We evaluate a practice observed on popular websites by conducting an experiment with one control and two treatment groups ($N = 150$ university students in two countries). We hypothesize that users’ consent decision is influenced by (1) the number of options, connecting to the theory of choice proliferation, and (2) the presence of a highlighted default button (“select all”), connecting to theories of social norms and deception in consumer research. The results show that participants who see a default button accept cookies for more purposes than the control group, while being less able to correctly recall their choice. After being reminded of their choice, they regret it more often and perceive the consent dialog as more deceptive than the control group. Whether users are presented one or three purposes has no significant effect on their decisions and perceptions. We discuss the results and outline policy implications.

KEYWORDS
usable privacy technologies, web privacy, controlled experiment, consent, deception, choice proliferation, GDPR

1 INTRODUCTION
The European Union’s General Data Protection Regulation (GDPR) came into force in May 2018. It contains provisions that data controllers (e.g., website operators) must have a legal basis for the collection and processing of personal data. One legal basis is consent: data subjects (users) agree to the data processing for specific purposes. While these requirements are not new, the GDPR’s threat of sanctions and effective enforcement led many website operators to rethink their cookie practices, or at least ensure compliance by obtaining consent before using cookies for purposes that are not covered by other legal bases [52]. Web cookies are key–value pairs stored on the client device for purposes ranging from session tracking, user recognition, counting unique users, third-party tracking to profiling and targeted advertising [18].

A common method for asking web users to decide on the cookie settings is a pop-up banner that appears at the beginning of each users’ first visit of a website. The banner typically includes a notice on the data collection and asks users whether they agree to (parts of) the practices. A recent study finds that 62% of the websites analyzed used such banners in June 2018 [15]. The study also shows that the implementation—specifically, the granularity of control offered to users—differs between common banner types. The authors conjecture that many cookie banners are not very usable because the choice mechanisms are often inefficient or confusing.

Independently, in November 2018, we noticed that some cookie banners contain consent dialogs that seem to be designed to nudge users to accept all displayed purposes. It is understandable that the industry finds cookie banners disadvantageous as they add friction to the user experience and might limit the ability to track users on and across sites. Hence, there is ample business interest in minimizing friction and maximizing positive consent decisions by optimizing interface design. Common design elements in the banners we observed (see Figure 1 for exemplary screenshots) are checkboxes for several purposes of data processing as well as buttons to either select all purposes at once or to confirm the manual selection before accessing the website.

We identify two components that might compromise usability. First, the highlighted button automatically accepts all purposes, regardless of whether any checkboxes have (not) been selected before the button is clicked. This button does not increase the user’s choice options, but might rather “trick” him or her into accepting all cookies without actively selecting them. Second, the number of selectable purposes may influence users’ choice as former studies in the field of psychology revealed that a high number of alternatives has adverse effects on individuals’ decision making [14, 27]. This phenomenon has also been demonstrated in the context of privacy settings [29].

These considerations call for a user study, which we have carried out in the form of a controlled classroom experiment and report in this paper. Our general research question is:

How do users react to design features of multi-purpose consent dialogs on the web in terms of actual behavior and stated perceptions?

The rest of this paper is structured as follows. First, we review literature on consent dialog designs in Section 2. Section 3 recalls the theoretical background on choice proliferation and deception, from which we derive our hypotheses. The instrument and the administration of the controlled experiment is described in Section 4. The results of our hypothesis tests (Section 5) precede the discussion of our findings (Section 6). We conclude with some recommendations for interface design and policy development in Section 7.
2 BACKGROUND

We first summarize the legal requirements for GDPR-compliant consent dialogs in Section 2.1, before we review the literature on engineering solutions for specifying privacy preferences (with emphasis on the purpose) in Section 2.2.

2.1 Legal Requirements for Consent Dialogs

Article 7 of the GDPR describes the requirements of legitimate consent: it needs to be (1) freely given, (2) unambiguous, (3) informed, and (4) withdrawable at any time [40]. In the event of a dispute, the data controller must prove that the subject has truly given consent to the processing practices [12]. Specifically, consent must be communicated “by a statement” or a “clear affirmative action” [40]. Regarding the clearness of this action, ticking a checkbox on a website is considered an acceptable form, while passiveness or predefined default settings that are not actively declined by the subject do not constitute clear consent [12].

If personal data is collected for more than one purpose, data subjects need to be informed and provided with distinct opt-in choices for every purpose [40]. Besides these rough guidelines, the GDPR’s purpose-binding does not specify any design template and thus leaves the exploration of the design space for consent dialogs to market participants.

For the specific case of web cookies, the market has adopted a rough classification of purposes into strictly necessary (which presumably does not require consent), preferences, statistics, and marketing (which includes third-party tracking) [e.g. 3, 15, Fig. 4 (d)]. This mirrors the approach taken in a user survey by Ackerman et al. as early as in 1999 [1]. The authors distinguish between cookies for “customized service”, “customized advertising”, and “customized advertising across many websites”. They report a decreasing willingness to agree, from 96% to 77% for users classified as “marginally concerned” about privacy, and from 43% to 14% for so-called “privacy fundamentalists” in a sample of 381 US internet users (Fig. 3 of [1]). While the former classification is implemented in popular content management systems, it is by no means the only way of defining purposes. As a result, website operators who can afford specialized lawyers enjoy more freedom in the design of consent dialogs. Others follow common practices in order to minimize legal uncertainty, or to comply with the terms of services of third parties who provide content or code to embed (e.g., Google Analytics). The bulk of the burden last on privacy-aware users, who have to understand and navigate each site’s specific model.

2.2 Technical Solutions for Seeking Consent

Researchers have studied ways to effectively inform users about privacy policies and seek their consent to data processing long before the GDPR. For example, a CHI paper from 2001 provides design recommendations for cookie consent dialogs after evaluating design changes of the then popular browsers over time [35]. The authors criticize that in some browsers, users had to invest great effort when searching for an alternative to the “accept all cookies” default setting. Consent dialogs are specific forms of privacy notices, a topic so profoundly researched that Schaub et al. [44] saw the need to systematize the literature. According to their proposed taxonomy, the design space can be divided along the dimensions timing, channel, modality, and control [44]. In the following, we use this terminology when applicable.

Bergmann [4] addresses the problem of complex and incomprehensible privacy choices. The author suggests a design for generic predefined privacy settings (timing: at setup) that are summarized in a limited number of categories. He defines four privacy profiles that differ in the acceptance level of transmission and processing of personal data. The suggested solution aims at decreasing the user’s cognitive effort when selecting suitable privacy settings, but we are not aware of any empirical study to evaluate this approach.

