Are Dark Patterns Self-destructive for Service Providers?: Revealing Their Impacts on Usability and User Satisfaction

Toi Kojima[1], Tomoya Aiba[1], Soshi Maeda[1], Hiromi Arai[2], Masakatsu Nishigaki[1], and Tetsushi Ohki[1,2(✉)]

[1] Shizuoka University, Hamamatsu, Shizuoka, Japan
{kojima,aiba,maeda}@sec.inf.shizuoka.ac.jp,
{nisigaki,ohki}@inf.shizuoka.ac.jp
[2] Riken AIP, Chuo-ku, Tokyo, Japan
hiromi.arai@riken.jp

Abstract. "Dark patterns," which are known as deceptive designs that intentionally induce users to take actions that benefit the company, have been widely adopted, especially in the field of digital marketing. In recent years, there has been a global increase in efforts to address and regulate dark patterns. The main disadvantages of dark patterns are that waste time as well as money and are addictive. However, there are other possible unintended effects on the user experience. In particular, users who are not deceived by dark patterns understand the methods behind them and may experiences stress and frustration when they spend extra time and effort to avoid them. In this study, we focus on users who are not deceived by these dark patterns and on the detriment to usability caused to these users for avoiding dark patterns. Through this usability study using web pages containing dark patterns, we explored the possibility that the cost incurred by avoiding dark patterns may be a factor that undermines trust in a company.

Keywords: dark patterns · deceptive design · UI · UX

1 Introduction

With the development of the Internet, the availability of online services has increased. However, companies are increasingly using deceptive-design practices that deceive users into taking profit-maximizing actions, particularly in the area of digital marketing. Such designs have been prevalent on the internet for some time. Nevertheless, around 2010, they were labeled as "dark patterns" [4] and became widely recognized.

The problems caused by dark patterns are recognized as concerns worldwide. For example, in India, the government has taken steps to regulate the use of 13 types of dark patterns by e-commerce companies. [1] This reflects a global trend of increasing efforts to address and control such practices in various countries.

F. F.-H. Nah and K. L. Siau (Eds.): HCII 2024, LNCS 14720, pp. 66–78, 2024.
https://doi.org/10.1007/978-3-031-61315-9_5

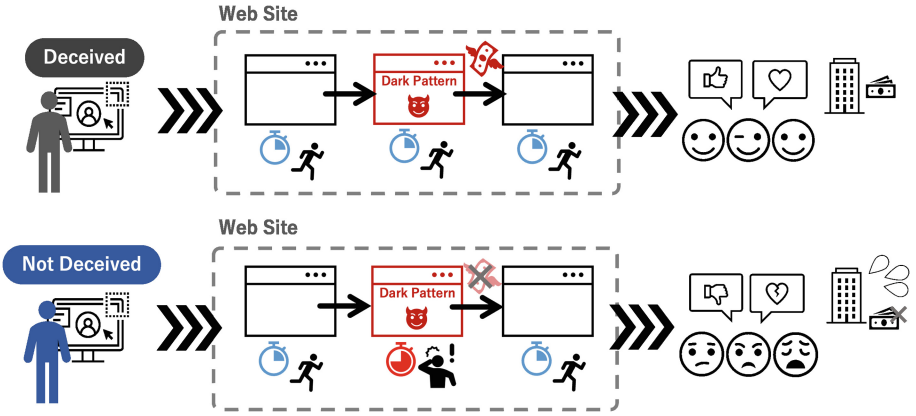


Fig. 1. Reactions to dark patterns from deceived and non-deceived users

Dark patterns are primarily used to maximize corporate profits. However, they can have detrimental effects on users, such as financial loss, exposure of personal information, and addiction to certain services [9]. They can also have unintended effects on users, particularly on those users who are not deceived by the patterns.

Users who are not deceived by dark patterns are assumed to understand the methods employed by dark patterns and to be cautious in their actions. Such users may invest additional time and effort in making decisions based on their intentions when using sites that employ these patterns, and this may lead to stress and dissatisfaction. Therefore, users who are not deceived by dark patterns are expected to experience disadvantages, unlike deceived users.

This chain of events can undermine corporate interests, which is contrary to the intended purpose of the patterns and poses a significant problem for companies as shown in Fig. 1.

