

Cookie Disclaimers: Impact of Design and Users' Attitude

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ABSTRACT

Dark patterns in cookie disclaimers are factors that are used to lead users to accept more cookies than needed and more than they are aware of. The contributions of this paper are (1) evaluating the efficacy of several of these factors while measuring actual behavior; (2) identifying users' attitude towards cookie disclaimers including how they decide which cookies to accept or reject. We show that different visual representation of the reject/accept option have a significant impact on users' decision. We also found that the labeling of the reject option has a significant impact. In addition, we confirm previous research regarding biasing text (which has no significant impact on users' decision). Our results on users' attitude towards cookie disclaimers indicate that for several user groups the design of the disclaimer only plays a secondary role when it comes to decision making. We provide recommendations on how to improve the situation for the different user groups.

KEYWORDS

cookies, privacy, web tracking, user study, dark patterns

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1 INTRODUCTION

Cookie disclaimers are nowadays an indispensable part of the Internet. According to the ePrivacy Directive, also known colloquially as the Cookie Law, website owners need to ask for informed consent before storing cookies on users' devices – other than the technically necessary ones¹. But there are also many cookies which website owners want users to accept in order to collect more data and sometimes even to link data of one user from various websites. The

¹The so called technically necessary ones are those cookies which are needed for the website to provide its service.

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General Data Protection Regulation (GDPR) deals more generally with the protection of personal data, which includes cookies, and consent to the processing thereof. According to the GDPR, consent needs to be “freely given, informed, specific and unambiguous”. As detailed regulations on the design are missing, so-called *dark patterns* are widely used, that is, design elements that are intended to lead the user into selecting an option for sharing more data than they would otherwise prefer. But are all dark patterns actually achieving their goal? As such, there is an acknowledged need of empirical studies aimed at a better understanding on which design elements in cookie disclaimers can be considered dark patterns [19].

However, a comprehensive analysis via such studies is challenging due to a large number of design elements used in cookie disclaimers: A number of such designs have been studied in previous research [8, 11, 12, 16, 17, 23]. Yet, given that these studies focused on different elements in different settings, and given that some of the studies came to different conclusions regarding the effectiveness of certain design elements in influencing users' behavior, there is a need for more research that investigates a variety of elements in a systematic way.

In this work, we select a number of design elements of cookie disclaimers to evaluate with a between-subject online user study with $N = 521$ participants, conducted as an experiment measuring participants' behaviour when interacting with a cookie disclaimer. For this study we chose the design elements in different dimensions: (1) the visual look and feel of the options provided to the participants (*Visual*), (2) the text label on the option to reject cookies (*Label*) and (3) the text in the disclaimer aiming to explain the usage of cookies to the user (*Explanation*). The goal of our study was to identify the dimensions – as well as specific design examples within these dimensions – that have the most effect on the users' behavior. In addition to the quantitative evaluation of how the design of the disclaimer influences users' decision, we conduct a qualitative analysis of free-text answers to better understand the reasons behind the participants' decisions. We used open coding to identify users' attitude for decision making in this context.

In short, our work provides the following **contributions**:

- (1) We show that two of the three studied dimensions on cookie disclaimers indeed have a potential to nudge the users into selecting the “accept” option, namely, the *Visual* and *Label* dimensions. By far the largest effect was observed for presenting the option to reject cookies as a link instead of a button. A lesser yet significant effect was furthermore

identified for highlighting the “accept” option compared to highlighting the “reject” option, confirming that similar to studies in other domains [1], users might gravitate towards an option that is presented as the default one. However, we did not detect a significant difference in terms of accepting cookies when the “accept” option was highlighted (while both options being presented as buttons next to each other) vs. keeping the “accept” and “reject” options the same. This is inline with the findings in [8], suggesting that the “default” effect loses its prominence in this case. With regards to the *Label* dimension, we furthermore show that the text on the “reject” button or link influences the acceptance rates independent on the visual presentation of the options, suggesting that the phrasing of these options indeed has a potential to influence users’ perceptions of what the consequences of them either accepting or rejecting cookies are. (iii) We did not detect significant differences between the level of bias presented in the explanation text of the cookie disclaimer (i.e. whether the participants are told about the benefits of accepting all cookies). In this we confirm the findings in previous research suggesting that the text accompanying the disclaimer does not influence users’ decisions (i.e. being either not read or not taken into account) [11, 12], while, as opposed to previous works, measuring actual behavior instead of relying on self-reporting.

- (2) From the qualitative analysis, we found that users’ attitudes towards decision making regarding cookie disclaimers are often influenced by factors that are orthogonal to the actual design of the cookie disclaimer. As such, we found that users accept all cookies for various reasons, such as lack of risk awareness, habituation effects, the fear of not being able to access the website, the fact that they use browser extensions or configured their browser in a way that cookies are deleted on a regular bases.

We conclude that the lack of structural approach to cookie disclaimers at the beginning of introduction of the relevant legislation – in particular, lack of guidelines regulating the use of dark patterns or blocking access to the website unless the user has agreed to accept all cookies – has lead to the issues of of habituation, fear, and coping strategies that we observed. While we recognise that a more precise regulation of design elements is challenging, we encourage the policy makers to request conducting independent empirical studies (i.e. a kind of evaluation) before implementing cookie disclaimers or any other privacy consent dialogue in the wild.

2 RELATED WORK

A literature review by Schaub et al. [21] discusses challenges wrt. designing usable and understandable settings interfaces and notices. These include complexity of available notices, lack of actionable choices, users’ fatigue, and lack of integration in user context. While a few researchers e.g. [3] think that addressing these challenges is impossible, several researchers have proposed, applied, and studied guidelines for improved interfaces e.g. [18]. Most notably, understanding users’ mental models is generally considered to be an important step towards designing usable privacy decision support

measures [18, 20, 21]. However, all this research assumes that the provider of the interface is interested in providing a fair UI wrt. privacy settings. A literature review by Schaub et al. [21] discusses challenges wrt. designing usable and understandable settings interfaces and notices. These include complexity of available notices, lack of actionable choices, users’ fatigue, and lack of integration in user context. While a few researchers e.g. [3] think that addressing these challenges is impossible, several researchers have proposed, applied, and studied guidelines for improved interfaces e.g. [18]. Most notably, understanding users’ mental models is generally considered to be an important step towards designing usable privacy decision support measures [18, 20, 21]. However, all this research assumes that the provider of the interface is interested in providing a fair UI wrt. privacy settings.

The study of effects that design elements have on users’ decisions have been the subject of multiple works. Particularly relevant to our work is the concept of *nudges*, or using specific patterns to increase the likelihood of a specific behavior [22], such as getting people to stop smoking or to save water due to environmental concerns. The usage of nudges in the digital world have furthermore been studied in various domains [4, 14] such as choice of cloud service, password creation, encryption of smart phone, choice of public wifi [24] or installing apps [1]. In most studies nudges were often evaluated by looking either at the so-called *content nudges* ([15, 24]) or *design nudges* [10]. In some contexts nudges appear to be more effective, when combined with information or strengthen active choice by giving more options.

