

# “This Website Uses Cookies”: Users’ Perceptions and Reactions to the Cookie Disclaimer

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**Abstract**—For many years, cookies have been widely used by websites, storing information about users’ behaviour. While enabling additional functionality and potentially improving user experience, cookies, especially cookies used by third parties for data analysis, can be a threat to users’ privacy. The EU data protection directive, among other prescriptions, require that the website providers inform the users about cookie use on their websites by displaying a so-called cookie disclaimer. It remains an open question, however, what effect does the cookie disclaimer have on the behaviour of users and whether it succeeds in providing them with sufficient information for making an informed decision. We have conducted an explorative user study in order to investigate the users’ perceptions of cookies when seeing the cookie disclaimer, the users’ reactions to such a disclaimer and different factors that influence the users’ decision to leave or continue using the website. In this paper we report on the study results and furthermore discuss the implications of the study results for research into methods for ensuring informed privacy-related decisions of users.

**Index Terms**—cookies, privacy notice, user study

## I. INTRODUCTION

Since 1994, cookies have been commonly used on websites. Originally introduced in order to provide better user experience and additional functionality, the usage of cookies has since evolved to include data collection from the user. Such data collection can threaten the users’ privacy. As the EU Data protection directive [17] prescribes informing the users regarding the use of cookies on the website, service providers include a corresponding disclaimer on their website (see Fig. 1).

Yet, research from related domains [2], [7], [15] shows that privacy and security notices are often ineffective in their purpose. As such, they often fail to provide the necessary information to the users in an understandable way, in order to enable the users to make an informed decision. Furthermore, these notices often fail to empower the user, not providing them with meaningful choices and measures for protecting their privacy. As the result, users often ignore the notices not perceiving them as useful, or make decisions based on them without being aware of the consequences.

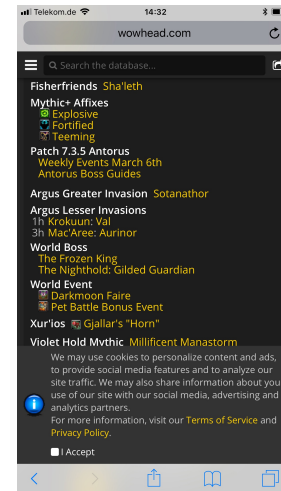


Fig. 1. An example of a cookie disclaimer on a mobile version of a website.

The goal of our work is to study the effect of the cookie disclaimer as a privacy notice on users. As such, in order to see whether the disclaimer succeeds in informing the users and empowering them in making decisions regarding their privacy, we consider the following research questions:

- 1) How do the users perceive the usage of cookies by the website provider when confronted with the disclaimer?
- 2) How do the users react to the displayed disclaimer?
- 3) Which factors influence the decisions of users regarding their surfing behaviour, when confronted with the cookie disclaimer?

In order to answer these questions, we have conducted an explorative study in form of an online survey with 150 participants. We provide both qualitative and quantitative analysis of the data collected within the study. The results of our study conclude, that a large part of the participants considered the cookie disclaimer as a nuisance in their surfing rather than useful means for providing information about the cookie usage. The study furthermore revealed that the text of the disclaimer did not play a significant role in users’ decision, with more important factors being, instead, the reputation of the website and the type of service it provides. At the same time, many participants claimed to have privacy concerns regarding cookies. Specifically, concerns were raised regarding the lack of transparency on how the data collected via cookies

is used by the service provider.

The paper is structured as follows. In Section II we provide the background information for our paper. We provide an overview of different groups of cookie disclaimers that are commonly used on websites in Section III. In Section IV we describe the study we performed, followed by the description of study results in Section V. We discuss our results and their possible implications in Section VI, and conclude the paper in Section VIII.

## II. BACKGROUND

In this section we provide general information about cookies and legal regulations of cookie use.

### A. Cookies

Cookies are small text files that are stored by the browser upon visiting a website. In this way, the website provider can store information on the users' computer, such as their login data, that can be accessed next time the user visits the website. As such, use of cookies provides advantage to the users, enabling certain functionality of the website. Additionally, the website provider can use cookies in order to collect information about the users and their behaviour on the website. This information, in particular, can be used for creating user profiles in order to personalise the advertisements shown to the users.

One distinguishes between two types of cookies: session cookies, and so-called persistent cookies. Session cookies, used, for example, in order to store the items in a user's shopping cart in an online store, are deleted as soon as the browser is closed. Persistent cookies, on the other hand, remain on a user's computer until they are explicitly deleted by the user, and can specifically be used for analysing the behaviour of the user. Such cookies, in particular, can be stored by both website providers as well as third parties, such as ad networks – the so-called third-party cookies.

### B. Legal Regulations

The EU Directive 2009/136/EG [17] concerning the protection of personal data, which includes the directive concerning cookies, prescribes that starting from 2011, the website providers should inform the users about the use of cookies: *“Member States shall ensure that the storing of information, or the gaining of access to information already stored, in the terminal equipment of a subscriber or user is only allowed on condition that the subscriber or user concerned has given his or her consent, having been provided with clear and comprehensive information, in accordance with Directive 95/46/EC, inter alia, about the purposes of the processing.”* (Art. 5 (3)). This prescription is handled in different ways, with either opt-in or opt-out. Opt-out means, that the users are considered consenting to the use of cookies, unless they explicitly disagree with it. Opt-in, on the other hand, means that the users must explicitly provide their consent before the cookies can be used.

Due to current lack of regulations that explicitly require an opt-in solution, the opt-out solution is often used in practice.

As such, a common practice in Germany based upon legal advice [5] consists of informing the users about use of cookies, yet assuming their consent as long as they continue using the website. A new regulation is planned to come into force in May 2018, potentially prescribing an opt-in solution for cookies [5].