This study aims to answer the following research questions:

RQ1 Are there differences in the disadvantages between users who are deceived by dark patterns and those who are not?

RQ2 What factors contribute to users being more susceptible to the negative effects of dark patterns?

This study addresses RQ1 and RQ2 by conducting task-based and questionnaire surveys on web pages that contain dark patterns. The goal of this study is to quantitatively analyze the decrease in usability caused by dark patterns and to identify the factors that contribute to this decrease.

2 Related Work

2.1 Taxonomy of Dark Patterns

Existing research on dark patterns has developed primarily as studies focused on its classification. In the early stages of dark pattern research, Brignull [4]

classified and systematized ethically-problematic designs which deceive users. Many subsequent dark-pattern-classification studies have expanded on Brignull's work. For example, Gray et al. [2] extended Brignull's classification by classifying dark patterns into five categories based on strategic motivation. In this study, we selected dark patterns by using the classification prescribed by these studies and conducted our investigation.

2.2 Deceived Users and Methods of Deception

In addition to these classification studies, research has been conducted primarily on the tendencies of users who are deceived by these dark patterns [7]. Studies have also examined the types and persistence of dark patterns and their impact on user decision-making [5]. These studies have focused on users deceived by dark patterns and the deceptive techniques used in them.

Gunawan et al. [3] proposed a methodology to empirically measure the efforts that users may undergo in avoiding dark patterns. Although there are efforts being made to effectively regulate dark patterns, the difficulty of clearly delineating the maliciousness of dark patterns poses a challenge. To address this situation, Gunawan et al. hypothesized that the severity of dark patterns depends, in part, on the severity of the burden users experience when avoiding inducements by dark patterns. The user's effort to avoid such patterns was measured by indicators such as the number of clicks required to access privacy settings or account deletion options, pop-ups encountered, and pages navigated; time taken to complete privacy-related tasks in the presence of dark patterns; or level of navigation required to complete these tasks. They argued that the severity of dark patterns could be quantified by calculating the sum of these indicators.

In this study, we adopt Gunawan et al.'s metric [3] as one of the metrics of the disadvantages that users experience due to dark patterns.

3 Study Design

We conducted a task-based survey on August 5, 2023. Participants were recruited through the crowdsourcing service lancers.jp[1]. They were invited to complete tasks on a survey website created specifically for this investigation and to respond to the associated questionnaires. All participants were provided with an explanation about the research objectives, and their consent to participate in the survey was obtained.

3.1 Participants

We recruited 350 participants, and all of them participated. Of the total, 230 were male, 118 were female, and 2 did not provide gender information. Every participant, who were all Japanese, was paid 165 JPY as a reward for participating in the survey. We set the reward at an amount above the local minimum wage after measuring the median time to complete the task in a laboratory study.

[1] https://www.lancers.jp.

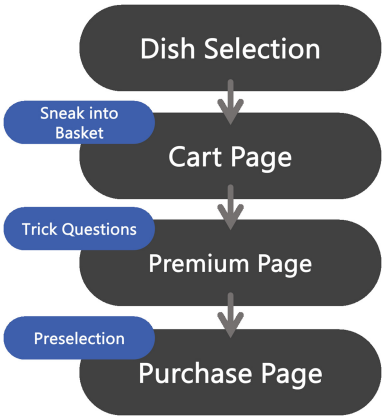


Fig. 2. The process of task-based survey

3.2 Research Method

Participants registered for the survey using their lancers.jp accounts on the dedicated survey request page within lancers.jp. Participants then anonymously performed the task and responded to the questionnaire on the survey webpage. Upon completion of the questionnaire survey, each participant was given a unique password to complete the task. To complete the entire task sequence, participants entered this password on the form created during the task request on lancers.jp. The average time per participant to complete the task survey, from the overview explanation to the display of the task completion password, was approximately 11 min.

3.3 Task-Based Survey

This task-based survey presented a simulation of a scenario, in which participants experienced the process of using a food delivery service on a website that included tasks from selecting dishes to completing an order. All participants were presented with the same website that used dark patterns, and their choices on the website were recorded. In addition, participants were informed of the presence of dark patterns in the post-task questionnaire and were asked whether they had noticed them. The purpose of this approach was to determine whether participants recognized these patterns and knowingly made choices that made them susceptible to these patterns, or whether they were deceived without recognizing these patterns.