Building on the concept of nudges, several works studied specific design elements to understand their effect on users’ behavior – in particular, whether these design elements are capable of increasing the likelihood of users to accept cookies (thus potentially enabling access to more data to the service providers). As such, several works investigated such *design nudges* as highlighting one of the options on the cookie disclaimers – that is, either accepting all cookies or rejecting all but necessary cookies – or leaving both options with the same look and feel [10, 16, 23]. The results were varying, with some studies finding a significant difference in users’ behavior when highlighting the “accept” option compared to presenting both the “accept” and the “reject” option equally [10, 16, 23], yet others not detecting any effect of highlighting the “reject” option [8]. Similarly varying findings resulted from investigations of the effect of the amount of clicks a user would need to make to either accept or reject [8, 17, 23] or the position of the disclaimer [17, 23]. Further studies focused on *content nudges*, such as the effects of explanations texts [11, 12, 23], showing either small effect or no significant effect.

While these studies provide us with some insights on the effectiveness of particular design elements in affecting users’ decisions, the combination of various elements with a potentially nudging effect – such as the look and feel of the “reject” option and the explanation text – have not been systematically studied, yet. With this work, we aim to make a first step towards conducting such an investigation,

3 METHODOLOGY

We aim to study the effect of various design elements in cookie disclaimers on users' behavior and how users make decisions when faced with cookie disclaimers.

3.1 Investigated design elements

We look at three kinds of design elements that we found a lot in real world cookie disclaimers.

3.1.1 Visual representation of the “reject”-option. We study the sub-dimensions “usage of highlighting” and “highlighting type” and consider overall five ways in which the “reject”-option can be represented:

Button-Same Both the “reject” and the “accept” options are presented as buttons and look the same

Button-Highlight-Accept Both the “reject” and the “accept” options are presented as buttons, but the “accept” option is highlighted

Button-Highlight-Reject Both the “reject” and the “accept” options are presented as buttons, but the “reject” option is highlighted

Link-End The “reject” option is presented as a text link and is located at the end of the explanation text

Link-Middle The “reject” option is presented as a text link and is located in the middle of the explanation text

In particular, for the variants that presented the “reject”-option as a button and highlighted one of the options (“Button-Highlight-Accept”, “Button-Highlight-Reject”), we conducted a pre-study to understand what kind of look and feel of buttons users perceive as highlighted². In this pre-study, the participants were presented with three images of cookie disclaimers, containing three different variants of using color and position – one after the other – to distinguish the “accept” and “reject” option: (D1: accept-white-right) with “reject” button with a *blue* background and to the *left*, and “accept”-button with a *white* background and to the *right*, (D2: accept-white-left) with “reject” button with a *blue* background and to the *right*, and “accept”-button with a *white* background and to the *left*, (D3: accept-blue-right) with “reject” button with a *white* background and to the *left*, and “accept”-button with a *blue* background and to the *right*. The participants were asked to select for each disclaimer, which button they perceived as most prominent, i.e. highlighted. As the result, the majority of the participants perceived the button that had a blue background as the one that is highlighted on all of the three disclaimers, with 96% of participants (68 out of 71) marking the “accept” option as highlighted on the disclaimer D3, 80% (57 out of 71) and 92% (65 out of 71) marking the “reject” option as highlighted on the disclaimer D1 and D2 respectively. We therefore concluded that the use of these colors, and to a lesser extent, of a position of the button (given the difference in responses between the disclaimers D1 and D2) would be appropriate markers for our main study in designing the buttons on the disclaimers “Button-Highlight-Accept”, “Button-Highlight-Reject”.

²The participants of the preliminary study were recruited using personal networks and social media of the paper authors, resulting in a total of 71 participants. They were not reimbursed for their participation. The study took less than five minutes.

3.1.2 Label of the “reject” option. For the *content*-dimension, we choose to study the effect of how the “reject” option is named on the disclaimer (sub-dimension “naming of options”). In particular, we study four of the possible labels that could be present either as a text on the corresponding button or the text to a corresponding link:

Reject The label states “Reject”³

No-Additional The label states “No additional cookies”

Only-Necessary The label states “Only necessary cookies”

Save-Choice The label states “Save choice”

3.1.3 Explanation text. For the *fairness* dimension, we consider the sub-dimension “impression generated” and investigate whether composing the explanation text in a way that attempts to convince the participants to share more of their data plays a role in participants' decisions. Namely, we consider following variants for the explanation text shown to the participants:

Bias The explanation text contains bias nudging the participants towards accepting the cookies, stating: “This website requires some cookies to function. If you allow us, we will additionally use other cookies to use them for marketing purposes. This helps us to present you with more relevant and personalized ads. This can significantly improve your internet experience. Therefore, we recommend that you agree to these cookies.”

No-Bias The explanation text does not contain bias nudging the participants towards accepting the cookies, stating: “This website requires some cookies to function. If you allow us, we will additionally use other cookies to use them for marketing purposes. You can change or revoke your consent later at any time.”

Figure 1 shows examples of displayed disclaimer for each one of the *Visual*-Options. The screenshots of disclaimers for all the combinations of *Visual*, *Label* and *Explanation* are provided in Appendix A.5.

3.2 Hypotheses

We aim to study the effect of various design elements in cookie disclaimers on users' behavior. To do so, we define the following null and alternative hypotheses for each one of the studied variables:

- $H_{1,0}$: There is no difference in terms of how likely the users are to accept all cookies, based on the *Visual* variable.
- $H_{1,1}$: There is a difference in terms of how likely the users are to accept all cookies, based on the *Visual* variable.
- $H_{2,0}$: There is no difference in terms of how likely the users are to accept all cookies, based on the *Label* variable.
- $H_{2,1}$: There is a difference in terms of how likely the users are to accept all cookies, based on the *Label* variable.
- $H_{3,0}$: There is no difference in terms of how likely the users are to accept all cookies, based on the *Explanation* variable.
- $H_{3,1}$: There is no difference in terms of how likely the users are to accept all cookies, based on the *Explanation* variable.