## III. GROUPS OF COOKIE DISCLAIMERS

The EU directive does not provide a uniform prescription regarding which information should be provided in the cookie disclaimer, aside from the bare statement that cookies are used. As such, a variety of such disclaimers have been used on the websites. In order to determine which disclaimers are most commonly used, we have studied the 50 most popular websites in Germany (according to the Alexa rating<sup>1</sup>). The disclaimers on these websites can be classified into five groups, depending on the content the disclaimer provides.

**Group 1:** The first group includes the disclaimers that provide only the minimal required information, namely, that the website uses cookies. A disclaimer from such a group can be seen, for example, on the Amazon website (see Fig. 2).



Fig. 2. Cookie disclaimer as seen on Amazon.co.uk.

**Group 2:** The second group includes the disclaimers that mention that cookies are used in order to improve the services provided by the website. An example of such a disclaimer can be seen on the Paypal website (see Fig. 3).



Fig. 3. Cookie disclaimer as seen on Paypal.com.

**Group 3:** The disclaimers in the third group mention that the cookies are being used for analysis purpose, often also mentioning personalised ads or other services enabled by such an analysis. A disclaimer from this group can be seen on the Microsoft website (see Fig. 4).

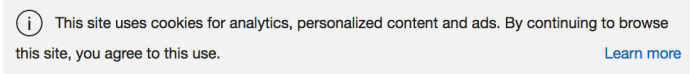


Fig. 4. Cookie disclaimer as seen on Microsoft.com.

**Group 4:** The disclaimers in the fourth group are characterised by their mentioning of third parties, i.e. partners of the website provider, that the cookies are used by. Similarly to the disclaimers from Groups 2 and 3, the disclaimers from Group 4 may include mentioning of personalised ads or service improvements. An example for a disclaimer from this group is displayed on the Twitter page, see Fig. 5.

<sup>1</sup><https://www.alexa.com/topsites/countries%3B0/DE>, as accessed on 04.10.2017

Fig. 5. Cookie disclaimer as seen on Twitter.com.

**Group 5:** The fifth group includes the disclaimers that furthermore refer to external use of the cookies by mentioning that the cookies are also used outside of the website the user visits. Similar to the disclaimers from Groups 2, 3 and 4, service improvements are often mentioned. Such a disclaimer is displayed on the Facebook website (see Fig. 6).

To help personalize content, tailor and measure ads, and provide a safer experience, we use cookies. By clicking or navigating the site, you agree to allow our collection of information on and off Facebook through cookies. Learn more, including about available controls: [Cookies Policy](#).

Fig. 6. Cookie disclaimer as seen on Facebook.com.

#### IV. STUDY DESIGN

In order to answer the research questions outlined in Section I, we have conducted an online survey using the Clickworker crowdsourcing platform<sup>2</sup>. The participants were recruited from Germany and received 1,80 Euro as their compensation. The study consisted of four parts, as described below. The questions in the study questionnaire are furthermore provided in the Appendix.

The first part of the study, the **general part**, consisted of general questions about participants' experience with the cookie disclaimer. As such, they were asked whether they remembered encountering cookie disclaimers while surfing. They were then asked how they felt seeing the disclaimers they encountered, and how they reacted upon it. They were furthermore asked whether their feelings or reactions have changed with time, or whether they differed depending on the website or the platform.

The second part of the study, the **disclaimer-specific part**, has been designed in order to consider the differences between various kinds of cookie disclaimers. For this purpose, we considered disclaimers of different kinds that can be found on websites. According to our findings described in Section III, we provided five disclaimers, one from each group. The disclaimers are provided at Table I.

Each participant of the study has been randomly assigned to one of the groups. The participants then were given a text of a disclaimer from the corresponding group and asked what their thoughts would be upon seeing the disclaimer. They were then asked whether the disclaimer would lead to them leaving the website and asked to explain their answer. The next question asked the participants to evaluate on a scale from 0 to 100, how likely would it be for them to look for additional information regarding use of cookies, e.g. by clicking on the link provided in the disclaimer. Finally, the participants were asked in which

<sup>2</sup><https://www.clickworker.de>

TABLE III  
AGE DISTRIBUTION

Age	Number of participants
<20	7
20-25	16
26-35	58
36-45	31
46-55	24
56-65	8
66-75	6
76-85	0
>85	0

cases the disclaimer would lead to them either leaving or staying on the website.

For the third part, the **disclaimer ranking part**, all participants were shown the disclaimers from all five groups and asked to rank them depending on how likely a particular disclaimer would lead the participants to leaving the website. The participants were then asked to explain their ranking.

In the fourth part, the **new disclaimers part**, additional disclaimers have been evaluated. As opposed to the disclaimers in the second part, which were based upon the texts commonly found on websites, the disclaimers in this part were composed specifically for the study in order to evaluate the effect of the disclaimer's text on users.

The participants of the study were again shown a disclaimer text from Group 2 ("This website uses cookies. By continuing to use the website you consent to the use of cookies. Cookies are used by us in order to improve our service for you."), referred to as standard disclaimer. They were then shown six different modifications of the disclaimer, each with different addition (A1-A6). The additions are provided on Table II

For each one of the modified disclaimers, the participants were asked whether the disclaimer is more likely to lead them to using the website compared to the standard disclaimer. They were then asked to explain their answer.

After the study, demographic data was collected, including gender, age, profession and experience in IT-security in years.

#### V. STUDY RESULTS

In this section we provide the results of our study evaluation. For the qualitative evaluation, an open coding approach has been applied, and the answers to the open questions have been coded by two of the paper authors. We provide quotes from the participants' answers in order to illustrate our findings.

##### A. Demographics

A total of 150 persons participated in the study, of them 73 female, 75 male and two participants who did not specify their gender. The age distribution among the participants is provided in Table III. A majority of the participants (106 out of 150) claimed to have no IT-security experience, while the remaining 46 participants had between one and 28 years of experience, with a median of 5 years.

