie decision out of habit".

The way the study was conducted may have led to participants acting differently than they would in their every day lives

In order to make the websites as realistic as possible and hinting as little as possible to the participants about the actual reason for the study, some of the displayed content differed across the websites, like products, layout, links, and others.
For the *bright* and *check* websites, the options that could be chosen on the *Shop* pages, which were the elements for which Bright and Dark Patterns were implemented, differed as well. For the *bright* website, participants could select to buy products once, threefold, or tenfold. The *pre-check* website offered a care package in addition to each product, and the *post-check* website offered an insurance for each product, as shown in Figure 3.6. Since these are different kinds of options, the comparison of the *bright* and *check* websites may have been influenced by the kind of choice that was presented along with the products.
The kind of Bright and Dark Patterns, that were chosen for this comparison between *bright* and *check* websites, allowed for better comparability between the websites, but at the same time limits the generalisability of these findings to other kinds of Dark and Bright Patterns.

Different content was shown for the Dark and Bright Patterns in the *bright* and *check* websites, which may influence the results

Our results indicate, that the *bright* websites does have an impact on the way participants perceive websites using Dark Patterns. This assumption is made, because of the comparisons of the evaluation of websites, before and after the *bright* website. Because we did not test all websites in an isolated manner and therefore did not establish a baseline,

There exists no baseline to compare the results to, such that our findings may not be based on the existence of the *bright* website

against which the results could be tested, we do not know if the effect can directly be attributed to the *bright* website or if the websites would have been evaluated in the same way if participants had not visited the *bright* website. Establishing baselines in Dark Pattern research has been proposed by Mathur et al. [2021], but went beyond the scope of this work.
Therefore, it is possible, that the study could yield the opposite results when the websites that were placed before the *bright* website, would have been placed after the *bright* website, and vice versa.

Website Design

Limitations that are caused by the way websites were designed, have an impact on the *internal validity* of our study.

Some details were inconsistent across websites

The design process for the websites used in our study included many aspects and details in order for the websites to appear realistic and be comparable for analysis. Some of these aspects were presented in Section 3.1.3. While an effort was made to take care of as many features as possible, some minor details were missed. Some of them were mentioned by participants in the interviews and were either perceived as especially positive or especially negative, which may have influenced website scores.

Elements were not always placed in the same position, potentially leading to different interactions

One participant mentioned disliking the *bright* website because of the positioning of the "shopping cart" icon, which redirects users to the *Checkout* page. This was found to be inconsistently placed, because this icon was placed on the left side of the navigation bar. On all other websites, it was placed on the right side of the navigation bar.
We found another inconsistent element placement on the website "Party Pals". Here, the "shop" element in the navigation bar was placed second from the right, while on most other websites that had a navigation bar, the "shop" element was placed second or third from the left. This would explain why fewer participants visited the *Shop* page on the website "Party Pals" compared to other websites. The same was the case for the website "Pet Paw Paradise", where the

"shop" element was hidden under a drop-down menu in the navigation bar.
These inconsistencies may make the scenario more realistic, as not all websites are structured in exactly the same way in the real world as well. They could however also make the website results less comparable.

In another statement, a participant mentioned, that they liked the website "Party Pals", because when changing the insurance option for a product, the price would update according to the selected option. This was not the case for products in the *bright* and *pre-check* websites "Pure Roots" and "She Treasures". Another inconsistency in these three websites was the price for delivery. The *bright* website offered standard shipping for free, while standard shipping cost 2.99$ on the *pre-check* website "She Treasures" and 3.99$ on the *post-check* website "Party Pals". There was however no comment made by any participant concerning the different prices of the delivery options. Also, as shown by Luguri and Strahilevitz [2021], the price attached to an element using Dark Patterns has little influence on the decision made by users.