The task sequence began with the selection of dishes on the page. After selecting the dishes for the order, participants moved to a cart page that displayed a list of currently-selected dishes. Participants could review the contents of the cart and then select a button to proceed with the order. Next, a page was displayed that promoted membership in a premium subscription. The benefits of becoming a premium member were presented, and the participant had to

decide whether or not to subscribe. After they made this choice, the participant was directed to the final purchase page to review the order details. This page included the terms of service, and the participant could finalize the order. This action completed the sequence of tasks shown in Fig. 2. The participant then transitioned to the questionnaire survey. Hereafter, we denote three pages of our main tasks, a page for shopping cart, a page for inviting premium members, and a page for purchasing, as `Cart`, `Premium`, and `Purchase`, respectively.

It should also be noted that the task-based survey only simulated the process of ordering dishes, and there was a potential for behavioral differences between the survey and actual-ordering scenarios. To create a more realistic situation, the survey scenario was designed for a party of six people, and the participants were instructed in advance to order dishes for the group.

3.4 Employed Dark Patterns

The dark patterns used in this survey were selected from various categories elaborated by previous studies [2,4]. In this study, we selected three representative dark patterns that might be expected in the context of delivery services: Sneak into Basket, Trick Questions, and Preselection.

Sneak into Basket: This dark pattern is set in `Cart` and involved adding items to the cart without the consent of the user. This action requires the user to notice the unauthorized items in the cart and manually remove them. In this task survey, users were presented with `Cart` to confirm the items after completing the dish selection. A bottle of iced tea that the user did not order was silently added to the cart. Figure 3 shows the actual dark pattern that was used in the survey.

Trick Questions: This dark pattern is set in `Premium` and guided users to specific choices by using confusing language in questions, making them carefully examine the content of the text to determine the appropriate option. In this task survey, a question on `Premium` encouraging a free trial was phrased as "Wouldn't you not like to try the 3-month premium membership free trial?" This wording aligned "No" with subscribing and "Yes" with not subscribing. The actual dark pattern used in the survey is shown in Fig. 4.

Preselection: This dark pattern is set in `Purchase` and involved "by-default-preselected" options to subscribe to newsletters or paid memberships, which forces users to deselect them if they do not intend to subscribe. In this task survey, a small checkbox for the newsletter was placed on `Purchase`, below the detailed terms and conditions, and was checked by default. The actual dark pattern used in the survey is shown in Fig. 5.

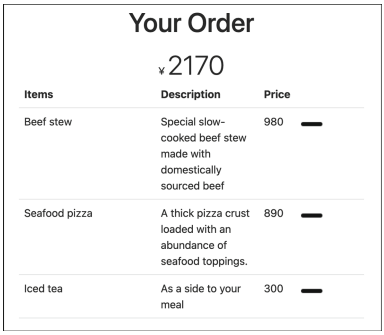


Fig. 3. Example of Sneak into Basket

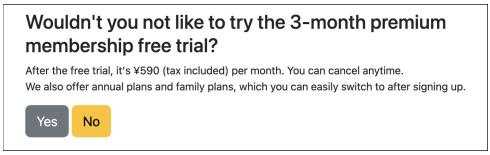


Fig. 4. Example of Trick Questions

3.5 Questionnaire Survey

This study evaluated the impact of dark patterns on usability using both objective and subjective evaluation metrics for RQ1 and RQ2. Objective metrics included task-completion times, whereas subjective metrics involved evaluations obtained through a post-task survey. To objectively assess the effort associated with the user avoiding dark patterns, we measured task completion times using the method proposed by Gunawan et al. [3]. Task completion time was defined as the time between navigating from one page to the next on the website. For example, the time spent on `Cart` until transitioning to `Premium` was considered to be the task completion time for `Cart`.