Pettersson et al. [42] discuss a similar design with predefined settings. They suggest the adoption of a privacy management system that asks users for consent before transmitting their personal data (timing: at setup). Moreover, users’ acceptance of data processing practices can be configured in advance and apply to future website visits. However, the authors point out that designing consent forms that are applicable to a large number of different websites is a complex task. It might require compromises on usability as many different settings need to be offered by the system. More specifically, Pettersson et al. [41] propose design paradigms that include suggestions for consent dialogs. Incorporating recommendations by data protection commissioners and legal experts as well as standards established in the PISA project [9], the authors present a dialog window with several mandatory and optional fields, an expandable privacy notice, information about the data recipients, and an “I agree” button. They also propose methods to overcome habituation by, for instance, implementing drag-and-drop actions for giving consent. The authors qualitatively evaluate the results of their usability tests and find that some users did not fully trust the privacy management system.
In a follow-up study, Bergman [5] empirically explores how to successfully communicate websites’ privacy policies to users. Specifically, he compared a conventional interface for online forms to an extended version with additional explanations of privacy information that pops up (Timing: just-in-time) while filling the form (so-called “privacy bars”). The authors find that participants who saw the extended version were significantly more likely to be aware of the policy than the control group. But he did not measure the cost of this sophistication in terms of response time or reduced usability. Moreover, looking at the screenshots of the extended dialog (Fig. 2 of [5]) lets us wonder whether there is a risk of information overload. Finally, as the dialog was only tested on desktop computers, it remains unclear how this information can be perceived on small mobile displays.

Tiny displays raise the need for non-interactive forms of privacy preference negotiations. An established (but meanwhile discontinued) standard for expressing privacy preferences on the web is P3P. The standard lets websites communicate their privacy policies in machine-readable XML format (Modality: machine-readable). Each XML element represents a component, such as the type of data, the purpose for data collection, and third party recipients [13]. A language called Appel has been developed for enabling users to express their privacy preference through predefined rules (Timing: at setup), so that automated privacy decisions can be based on the user’s specific settings [31]. Since P3P focuses on the technical transparency of information practices, researchers have criticized the standard’s lack of clear communication to end-users [13].

A recent approach towards facilitating informed and GDPR-compliant user consent is proposed by Ulbricht and Pallas [51]. The authors present a privacy preference language, called YaPPL, that is targeted on consent for data practices on the Internet of Things (IoT). For the development, they analyze legal requirements for consent and transform them to technical standards that suit IoT devices (Modality: machine-readable, Channel: primary or secondary). The language is prototypically tested in real-world IoT applications. The authors hope that the underlying challenge of YaPPL will also be implemented in IoT applications that do not have to meet the standards of GDPR, but require a technical representation of users’ privacy preferences.

Dissatisfied by the observation that many users tend to ignore notices with privacy impact [23, 53] and have been habituated to “click away” consent dialogs [8], several researchers investigated how to design more effective privacy notices. For instance, Felt et al. [19] propose design guidelines that aid mobile application developers in appropriately asking for permissions. They find that more than half of all permission requests can be automated while 16% require consent dialogs. By minimizing the number of runtime consent dialogs, the authors intend to decrease the required user attention. While technical permissions differ from legal purposes in several respects, it is conceivable that the results also apply to purposes, but we are unaware of relevant research in this direction.

The works on consent dialogs discussed so far are selected pieces of the literature. They are representative in that the field focuses on technical and human aspects in many facets, but (with a few exceptions) it largely ignores economic interests [47]. In practice, we must expect that businesses use the flexibility in the design of consent dialogs for their own interest by maximizing data disclosure instead of helping users to make privacy-conscious decisions.

3 THEORY
User studies integrate better into the body of knowledge (and, arguably, generalize better), if the hypothesized causal links are derived from established theory. Therefore, we revisit relevant theories for explaining the effect of the two characteristic components in the consent dialogs inspiring this work (Fig. 1). Specifically, we review choice proliferation in Section 3.1 to reason about the number of purposes, and social norms in combination with deception in Section 3.2 to predict the effect of the default button. Then, we formulate our hypotheses in Section 3.3.

3.1 Choice Proliferation
Choice proliferation is a line of research in psychology that analyzes the influence of an increasing number of alternative choices on the human decision-making process. The phenomenon that more options result in negative effects, such as dissatisfaction, has mainly been studied in a marketing context [25, 45] and is often referred to as “too much choice”, “tyranny of choice”, or “choice overload”.

As pointed out by Johnson et al. [25], two main aspects have to be considered when evaluating the number of choices offered. On the one hand, a high number of alternatives increases the cognitive load while causing individuals to feel stressed, overwhelmed, and more likely to regret one’s decision [14, 27]. On the other hand, the likelihood that the choice suits the individual’s preferences increases when more options are given. Thus, the practical challenge is to find the right balance.

In the context of privacy, a few works investigate the effect of increasing privacy choices on users’ decision making. Korff and Böhme [29] experimentally study the influence of choice amount and choice structure in the context of privacy preferences on a business networking website. They find that participants who were confronted with a larger number of privacy settings to chose from were less satisfied with their choice and experienced more regret. The works by Knijnenburg et al. [28] and Tang et al. [49] investigate the number of privacy choices in the context of mobile location sharing. Both studies find that the structure of presented choices significantly impacts users’ tendency to disclose personal data. Krasnova et al. discuss the effect of an increasing amount of information items in mobile applications’ permission requests [30]. The results of their experiment show that users tend to be more concerned if the permission request asks for more information items. This aspect of choice proliferation seems to be specific to privacy, because options in privacy dialogs often remind users of threats. This is rarely the case in the marketing literature on choice proliferation, where the typical study varies the number of form of a retail product.

Broadly related to the number of options is the number of occasions for privacy decisions. Böhme and Grossklags [7] discuss the adverse effects of escalating too many privacy (and security) decisions to the end-user. They postulate that only the most important decisions should be made by users, so that they do not get habituated to ignore notices as a consequence of too high complexity. Several empirical studies support this interpretation. For example, Egelman [17] attributes the null result in an experiment on more or
less verbose variants of the well-known consent dialog of Facebook Connect to habituated ignorance.

Our study connects to the literature on choice proliferation by experimentally varying the number of purposes. We adapt established constructs to measure perceived task difficulty and regret.