TABLE I

DIFFERENT GROUPS OF COOKIE DISCLAIMERS AND EXAMPLES OF WEBSITES WHERE THEY CAN BE ENCOUNTERED. THE UNDERLINED TEXT SIMULATES THE LINK TO FURTHER INFORMATION PROVIDED WITHIN THE DISCLAIMER.

Group	Disclaimer
G1	This website uses cookies. By continuing to use the website you consent to the <u>use of cookies</u> .
G2	This website uses cookies. By continuing to use the website you consent to the <u>use of cookies</u> . Cookies are used by us in order to improve our service for you.
G3	This website uses cookies. By continuing to use the website you consent to the <u>use of cookies</u> . Cookies are used by us for analysis in order to improve our service for you.
G4	This website uses cookies. By continuing to use the website you consent to the <u>use of cookies</u> . Cookies are used by us and by our partners (the so-called third parties cookies) in order to improve our service for you.
G5	This website uses cookies. By continuing to use the website you consent to the <u>use of cookies</u> on and off our website. Cookies are used by us in order to improve our service for you.

TABLE II

ADDITIONS TO THE STANDARD DISCLAIMER IN THE NEW DISCLAIMERS PART.

Addition	Text
A1	Furthermore, the cookies will be used by us to show you personalised advertisements.
A2	Furthermore, the cookies will be used by us in order to increase the security of the users.
A3	Furthermore, the cookies will be used by us in order to improve your user experience and present relevant advertisements to you.
A4	Furthermore, the cookies make it easier for us to provide our services.
A5	Furthermore, the cookies will be used in order to collect data about you.
A6	Furthermore, the cookies will be used in order to collect data about you, as data is very valuable today and can be sold for a higher price.
A7	Furthermore, the cookies will be used in order to collect data about you, as data is very valuable today so that we can sell advertisement placements on our website for a higher price.

### B. Users' Perception of Cookies

In order to answer the first research question, we coded the answers both from the first and second part of the survey, that is, from the general part and the disclaimer-specific part. We considered the answers to the following questions:

- General part: [For the disclaimers the participants recalled encountering] What thoughts or feelings did you have while reading the disclaimer?
- Disclaimer-specific part: [For one of the disclaimers G1-G5] What thoughts or feelings did you have while reading the disclaimer?
- Disclaimer-specific part: [After asking, whether the disclaimer motivate the participant to leave the website?] Please explain your answer.

The answers from the participants over the study can be categorised into the following categories: *disturbance*, *privacy concern*, *habituation*, *misconceptions*, *lack of information*. We elaborate on the categories below, providing examples as the quotes from the participants<sup>3</sup>.

1) *Disturbance*: A large number of the participants claimed to be annoyed by the cookie disclaimer, as they considered it a disturbance in their surfing: “As these messages appear constantly, I find them to be disruptive and annoying”.

2) *Privacy Concerns*: Another common theme was the concern of the users regarding their privacy: “I feel myself observed”.

These concerns have been mentioned in a variety of ways, ranging from abstract feeling of uneasiness (“As I read it

the first time, I had a bad feeling”) to participants naming concrete consequences for their privacy (“I do not want to be recognized anywhere or get fitted ads”).

3) *Habituation*: Due to prominence of cookie disclaimers, many participants claimed to being used to it and not to pay much attention to the disclaimer. As such, many participants reacted in a neutral way to the disclaimer: “It does not bother me, since cookies are a common tool”.

At the same time, a number of participants still claimed to have negative feelings towards cookie use. Still, as they felt that there is no way to avoid it, they admitted to being resigned in their attempts to act against it: “As this is the case with so many websites, I don't have much thoughts anymore regarding these cookies. [...] One feels somewhat helpless, but I seldom have this feeling and it is not so strong. When it comes to privacy protection in the internet (where cookies also belong), I've rather resigned myself”.

Furthermore, the participants were annoyed that they did not have any choice in accepting or declining the use of cookies (if they wanted to continue using the website), considering the disclaimer itself therefore useless: “One cannot decline the cookies, therefore I find that the message does not make much sense”.

4) *Lack of Information*: The answers from the participants revealed that many of them do not feel informed enough to understand what consequences the cookies have for their privacy. A common theme was that the participants expressed the need for more detailed information on what consequences cookie use can have for them, what data is collected and how it is used, and that the lack of such information made them feel nervous: “It is unpleasant to me, as I do not know exactly

<sup>3</sup>All quotes in the paper are translated from German.

what it means to allow cookies, and what consequences it has for me”.

Some admitted being unfamiliar with the concept of cookies all together: “Frankly speaking, I don’t know exactly what cookies do”.

Another theme was that the participants were unaware at what point exactly they do consent to the use of cookies: “And I ask myself, whether cookies are set after the point when I click OK, or already earlier”.

Consequently, some of the participants questioned the idea of informed consent that the disclaimer theoretically aims to provide: “The problem [with the cookie disclaimer] is that one does not have to actively give consent, but instead consents passively by using the website. Many users will not, however, read the disclaimer correctly, or maybe they will simply overlook it. In this case there is no real informed consent given”.

5) *Misconceptions*: Aside from participants, who were aware that they lack information regarding cookie use, a number of participants had misconceptions regarding what cookies are and what the consequences of cookie use are. As such, some of them were concerned about risks that are usually not connected with cookies: “Maybe I have a feeling that I am attacked by a virus”.

Others were unaware of possible implications of cookies: “I would not know why I should leave the website, it is not a forbidden website”.

### C. Users’ Reactions to Cookie Disclaimers

In order to answer the second research question, we considered answers to the following questions from the general part and the disclaimer-specific part:

- General part: How did you react to the disclaimer? For example, did you leave the website, got additional information...?
- Disclaimer-specific part: What thoughts or feelings did you have while reading the disclaimer?
- Disclaimer-specific part: Will the disclaimer move you to leaving the website? Please explain your answer.
- Disclaimer-specific part: How likely is it that you get further information by clicking on a link in the disclaimer (scale from 0 to 100)?