³Here and in the rest of the paper, the text used in the study is translated from German

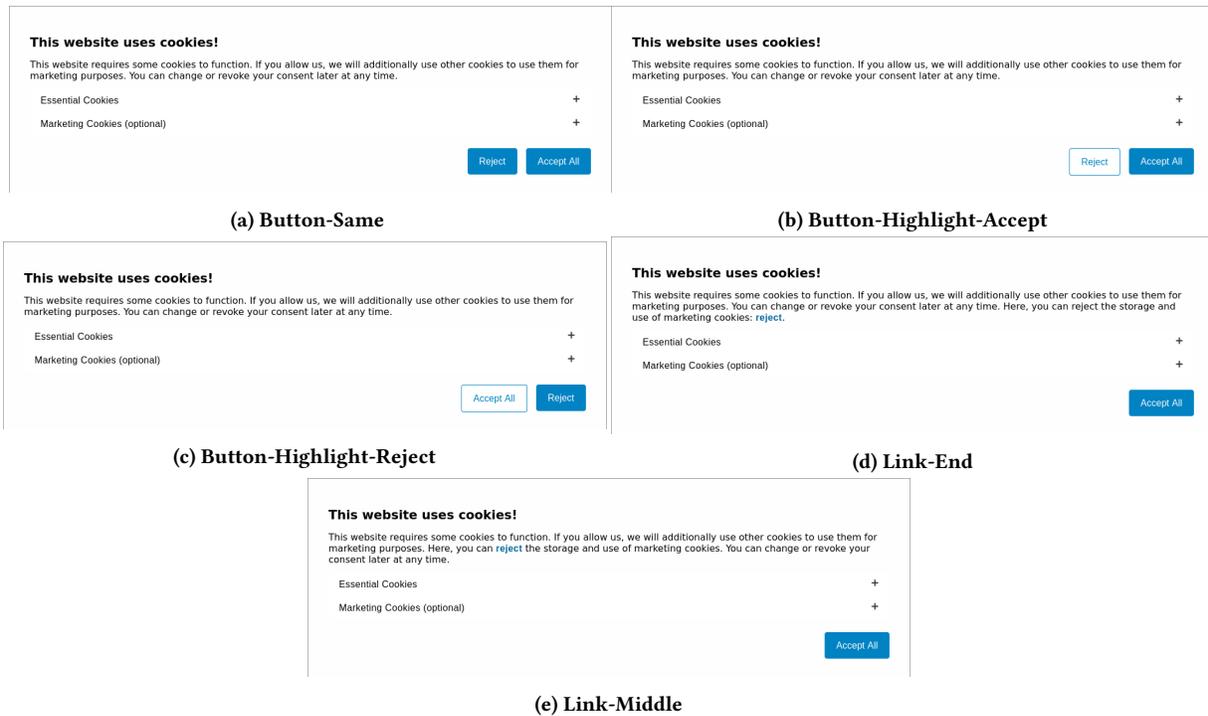


Figure 1: Examples of cookie disclaimers with different visual representations of the “reject”-option (*Visual*). In all the examples, the reject option is labeled as “Reject”, and the explanation does not include bias. Note, the text in the provided figure is translated from original German.

3.3 Study procedure

We use a between-subject factorial design, where each participant is randomly exposed to a cookie disclaimer with (1) either “Button-Same”, “Button-Highlight-Accept”, “Button-Highlight-Reject”, “Link-End” or “Link-Middle” for visual representation of the “reject”-option (variable *Visual*), (2) either “Reject”, “No-Additional”, “Only-Necessary” or “Save-Choice” for labeling of the “reject” option (variable *Label*) and (3) either “Bias” or “No-Bias”) for the explanation text (variable *Explanation*). Thus, participants got one of $40 = 5 \times 4 \times 2$ possible combinations of the investigated variables.

In order to get insights of the real-world behavior of users, we used deception in our study, where the participants were *not* told that their interaction with the disclaimer is the real subject of the study. Instead, the study was advertised using a cover story, where the users were told that the purpose of the study is to study user experience on website UIs. After clicking on the link that lead to the questionnaire, one of the 40 cookie disclaimers was randomly selected and displayed. Once the participants selected either the “accept” or the “reject” option on the disclaimer, they were forwarded to the debriefing page, where they were told about the real purpose of the study, informed that regardless of their decision no actual cookies have been stored on their devices, and were asked whether they consent to further participation in the survey. If the participants chose not to consent, their data was not included in further evaluations. If the participants consented, they were asked further questions about their interaction with the cookie

disclaimer in the study, as well as their demographics. The questions furthermore included an attention check where the participants were asked to select a particular option.

3.4 Recruitment and ethics

In order to test these hypotheses, we aimed to recruit at least 500 participants, following the guidelines for choosing the sample size for logistic regression [5]. The guidelines recommend a sample size of $n = 100 + 50i$, with i as the number of independent variables, which in our case would equal to 8 (counting the dummy variables of $4+3+1$ representing the values of *Visual*, *Label* and *Explanation* correspondingly). We furthermore decided to recruit 100 additional participants to account for possible exclusion due to insufficient response quality (e.g. due to failed attention checks, see Section 3.3).

The participants in both our studies were recruited using the Clickworker platform⁴. They were offered 1.60€, which was calculated based on the study duration of 10 minutes (as estimated by pretests of both of the studies) and the minimal hourly wage of 9.60€ in Germany, where the study was conducted. While there is no mandatory IRB approval at our institution, we took measures to avoid harms to our participants, following the guidelines for empirical research suggested by the American Psychological Association [2]. In particular, since our studies involved deception due to the need to test the reactions of the participants on cookie disclaimers without biasing them with the real purpose of the study,

⁴<https://clickworker.com>, last accessed March 23rd, 2022

we took measures to ensure proper debriefing and obtaining informed consent for using the data provided by the participants. The study furthermore involved attention checks to ensure proper data quality. The participants were informed about the presence of such checks, as well as about the fact that they would not get any reimbursement if they fail these checks, at the beginning of the study.

4 STUDY RESULTS

There were 644 participants completing our study (excluding participants who started the study but decided to drop out at any point). Of them, 123 were excluded from further analysis for the following reason: 47 failed the attention check, 66 were cases of suspected or confirmed repeated participation⁵, five did not have their decision recorded by the survey system due to a technical error, two reported using smartphone instead of a computer⁶, one reported not seeing the disclaimer, thus suspecting that there was a technical problem with the study, one suspected that the shown disclaimer is a part of the study due to the fact that cookie disclaimers are usually blocked for them because of browser addons, and one reported that they would act differently if it were not for participating in the study.

Out of the remaining participants, 306 were men, 209 women, one non-binary person, one person identifying as both man and woman and three participants who did not input their gender⁷. The most common age group of the participants was 30 to 34 years old (107 participants, of them 63 men, 44 women), followed by 25 to 29 years old (81 participants, of them 45 men, 33 women) and 20 to 24 years old (65 participants, of them 29 men, 36 women). Further demographic data, including education and employment status of the participants is provided in Appendix A.2.

Overall 69% of participants (360 out of 521) selected the option for accepting all cookies. The majority of the participants reported reading the header of the disclaimer (74%, 385 out of 521) and the labels on the buttons (73%, 381 out of 521); on the other hand, only around a third of the participants (34%, 178 out of 521) reported reading the explanation text, and less than 15% reported reading detailed information about marketing cookies (13%, 67 out of 521) or essential cookies (14%, 74 out of 521).

4.1 Comparison between groups

The distribution of participants into groups according to the variables *Visual*, *Label* and *Explanation* is provided on Table 1. Figures 2 to 4 show the rate of participants accepting all cookies grouped by variables *Visual*, *Label* and *Explanation* correspondingly.

We use a logistic regression model⁸, with the participants' decision to accept all cookies as the outcome and the variables *Visual*, *Label* and *Explanation* as predictors. The analysis of deviance for the model is provided on Table 2, showing significant effects of the

⁵Note, the recruitment for the study was performed in two rounds, and due to technical issues in some cases repeated participation could not be conclusively excluded.