3.2 Deception and Social Norms

The concept of deception is often described as being misled due to unfair practices and can occur in many contexts when interests of different parties collide [26]. Deception has been studied in several areas such as marketing [11, 36, 43, 55] and organizational research [20, 24, 56]. A deceptive practice is being conducted if the targeted individual receives false information that lead to false impressions of a situation. Such false impressions may trigger decisions or opinions that would have been formed in a different way without the deceiving act.

However, deception is not always based on lying, as it may also comprise purposeful evocation of specific actions by the targeted party; for instance, by increasing the complexity of information, or by making use of behavioral clues or clue patterns. A study by Nochenson and Grossklags [36] investigates how users of web shops are tricked into falling for post-marketing strategies due to specific design elements in notices. In an experimental setup, they test the purchasing behavior of more than 500 users and find that above 40% unintentionally signed up for an extra service for an additional fee. The authors find that opt-in and opt-out default buttons significantly impact the users’ tendency to fall for the trick.

In privacy research, deception has been studied in the context of strategies used by malicious parties. Bösch et al. [10] present a conceptualization of strategies, so-called “dark patterns,” that are commonly adopted to invade privacy. The authors explain that users fall for these strategies because of their habits and thinking processes. For instance, users typically do not read privacy notices completely [33] and often intuitively agree to the presented conditions. This behavior can be exploited by hiding undesirable terms in privacy notices.

Citing usability guidelines [46], Böhme and Köpssel [8] underline that the default option should include the most frequently selected settings so that inexperienced users can be assisted by the decision of the majority. In this sense, default buttons can be interpreted as a descriptive social norm. However, as highlighted in a study on default privacy settings on social media websites, the preset or default options are often very disclosing and do not seem to reflect the majority of users’ actual privacy preferences [54]. Over the years, it seems that the default button has mutated from a usability tool that improves efficiency when selecting the typical choice to a strategic tool that supports the interests of the system designer.

In the spirit of the GDPR, one could argue that tactics involving increased complexity, hidden information, or unwanted default settings—if effective—violate the requirements for clear and informed consent. Our study adds empirical evidence on the effectiveness of these tactics in the specific context. We vary the presence of a “dark” default button and measure perceived deception, unlike the wealth of studies that quantify the outcome bias caused by benign default buttons. Since deceptive practices in the privacy context are often based on increasing cognitive load, we devise a combined experiment with choice proliferation. This allows us to interpret perceived difficulty and response time—both proxies for cognitive load—in relation to perceived deception.

3.3 Hypotheses

Against the backdrop of our observations of features in consent dialogs used by popular websites and the underlying theoretical considerations, we postulate four hypotheses:

H1 If consent dialogs include a highlighted default button that selects all purposes, users consent to more purposes.

H2 If consent dialogs include a highlighted default button that selects all purposes, users (a) more often regret their decision, and (b) perceive the website as more deceptive after being informed about the purposes they agreed to.

H3 If consent dialogs present multiple purposes, users require more effort as indicated by longer time to respond.

H4 If consent dialogs include multiple purposes, users perceive the task as more difficult.

4 METHOD

To test the proposed hypotheses, we conducted a controlled experiment. We describe the instrument in Section 4.1, then report from our pretests (Section 4.2) and the survey administration (Section 4.3). Ethical considerations are discussed in Section 4.4. Descriptive statistics are presented in Section 4.5.

4.1 Instrument

The survey instrument has two main components: a functional mock-up website offering flight search, and an exit questionnaire. As experimental factor, the mock-up randomly presents the user one of the three consent dialogs depicted in Figure 2. When categorizing these dialogs along the dimensions proposed by Schaub et al. [44], they constitute privacy notices which appear at setup (timing), in the primary channel, as visual pop-ups (modality) that include a blocking control.

The treatment of the first group is a deceptive dialog, which closely resembled the banner we saw on the German airline website (cf. Figure 7). It contains an explanation text about different cookie settings, three selectable purposes with checkboxes, an expandable part providing more details about the categories, and two buttons. The first button with the text “Select all and confirm” stands out due to its yellow color. The second button is colorless and says “Confirm selection” in gray font. If the yellow button is clicked, the user (theoretically) agrees to all three cookie categories, regardless of which boxes are checked. In contrast, a click on the second button only confirms the settings that have actively been selected by the user. The second treatment differs in the reduction of selectable categories. Specifically, it only includes the “personalization” purpose. Arguable, this consent dialog appears somewhat artificial, but it was the best way we could think of reducing the number of choices without changing the banner type to a yes/no.

The default effect is in the order of 5 %-pts. for a consent dialog where about one of two participants agrees [8].
question. We could not spot any indication that users perceived this dialog as odd in the responses to an open-ended question in the exit survey.

In contrast to the two treatments, the control group did not see a highlighted default button. The control dialog offers the same three purposes as observed in reality. We refrained from presenting a version with one purpose and no default button for the lack of hypotheses on potential interaction effects, and to increase the number of subjects in the interesting three groups. Therefore, our study technically combines two $1 \times 2$ experiments with one overlapping group rather than realizing a complete $2 \times 2$ design.

We copied the three purposes (statistics, comfort, personalization) from the airline website in verbatim in order to maximize external validity, noting that they differ from the convention discussed in Section 2.2. Users could learn more about the purposes by clicking on a small roll-down button labelled “show details” (see screenshot in Fig. 11 in the Appendix). Accordingly, comfort corresponds to preference, and personalization to marketing, however without an indication whether this includes third-party tracking.

The actual flight search website has a simplistic design and only contains text fields and date selectors for the search input. To increase realism, some “special offers” for specific destinations are depicted next to a photo of the respective city. These measures were intended to draw the focus away from the cookie banner. The participants’ interaction on the website is captured and continuously transmitted to our server. This allows us to analyze response time, click trajectories, and possible dropouts post-hoc.

We measure the participants’ perceptions of the website in an exit questionnaire. At first, participants are asked to freely list positive and negative aspects of the website. Thereafter, they should recall their chosen cookie settings in the banner; first in free-text form and then with specified options. Besides general questions on the cookie dialog, four established constructs are measured through multi-item scales. Such scales are common in psychometrics to attenuate the measurement error of individual items. All construct items are reported in Table 1. Answers were collected on 5-point rating scales with semantic anchors “strongly disagree” (1) and “strongly agree” (5). Perceived deception (PDE) is assessed using three (of originally four) items by Roman [43], adapted to the context of our study. Additionally, we measure perceived difficulty (PDI), privacy attitudes (PA), and regret (RE). RE is measured twice in the questionnaire: before and after reminding the participants of their effective cookies settings.