Table 1 shows the questionnaire items used in the post-task survey. Post-task surveys were used to derive the assessment metrics for evaluating the usability of the service. The questions were adapted from the Web Usability Scale (WUS) [8], which is a well–established scale for quantifying web usability. Participants were asked to rate their perceptions of each screen using a 5-point Likert scale, ranging from "Strongly Agree (5 points)" to "Strongly Disagree (1 point)," without mentioning of the existence of dark patterns. In addition, the Net Promoter Score (NPS) [10], which is a customer satisfaction rating scale, was employed. Participants were asked to rate for each page, on a scale of 0 to 10, how likely they would be to recommend the service to friends or colleagues.

To assess whether participants were deceived by the dark patterns, a set of questions was posed. We informed participants about each dark pattern and asked them to indicate whether they had noticed the tactics. We offered a binary

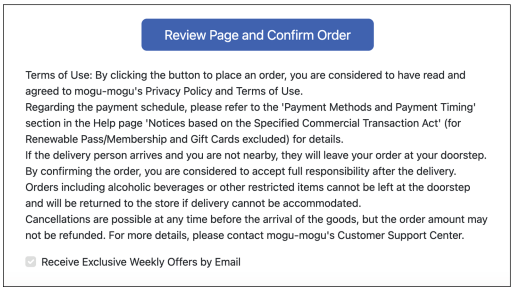


Fig. 5. Example of Preselection

Table 1. Questionnaire items used in the survey

Category	Content	Number of Questions
Overview of the task survey	Explanation of the study and confirmation of consent to participate	
Subjective metrics evaluation	Questions related to usability assessment of the service (WUS)	63
	Questions related to satisfaction assessment of the service (NPS)	3
Evaluation of deception	Questions about the intention behind the selected actions	3
Literacy assessment	Questions about web access literacy	21
Demographic	Questions about gender, age, and education level	3
Attention test (DQS) [6]	Question to verify whether participants minimize effort	1

choice of "Yes" or "No" in the survey. We also included demographic questions and queries related to internet literacy to analyze the potential influence of individual differences in susceptibility to these tactics. The questions on internet literacy were derived from a subset of the Web Access Literacy Scale, which was developed by Yamamoto et al. [11].

3.6 Methods for Distinguishing Users Deceived by Dark Patterns from Those Not Deceived

In this section, we define the criteria for distinguishing between users who were deceived by dark patterns (D group) and those who were not (ND group). The determination of whether a user was deceived was based on two criteria: whether they made choices that the company was leading them to make on the website and whether they were aware of the dark pattern.

The users were classified into the D group based on this criteria: if a user made choices that the company was leading them to make on the website and answered "did not notice" to the question about whether they were aware of the dark pattern, we classified them as "deceived" and placed them in the D group. Even if a user made choices that did not benefit the company on the website but answered "did not notice the dark pattern" in the questionnaire, we assumed that they accidentally avoided the dark pattern and could still have been deceived, thus meeting the definition of the D group.

Next, the users were classified into the ND group on the basis of not making choices that the company was leading them to make on the website and answered

Table 2. Results of the Mann–Whitney U test for each indicator for each page

Page	Elapsed Time	WUS	NPS
`Cart`	$p \ll 0.001^{**}$	$p \ll 0.001^{**}$	$p \ll 0.001^{**}$
`Premium`	$p \ll 0.001^{**}$	0.00144^{*}	0.0384^{*}
`Purchase`	$p \ll 0.001^{**}$	0.221	0.00260^{*}

"noticed" to the question about the dark-pattern awareness. However, if a user answered "noticed the dark pattern" in the questionnaire but made choices that benefited the company, we assumed that the user found the choice appealing and selected it with intent. Therefore, we excluded such users from both the D and ND groups from the analysis.