The answers are analysed both qualitatively via open coding, and quantitatively. The actions of the users upon encountering the disclaimer have been classified into the following categories: *ignore*, *accept*, *deny*, *get informed*, *apply countermeasures*. We elaborate on the categories below.

1) *Ignore*: A large part of the participants claimed to ignore the disclaimer, considering it a disturbance in their surfing rather than information they should pay attention to. Other times, the participants claimed that they clicked the disclaimer away, so that they can continue surfing: “Sometimes the displayed window irritates me and I click on close, but sometimes I leave it open”.

2) *Accept*: Other participants claimed that they decided to accept the cookies by clicking OK on the disclaimer: “Mostly I click ‘OK’, what else is there to do?”

While many who answered did not provide any explanation why they chose to accept the use of cookies, others elaborated that they did not see any harm in cookies and considered them useful for the functionality of the website: “Every website does this. As a programmer I know that cookies are necessary for many functions of modern websites”.

Other participants admitted accepting the cookies as otherwise they would not be able to use the website they need: “When I visit a website, that it is mostly because I can get information or other benefits from it. So I don’t leave the website”.

A similar theme has been mentioned by other participants, who chose to accept cookies as a trade-off for using the website: “This is simply the deal online: using websites in exchange of some sort of payment (infos)”.

3) *Deny*: Many of the participants were unhappy with the cookie use and chose different ways to deny it.

a) *Not explicitly accepting*: A number of the participants had the perception that the cookies will not be used as long as they do not explicitly agree to it: “I tried to click it away without accepting the cookies or ignore it when the disclaimer was not in the way”. Note that while this is true for opt-in methods, such perception might be false in many cases, as opt-out methods are commonly used.

b) *Using countermeasures*: A number of participants claimed to apply specific countermeasures that minimise the impact from cookies while still allowing to visit the website. In particular, such countermeasures as using a different browser (“I left the website or used a different browser”), deleting (“I’ve never left the website, but deleted the cookies after using the website”) or blocking the cookies (“One can block the cookies and automatically delete them with the right addons”) have been mentioned.

c) *Leaving the website*: Other participants claimed to prevent cookie use by leaving the website that displays the disclaimer: “Left the website, I never accepted”.

When asked directly (in the disclaimer-specific part) whether they would leave the website if they saw a disclaimer, more than half (58%) of all the participants answered that they would not leave the website based upon the disclaimer, while 19% answered that they would leave and 23% were not sure (see Fig. 7). In order to investigate the differences between the disclaimers in groups G1-G5, the answers were compared using the chi-square test (recall, that the participants in the disclaimer-specific section were randomly divided in five groups and shown a disclaimer from the corresponding group). The test did not reveal any significant differences between the groups ( $\chi^2 = 4.41$ ,  $p = .82$ ), indicating that all the disclaimers in the study had a similar effect on the participants decision to continue using the website.

4) *Get informed*: Some of the participants mentioned in their answers, that they would try to get additional information, either from the website itself (“I clicked on ‘learn more’”) or

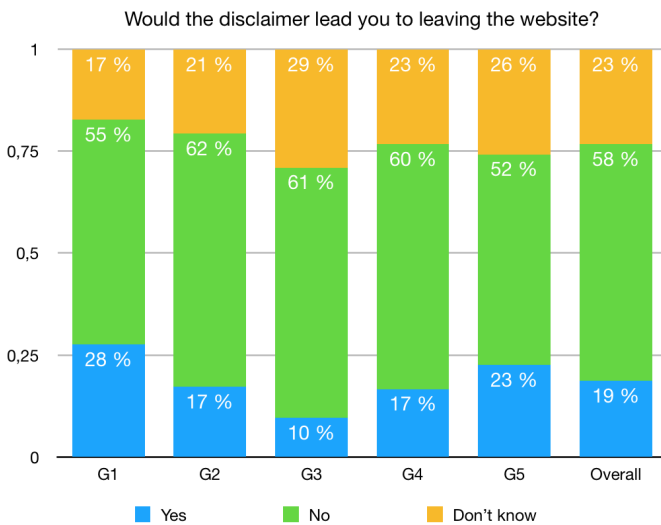


Fig. 7. Answer to the question whether the participants would leave the website upon seeing the disclaimer. The values are provided for each individual group (G1-G5), as well as for the participants overall.

from external sources (“I first googled the term ‘cookies’”) that would help them make a decision.

Yet, when answering a direct question on how likely it is that they would click on the link in the disclaimer and get additional information (on a scale 0 to 100), most of the participants indicated the likelihood to be low. As such, half of all the 150 participants considered the likelihood of them getting additional information to be less than 13%, while only 25% of them considered the likelihood to be higher than 40% (see Fig. 8). In order to compare the disclaimers in groups G1-G5, a Kruskal-Wallis test was conducted. The test did not reveal significant difference between the responses among the different groups ( $H = 2.51, p = .64$ ), indicating that the different disclaimers had similar likelihood of moving participants towards getting further information.

#### D. Factors in Users’ Decisions on Cookies

We answer the third research question by studying the factors that influence the decisions of users (i.e. which reaction they choose from the ones outlined above) after reading the cookie disclaimer. In this, we evaluate the answers to the following questions in our study:

- General part: If you saw the disclaimer more than once, were your thoughts, feelings and reactions different?
- Disclaimer-specific part: In what situation will the disclaimer move you to stay on the website?
- Disclaimer-specific part: In what situation will the disclaimer move you to leave the website?
- Disclaimer-ranking part: Please sort the disclaimers as follows: put the disclaimer that would most likely lead you to leave the website on the first place, put the disclaimer whereby it is least likely that you leave the website because of the disclaimer on the fifth place. Please explain your answer.