⁶While the behavior of the users with devices with smaller screens with regards to cookie disclaimers is an interesting research question, we decided to exclude such participants from our study, since the way the disclaimers were displayed to them would be too different compared to the rest of the participants.

⁷Note, it was possible to select multiple options as one's gender

⁸The statistical analysis is performed using R packages "stats" and "emmeans". The assumption for applying logistic regression to the data have been fulfilled.

Visual	Label	Explanation	
		Bias	No-Bias
Button-Highlight-Accept	No-Additional	14	14
	Only-Necessary	7	13
	Reject	11	13
	Save-Choice	17	14
Button-Highlight-Reject	No-Additional	12	15
	Only-Necessary	17	14
	Reject	11	12
	Save-Choice	13	15
Button-Same	No-Additional	11	11
	Only-Necessary	14	13
	Reject	8	14
	Save-Choice	12	12
Link-End	No-Additional	15	15
	Only-Necessary	16	11
	Reject	13	12
	Save-Choice	13	13
Link-Middle	No-Additional	12	15
	Only-Necessary	15	10
	Reject	14	14
	Save-Choice	15	11

Table 1: Number of participants in the group for each combination of *Visual*, *Label*, *Explanation*

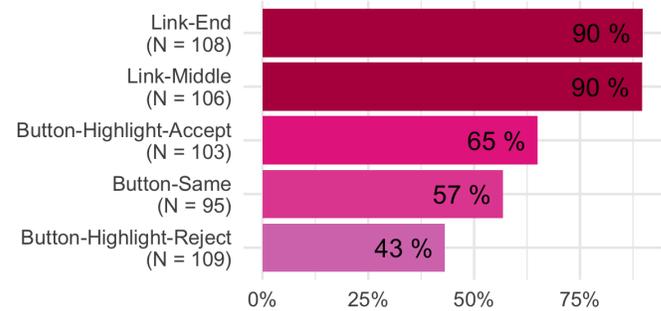


Figure 2: Percentage of participants accepting all cookies for each visual representation of the "reject"-option (*Visual*)

variables *Visual* and *Label*. Thus, $H_{1,0}$ and $H_{2,0}$ are rejected, but $H_{3,0}$ could not be rejected.

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Visual	4	18.05	4.51	25.50	<.0001
Label	3	2.52	0.84	4.75	0.0028
Explanation	1	0.04	0.04	0.23	0.6311
Residuals	512	90.63	0.18		

Table 2: Analysis of deviance for the logistic regression model

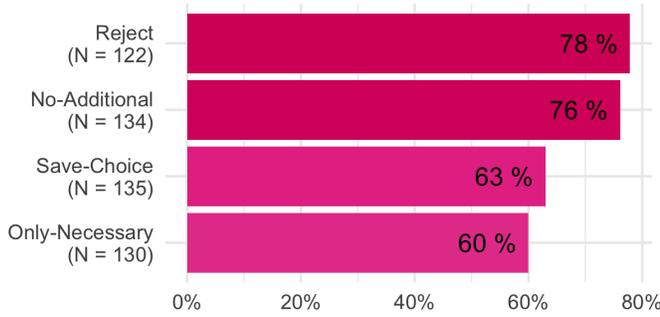


Figure 3: Percentage of participants accepting all cookies for each label of the “reject”-option (Label)

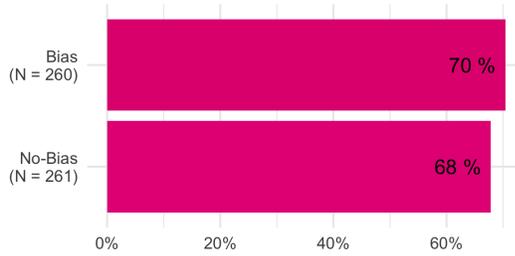


Figure 4: Percentage of participants accepting all cookies for each explanation (Explanation)

We furthermore computed pairwise comparisons for the variables *Visual* and *Label*, with the odd ratio values and their confidence intervals shown on Figures 5 and 6. The analysis shows significant differences between disclaimers that displayed the “reject”-option as the link (Link-End, Link-Middle) and the ones that displayed both the “reject” and “accept” options as buttons (Highlighted-Accept, Highlighted-Reject, Same), with users being 5 to 12 times less likely to accept cookies if the “reject” option was presented as a button (OR from 0.0835 [0.0299, 0.234] to 0.2098 [0.0735, 0.599]). Smaller, albeit still statistically significant differences were furthermore identified between displaying the “reject”-button as highlighted, versus highlighting the “accept”-button, with users more than twice more likely to accept cookies in the later case ($OR = 2.43 [1.1045, 5.346]$). We detected smaller effects with regards to the “Label” variable. As such, labeling the “reject” option “Only necessary cookies” made it 2.5 times less likely to accept cookies compared labeling this option as “Reject” ($OR = 0.404 [0.183, 0.893]$). Similarly, changing the label from “No additional cookies” to “Only necessary cookies” makes it more than twice as likely for the users to accept cookies ($OR = 2.25 [1.049, 4.828]$). No further significant differences between the different labels were identified. The full statistical output of the pairwise comparisons is provided in the Appendix, see Tables 8 and 9.

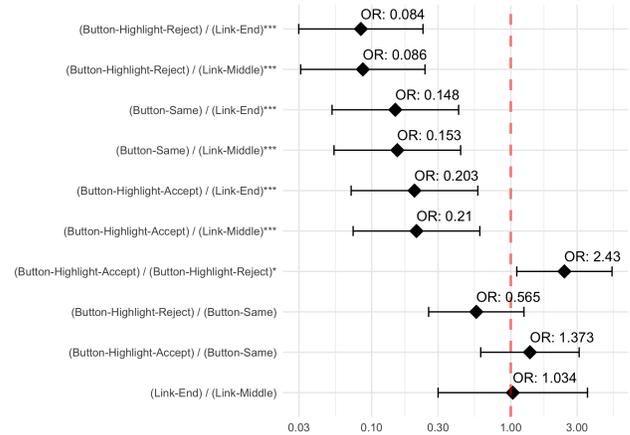


Figure 5: Odds ratios and their 95% confidence intervals for pairwise comparison of *Visual* variable. The x-scale is logarithmic, * signifies p-value < .001, * signifies p-value between .01 and .05.**

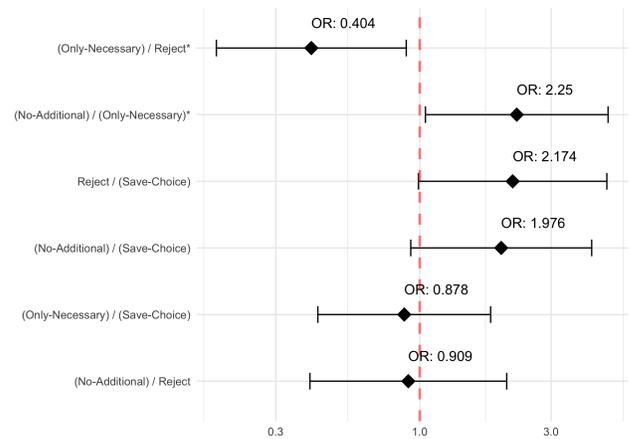


Figure 6: Odds ratios and their 95% confidence intervals for pairwise comparison of *Label* variable. The x-scale is logarithmic, * signifies p-value < .001, * signifies p-value between .01 and .05.**