4 Result

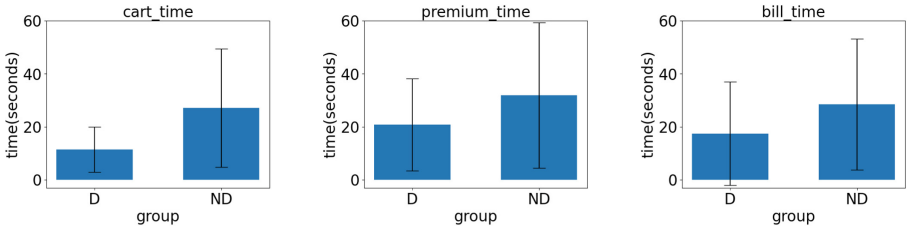
An analysis was conducted to determine if there were differences in the value of the evaluation metrics between the D and ND groups. Furthermore, we examined the relationships between each evaluation metric and the demographic factors and web literacy. For our analysis, we used the responses from 342 participants (224 males, 116 females, and 2 participants who did not disclose their gender) of the 350 survey respondents. Eight individuals who provided incorrect responses in the attention test, Directed Question Scale (DQS) [6], were excluded from the analysis. With respect to the number of participant in the D and ND groups in each pages, `Cart`, `Premium`, `Purchase`, 141 were classified to the D group as having been deceived by Sneak into Basket in `Cart`, whereas 29 were classified to the ND group. In the case of Trick Questions in `Premium`, 246 participants were classified to the D group, whereas 52 were classified to the ND group. For Preselection in `Purchase`, 200 participants were classified to the D group and 79 were classified to the ND group. We performed Mann–Whitney U test for each group because the Shapiro–Wilk test indicated nonnormality for both groups.

4.1 Task Duration

We tested the task duration against the D and ND groups using Mann–Whitney U test with a significance level of 0.05. If we reject the null hypothesis of no difference between the two groups, this would imply a significant difference in task duration and suggest that the ND group spent significantly more time completing the task. Figure 6(a), 6(b), and 6(c) present the average and standard deviation for the D and ND groups in `Cart`, `Premium`, and `Purchase`, respectively. Table 2 summarizes the p-values obtained from the tests. At a significance level of 0.05, there was a statistically significant difference between the D and ND groups for all pages, where $p < 0.001$ for all tests. This suggests that participants who were not deceived by dark patterns spent significantly more time on each page.

4.2 Usability and Satisfaction Evaluation

We conducted an analysis using the WUS questionnaire responses [8] as indicators and performed the Mann–Whitney U test. As we did with the elapsed time indicator, we developed the null hypothesis that there was no difference between the two groups. Rejecting this null hypothesis would indicate a difference between the two groups and demonstrate that the ND group rated usability of the page significantly lower. The average and standard deviation of the D and ND groups for `Cart` are shown in Fig. 7(a), for `Premium` in Fig. 7(b), and for `Purchase` in Fig. 7(c). The obtained significance probability p is presented in Table 2. Table 2 shows a significant difference between the D and ND groups for `Cart` and `Premium` with significance lefel of 0.05. However, no significant difference was observed for `Purchase`. This indicates that users who were not deceived rated lower usability than the deceived users for `Cart` and `Premium`.



(a) `Cart` (b) `Premium` (c) `Purchase`

Fig. 6. Mean and standard deviation of the D and ND groups for elapsed time on each page

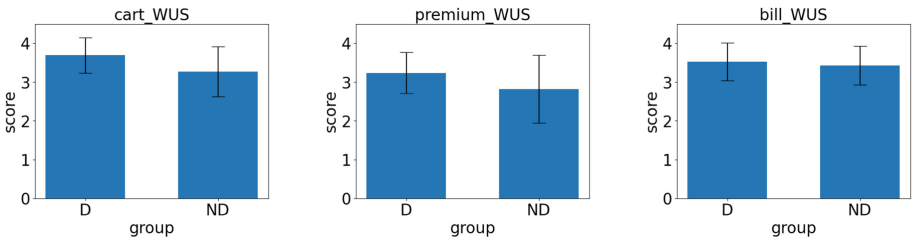
4.3 Net Promoter Score Evaluation

We conducted an analysis using the responses to the NPS questionnaire [10] as indicators of customer satisfaction. As we did with the elapsed time and WUS indicators, we employed the Mann–Whitney U test, using the null hypothesis that there was no difference between the two groups. Rejecting this null hypothesis would indicate a difference between the two groups, demonstrating that the ND group significantly rated customer satisfaction as lower than those by the D group. The average and standard deviation of the D and ND groups for `Cart` are shown in Fig. 8(a), for `Premium` in Fig. 8(b), and for `Purchase` in Fig. 8(c). The obtained significance probability p is presented in Table 2. At a significance level of 0.05, there is a significant difference between the D and ND groups for all pages, which indicates that satisfaction with each page was significantly lower for users who were not deceived than those who were deceived.