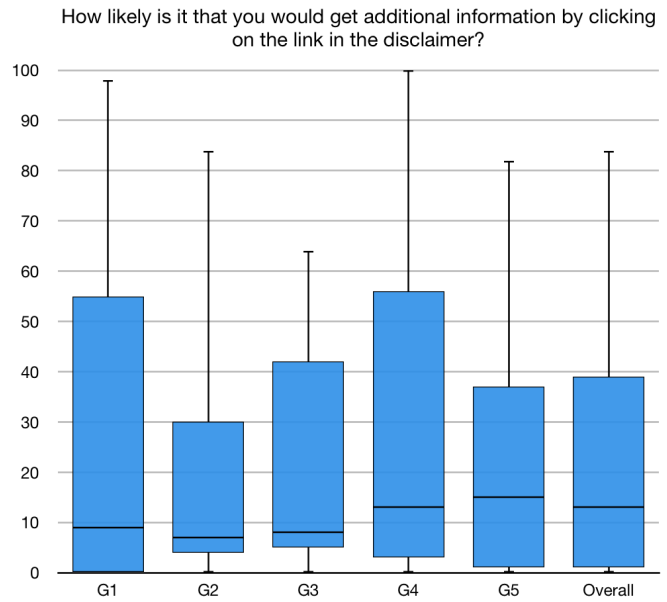


Fig. 8. Answers to the question how likely the participants considered getting additional information (scale 0 to 100) as a box plot. The values are provided for each individual group (G1-G5), as well as for the participants overall.

- New disclaimers part: [For each one of the new disclaimers with additions A1-A7] How would the following additions change the probability that you would use the website?

From the participants’ answers we were able to distinguish between two types of factors: *disclaimer-based* and *website-based*. These factors are elaborated on below.

1) *Disclaimer-specific factors*: We first outline the factors related to the displayed disclaimer itself.

a) *Design of the disclaimer*: Some participants mentioned that their decision depends on the design of the disclaimer itself. As such, disclaimers that were too prominent or blocking large parts of the website contents were considered a large nuisance, hence, would lead to users leaving the website: “It depends on whether I can ignore the disclaimer or not. Often the message is placed so unfortunately, that one cannot use certain menus. In this case I would leave [the website]”.

b) *Text of the disclaimer*: The purpose of the disclaimer-specific part, the disclaimer-ranking part and the new disclaimers part of our study was to determine, to which extent the text provided by the disclaimer influences the users’ decisions. However, as mentioned in V-C3c and as seen in Fig. 7, there have been no significant differences between the groups of participants who saw one of the disclaimers and were asked whether they would leave the website reading this disclaimer.

On the other hand, the disclaimer ranking part revealed additional insights with regards to whether the participants themselves perceived a significant difference between the disclaimers. As such, the participants’ rankings of the disclaimers G1-G5 were analysed using the Friedman test, which indicated

TABLE IV

COMPARISON OF DISCLAIMER RANKINGS. “+” INDICATES SIGNIFICANT DIFFERENCE BETWEEN THE GROUPS ( $p < .05$ ), “-” INDICATES LACK OF SIGNIFICANCE.

	G1	G2	G3	G4
G2	-			
G3	+	+		
G4	+	+	+	
G5	+	+	+	-

significant differences between the rankings ( $\chi_r^2 = 147.98$ ,  $p < 0.001$ ). In order to elaborate on these differences, pairwise comparisons between the disclaimers were conducted using the Nemenyi test. As such, most of the participants preferred the disclaimers from groups G1 (“This website uses cookies. By continuing to use the website you consent to the use of cookies.”) and G2 (“This website uses cookies. By continuing to use the website you consent to the use of cookies. Cookies are used by us in order to improve our service for you.”) followed by the disclaimer from G3 (“This website uses cookies. By continuing to use the website you consent to the use of cookies. Cookies are used by us for analysis in order to improve our service for you”), while the disclaimers from groups G4 (“This website uses cookies. By continuing to use the website you consent to the use of cookies. Cookies are used by us and by our partners (the so-called third parties cookies) in order to improve our service for you”) and G5 (“This website uses cookies. By continuing to use the website you consent to the use of cookies on and off our website. Cookies are used by us in order to improve our service for you.”) received the worst rating. An overview of the rankings is provided in Fig. 9, and the significance of differences between individual disclaimers is provided in Table IV.

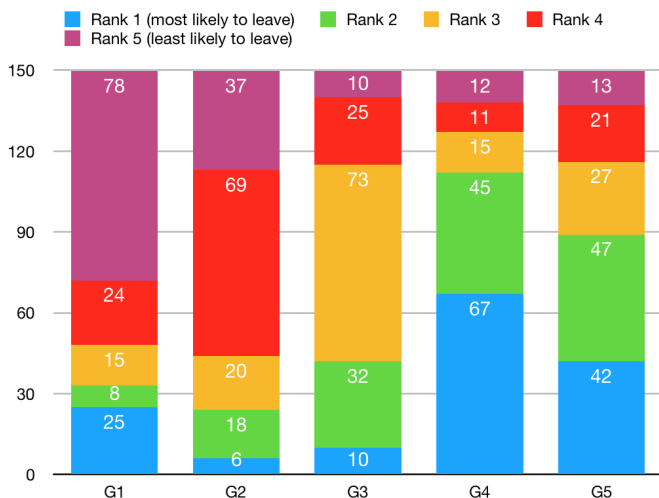


Fig. 9. Numbers of participants who placed a disclaimer from the corresponding group (G1-G5) in each rank.

The responses in the new disclaimers part also revealed significant differences between the disclaimers, whereby all

TABLE V

COMPARISON OF NEW DISCLAIMERS. “+” INDICATES SIGNIFICANT DIFFERENCE BETWEEN THE DISCLAIMERS ( $p < .05$ ), “-” INDICATES LACK OF SIGNIFICANCE.