4.2 Users’ attitudes

In order identify the attitudes of users regarding cookie disclaimer that affected their decisions, we conducted an open-coding analysis of their answers to the question “Why have you chosen this option on the cookie disclaimer?”. The coding was done by two researchers. The code-book was developed in the following steps: Two of the authors developed a code book based on 10% of the responses (randomly selecting while making sure those from different groups were covered as well as those from participants having accepted all cookies). The two code books were discussed during a meeting. It was agreed on a common code-book. Afterwards each author coded the entire code-book. During this step new codes

assigned the code 'if possible, only essential cookies' (while several referred to if easily possible) an 58 times the code '(Protection of) Privacy - abstract'. While these are the top four, it might be worth mentioning that 14 answers were assigned to the individual code 'Perceived only one option', 21 to the individual code 'trust in the site', and 41 to the individual code 'website functionality', i.e. those were afraid that they cannot use the website if they do not accept everything.



Figure 7: Frequency of codes from each category being mentioned by participants (as a percentage of total codes mentioned by participants shown a disclaimer with a particular Visual and making a particular decision).

5 DISCUSSION

5.1 Effect of the Design of Cookie Disclaimers

Our results show that participants indeed are swayed to share more data just by modifying the design elements of the cookie disclaimers. Thus, our research once again stresses the ephemeral nature of consent in the context of web tracking: if the users tend to select different options depending on the web design, it can hardly be argued that the consent they provide is indeed informed.

In particular, the design nudges that was shown to affect the participants the most was the visual representation of the “reject”-option: Only very few participants (10%) chose the option that would allow them to reject all but necessary cookies, if that option was represented as a link instead of a button. The participants’ follow-up explanations furthermore have shown that some of them (14 participants) stated that they did not notice the “reject”-option at all. Others accepted because they thought there is no easy way to reject.

Thus, we underline the request from [23] “for regulation to not just require consent, but also provide clear requirements or guidance for how this consent has to be obtained in order to ensure that users can make free and informed choices.”. In particular it should be regulated that presenting the “reject”-option as a link while showing the “accept” option as a button is illegal. It is worth mentioning that presenting the “reject”-option as a link while showing the “accept” option as a button has already been criticized by data protection agencies, in particular, the data protection agency in Denmark issuing guidelines cautioning against such practice [6].

Our results show that without highlighting and with highlighting the reject option (bright pattern), an accept-all rate of 57% and 43% respectively was measured. Furthermore, our study did not reveal significant differences between presenting both the “accept” and “reject” option as buttons with similar look and feel and highlighting either one of them.

Our findings regarding the visual nudges of the “reject”-option can be seen as complementing previous research: as such, we did not find a significant difference between highlighting the “reject” button versus presenting both options as buttons with the same look and feel, as opposed to the findings of Utz et al. [23]. While it might indicate that the effect is too small to be detectable given our study sample, it is worth noting that our findings are inline with the results of Grassl et al. [8]; given the time gap between these studies, it is possible that the effect of highlighting a button has reduced as the participants became more familiar with the cookie disclaimers (hence, those of them who were concerned about their privacy knew not to click on the highlighted button). Given these distinctions, however, and the variety of highlighting effects that were not yet investigated (e.g. positioning of the button), future work is needed to understand which of these effects might have played a role in the participants’ choice as well.

However, already from our study, we can conclude that it is not enough to legally require a change of the design, although it is a first step. To get more insights, we tried to understand how participants made decisions and found that more than half of those participants having accepted all cookies mentioned attitude related and less than one third of those participants mentioned in their answers anything that could indicate an informed decision (classified as deliberation). This influence on decision is discussed further in Section 5.2.

Code	Description	Example(s)
UI		
Perceived only one option	Participants have perceived only one option. They either say this specifically	Because I saw no other option / Since only this was clickable
Highlighted option	Participants mention that the accept button was highlighted – either in general or by being more precise e.g. mentioning the different background colours.	was highlighted / it was the most prominent option / The highlighted one is usually the fastest / It was highlighted and I wanted to click the message away [...]
Attitude		
No specific reason	Particular stated that there is no particular reason for it. Participants wrote that they did not think about it or they have no memory anymore.	No idea / No specific reasons / Because I don't care / I don't remember
Effort factor	The goal was to leave the disclaimer as soon as possible with as less effort as possible. Participants mentioned that they did not want to take the time.	Easier for me / Because it was the fastest option / So that the box disappears quickly. / The highlighted one is usually the fastest / reject means usually several clicks
Habit (Routine)	This is done in the sense of always just clicking everything away. Other concepts assigned to this code are gut feeling and reflex.	I always choose this option, so habit. / Since you do it out of habit - cookies are required everywhere. / I always act like this
Nothing bad / Something good	Cookies are generally not perceived as something bad thing / possibly even a good thing. The spectrum of quotes assigned here ranges from collecting data is accepted up to cookies are good advertising media.	I don't consider cookies as something bad / Cookies don't bother me
Carelessness	Participants state about themselves that they are careless. They may also say that they know they should care more.	Careless / Because I am too lazy to read / Out of laziness I did not read the text and agreed
Accident		
Clicked on accident	Participants regret now that they thought of it. They state they selected this option by accident. This code also contains those who say they rejected or they wanted to reject but they actually accepted all cookies.	[note all these participants accepted all cookies] I only wanted to accept essential cookies / Because I always only accept the essential cookies / Because I wanted to avoid marketing cookies / I wanted to accept only essential cookies but the buttons were not clear about this [none highlighting group] / I do not wish to receive advertising / No need to choose the other option. No desire for advertising. / Marketing cookies was not selected
Deliberation		
If possible, only essential cookies	Participants wrote that they want to accept as few cookies as possible or always rejects what is possible. Other state that they only accept essential cookies but nothing else. Those participants assigned to this code rejected the marketing cookies	For all cookie messages, I only allow the essential cookies as a rule. / Reject cookies in general / Since I usually only allow essential cookies
Regular deletion of cookies	Participants wrote that they delete cookies on a regular bases while some took a manual and other an automatic approach to do so. Some participants stated that accepting cookies is okay or it doesn't matter for them because they are deleted regularly.	Since I delete cookies regularly (usually before closing the browser). / This option is automatically selected. At the end of the day, all cookies are deleted again. / Cookies are deleted automatically when I close the browser
Habit as cookies are deleted	Participants stated that they either always take this option or that they take any option or the fastest / highlighted option. Those participants assigned to this code were also assigned to the previous code	This option is automatically selected. At the end of the day, all cookies are deleted again.
(Protection of) privacy - abstract	Participants stated the protection of their privacy as the main reason.	Does not want to be tracked / Because I wanted as little data as possible to be collected about me / I don't want to be controlled and watched all the time.
Obligatory	Participants who say it's obligatory and they have to agree to cookies. For this code it is not further specified whether e.g. they did not notice another option or whether they think it is needed for the webpage.	So that I can get to the survey / I had to accept / Because without one cannot do anything / Because I wanted to continue
Website functionality	Participants thought that accept all is important for the use of the website; They thought otherwise they cannot use the website/ participate in the study. Those few stating that they wanted to influence the usage of the study page.	As I thought that without the selection I would not be able to participate further. / Assuming that this is necessary for this survey / Optimal user experience
Trust in the site	Participants mentioned that their decision was based on trust: Either in general or trust involved parties (because it is a university / a SoSciSurvey site or offered by Clickworker).	The site seems trustworthy to me / I did not want to look more deeply into cookie options as I trust an Institute ... that they would not misuse my data. / Because I did not see an option to reject but as it was provided by Clickworker I thought this page would not be selling my data
Informed decision - non-specific	Participants state that they thought of it and came to the conclusion that this is the best option or that this option made sense to them. However, they did not specify why or just mention privacy reasons.	As I am professionally familiar with the topic and do not want to provide unnecessary data according to GDPR. / I don't want sites to simply use my data and pass it on to others, and I've already done a lot of research on the subject. / This option made sense to me.
As little advertising as possible	As little advertising as possible is the given reason.	I do not wish to receive advertising / No need to choose the other option. No desire for advertising.
Emotions		
Cookies messages annoy	Participants express their annoyance by cookie disclaimer.	Cookies messages are unfortunately something very annoying and I am personally very jaded about these messages. / [...] Personally, they just annoy me.
Anxiety	Participants mentioned that they are cautious about new websites or is afraid of sharing data.	Out of habit, I fear that my personal data will be spread more and more. / As I am more cautious especially with new websites and want to prevent the data from being passed on.
Nonsense / Others		
Nonsense / Others	There is no kind of entry or the provided input does not make sense. We found some type of answers that were only mentioned by one or two participants and thus not coded separately.	Z / ___ / I tried to help / I don't think I can be influenced by advertisements / security reasons / for safety