### 4.2 Pretests

Two pretests were conducted in order to assess the clarity of the instructions and survey questions. First, we carried out two one-on-one tests using verbal probing and think aloud techniques. Specifically, test subjects were asked to express their thought process and potential obstacles while going through the survey. Since we found that it is confusing to first open a link with a cookie banner, and then receive the flight search task, we decided to rearrange the instructions. This way, the participants are even more focused on flights than on cookies before visiting the website.

| Table 1: Constructs and corresponding items. |
|---------------------------------------------|
| **Item** | **Item text (translated from German)** |
| **Perceived Deception (PDE)** | |
| PDE1 | When it comes to cookie settings, the website is dishonest towards its users. |
| PDE2 | The website tries to mislead users towards selecting cookie settings which they do not intend to select. |
| PDE3 | The website makes use of misleading tactics so that users select cookie settings which they do not intend to select. |
| **Perceived Difficulty (PDI)** | |
| PDI1 | It was incomprehensible to select cookie settings. |
| PDI2 | It was frustrating to select cookie settings. |
| PDI3 | It was easy to select cookie settings. |
| **Regret (RE)** | |
| RE1 | I regret my choice of cookie settings. |
| RE2 | I would change my cookie settings if it was possible. |
| RE3 | I am satisfied with my choice of cookie settings. |
| **Privacy Attitudes (PA)** | |
| PA1 | It is important for me to protect my privacy online. |
| PA2 | If websites use cookies, my online privacy is impaired. |
| PA3 | I am concerned about my online privacy being impaired by website cookies. |

The scales of items marked with ‘↔’ were reversed for the analysis.

In order to simulate the actual survey environment in a lecture hall, the second pretest was conducted with 20 Austrian undergraduate students in a computer lab. This way, we were able to estimate the required time for each survey step. During the test, we observed that several test subjects glanced at their neighbors’ screens and talked to one another while completing the survey. As this behavior might reduce the data quality, we added the appeal to work quietly and by oneself to the instructions. Additionally, technical adjustments were made that concerned the collection of timestamps.

### 4.3 Survey Administration

The data collection took place on two days in January 2019 at an Austrian and a German university. All parts of the instrument and the written and spoken instructions were provided in the local language (German). We report the original wording of scale items and selected screenshots in the appendix (Section 8) to facilitate error analysis and possible replication studies. The survey was administered at the beginning of lectures attended by undergraduate computer science students, mainly in the first year. Figure 3 summarizes the steps of the data collection, along with the order of the measured constructs.

During the briefing, we informed the participants that their data will be held confidential and cannot be linked to their identity. We also pointed out the voluntary nature of participating in the study.
and asked them to conscientiously follow the instructions without interacting with one another. We communicated that the scope of the study is about the user experience of flight search websites, without mentioning the focus on cookie banners or privacy.

In the second step, participants were given the task to search for a flight with a specific departure, destination, and time. Then, we provided the link to the flight search website that is described above. When visiting the link, one of the three cookie banners depicted in Figure 2 was randomly assigned to each participant. After reacting to the banner and entering the flight search, a modal window appeared, which asked to wait for further instructions.

When the vast majority had reached this step, a key combination for opening the questionnaire was displayed on the lecture hall’s main projector. This way, participants started answering the questions almost simultaneously. On average, it took them 6’ 34” to complete the questionnaire while 90% were finished after 9’ 06”.

In the debriefing, we informed the participants about the topic of the study and showed them screenshots of cookie banners used by real websites. We ran the classroom experiment exactly once at each university, one in Austria and one in Germany, thereby minimizing the likelihood that earlier participants could tell later participants the true purpose of the study.

### 4.4 Research Ethics

In fulfillment of approved ethical standards, we clearly communicated that participation is voluntary and anonymous. Respondents could skip questions they did not want to answer. The search task itself and the surrounding stimulus material was chosen to not raise emotions or strong feelings. Independent of the participants’ selected cookie settings, we did not store cookies and only transmitted data to our servers that are relevant for the research purpose.

In not revealing the true purpose of our study right away, we applied deception ourselves as part of the research method. This is common practice and was in accordance with the ethical oversight bodies at all universities involved. The practice is deemed acceptable in particular because of the low probability of causing harm and the fact that we revealed the purpose of our study in the debriefing, where we also provided contact information and offered the communication of results.
4.5 Descriptive Statistics

Table 2 reports descriptive statistics of our sample. In total, 164 students took part in the study whereof 158 completed the survey. We deleted 8 records due to more than four missing responses on critical construct items. The remaining 13 records with missing answers contained a total of 20 missing values, which were replaced by the mean of the observed item score. Consequently, the analysis uses 150 valid cases. As a consequence of the convenience sample, the ratio of female participants was below 20%, which is typical for German-speaking computer science undergraduates.

Even though we asked participants to use their laptops for completing the survey, we allowed those without one to chose another device they had at hand. While 42.7% followed the survey instructions on a screen width below 500 pixels (i.e., likely smartphones), 52.7% had a screen width above 1000 pixels (i.e., likely notebooks). Most participants opened the website on Chrome (54.0%); others used Safari (19.3%) or Firefox (20.0%). We did not observe noteworthy differences in results between device types or browsers and thus refrain from reporting breakdowns in the following analyses.

By asking whether participants know what browser cookies are, we find that 68.0% are able to provide a correct explanation. Only 12.7% claim to know what cookies are, but provided either no explanation or an incorrect one. The remaining 19.3% stated that they have no knowledge about cookies.

Table 2: Descriptive statistics.

| Item                              | Number | Fraction |
|-----------------------------------|--------|----------|
| All                               | 150    | 100.0%   |
| **Group**                         |        |          |
| T1                                | 50     | 33.3%    |
| T2                                | 48     | 32.0%    |
| Control                           | 52     | 34.7%    |
| **Location of the university**    |        |          |
| Austria                           | 90     | 60.0%    |
| Germany                           | 60     | 40.0%    |
| **Screen width**                  |        |          |
| 500px–1000px                      | 64     | 42.7%    |
| >1000px                           | 79     | 52.7%    |
| **Browser**                       |        |          |
| Chrome                            | 81     | 54.0%    |
| Firefox                           | 30     | 20.0%    |
| Safari                            | 29     | 19.3%    |
| Other                             | 10     | 6.7%     |
| **Knowledge about cookies**       |        |          |
| Self-reported knowledge           | 121    | 80.7%    |
| Correctly described cookies       | 102    | 68.0%    |
| **Privacy measures (self-report)**|        |          |
| Regularly deletes cookies          | 64     | 42.7%    |
| Has cookies disabled              | 36     | 24.0%    |
| Uses ad-blocker                   | 113    | 75.3%    |
| Uses anti-virus software          | 80     | 53.3%    |

On average, it took participants 11.8 seconds to respond to the cookie banner. Only 8.7% expanded the banner by clicking on “Show details”, and 3.3% edited their initial choice by unselecting at least one purpose. In total, 41.3% did not agree to any cookie purpose, while 30.7% accepted all purposes offered. Of all participants in the two treatment groups (n = 98), 56.1% clicked on the default button, which results in accepting all purposes regardless of which purposes were actively selected. Of these participants, 34.5% (n = 19) still selected at least one purpose.