	A1	A2	A3	A4	A5	A6
A2	+					
A3	+	+				
A4	+	+	+			
A5	+	+	+	+		
A6	+	+	+	+	-	
A7	+	+	+	+	-	-

the 150 participants were shown the same additions to the “standard disclaimer” and asked for each one of them, whether the addition was more likely to move the participant to use the website. The responses (given the options “yes” and “no” for each one of the additions) were compared among all the participants in order to find out whether some additions were more likely to move the participants to leaving the website. The comparison was done with the Cochran Q test, revealing significant differences between the additions ( $Q = 331.88$ ,  $p < 0.01$ ). These differences were furthermore investigated in pairwise comparisons between the additions using the Wilcoxon sign test. The results show, that the participants reacted most positively to the disclaimer with the addition A2 (“Furthermore, the cookies will be used by us in order to increase the security of the users”), preferred to the “standard” disclaimer G2 by 112 out of 150 participants (75%). A2 has been followed by A4 (“Furthermore, the cookies make it easier for us to provide our services”, preferred to G2 by 57% of the participants), A3 (“Furthermore, the cookies will be used by us in order to improve your user experience and present relevant advertisements to you”, preferred to G2 by 33% of the participants) and A1 (“Furthermore, the cookies will be used by us to show you personalised advertisements”, preferred to G2 by 19% of the participants). Disclaimers that elicited the most negative reaction from the participants contained additions A5 (“Furthermore, the cookies will be used in order to collect data about you”), A6 (“Furthermore, the cookies will be used in order to collect data about you, as data is very valuable today and can be sold for a higher price”) and A7 (“Furthermore, the cookies will be used in order to collect data about you, as data is very valuable today so that we can sell advertisement placements on our website for a higher price”), preferred to G2 from 10% to 11% of the participants. An overview of the answers is provided in Fig. 10, and the significance of differences between individual new disclaimers is provided in Table V.

When asked to explain their answers, the following themes emerged in the disclaimer ranking part.

**No difference** Many of the participants claimed not to see any difference between the displayed disclaimers in the disclaimer ranking part: “I never read through these disclaimers and click them away, these disclaimers lead me neither to leave nor to stay on the website”.

**External use of cookies:** Not surprisingly, when asked to

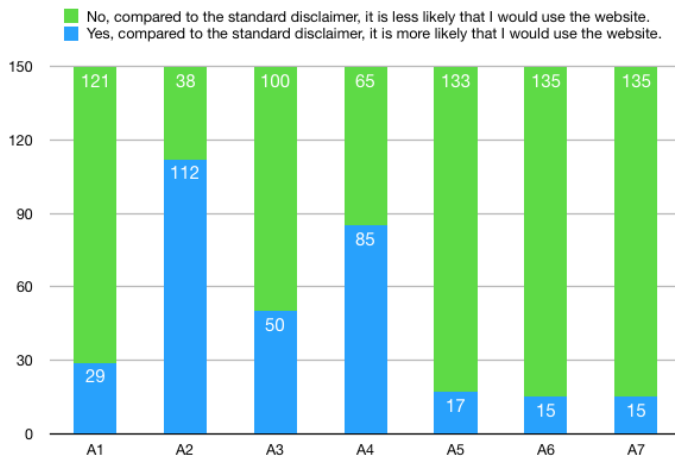


Fig. 10. Numbers of participants who considered a corresponding new disclaimer (A1-A7) either more or less likely to lead them to stay on the website.

compare the different groups of disclaimers, many participants had a particularly negative reaction to the disclaimers that mentioned use of cookies by either another entity or another website than the one the user interacts with (G4 and G5): “I am against the processing of data by third parties and off the website. If it happens within the website, it seems OK to me”.

**Analysis:** Some of the participants were put off by the mentioning of analysis (G3), considering it a threat to their privacy: “‘Analysis’ points explicitly that my data will be stored, this is dangerous.”

**Service improvements:** The promise of the disclaimer to use cookies in order to improve the provided services (G2) was seen as positive by some of the participants: “In order to improve our service, it sounds at least positive.”

**Length of text:** The participants voiced different preferences regarding the length of the text in the disclaimer. As such, some preferred the disclaimer that provides only the bare minimal information (G1), considering longer explanations to be suspicious: “I perceive all the additional information as excuses and dishonesties. Therefore I would rather accept it, when simply the inevitable is pointed at.”

On the other hand, lack of any explanation was perceived by some of the participants as negative, lacking in transparency: “The more information is given in the disclaimer, the more probable it is that I stay on the website, since I feel well informed then.”

**Intuitive decision:** A number of participants, on the other hand, did not provide any concrete explanation of their ranking, referring to their intuitive feeling: “Pure gut feeling.”

Following additional themes emerged from the new disclaimers part:

**Advertisements:** A number of participants expressed negative feelings towards disclaimers that mentioned using cookies for advertisements (A1, A3), including personalised advertisements: “I think that a direct reference to ads always works off-putting to me, also when it is personalised.”

Some furthermore claimed, that attempts to show them personalised adds threatens their agency, as they would prefer to decide themselves what is relevant for them: “I want to decide myself, which ads fit me.”

On the other hand, other participants had a more positive attitude towards personalised advertisements, seeing potential benefits in it: “It is better to see personalised ads than something that does not interest or concern me at all.”

**Benefit for the user:** Many of the participants reacted positively to the disclaimers that promised improvements relevant for the user (A2, A4). As such, many participants liked the promise of better security in A2: “Security is in my own interest”. Similarly, many expected to benefit if it gets easier for the website to provide the requested services: “Easier to provide services is surely also good for me”.

**Benefit for the service provider:** The participants reacted negatively to the disclaimers where they perceived that the cookies are used mainly to benefit the service provider (A4-A7). Particularly drastic was the reaction to the disclaimers A5-A7, that, as opposed to A4, did not promise any benefits to the users: “Evidently, some benefits will be drawn here from collecting my data. Where are my benefits?”