Table 4: Code-book

For the text-changes we made to generate some bias towards accepting had no effect on participants decision to accept all cookies or not, similar to findings in [11, 12]. One of the reasons can very well be the fact that only a relatively small amount of users actually reads the text at all; as such, only 34% of our participants reported reading the explanation text, and looking at the analyses of the free-text answers reveals reasons for such low engagement: e.g. 110 mentioned time related issues and 66 (see Table 10 for the numbers) that they just click it away (habit). This also explains that 13, see Table 10, specifically mention that they did not notice the link in the text and that the accept-all rate for the groups with the reject-link is so high. Not reading is also supported by the following finding: We had several participants believing that they would not be able to use the website afterwards – ostensibly overlooking the fact that the explanation on our mock cookie disclaimers explicitly mentioned that the website functionality would not be impaired. Note, also from those rejecting only one mentioned something related to the text 'criminal way in phrasing text in cookie disclaimers'. Thus, it looks like the actual text has limited effect also on those who try reject all cookies other than essential one.

While the main text nudge seems to have little influence the text on the button for the reject option makes a difference: Participants were more likely to reject all but essential cookies if the corresponding option was labeled as "Only necessary cookies" as opposed to "Reject" or "No additional cookies". A possible reason for this can be deduced from the analyses of the free-text answers: 49 participants mentioned that they were afraid that they would either not be able to use the website at all, or use it with limited functionality if they do not accept all cookies. Some refer even to past experience. Thus, it might be that negative phrasing should be avoided to enable more informed decisions. In general more clear labeling of options is needed which shows the percentages of participants who misunderstood the options and thus selected one option but misinterpreted them (see category accident in fig. 7). While this is due to the best of our knowledge the first study analyzing different labeling of options, more research in this direction is needed. In case future research can support our findings it is highly recommended that labeling of options is also discussed in future legal regulations.

5.2 Influence of Non-Design Aspects

Participants' explanations regarding their interactions with the cookie disclaimer shed light on their decision-making process. Participants reporting using both of *Kahnemann's systems* [9] in their reactions to the cookie disclaimer: System 1 (i.e. decision making that relies on quick heuristics) – in particular codes assigned to the 'attitude' category – and System 2 (decision making that relies on some level of deliberation) – in particular codes assigned to the 'deliberation' category. This finding confirms the findings in [8]: The authors also discussed the distinction between System 1 and System 2 decision process when it comes to reactions to cookie disclaimers. It is worth mentioning, that despite using system 2, several participants made a deliberate choice to accept all cookies, in particular there were 48 of our 521 participants believing that they would not be able to use the website afterwards – while some mention corresponding negative experience in the past. This is of particular interest as the idea of technically necessary cookies is that the website should work with only these cookies. Thus, either the websites they visited in past did not implement this concept properly and/or these participants are not entirely aware of the concept of technically necessary cookies.

Note, some having the attitude towards accepting all cookies, seem to have 'learned' that this is usually the highlighted option. This may also explain the 36% codes related to the category 'attitude' in group 'button-highlight-reject' (see Figure 7). It might be that several of those who rejected the marketing cookies only rejected by accident as they just followed their *habit* to click on the highlighted option without reading it. One may argue that this is also not an informed decision, anymore. While it is not likely that many websites would actually highlight the reject option. This result shows that – due to the habituation effect after having interacted with so many cookie disclaimers – it is not recommendable to highlight the reject option but rather show both or all options the same way.

Several individual codes – in particular in the category 'attitude' – indicate a *lack of awareness*: A general lack of awareness for privacy risks and countermeasures (confirming past research such as [11]) and regarding the concept of technically necessary cookies as well as questioning trust in the service as such versus trust in their privacy policies. Thus, our results shows once more, that it is important to raise peoples awareness for privacy risks – in general but also for specific contexts. Note, our finding regarding the missing awareness of the concept of technically necessary cookies, may also explain the findings regarding the n text for the rejection-option, e.g. 'reject' may sound more scaring than just 'only necessary' or 'only necessary'.

We identified several codes, i.e. users' attitude, which indicate that *decisions are made independent from the actual design/text*: There are all those which are likely to accept all cookies independent from the actual design and without reading the text, either due to their 'attitude' (e.g. don't care, no risk), because they are afraid not to be able to use the website without accepting all cookies ('Website functionality' and partially 'Obligatory'), because they 'trust in the site', or because they delete them either manually or automatically ('Regular deletion of cookies', 'habit as cookies are deleted'). Then there are those which are likely to reject all non-technically necessary cookies and would take the extra steps: '(Protection of) privacy - abstract', 'As little advertising as possible' – which are 73 of the 521 participants. There are only view codes related to the actual design (not related to the actual text): 'If possible, only essential Cookies' and the 'UI' category – in total only 62 of the 521 responses we analyzed. Thus most have developed their coping strategies after having seen for months/years cookie disclaimers on almost all websites. Also note that still 57% of our participants in the 'Button-Same' group selected the 'accept all' option. Thus, it is questionable whether just adopting the regulations towards prohibiting dark patterns actually makes a big difference. It looks like, as a privacy community we also need to focus more on awareness and/or tool support – if possible – which would decide based on our pre-configured privacy settings.