To evaluate the construct reliability of PDE, PDI, RE und PA, we examine internal consistency by calculating Cronbach’s α. As shown in Table 3, each constructs’ Cronbach’s α value lies above 0.7, indicating that they are sufficiently consistent [6] and thus suitable for further analysis.

Table 3: Construct reliability.

| Construct | Cronbach’s α | Mean | Median | SD  |
|-----------|--------------|------|--------|-----|
| PDE       | 0.79         | 3.52 | 3.67   | 1.13|
| PDI       | 0.73         | 2.82 | 2.67   | 1.17|
| RE-before | 0.83         | 2.39 | 2.33   | 1.14|
| RE-after  | 0.74         | 2.62 | 2.33   | 1.20|
| PA        | 0.80         | 3.61 | 3.67   | 0.91|

Each construct has 3 items.

5 RESULTS

We begin with the deductive hypothesis tests, before we investigate additional aspects in a quantitative explorative way (Section 5.2).

5.1 Hypothesis Tests

We test $H1$ by analyzing whether the deception group and the control group differ in the number of purposes they effectively agreed to. To do so, we assign a score from 0 (no purposes, by clicking on “Confirm selection” without checking any box) to 3 (all purposes by either checking all boxes and then clicking any button, or by clicking the highlighted default button). Participants who were confronted with the deceptive banner effectively agreed to more purposes. Table 4 presents the score values by treatment and control group. Since the score is a count variable, we use the Kruskal–Wallis (KW) test, which indicates as strongly significant effect ($\chi^2(1) = 7.2$, $p < 0.01$) in the hypothesized direction. This supports $H1$. The effect of the deceptive default button on agreeing to no or all purposes is in the order of 20 %-pts., about four times larger than the plain default effect reported for an application consent dialog in [8]. We additionally check if participants in the deception group are more likely to agree to all three instead of two or less purposes by applying a Chi-squared test ($\chi^2(1) = 9.05$, $p < 0.005$). Again, the test reveals a highly significant difference.

To test $H2a$, we compare the measurements of regret before (RE-before) and after (RE-after) participants got informed about the purposes they effectively agreed to. Results of the paired t-test reveal a significant difference between the before/after states for the deception group ($t(49) = 3.07$, $p < 0.01$, $d = 0.40$). This supports $H2a$. The difference in the control group is not significant.
(t(51) = 1.63, p = 0.11, d = 0.23). Thus, we can attribute the regret to the misinformation caused by the deceptive design.

When analyzing perceived deception (PDE) for testing H2b, a notable difference between groups can be found (Figure 4). The t-test shows that PDE of the deception group is significantly higher than of the control group (t(96.8279) = 2.24, p < 0.05, d = 0.44). Therefore, H2b is also supported.

Drilling down into the findings on H2a and H2b, we analyze if participants within the deception group who clicked on the deceptive default button perceive even more regret and deception after being informed about the consequence of their response. Indeed, our measurements of RE-after are significantly higher for those who clicked the default button compared to all other participants in T1 (t(43.962) = −3.82, p < 0.0005). However, no significant differences for perceived deception can be found (t(47.73422) = 0.64, p = 0.64). These two results can be explained by the presence of smart participants who debunk the default button as deceptive and do not fall for it. Hence, they have less to regret than those who only understand the button’s effect after the fact.

To test H3, we investigate the time needed to complete the consent dialogs. The measurement starts when the cookie banner appears and ends when the participant clicks a button. This measure reflects the effort required for responding to the banner. As shown in Figure 5, participants in the group with reduced choice spent on average five seconds less on their response than those who were presented with three purposes. The difference in medians shows the same trend, albeit less pronounced due to the skewed distribution. We choose non-parametric statistics to account for this fact. When only comparing the deception and reduced choice group, the KW-test reveals that the difference (χ²(1) = 8.89, p < 0.005) is highly significant, which supports H3. We additionally find a significant difference between the reduced choice group and the control group (χ²(1) = 9.73, p < 0.005). The difference between the deception and control group, which offer the same number of purposes, is not significant (χ²(1) = 0.17, p = 0.68). The results indicate that the number of purposes is positively associated with cognitive load, even if the number of options is way below Miller’s “magic seven” [34].

Regarding H4, we interpret perceived difficulty (PDI) as a measure of dissatisfaction. Specifically, we test the difference between the two treatment groups in order to show whether the number of purposes in the consent dialog affect the participants’ perceptions. Since the t-test results in no significant difference (t(95.99) = 0.16, p = 0.88, d = 0.07), H4 must be rejected.

5.2 Post-hoc Analyses

At the beginning of the questionnaire, we asked participants to recall which purposes they have agreed to in the consent banner. Thus, we are able to compare the accuracy of participants’ statements between groups. As reported in Table 4, the difference is highly significant between all three groups (χ²(2) = 11.01, p < 0.005).

When looking at the proportion of participants who declined all purposes, it is notable that 50% of the control group, but only 32% of the deception group chose this option. After informing participants about their choice, we specifically asked those who agreed to at least one purpose, whether they had been aware of the possibility to decline all purposes. Only 32% stated to be aware of this option. However, the proportion of aware participants does not differ significantly between the deception and control group (χ²(1) = 2.71, p = 0.10). It seems that even the design of our control dialog, possibly in combination with learned expectations, imposes some pressure to select at least one option to a subset of the participants. This highlights that future research could seek to improve the communication of the “freely given” aspect of GDPR-compliant consent (cf. Section 2.1).

To test whether users’ privacy attitudes regarding cookies influence their reaction to the cookie banner, we also test the relationship between the number of chosen purposes and PA. For this analysis we only consider the groups that were presented all three purposes.