The *bright* and *check* websites had pricing inconsistencies

The pricing of the products was not mentioned in any interview either, however two participants stated that the insurance option for the website "Timepiece Trove" was too expensive in order to be considered taking. This insurance was preselected as an option in the checkout window and was meant to realise the Dark Pattern *Sneaking*. A lower price for this insurance could therefore lead to more participants electing to keep the insurance, which means a higher rate of manipulation for this Dark Pattern.

The price for an element of the Dark Pattern *Sneaking* was mentioned as being too high, potentially resulting in a lesser effect

Chapter 5

Summary and future work

The following chapter presents a summary and overview of the contributions of this work. The thesis is concluded by proposing future work that builds upon the findings presented.

5.1 Summary and contributions

The goal of this thesis was to gain a better understanding of the way Bright Patterns influence user perception of Dark Patterns. We focused on Dark and Bright Patterns in websites and designed a study that would simulate a real world scenario of browsing shopping websites. Participants visited ten shopping websites, that were created specifically for the purpose of this study, nine of them contained Dark Patterns and one website was designed with Bright Patterns. The websites were evaluated on the decisions made by the participants, and questionnaire scores. To get further insights in the thought process of the participants, a semi-structured interview was held after their interaction with the websites.

We conducted a study in which participants visited ten shopping websites, in order to answer our research question

The results showed that participants spent the least amount

of time on the *bright* website, and an analysis of the interactions of the participants showed that participants selected user-hostile options less often after visiting the *bright* website.

Websites were evaluated by the participants using a questionnaire

For the analysis of the questionnaire scores, we conducted two kinds of pre-post-comparisons. The first one compared selected (*check*) websites, that were placed before and after the *bright* website, and were designed using the Dark Pattern versions of the Bright Patterns used in the *bright* website. This way we could compare websites independent of the type of Dark Patterns used on these websites. While the results were significant only for the *attractiveness* scale, the *post-check* website was rated lower than the *pre-check* website on all scales.

The second comparison treated the websites before and after the *bright* website as blocks of websites, which let us find out if there was a general effect of the *bright* website on Dark Pattern perception.

The results indicate, that the *bright* website negatively influences the perception of websites using Dark Patterns

For the comparison of the two blocks, the difference between the scale means was significant for all three scales. These results indicated, that a single website using Bright Patterns could influence the perception of websites using Dark Patterns.

The thematic analysis of the interviews showed, that the approach to answering our research question seemed to be valid, and confirmed results of our quantitative analysis.

While our results support previous findings, more research is needed to understand the topic in a more faceted way

Our findings on the impact of Bright Patterns underlines findings from previous research, that users prefer Bright Patterns over Dark Patterns, and that Dark Patterns can harm users in multiple ways. In addition to that, our results indicated that Bright Patterns have an effect on user perception of Dark Patterns.

Because of the novelty of the construct of Bright Patterns, there still exist a lot of variables with unknown effect for a study like this, which is why more research in this field is required. Some approaches for future work will be discussed in the next section.

5.2 Future work

Some of the limitations of our study, that were discussed in section 4.4, could be addressed in future studies. One way this could be done is by repeating our study with the websites being placed in the opposite order. This would verify our results and the conclusion that Bright Patterns do have an impact on Dark Pattern perception by getting rid of the order effects in the comparison of websites before and after the *bright* website.

Repeating our study with some adaptations addresses our limitations

In Section 3.1.1 "Positioning of the *bright* website", we briefly discussed the positioning of the *bright* website. A replication of our study, with a different positioning of the *bright* website, may give some insight on the impact of the positioning.

In our study, we assumed that participants would perceive all kinds of Dark Patterns similar and differences in the perception would be negligible because multiple websites were combined for the comparison of websites before and after the *bright* website. As found by Luguri and Strahilevitz [2021], different kinds of Dark Patterns have different effects on users. To our knowledge, there exists no study that investigated the differences in effects for Dark Patterns in a larger sense, e.g. for an entire taxonomy. Such a comparison could be helpful for designing future studies, as well as the interpretation of results.