Many also spoke of feeling used: “This wording makes one feel used, and it also sounds audacious, and I feel not esteemed as a user”.

**Too direct:** Not surprisingly, the participants in our study had a particularly harsh reaction towards the last two disclaimers (A6-A7) that directly spoke of selling users’ data. While a number of users admitted that they felt these disclaimers were just more honest than the others, most were still put off that the purpose of cookie collection was stated in such a direct way: “Very bad. If it is said so openly, this puts me off. No one wants to know it so open”.

2) *Website-specific factors:* When asked in the disclaimer-specific section, in which cases the users would leave or stay on the website, the factors mentioned by the participants were related to a specific website that displays the disclaimer. These factors include the type of the service the website provides, as well as general characteristics of the website.

a) *Specific services:* Some participants mentioned specific types of services as an example of the website they would either allow or deny use of cookies. These services include, in particular, online banking, social networks, video streaming, email and news. Note, that each type of these services was mentioned both as an example of the website the participant would stay on, as well as the example of the website the participant would leave. This was particularly prominent for the websites that were dealing with sensitive data such as online banking. As such, some users claimed they would stay on the website, as it was important for them to be able to use the service (e.g. to access their emails or to make a bank transaction): “If I have to complete some task, for example, with emails and online banking”.

Others, on the other hand, would leave the website if it used cookies, as they were concerned about possible implica-



tions towards their privacy: *“Online banking, shopping... all situations that have something to do with my privacy”*.

b) *Service-independent characteristics*: Instead of mentioning specific services, many of the participants named the following characteristics of the website that would lead them to either leave or stay on it.

**Importance of website contents**: Not surprisingly, a large number of users mentioned that their decision whether or not to leave the website depends on how important the contents of the website are to them: *“It depends on the website, how urgent I need it”*.

**Trustworthiness of the website**: Another factor in deciding whether to leave the website, mentioned by many of the participants has been the trustworthiness of the website. While some referred to a general feeling of uneasiness (*“If something seems odd to me”*), some mentioned specific concerns that the website is going to misuse the data collected with cookies (*“If I have a feeling that my data is not secure”*).

**Sensitivity of input data**: Several users mentioned the type of data the website seems to collect as a factor in deciding whether they would leave the website: *“As long as it is evident that personalised data is collected”*.

In particular, some of the users referred to the data they input on the website: *“If it is a website where one inputs sensitive data”*.

**Familiarity with the website**:

Finally, an important factor in deciding whether to continue using the website, named by many users, is the familiarity that the users have with the website: *“The more known the source is, the more likely I will stay”*.

## VI. DISCUSSION

The purpose of the cookie disclaimer has been to provide clear and understandable information to the users regarding cookie use. However, as evidenced from responses in our study, users often click the disclaimer away without paying attention, or ignore it. Some claim not to understand what the disclaimer is saying, are suspicious due to perceived lack of transparency (e.g. not being able to tell how the collected data will be used by the service provider), are not aware of possible privacy-related consequences of cookie use or have other misconceptions regarding what the collection of cookies means to them. Hence, the disclaimer often fails its purpose of informing the users. Moreover, prescribing an opt-in solution might not alleviate the issue. As long as users do not read the disclaimer and try to click it, it is possible that in trying to get rid of the disclaimer they click on the “agree” button, without realizing the consequences for their privacy.

As such, additional measures for educating the user might be necessary. In addition to addressing the misconceptions the users have towards cookies, such measures would aim to support users who feel resignation towards their privacy. As the responses in our study show, many users accept the use of cookies as a “necessary evil” online. Education towards measures that one can take to protect their privacy would benefit such users. These measures, in particular, would

include deleting stored cookies or blocking cookies from third parties and particular service providers, as well as using more advanced tools such as the anonymous mode in browsers and anti-tracking browser extensions.

Other measures for supporting informed decisions of the users would include focusing on providing better transparency regarding how the website providers use the data collected via cookies. While there are privacy policies available, our study results show that the users are unlikely to consult such policies by clicking on the link within the disclaimer. Previous research also shows that the privacy policies are too complicated and are seldom read or understood by the users [13]. While more understandable presentations of the policies have been proposed [6], their wide-spread adoption and evaluation in different contexts is yet to be achieved.

Furthermore, the users mention judging the website itself when deciding whether to allow cookies – a finding that is consistently confirmed in research, see e.g. [3]. Therefore, methods that allow the users to evaluate the trustworthiness of a given website are required. These may include a set of heuristics that the users can apply (similar, for example, to the heuristics for app choice as proposed in [8]). Alternatively, a trust rating can be displayed to the user, coming either from an external source (e.g. PrivacyScore [10] for evaluating the security and privacy practices of the website) or crowd-based. Given such a rating, an appropriate visualisation that is understandable to the user has to be considered.

The results of our study furthermore show that many people have negative reactions towards cookie use of websites, either perceiving the disclaimer as a nuisance, or being concerned about their privacy. Even if the text of the disclaimer included positive statements regarding use of cookies, some of our participants were distrustful towards such statements and whether they accurately reflect how the collected data is handled.

Our study did not reveal any significant effects of the disclaimers’ text on users’ behaviour. As such, during the disclaimer-specific part of the study, when the participants were shown a disclaimer from one out of five groups and asked whether they would leave the website with this disclaimer, no statistically significant differences between the groups have been found. At the same time, however, when asked to read and compare different groups of disclaimers, many participants had a negative reaction when third parties or external use of cookies have been mentioned. Still, as evidenced from prior responses, the perceived differences between the disclaimers are not critical enough to change the users’ decision to stay or leave the website.

On the other hand, a commonly named factor in users’ decisions are the characteristics of the website itself. As such, many users claimed that they would be more likely to allow the use of cookies on websites they considered trustworthy or were familiar with, as well as on websites with contents or services important to the user. This finding suggests that trustworthy websites can include more information in the cookie disclaimer, such as including use of cookies by third parties, that would normally put users off, without users leaving the

website. The trade-off to the user between the trustworthiness of the website and potentially privacy-infringing practices of cookie use as indicated in the disclaimer is yet to be studied.