### Table 4: Overview of results by treatment group.

| Dependent variable | Group       | T1       | T2       | Control | Test |
|--------------------|-------------|----------|----------|---------|------|
| Number of agreed purposes | KW-test     |          |          |         |      |
| 0                  |             | 32.0%    | 41.7%    | 50.0%   |      |
| 1                  |             | 12.0%    | 58.3%    | 19.2%   |      |
| 2                  |             | 2.0%     | –        | 7.7%    |      |
| 3                  |             | 54.0%    | –        | 23.1%   | ** H1|

| Construct means | t-test |          |          |         |      |
|-----------------|--------|----------|----------|---------|------|
| PDE             | 3.68   | 3.74     | 3.15     | * H2b   |      |
| PDI             | 2.87   | 2.90     | 2.69     | n.s. H4 |      |
| RE-before       | 2.30   | 2.64     | 2.23     | n.s.    |      |
| RE-after        | 2.69   | 2.79     | 2.39     | n.s.    |      |
| PA              | 3.50   | 3.70     | 3.62     |         |      |

| RE-after minus RE-before | paired t-test |          |          |         |      |
|-------------------------|---------------|----------|----------|---------|------|
|                         | 0.39          | 0.15     | 0.16     | ** H2a  |      |

| Response time for consent dialog (seconds) | KW-test |          |          |         |      |
|-------------------------------------------|---------|----------|----------|---------|------|
| Median                                    | 5.36    | 3.16     | 7.24     | ** H3   |      |
| Mean                                      | 10.95   | 5.41     | 11.62    |         |      |

| Correct recall of effective purposes | χ²-test |          |          |         |      |
|-------------------------------------|---------|----------|----------|---------|------|
|                                     | 73.5%   | 60.9%    | 90.0%    | **      |      |

|                                     | (n = 27) | (n = 28) |
|                                     | (only subjects who clicked the default button) |

|                                     | 55.6%   | 53.6%    | –        |         |      |

Legend: * p < 0.05, ** p < 0.01, n.s. not significant.
The test results refer to the bold values in the same row.
Next we reflect on the results, then discuss limitations (Section 6.2), and comment on recent developments in the space (Section 6.3).

6 DISCUSSION

We find a weak but significant negative correlation between privacy attitudes and the number of consented purposes (\( r = 0.23, p < 0.05, n = 102 \)). However, the difference in PA between those who clicked the deceptive button and those who did not, is not significant (\( t(91.9) = -1.04, p = 0.30, n = 98 \)). Moreover, as expected, privacy attitudes do not differ significantly between groups as participants were randomly assigned to groups. This reassures us that the PA items measure trait rather than state, and are pretty robust to question order effects.

6.1 Summary and Interpretation

Our experimental results confirm the common conjecture that design elements of consent dialogs can nudge users towards making specific choices. We show empirically—to the best of our knowledge for the first time—that the selection of data processing purposes, as required by the GDPR, is not exempt: users agree to more data collection purposes when consent dialogs integrate a highlighted default button that selects all purposes at once. Surprisingly, we observe a four times stronger effect for our multi-purpose consent dialog than previously reported for simple default buttons in binary consent dialogs. Moreover, the fact that users who click this button are less likely to correctly recall the consented purposes casts doubt on the morality and legitimacy of this design element, as it might lead users to act against their intention. This interpretation is further supported by the finding that users tend regret their decision after being informed about the effective purposes.

Besides the effect of deceptive default buttons (which primarily merited a study because we encountered them on popular websites), we present more encouraging results on the possibility to differentiate between consent decision for multiple purposes in one dialog: although the number of purposes significantly affects the response time, the difference in perceived difficulty are insignificant. This indicates that most users can handle three different purposes without experiencing the negative effects predicted by the theory of choice proliferation. Of course, further studies are needed to investigate more closely the critical number of purposes. Also the choice structure, the other relevant determinant in choice proliferation, requires further attention [29].

Our analysis of control variables reveals that users with stronger stated privacy attitudes agree to fewer purposes. While this result seems to challenge the privacy paradox (a term for the often observed discrepancy between stated attitudes and privacy behavior [22, 37, 48]), it must be interpreted with caution. First, our instrument is not ideal to study the paradox. It confounds this relationship with the dominant effect of a deceptive default button and measures the privacy attitude only after recalling the effective purposes. Second, unlike in many studies that find the paradox, our items measure privacy attitudes quite narrowly for the specific domain: two out of three items mention cookies. According to the principle of compatibility, behavior is more predictable from attitudes if it is measured on the same level of specificity [2]. To some extent, this corroborates nuanced or critical perspectives on the privacy paradox [16].

6.2 Robustness and Limitations

To check for possible risks to external validity, we analyzed the participants’ free-text responses for prejudiced assumptions about our study. Only one participant exhibited demand characteristics. The person wrote that he or she has agreed to all purposes because the website was part of a scientific experiment. All remaining participants answered as if they were dealing with an actual flight
search website. Moreover, we do not find further indications that the participants might have perceived our stimuli as artificial.

It is important to mention that the study has limitations. First, the experimental setup may not fully reflect users' actual behavior regarding consent dialogs. Even though we made an effort to hide the research purpose of our study, we cannot rule out that participants might have guessed our focus on cookie banners or privacy in general. Moreover, our sample is limited to German-speaking computer science students who are probably more educated about the functionality of cookies and the web in general. This bias, however, does not compromise the upshot of this working paper: if even computer literate populations fall for the deceptive design, we must assume that the outcome for the general public is even worse.

6.3 Recent Developments
A simple interface adjustment—meanwhile implemented in the airline website—is to change the button text from "Select all and confirm" to "Select and confirm" (and change the behavior accordingly) as soon as the first checkbox is selected. While this breaks with the design principle that button semantics should not be stateful, it might avoid the severest mishaps where cognitive effort that went into selecting purposes is wasted. It requires another user study with many more participants to gauge if this modification reduces the disappointment in the subset of users who select at least one but not all purposes.

In the past months, we have observed other "innovative" consent dialogs, such as page-long lists of affiliate partners for third-party tracking, that call for tailored user studies through the lenses of deception and choice proliferation. For example, a popular meeting scheduling service uses a modal banner entitled "We value your privacy" with a prominent button labeled "I accept." To access literally hundreds of options, one has to click on "Show purposes," which is a text link next to three others (see Fig. 6). Interestingly, this dialog seems to be operated (and presumably evaluated) by an intermediary specialized on consent management. This fits into the picture where ENISA, a EU agency, mentions "consent management" as a new business opportunity for cybersecurity startups [21, p. 10].