5.3 Limitations

Our participants were younger and more educated compared to the general German population. As participants in the crowdsourcing platforms, they were also likely to be more active as Internet users. It is also possible they were more likely to trust the website advertised on the platform they actively use, and more incentivised to continue browsing the website (hence, less likely to risk not being able to access the website due to rejecting cookies) in order to get their monetary reward. However, if they would have read the cookie disclaimer they would have noticed that they can continue to the actual study without actually accepting marketing cookies. Thus, in world in which people read these disclaimers the influence should be very limited but as our study results also show, many do not read it is likely that on other webpages with the same cookie disclaimers less participants would have accepted the marketing cookies. We expect that this would be the case of all groups. We furthermore had to rely on self-reporting with regards to participants reading the disclaimer or its specific parts, as well as regarding their reports on how they interact with cookie disclaimers outside of the study setting. Nonetheless, the differences observed in our study – in particular, the fact that the disclaimer design did have an influence on participants’ decisions – provide us with some insights about participants’ attitudes towards cookie disclaimers and their role in informing them about their data protection.

6 CONCLUSION

With our research, we show that not everything that looks like a dark pattern actually has a significant effect on peoples decision. Thus, studying different instantiating of design elements is worth to continue. Furthermore, we demonstrate that some design elements of cookie disclaimers influence peoples decision significantly. Thus, while legal regulations could and should be more precise, it is very difficult to be very precise as there are so many different ways to design cookie disclaimers and so many ways to change the text description. To address this shortcoming, we invite the data protection community to discuss the following alternative way to address dark patterns: Regulations could require the owner of informed consent dialogues such as cookie disclaimers to conduct empirical studies to kind of proof that there is no nudging affect – while ideally the study would be conducted by independent institutions.

Our study also reveals that adopting legal regulations will not be enough to only observe informed decisions. Habituation effects need to be addressed, too. This can be achieved via complementary approaches of (1) increasing privacy awareness among the end users, (2) working with service providers in ensuring that the information and control options provided to the users are actually meaningful for their decision making (so that the users would not be tempted to click the disclaimers away because they perceive the disclaimers to be useless). While there are valid criticisms towards relying on user awareness to make privacy-protective decisions [7], there is value for the users in involving them user in such decisions in their data, as acknowledged by both legislation and empirical studies (see e.g. [13]), so that effective ways of enabling such involvement should be a topic of future investigations.

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A APPENDIX

A.1 Debriefing and informed consent

The following text was shown to the participants in our survey as their debriefing, also asking them to give consent to participation in the study now that they know its real purpose (translated from German):

Thank you for participating in this survey. In the following you will be informed about the **study on cookie disclaimers**. Please read the rest of the information carefully:

You should have been presented with a **cookie disclaimer** to interact with at the beginning of the survey. This disclaimer was already **part of the study**. Contrary to what is stated in Clickworker, the **real goal** of the study was to evaluate how you deal with cookie disclaimers in your everyday life. Therefore, we could not tell you the true goal of the study at the beginning. We apologize for this. Note that **no cookies were stored by us**. It was only stored within this survey on which option you clicked on the cookie disclaimer.

In their everyday lives, users usually do not encounter cookie disclaimers as a primary task. Rather, they are an additional step required to use websites. We wanted to create such a situation as well by displaying what appeared to be a cookie disclaimer from SoSci Survey. Since we wanted to create a **situation as realistic as possible** for the cookie disclaimer, we could not inform you beforehand what the real content of this study is.

The study is part of a **thesis at the XXX**¹⁰. The aim is to find out whether the presentation of the options on cookie disclaimer has an effect on the behavior of users. The participants of the study are therefore shown different disclaimers, which always give the option to accept all cookies with one click or to accept only essential cookies with one click.

Cookies are small text files that are stored by website operators on users' devices in order to recognize them during future visits. This can be used, for example, to save shopping baskets when shopping online, even if the page is closed. However, cookies can also be passed on to third parties in order, for example, to be able to display suitable advertisements.

Cookie disclaimers are required to inform users and obtain their consent. It is mandatory for website operators to inform their users which cookies they store for which purpose and to whom they are passed in case of doubt. In addition, it must be possible to object to the storage and use of cookies. Technically necessary cookies (referred to here as essential cookies) are an exception. These are required by law to operate the website and do not require consent.

By interacting with the disclaimer just displayed, **no cookies were stored on your device**. The data was collected within the study and stored on a server of SoSci Survey in Germany. This data can only be viewed by those conducting the study and is only used for study purposes. The SoSci Survey tool itself also does not use cookies. Due to a unique user ID within a survey, which is transmitted from one page to the next, no data is permanently stored on your end device.

You have the option to cancel the survey at this point. In this case, the data collected so far (i.e. your click behavior at the cookie disclaimer) will not be used for the study. Please note: If you do not agree to the use of your data, Clickworker will consider your order as "canceled". You will then not receive any fee from Clickworker.

¹⁰Name of the institution removed due to anonymisation

A.2 Demographics of our participants

	Women	Men	Non-binary/Other
19 or younger	0	5	0
20-24	36	28	1
25-29	33	45	3
30-34	44	63	0
35-39	23	39	0
40-44	16	40	1
45-49	12	24	0
50-54	21	19	0
55-59	15	21	0
60-64	7	13	0
65 or older	2	9	0
Not answered	0	0	1

Table 5: Age and gender of the participants (note, the participation was only allowed for participants who were at least 18 years old).

	Number of participants
Pupil	2
In apprenticeship	12
Student	64
Employee	281
Official	11
Self-employed	93
Unemployed/Looking for work	30
Other	27
Not answered	1

Table 6: Employment

	Numb. of part.
School finished without graduation	0
Elementary or lower secondary school leaving certificate, Quali	5
Intermediate or secondary school leaving certificate, or equivalent qualification	26
Completed apprenticeship	81
Vocational baccalaureate, entrance qualification & for a university of applied science	38
Final secondary-school examinations, university entrance qualification	141
University of Applied Sciences school diploma/ university degree	223
Still a pupil	1
Other degree	5
Not answered	1