Comparing effects of different kinds of Dark Patterns

One issue we encountered while designing the study, was the definition of Bright Patterns or the lack thereof. The way they were first defined was by "flipping" the direction of the manipulation of Dark Patterns [Graßl et al., 2021]. This approach works for some Dark Patterns, but not for all of them, which makes a complete comparison of these Patterns impossible. Sandhaus [2023a] defined Bright Patterns in a different way, that rather describes user-friendly ways of implementing certain elements on websites. This taxonomy does not include Bright Pattern variants of some Dark Patterns, such as *Preselection*. As described in Section 3.1.3 "Bright Patterns", we found that there are two main ways to design elements in a "bright" way. This finding could be investigated further, in order to establish a consistent way

A consistent definition for Bright Patterns is needed for future work in the field

to define Bright Patterns, which would help future research to be more comparable.

Further research in countermeasures against Dark Patterns could help to shield users from ill-intentioned manipulation

While there exists some research that is concerned with creating countermeasures against Dark Patterns, our results showed, that there is a need for countermeasures in multiple contexts, for example in the *Shop* or *Checkout* pages of shopping websites. This became apparent with participants stating that they did not notice Dark Patterns, and therefore made decisions they would usually not have made.

Appendix A

Codebook

In Figure A.1, the codebook, that contains all codes and categories that were found during the Thematic Analysis of the interviews, is shown.

Code System	Frequency
1. Study Related Themes	
1.1 Purpose of the study	15
1.1.1 Dark Patterns	7
1.1.2 General perception of websites	5
1.1.3 User behaviour on websites	3
1.2 Memories	27
1.2.1 Exact negative memory	6
1.2.2 Wrong negative memory	2
1.2.3 Correct negative memory	11
1.2.4 Exact positive memory	3
1.2.5 Correct positive memory	5
1.3 Cookie Decisions	23
1.3.1 Special cookie decision	1
1.3.2 No cookies for data privacy reasons	8
1.3.3 Accepting cookies for convenience	5
1.3.4 Cookie decision out of habit	9
1.4 First Impressions	124
1.4.1 Negative impression	33
1.4.2 Standard, neutral impression	26
1.4.3 Positive impression	65
1.5 Purchase decisions	59
1.5.1 Random product choice	3
1.5.2 Choice for price reasons	17
1.5.3 Decision based on appearance	26
1.5.4 Decision based on function	13
1.6 Pattern Decision	162
1.6.1 Decided for a pattern	69
1.6.2 Decided against a pattern	93
1.7 Pattern Perception	160
1.7.1 Pattern perceived as „negative“	97
1.7.2 Pattern perceived as „neutral“	21
1.7.3 Pattern perceived as „positive“	17
1.7.4 Pattern was not noticed	25
1.8 Delivery options	22
1.8.1 Standard delivery since there is no time pressure, or it is cheaper	19
1.8.2 Express delivery for time reasons	3
2. Additional Comments	
2.1 Study Related Comments	28
2.1.1 Initial troubles	2
2.1.2 Illegal cookie banner	2

2.1.3 Act differently in hindsight	12
2.1.4 Price is too high	2
2.1.5 Different behaviour because of the study situation	10
2.2 Design Related Comments	79
2.2.1 Description for desired cookie design	2
2.2.2 Proposal for better / more user friendly design	36
2.2.3 Unclear website element	38
2.2.4 Desire for the price to update	2
2.2.5 Design leads to negative evaluation	1
2.3 Pattern leads to negative evaluation	19
2.4 Familiar from everyday life	23
2.5 Feeling of upselling	8

Figure A.1: Codebook containing all codes and themes from the thematic analysis of the interviews

Appendix B

Informed Consent Form

In Figure B.1, the informed consent form that was given to the participants is shown.

Informed Consent Form

Exploring Shopping website user experience

Principal investigator: Moritz Failing
RWTH Aachen University
Email: moritz.failing@rwth-aachen.de

Purpose: Getting a general understanding of how users experience new websites.