7 CONCLUSION
This study presents new empirical evidence supporting that design elements used in consent dialogs of popular websites might deceive users into agreeing to more data processing purposes than intended. It complements recent measurement studies [15, 50, 52] that emphasize the wide adoption of such "dark patterns" [10]. The findings suggest recommendations for interface design and policy.

Our first recommendation sounds like a commonplace: instead of nudging users towards agreements that mainly benefit the party who owns and controls the website, web designers should offer default settings that reflect a more privacy-aware choice by eliciting the majority’s preferences. This could be achieved by designing a set of best-practice consent dialogs, incorporating the body of knowledge from behavioral privacy research. These templates can be made available to organizations who value consumers’ privacy or seek legal certainty without commissioning an intermediary.

However, past and ongoing efforts in the usable privacy research community towards understanding how to nudge users into making safer choices are void if the industry tries to achieve the opposite. Since the value of personal data increases with the number of possible secondary uses [47], businesses have incentives to maximize the number of consented purposes. It is tempting to call for a regulator or oversight body to step in and ensure that dialogs are designed in the users’ interest. But we are hesitant about suggesting more (or more specific) regulations for two reasons. First, the GDPR stipulates freely given, unambiguous, and informed consent. Maybe it takes a court decision, supported with empirical data collected on a more systematic basis, to provide clarity over the fact that the practices we observe do not meet these requirements and hence cannot provide a legal basis for personal data processing. Second, the time and cognitive effort millions of users regularly spend on consent dialogs may not be worth its outcome at the societal level. Rather than mandating special forms of consent dialogs (which hardly work for devices without display or network services that are not customer-facing), a policy priority should be the establishment of a standard for non-interactive privacy preference negotiations.

It seems that P3P [13] was 20 years ahead of its time, and the do-not-track header too simple and polarized [38]. It is time to agree on a middle ground. Consent dialogs would not disappear, but their design moves from the hands of data controllers to developers of user agents, who offer a more consistent user experience and can compete for the best service in the data subject’s interest. In order to foster competition, and not to repeat the mistakes of do-not-track, it is important that browser and app vendors should be required to interoperate with any privacy agent of the user’s choice.

REFERENCES
[1] Mark Ackerman, Lorrie Faith Cranor, and Joseph Reagle. 1999. Privacy in e-commerce: Examining user scenarios and privacy preferences. In Proceedings of the 1st ACM Conference on Electronic Commerce (EC). ACM, 1–8.
[2] Icek Ajzen. 1998. Models of human social behavior and their application to health psychology. Psychology and Health 13, 4 (1998), 735–739.
[3] Cybot A/S. 2019. WordPress and GDPR, and how to deal with cookies and plugins. Copenhagen, Denmark. https://www.cookiebot.com/en/wordpress-cookie-plugin/.
[4] Mike Bergmann. 2007. Generic predefined privacy preferences for online applications. In IFIP International Summer School on the Future of Identity in the Information Society. Springer, 259–273.
[5] Mike Bergmann. 2008. Testing privacy awareness. In IFIP Summer School on the Future of Identity in the Information Society. Springer, 237–253.
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[6] J Martin Bland and Douglas G Altman. 1997. Cronbach’s alpha. British Medical Journal 314, 7080 (1997), 572.

[7] Rainer Böhme and Jens Grossklags. 2011. The security cost of cheap user interaction. In New Security Paradigms Workshop (NSPW 2011). ACM, 67–82.

[8] Rainer Böhme and Stefan Köpsell. 2010. Trained to accept?: A field experiment on consent dialogs. In Human Factors in Computing Systems (CHI 2010). ACM, 2409–2416.

[9] John J Borking. 2001. Privacy incorporated software agent (PISA): Proposal for building a privacy guardian for the electronic age. In Designing privacy enhancing technologies. Springer, 130–140.

[10] Christoph Bisch, Benjamin Erb, Frank Kargl, Henning Kopp, and Stefan Pfattheuser. 2014. Too much choice: End-user privacy decision in Facebook Connect. In ACM Conference on Human Factors in Computing Systems (CHI 2014). ACM, 237–254.

[11] David M Boush, Mariam Friezstad, and Peter Wright. 2015. Deception in the marketplace: The psychology of deceptive persuasion and consumer self-protection. Routledge/Taylor & Francis Group, New York, NY, US.

[12] European Commission. 2018. The GDPR: New opportunities, new obligations. Technical Report. Publications Office of the European Union, Brussels, Luxembourg.

[13] Lorrie Faith Cranor. 2003. P3P: Making privacy policies more useful. IEEE Security & Privacy 9, 6 (2003), 50–55.

[14] Henrik Cronqvist and Richard H Thaler. 2004. Design choices in privatized social-media systems: Learning from the swedish experience. American Economic Review 94, 2 (2004), 434–448.

[15] Martin Degeling, Christine Utz, Christopher Lentzsch, Henry Hosseini, Florian Schaub, and Thorsten Holz. 2019. Measuring the GDPR’s impact on web privacy. In Proceedings of the 26th Annual Network and Distributed System Security Symposium (NDSS) Internet Society.

[16] Tobias Dienlen and Sabine Treppe. 2015. Is the privacy paradox a relic of the past? An in-depth analysis of privacy attitudes and privacy behaviors. European Journal of Social Psychology 45, 3 (2015), 285–297.

[17] Serge Egelman. 2013. My profile is my password, verify me!: The privacy/convenience tradeoff of Facebook Connect. In ACM Conference on Human Factors in Computing System (CHI). ACM, 2369–2378.

[18] Steven Englehardt and Arvind Narayanan. 2016. Online tracking: A 1-million-site measurement and analysis. In Proceedings of the ACM Conference on Computer and Communications Security (CCS 2016). ACM, 1388–1401.

[19] Adrienne Porter Felt, Serge Egelman, Matthew Finifter, Devadatta Akhawe, David A Wagner, et al. 2012. How to ask for permission. HotSec 12 (2012), 7–7.

[20] Peter Fleming and Stelios C Zygoulidopoulos. 2008. The escalation of deception in organizations. Journal of Business Ethics 81, 4 (2008), 837–850.

[21] European Union Agency for Network and Information Security. 2019. Challenges and opportunities for EU cybersecurity start-ups.

[22] Nina Gerber, Paul Gerber, and Melanee Volkamer. 2018. Explaining the privacy paradox: A systematic review of literature investigating privacy saving and behavior. Computers & Security 77 (August 2018), 226–281.

[23] Jens Grossklags and Nathan Good. 2001. Empirical studies on software notices and multiple purposes, multiple problems: The privacy paradox. A systematic review of literature investigating privacy attitude and organizations. Journal of Business Ethics 95, 3 (2010), 373–391.