4.4 Individual Differences

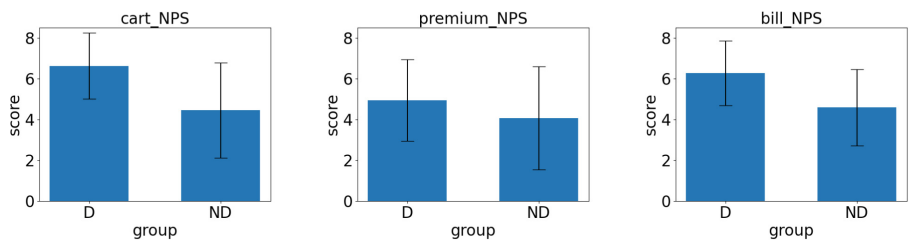
We conducted an analysis of the individual differences in the ND group and their susceptibility to disadvantages. First, we performed multiple regression analysis using gender, age, and education level as the independent variables and elapsed time, usability evaluation (WUS), and satisfaction evaluation (NPS) as the dependent variables. However, no significant factors were identified.

Furthermore, we conducted Mann–Whitney U tests between the D and ND groups on the assumption that user awareness of dark patterns is related to internet literacy. The obtained significant probabilities (p) are presented in Table 3. At a significance level of 0.05, no significant differences were observed for any page. Therefore, it can be concluded that there was no difference in internet literacy between users who were deceived and those who were not.



(a) `Cart` (b) `Premium` (c) `Purchase`

Fig. 7. Mean and standard deviation of the D and ND groups as per the Web Usability Scale for each page



(a) `Cart` (b) `Premium` (c) `Purchase`

Fig. 8. Mean and standard deviation of the D and ND groups of the Net Promoter Score for each page

5 Discussion and Limitations

5.1 Discrepancy in Disadvantages Between Users Who Were Deceived and Those Who Were Not

From Table 2, significant differences were observed between the D and ND groups for all items except for the WUS on `Purchase`. Phenomena such as increased task duration, decreased usability, and reduced user satisfaction were observed among users who were not deceived by the dark patterns. These phenomena are considered to be the result of the efforts required to avoid dark patterns. Users who were not deceived by dark patterns likely refrained from making intuitive or suggested choices to avoid them. For example, the Trick Questions used in `Premium` resulted in interfaces that were less intuitiveness and imposed a higher cognitive load, complicating intuitive decision-making and prolonging service use duration. Moreover, users who struggled with intuitive choices challenging generally rated usability lower than those who did not encounter such difficulty. These factors collectively contributed to a decrease in user satisfaction.

In open-ended responses, participants expressed reactions such as "losing trust in the website due to discovery of dark patterns and becoming more skeptical when interacting with websites." The presence of dark patterns contributed not only to decreased usability and satisfaction but also to a diminished trust in the website or service among all users.

Table 3. Results of Mann–Whitney U test for Internet literacy for each page

Page	p-value
`Cart`	0.813
`Premium`	0.460
`Purchase`	0.164

5.2 Factors Contributing to Increased Susceptibility to Disadvantages Caused by Dark Patterns

In Sect. 5.1, a difference between the D and ND groups was confirmed. We hypothesized that a potential factor contributing to this difference is a disparity in internet literacy levels between the D and ND groups. However, as shown in Table 3, no significant difference in internet literacy was observed between users who were deceived and those who were not. Contrary to our initial hypothesis, it implied that users can notice dark patterns independent of their internet literacy skills. In the open-ended sections, several responses were observed indicating that participants were deceived due to a habitual lack of attention or carelessness, while others mentioned that they were able to avoid being deceived because they recognized the tactics from previous experiences. In addition, some

responses indicated that complete trust in a website led to deception. These findings highlight the complex interplay between user behavior, experience, and trust in the digital environment's susceptibility to dark patterns.

5.3 Limitations

According to Sect. 5.2, a susceptibility to dark patterns may be influenced by the trustworthiness of websites or services. However, the task-related investigation related to dark patterns conducted in this study involved participants being informed that the tasks simulated a pseudo-service, potentially leading to a perception of trustworthiness that was distinct from that experienced during actual service use. Consequently, if a similar investigation was conducted while participants were engaging with real services, the results could differ. To address this consideration, some existing studies, such as [5], have employed deception by misleading participants into believing that the study involved real services. Therefore, conducting investigations in a "deception study format" may mitigate these influences.