Procedure: You will visit ten different shopping websites and perform specified tasks on each website. Following your interaction with each website, you will fill out a brief questionnaire regarding the website. Your participation involves navigating these websites and providing feedback via the questionnaires provided. After that, you will give some demographic information. The study is done on a computer by the institute. The entire interaction will be screen-recorded without audio. This recording will be discussed afterwards between the participant and the instructor. The audio of this discussion will be recorded.

Risks: There are no known risks for the participants. Still, you can stop the study at any time.

Confidentiality: Any Information about the participant will be stored anonymously. With this, no publication will allow any conclusions to be drawn about you as a person.

Costs and Compensations: The participation is completely voluntary, the participant will not be compensated for the participation.

☐ I have read and understood the information on this form.

☐ I have had the information on this form explained to me.

☐ I agree that the audio of the interview will be recorded.

Participant's Name	Participant's Signature	Date
	Principal Investigator	Date

Figure B.1: Consent form that was filled out by the participants befor starting the study

Appendix C

Website Template Sources

In Table C.1, the sources for the templates and checkout windows used on each website are given.

Website	Template Source	Checkout Window Source
Seat Serenity	HTML.Design[a]	Bootstraptor[b]
Peak Venture	HTML.Design[c]	BBBootstrap[d]
Pet Paw Paradise	Templatemo[e]	Codepen[f]
She Treasures	HTML.Design[g]	MDBootstrap[h]
Timepiece Trove	HTML.Design[i]	Codepen[j]
Pure Roots	HTML.Design[k]	Bootstraptor[l]
Fit Finds	HTML.Design[m]	BBBootstrap[n]
Gent's Treasure	HTML.Design[o]	BBBootstrap[p]
Party Pals	HTML.Design[q]	Codepen[r]
Sonic Sensation	HTML.Design[s]	BBBootstrap[t]

Table C.1: Sources for the website templates and the checkout windows

[a] https://html.design/download/niture-free-furniture-html-template/ Accessed: May 27, 2024
[b] https://bootstraptor.com/snippets/bootstrap-4-snippet-shopping-cart/ Accessed: May 27, 2024
[c] https://html.design/download/timups-smart-watches-html-template/ Accessed: May 27, 2024
[d] https://bbbootstrap.com/snippets/ecommerce-shopping-cart-30657531 Accessed: May 27, 2024
[e] https://templatemo.com/tm-571-hexashop Accessed: May 27, 2024
[f] https://codepen.io/dannyhuang/pen/eyMWBg Accessed: May 27, 2024
[g] https://html.design/download/gift-ecommerce-shop-template/ Accessed: May 27, 2024
[h] https://mdbootstrap.com/docs/standard/extended/shopping-carts/# example7 Accessed: May 27, 2024
[i] https://html.design/download/watches-website-emplate/ Accessed: May 27, 2024
[j] https://codepen.io/mha-el-sayed/pen/zLmoMX Accessed: May 27, 2024
[k] https://html.design/download/vegetables-html-template/ Accessed: May 27, 2024
[l] https://bootstraptor.com/snippets/bootstrap-4-snippet-shopping-cart/ Accessed: May 27, 2024
[m] https://html.design/download/famms-ecommerce-html-template/ Accessed: May 27, 2024
[n] https://bbbootstrap.com/snippets/bootstrap-ecommerce-shopping-cart-plus-minus-icons-55469617 Accessed: May 27, 2024
[o] https://html.design/download/cla-computer-accessories-html-template/ Accessed: May 27, 2024
[p] https://bbbootstrap.com/snippets/simple-shopping-cart-coupon-code-input-text-39165166 Accessed: May 27, 2024
[q] https://html.design/download/foodfinda-restaurants-website-template/ Accessed: May 27, 2024
[r] https://codepen.io/CorDBite/pen/GxaKbd Accessed: May 27, 2024
[s] https://html.design/download/basic-ecommerce-psd-template/ Accessed: May 27, 2024
[t] https://bbbootstrap.com/snippets/bootstrap-ecommerce-shopping-cart-item-summary-44021562 Accessed: May 27, 2024

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