## VII. RELATED WORK

The users' perceptions and mental models of cookies and other tracking tools, as well as of factors influencing users' decisions, have been investigated in a number of studies. As such, the study by Ha et al. in [4] using focus groups has revealed a number of misconceptions among the users regarding the use of cookies and its purpose. Similar to our results, the study furthermore revealed the feelings of resignation among the participants regarding their privacy protection. Studies by McDonald et al. [11], [12], in form of interviews and online surveys, further revealed lack of awareness and misconceptions prevalent among the users regarding cookies. Shirazi et al. furthermore revealed a number of misconceptions, including lack of awareness and feeling of resignation, regarding web tracking and countermeasures against it in their interviews [16]. Similarly, the prevalence of misconceptions regarding cookies and online trackings emerged from the study by Ur et al. [18] conducted in the form of interviews. The study furthermore investigated the factors influencing users' decision to share data with advertisement companies, demonstrating that the users were more likely to share data with companies they were familiar with (e.g. Google) than with companies they did not know. Chanchary et al. [1] conducted an online study that investigated factors that influenced the users' decision to share data with advertising companies. Their results have demonstrated, that the level of control over the collected data that the service providers enable the users has only a moderate effect on users' decision, while other factors such as general privacy attitudes of the users and the frequency of their visits to the website, play a more significant role.

Further studies focused on privacy notices in the context of online tracking. Leon et al. [9] conducted an online survey, studying factors that influence the participants' willingness to share data with online advertisers, requiring the users to read the privacy policies provided on the website of a health services provider. The study revealed that the privacy policies had a larger effect on users' decisions than the trustworthiness of the website. As the text of the cookie disclaimer in our study did not have a significant influence on users' decisions, the effect of privacy notices in different forms (i.e. as a disclaimer or as much more detailed privacy policy description) is to be investigated more closely. Miyazaki [14] investigated the effect of disclose about cookie use towards users' attitude towards cookies in several user studies. The results of the studies have shown that users are less likely to have a negative reaction to cookies if the website provided a prior disclosure. While many participants in our study still expressed a negative reaction to the cookie disclaimer, either perceiving it as a nuisance or considering cookie use a threat to their privacy, we did not compare their reactions to cookie use without a notifying disclaimer (in [14], instead of the disclosure for the website,

the control group received a notification from the browser as soon as cookies were set).

## VIII. SUMMARY AND FUTURE WORK

Cookies are a tool commonly used on websites, which can serve for improving the user experience as well as enable additional functionality. At the same time, cookies can be used to collect data from website users, potentially using it to create user profiles and infringe on the users' privacy. The EU directive, aiming to support users in protecting their data, prescribes including a disclaimer on the websites that informs the user about the use of cookies.

We have conducted an explorative online survey with 150 participants in order to study the perception of such a disclaimer among the users, as well as the users' reactions to such a disclaimer and factors that influence these reactions. Our study has shown that the users tend to have a negative perception of the disclaimer, either perceiving it as a nuisance or as a threat to their privacy. According to the results of our evaluation, the text of the disclaimer does not have a significant effect on whether the users decide to leave the website. The common theme in such a decision, however, has been the trustworthiness of the website itself, its familiarity to the user and the importance of its contents. Our study furthermore revealed a lack of information regarding cookies and their implications, as well as regarding possible countermeasures, among the users.

As future work, further investigations into the effects of cookie disclaimers on users are necessary. As such, one possible direction is a more elaborate study of the trade-off between the trustworthiness of the website and its privacy policies as outlined in the cookie disclaimer that the users are willing to make. The extent to which the service providers are legally obliged to explain their privacy policies in the disclaimer, is another topic of future research conducted in collaboration with legal experts. Another direction of future work is developing methods for informing the users. These methods, in particular, would include awareness campaigns explaining the concept of cookies and its potential implications towards users' privacy, as well as available protection measures. Other methods for informing the users would focus on providing decision support, for example, by aiming to develop understandable summaries of privacy policies or methods for evaluating the trustworthiness of the websites.

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## APPENDIX

In this appendix we provide the questions in our survey, translated from German. As described in Section IV, the questionnaire consisted of four parts: the general part, the disclaimer specific part, the disclaimer ranking part and the new disclaimers part. The questions in each part are provided below.

- General part:
  - 1) Can you remember seeing a cookie disclaimer (for example, as a pop-up window or directly on a website, mostly on the upper or lower margin)?
  - 2) Can you recall the content of the disclaimer? What is it, approximately?
  - 3) What thoughts or feelings did you have while reading the disclaimer?
  - 4) How did you react to the disclaimer? For example, did you leave the website, got additional information...?
  - 5) If you saw the disclaimer more than once, were your thoughts, feelings and reactions different?
- Disclaimer specific part:
  - 6) What thoughts or feelings did you have while reading the disclaimer?
  - 7) Will the disclaimer move you to leaving the website?
  - 8) Please explain your answer.
  - 9) How likely is it that you get further information by clicking on a link in the disclaimer (scale from 0 to 100)
  - 10) In what situation will the disclaimer move you to stay on the website? (For example, by checking emails, visiting a news website, using social networks, online banking)
  - 11) In what situation will the disclaimer move you to leave the website? (For example, by checking emails, visiting a news website, using social networks, online banking)
- Disclaimer ranking part:
  - 12) Please sort the disclaimers as follows: put the disclaimer that would most likely lead to you leave the website on the first place, put the disclaimer whereby it is least likely that you leave the website because of the disclaimer on the fifth place.
  - 13) Please explain your answer.
- New disclaimers part:
  - 14)-20) How would the following addition change the probability that you would use the website?