Table 7: Education

A.3 Statistical analysis

A.4 Coding Results

	All cookies cookies accepted	Only necessary cookies accepted
UI		
Perceived only one option		
Button-Highlight-Accept	0	0
Button-Highlight-Reject	1	0
Button-Same	0	0
Link-End	8	0
Link-Middle	5	0
Highlighted option		
Button-Highlight-Accept	2	0

continues on next column

contrast	odds.ratio	SE	asympt.LCL	asympt.UCL	z.ratio	p.value
(Button-Highlight-Accept) / (Button-Highlight-Reject)	2.4299	0.7024	1.1045	5.3460	3.072	0.0181
(Button-Highlight-Accept) / (Button-Same)	1.3733	0.4104	0.6078	3.1031	1.062	0.8262
(Button-Highlight-Accept) / (Link-End)	0.2030	0.0780	0.0711	0.5793	-4.148	0.0003
(Button-Highlight-Accept) / (Link-Middle)	0.2098	0.0807	0.0735	0.5991	-4.060	0.0005
(Button-Highlight-Reject) / (Button-Same)	0.5652	0.1635	0.2568	1.2440	-1.973	0.2792
(Button-Highlight-Reject) / (Link-End)	0.0835	0.0315	0.0299	0.2337	-6.581	<.0001
(Button-Highlight-Reject) / (Link-Middle)	0.0864	0.0326	0.0308	0.2418	-6.490	<.0001
(Button-Same) / (Link-End)	0.1478	0.0568	0.0518	0.4215	-4.976	<.0001
(Button-Same) / (Link-Middle)	0.1528	0.0587	0.0535	0.4360	-4.887	<.0001
(Link-End) / (Link-Middle)	1.0338	0.4687	0.3002	3.5604	0.073	1.0000

Results are averaged over the levels of: Label, Explanation
 Confidence level used: 0.95
 Conf-level adjustment: tukey method for comparing a family of 5 estimates
 Intervals are back-transformed from the log odds ratio scale
 P value adjustment: tukey method for comparing a family of 5 estimates
 Tests are performed on the log odds ratio scale

Table 8: Pairwise comparisons of different visual representations of the “reject”-option (variable *Visual*)

contrast	odds.ratio	SE	asympt.LCL	asympt.UCL	z.ratio	p.value
(No-Additional) / (Only-Necessary)	2.2500	0.6687	1.0485	4.8283	2.728	0.0323
(No-Additional) / Reject	0.9087	0.2910	0.3992	2.0686	-0.299	0.9907
(No-Additional) / (Save-Choice)	1.9759	0.5817	0.9275	4.2095	2.313	0.0950
(Only-Necessary) / Reject	0.4039	0.1248	0.1826	0.8932	-2.934	0.0176
(Only-Necessary) / (Save-Choice)	0.8782	0.2469	0.4265	1.8083	-0.462	0.9673
Reject / (Save-Choice)	2.1743	0.6665	0.9893	4.7789	2.534	0.0549

Results are averaged over the levels of: Visual, Explanation
 Confidence level used: 0.95
 Conf-level adjustment: tukey method for comparing a family of 4 estimates
 Intervals are back-transformed from the log odds ratio scale
 P value adjustment: tukey method for comparing a family of 4 estimates
 Tests are performed on the log odds ratio scale

Table 9: Pairwise comparisons of different variants of labeling the “reject”-option (variable *Label*)

	All cookies cookies accepted	Only necessary cookies accepted
Button-Highlight-Reject	1	1
Button-Same	1	0
Link-End	2	0
Link-Middle	5	0
Attitude		
No specific reason		
Button-Highlight-Accept	10	0
Button-Highlight-Reject	5	6
Button-Same	3	2
Link-End	10	0
Link-Middle	12	0
Effort factor		
Button-Highlight-Accept	26	0
Button-Highlight-Reject	11	11
Button-Same	11	3
Link-End	34	1
Link-Middle	28	0
Habit (Routine)		
Button-Highlight-Accept	11	1
Button-Highlight-Reject	12	8
Button-Same	10	4
Link-End	18	0
Link-Middle	15	1
Nothing bad/ Something good		
Button-Highlight-Accept	3	0
Button-Highlight-Reject	1	1
Button-Same	4	0
Link-End	0	0
Link-Middle	3	0
Carelessness		
Button-Highlight-Accept	4	1
Button-Highlight-Reject	0	1
Button-Same	1	0
Link-End	4	0

continues on next column

	All cookies cookies accepted	Only necessary cookies accepted
Link-Middle	4	0
Accident		
Clicked on accident		
Button-Highlight-Accept	2	0
Button-Highlight-Reject	4	0
Button-Same	1	0
Link-End	8	0
Link-Middle	11	0
Deliberation		
If possible, only essential cookies		
Button-Highlight-Accept	2	16
Button-Highlight-Reject	0	17
Button-Same	0	10
Link-End	0	6
Link-Middle	3	8
Regular deletion of cookies		
Button-Highlight-Accept	2	1
Button-Highlight-Reject	4	0
Button-Same	0	0
Link-End	5	0
Link-Middle	7	0
Habit as cookies are deleted		
Button-Highlight-Accept	2	1
Button-Highlight-Reject	1	3
Button-Same	0	3
Link-End	3	1
Link-Middle	4	0
(Protection of) privacy - abstract		
Button-Highlight-Accept	0	16
Button-Highlight-Reject	0	15
Button-Same	0	17
Link-End	2	4
Link-Middle	0	4
As little advertising as possible		
Button-Highlight-Accept	0	3
Button-Highlight-Reject	0	6
Button-Same	1	4
Link-End	1	2
Link-Middle	0	2
Obligatory		
Button-Highlight-Accept	5	0
Button-Highlight-Reject	1	0
Button-Same	5	0
Link-End	4	0
Link-Middle	2	0
Website functionality		
Button-Highlight-Accept	8	2
Button-Highlight-Reject	8	0
Button-Same	10	2
Link-End	4	0
Link-Middle	7	0
Trust in the site		
Button-Highlight-Accept	4	0
Button-Highlight-Reject	3	1
Button-Same	4	1
Link-End	5	0
Link-Middle	5	0
Informed decision - non-specific		
Button-Highlight-Accept	1	3
Button-Highlight-Reject	0	2
Button-Same	2	3
Link-End	1	0
Link-Middle	2	0
Emotions		
Cookies messages annoy		
Button-Highlight-Accept	6	3
Button-Highlight-Reject	2	3
Button-Same	4	1
Link-End	4	1
Link-Middle	6	1
Anxiety		
Button-Highlight-Accept	1	0
Button-Highlight-Reject	1	1
Button-Same	0	1

continues on next column

	All cookies cookies accepted	Only necessary cookies accepted
Link-End	0	0
Link-Middle	0	0
Nonsense / Others		
Nonsense		
Button-Highlight-Accept	2	0
Button-Highlight-Reject	4	2
Button-Same	4	1
Link-End	4	1
Link-Middle	7	0
Others		
Button-Highlight-Accept	0	0
Button-Highlight-Reject	0	1
Button-Same	1	2
Link-End	3	0
Link-Middle	0	0

Table 10: Number of times each code was mentioned by participants shown a notice with a particular *Visual* and making a particular decision. Note, the responses of some of the participants were assigned multiple codes.

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(522)



(532)



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Figure 8: Fictitious cookie dialogs ($5 \times 4 \times 2 = 40$) in the original language German. (source: own picture)