In this study, we employed Sneak into Basket, Trick Questions, and Preselection as dark patterns. However, because there are various types of dark patterns, each with different characteristics in terms of timing, psychological effects, cognitive load, etc., we anticipate that conducting a similar investigation with a different set of dark patterns could yield results distinct from those obtained in this study. Furthermore, the choice of dark patterns may inform the indicators that could be used for validation. Therefore, we believe it is necessary to conduct future validations using alternative dark patterns to comprehensively explore the landscape of deceptive user experiences.

5.4 Ethical Consideration

The questionnaire administered in this study was administered following an assessment of its content and procedures in accordance with the ethical standards established by the ethics committee of the organization to which the correspondence author belong. It was confirmed that the study fell within the required scope and did not require formal ethical review. Before they participated, survey participants were informed about the questionnaire content and voluntarily joined the study by their own free will. In addition, participant incentives were determined by estimating the survey time from lab and pilot surveys and considering the minimum wage in the survey region. The handling of personal information was in compliance with Japan's Personal Information Protection Act.

6 Conclusion

In this study, we conducted both task-based and questionnaire surveys on users who were deceived by dark patterns and those who were not. By analyzing the

survey results, we aimed to reveal the presence of specific disadvantages for users who were not deceived by dark patterns by examining the time elapsed during website interactions and conducting usability evaluations of the services.

Our analysis of survey results indicated that, in many cases, users who were not deceived by dark patterns experienced significant disadvantages compared with those who were deceived. This suggests that avoiding dark patterns causes unintended negative consequences for users. The results highlight the specific disadvantages for users who were not deceived by dark patterns and suggest the potential consequences of prioritizing short-term gains in digital marketing, which could lead to long-term risks and loss of trust.

By understanding that the use of dark patterns by companies not only brings short-term benefits but also introduces the risk of customer disengagement, we hope that companies can achieve mutually beneficial service provision for both the company and the users.

References

1. Dipak, K., Dash, A.D.: Government bans e-commerce firms from using 'dark patterns' | india news - times of india (Dec 2023). https://timesofindia.indiatimes.com/india/government-bans-e-commerce-firms-from-using-dark-patterns/articleshow/105668112.cms. Accessed 02 Feb 2024
2. Gray, C.M., et al.: The dark (patterns) side of ux design. In: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems, pp. 1–14 (2018)
3. Gunawan, J., et al.: Towards an understanding of dark pattern privacy harms. In: Position Paper at the CHI 2021 Workshop: What can CHI do About Dark Patterns (2021)
4. Harry, B.: Deceptive design - formerly darkpatterns.org. https://www.deceptive.design/. Accessed 26 July 2022
5. Luguri, J., et al.: Shining a light on dark patterns. J. Legal Anal. **13**(1), 43–109 (2021)
6. Maniaci, M.R., Rogge, R.D.: Caring about carelessness: Participant inattention and its effects on research. J. Res. Pers. **48**, 61–83 (2014)
7. Nagda, Y.: Analyzing ocular parameters to investigate effect of dark patterns on HCI (2020)
8. Nakagawa, K.: The development of questionnaire for evaluating web usability. Proceedings of the 10th Human Interface Society of Japan, Oct. 2001, pp. 421–424 (2001). https://cir.nii.ac.jp/crid/1571135650780718336
9. Narayanan, A., Mathur, A., Chetty, M., Kshirsagar, M.: Dark patterns: past, present, and future: The evolution of tricky user interfaces. Queue **18**(2), 67–92 (2020)
10. Reichheld, F.F.: The one number you need to grow. Harvard business review **81 12**, 46–54, 124 (2003). https://api.semanticscholar.org/CorpusID:1681767
11. Yusuke, Y., Takehiro, Y., et al.: Development of a web access literacy scale. Trans. Inform. Process. Society Japan (TOD) **12**(1), 24–37 (January 2019). https://cir.nii.ac.jp/crid/1050001337909767296