[24] Karen A Jehn and Elizabeth D Scott. 2008. Perceptions of deception: Making sense of responses to employee deceit. In Financial Cryptography and Data Privacy. Springer, 130–140.

[25] Lukas Olejni. 2019. A second life for the ‘do not track’ setting—with teeth. Wired (2019).

[26] European Parliament and the Council. 2002. Directive 2002/58/EC of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications).

[27] European Parliament and the Council. 2016. Regulation (EU) 2016/679 of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and the free movement of such data, and repealing directive 95/46/EC (General Data Protection Regulation).

[28] John Sören Pettersson, Simone Fischer-Hubner, Ninni Danielsson, Jenny Nilsson, Mike Bergmann, Sebastian Claus, Thomas Kriegelstein, and Heruy Kraemans. 2005. Making PRIME usable. In Symposium on Usable Privacy and Security (SOUPS 2005). ACM, 53–64.

[29] John Sören Pettersson, Simone Fischer-Hubner, Marco Cassassa Mont, and Siani Pearson. 2006. How ordinary internet users can have a chance to influence privacy policies. In Nordic conference on Human-computer interaction: Changing roles (NordiCHI 2006). ACM, 473–476.

[30] Sergio Roman. 2010. Relational consequences of perceived deception in online shopping: The moderating roles of type of product, consumer’s attitude toward the internet and consumer’s demographics. Journal of Business Ethics 95, 3 (2010), 373–391.

[31] Florian Schaub, Rebecca Balebako, Adam L Durity, and Lorrie Faith Cranor. 2015. A design space for effective privacy notices. In Symposium On Usable Privacy and Security (SOUPS 2015). 1–17.

[32] Benjamin Scheibehebner, Rainer Greifeneder, and Peter M Todd. 2010. Can there ever be too many options? A meta-analytic review of choice overload. Journal of Consumer Research 37, 3 (2010), 409–425.

[33] Ben Shneiderman, Michael Leavitt, et al. 2006. Research-based web design & usability guidelines. Washington DC, Department of Health and Human Services. Washington DC, USA.

[34] Sarah Spiekermann, Alessandro Acquisti, Rainer Böhme, and Kai Lung Hui. 2015. The challenges of personal data markets and privacy. Electronic Markets 25, 1 (2015), 161–167.

[35] S Shyam Sundar, Hyunjin Kang, Mu Wu, Eun Go, and Bo Zhang. 2013. Unlocking the privacy paradox: Do cognitive heuristics hold the key?. In CHI ’13 extended abstracts on human factors in computing systems. ACM, 811–816.

[36] Karen Tang, Jason Hong, and Dan Siewiorek. 2012. The implications of offering more disclosure choices for social location sharing. In Human Factors in Computing Systems (CHI 2012). ACM, 391–394.

[37] Martina Trevisan, Bassi Eleonora Traverso, Stefano, and Marco Melia. 2019. 4 years of EU cookie law: Results and lessons learned. In Proceedings on Privacy Enhancing Technologies 2 (2019), 126–145.

[38] Max-Robert Ulbricht and Frank Pallas. 2018. VaPFL – A lightweight privacy preference language for legally sufficient and automated consent provision in IoT scenarios. In Data Privacy Management, Cryptocurrencies and Blockchain Technology. Joaquín García-Alfaro, Jordi Herrera-Joancomartí, Giovanni Lavraga, and Ruben Rios (Eds.). Number 11025 in Lecture Notes in Computer Science. Springer, Cham, 329–344.

[39] Rob van Eijk, Hadi Asghari, Philipp Wenzel, and Arvind Narayanan. 2019. The impact of user location on cookie notices (inside and outside of the European Union). In Proceedings of the Workshop on Technology and Consumer Protection (ComPro ’19). San Francisco, CA.

[40] Tony Vila, Rachel Greenstadt, and David Molnar. 2004. Why we can’t be bothered to read privacy policies. In Economics of Information Security. Springer, 143–153.

[41] Jocelyn Watson, Heather Richter Lipford, and Andrew Besmer. 2012. Mapping user preference to privacy default settings. Transactions on Computer-Human Interaction (TOCHI) 22, 6 (2015), 32.

[42] Bo Xiao and Izak Benbasat. 2011. Product-related deception in e-commerce: A multidisciplinary perspective. MIS Quarterly 35, 1 (2011), 169–196.

[43] Kay Yoon, Kendra Knight, and Donald Martin. 2018. Deceiving team members about competence: Its motives and consequences. Western Journal of Communication (2018), 1–22.
8 APPENDIX

Table 5: Constructs and corresponding items as used in the survey.

| Item | Item text (German) |
|------|--------------------|
| **Perceived Deception (PDE)** | |
| PDE1 | Die Seite ist bezüglich der Cookie-Einstellungen unehrlich gegenüber ihren Nutzern. |
| PDE2 | Die Seite versucht Nutzer dazu zu führen, Cookie-Einstellungen zu wählen, die sie nicht wählen wollen. |
| PDE3 | Die Seite benutzt irreführende Taktiken, damit Nutzer Cookie-Einstellungen wählen, die sie nicht wählen wollen. |
| **Perceived Difficulty (PDI)** | |
| PDI1 | Es war unverständlich, eine Auswahl zu treffen. |
| PDI2 | Es war frustrierend, eine Auswahl zu treffen. |
| PDI3 | Es war einfach, eine Auswahl zu treffen. |
| **Regret (RE)** | |
| RE1 | Ich bereue meine getroffene Auswahl. |
| RE2 | Ich würde meine Auswahl ändern, wenn ich die Möglichkeit hätte. |
| RE3 | Ich bin mit meiner Auswahl zufrieden. |
| **Privacy Attitudes (PA)** | |
| PA1 | Der Schutz meiner Privatsphäre im Internet ist mir wichtig. |
| PA2 | Wenn Webseiten Cookies verwenden, schränkt dies meine Privatsphäre ein. |
| PA3 | Ich bin besorgt darüber, dass meine Privatsphäre durch Cookies von Webseiten eingeschränkt wird. |

The scales of items marked with ‘↔’ were reversed for the analysis.

Figure 7: Functional mock-up website offering flight search.
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Figure 11: German version of the expanded cookie banner after clicking on “details”.

Figure 8: German version of the consent dialog (T1).

Figure 9: German version of the consent dialog (T2).

Figure 10: German version of the consent dialog (control).

Figure 12: Pop-up with questionnaire.