

# Crumbling Cookie Categories: Deconstructing Common Cookie Categories to Create Categories that People Understand

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## ABSTRACT

Users of online services often encounter cookie banners that ask them to consent to different categories of cookies. Frequently, these categories are labelled using the four categories defined by the 2012 Cookie Guide from the UK's International Chamber of Commerce (ICC). However, prior research suggests that users have difficulty understanding what these category labels actually mean. We conducted a four-part study to identify labels that more intuitively convey the four cookie categories. First, we crowd sourced new category labels. We then evaluated users' comprehension and sentiment towards the labels in a series of surveys focused on definitions and hypothetical scenarios. Finally, we selected a new slate of category labels based on the results of the prior surveys, and conducted a between-subjects, online behavioral experiment to compare the new slate with the original labels. We ultimately recommend that the industry adopt the category label "anonymous analytics cookies" in lieu of the term "performance cookies" and "extra functionality cookies" instead of "functional cookies." Adopting our recommended terms would both improve the usability of current cookie consent interfaces and any future privacy consent mechanisms that use the same categorization. We also recommend revisiting the categories themselves as the distinctions between these categories do not seem to be well understood and may not reflect useful distinctions for privacy decision making.

## KEYWORDS

cookies, comprehension, cookie consent, cookie categories

## 1 INTRODUCTION

Often, when a person visits a new website, they are prompted to accept all cookies, deny all cookies, or select the cookies they would like to accept or deny. Rather than requiring users to consent to individual cookies, which would be time consuming and impractical, websites usually group cookies into categories defined based on their data collection purpose. Current cookie terminology in common use has been derived from the United Kingdom's International Chamber of Commerce's (ICC) Cookie Guide, which was released in 2012 to "help website operators obtain informed consent from

their visitors and comply with the new rules governing the use of cookies" [2]. The ICC Cookie Guide divides cookies into four categories<sup>1</sup> (paraphrased here):

- **Strictly Necessary Cookies:** Cookies that are essential to navigate the website, enables users to use explicitly requested features, and often creates a unique identifier for each user that creates a consistent, reliable experience. Examples of features enabled by these cookies are shopping carts and multimedia content players.
- **Performance Cookies:** Cookies that collect information about use of a website without identifying users; they are only used in aggregate form to improve the website.
- **Functionality Cookies:** Cookies used by the website to remember a user's preferences (like language, region and font size), are typically inserted only when a user performs an action (such as commenting on a blog or watching a video) but can also be used to enable features that have not been explicitly requested, and collects anonymized information on users without cross-site tracking.
- **Targeting Cookies/Advertising Cookies:** Cookies that help serve users personalized ads, prevent repetitive advertisements, and record advertisement-related metrics; these cookies share data with advertising networks and advertisers.

The complete category definitions can be found in Appendix A.1. While this specific categorization is not required by law, these four categories have become an industry standard and have been adopted by Consent Management Platforms (CMPs) such as OneTrust Cookie Consent,<sup>2</sup> which is the largest CMP by market share [4].

Most previous research has focused on the usability of cookie consent interfaces rather than the terms themselves, and this paper aims to address that gap. During those previous studies, researchers found that these standard cookie terms are not clear to users and they struggle to identify their meanings. Functional and performance cookies appear to be particularly problematic [12, 17]. As cookie consent interrupts users' normal activity, it is essential that these terms intuitively convey their meaning, without requiring users to read complicated definitions.

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<sup>1</sup>Throughout this paper we refer to these four categories without quotation marks. When we are referring to the name of the category or an alternative name we tested we indicate this using quotation marks.

<sup>2</sup><https://www.onetrust.com/>

In order to improve users' consent experience, we seek to develop new category labels. In particular, our study aims at answering the following research questions:

- (1) What terms/phrases could best describe the four common cookie categories?
- (2) Do these terms/phrases provide a better understanding of cookie categories than the current industry standard?

We conducted a four-part study to create a comprehensive evaluation of current cookie category terminology and attempt to identify better understood terms. The first part of the study focused on sourcing alternative cookie terms, which we did through a survey asking participants what terms they would use to describe different cookie definitions (Survey 1). Equipped with these potential alternative terms, we then evaluated how well participants understood these terms by asking them to match terms to definitions (Survey 2). In the third phase, we evaluated a smaller set of the better-performing candidate terms from Survey 2 with scenario-based questions designed to evaluate whether participants could correctly identify the type of cookie responsible for a feature (Survey 3). In the fourth and final part of the study (Survey 4), we asked participants from the US and the UK to perform a task on a fictitious e-commerce website derived from prior work [12, 17]. When participants visited our website, they encountered a cookie consent interface with one of two potential slates of cookie terms: a new slate derived from the previous three parts and a slate of the original ICC category labels. We then asked participants various questions to compare the usability of the consent experience with each set of terms.

As the results of each part of our study informed the next part, we present the methods and results of each study together in four sections, one section for each part (Sections 3 through 6). All parts of this study were reviewed and approved by the Carnegie Mellon University Institutional Review Board (IRB). We conducted all of our surveys using the Prolific crowdworking service.<sup>3</sup> Our participant demographics are shown Table 10.

We found that the original terms “strictly necessary” cookies and “targeting/advertising” cookies performed reasonably well, with no alternatives performing consistently better. However, the original terms “performance” cookies and “functional” cookies were not well understood. We found that alternative terms “anonymous analytics” and “extra functionality” were better understood by users. As we discuss in Section 7, adopting these alternative terms would both improve the usability of current cookie consent interfaces and any future privacy consent mechanisms that use the same categorization for data use. We also recommend revisiting the categories themselves as the distinctions between these categories do not seem to be well understood and may not reflect useful distinctions for privacy decision making.

## 2 BACKGROUND AND RELATED WORK

In this section we review related work and background knowledge that underpins our research. We first discuss privacy regulation, before discussing prior research on cookie consent interfaces. We conclude with a brief discussion of nomenclature and the naming of technology.

<sup>3</sup><https://www.prolific.com>

### 2.1 Cookie Regulation

Cookie consent interfaces have become increasingly common since the passing of the European Union's (EU) ePrivacy Directive in 2002 (amended in 2009) [10] and the EU General Data Protection Regulation (GDPR) in 2018 [16]. Companies are required by these rules to obtain consent prior to processing personal data that is not necessary for a legitimate business purpose. Consent must be affirmative and cannot be obtained via default settings or prefilled check boxes. Users must be able to withdraw their consent at any time. Although the UK has subsequently left the EU, the “key principles, rights and obligations remain the same” under the nearly identical UK GDPR [20].

There is no federal general data protection regulation in the United States, however, several states have passed privacy laws. For example, the California Consumer Privacy Act (CCPA) [30] and the California Privacy Rights Act (CPRA) [13], went into effect in 2020 and 2023 respectively. Among other rules, they require that certain companies provide consumers with notice related to data collection, the ability to opt-out of the sale and sharing of information with third parties, and the ability to opt-out of the use of sensitive personal information. In practice, these notice and choice requirements are commonly implemented with GDPR-style cookie consent banners [18]. Outside of Europe and the United States, other jurisdictions have adopted similar privacy regulations (e.g. the Brazilian General Data Protection Law [24]).

Data protection regulations are generally technology agnostic. They apply not just to cookies, but to any technology used to collect user data. While browser fingerprinting [21] and other non-cookie tracking mechanisms are becoming more common, in practice, cookies are still a prevalent web tracking technology, and many services implement cookie consent interfaces to comply with regulation.

### 2.2 Cookie Consent Interfaces

Websites implement a variety of cookie consent interfaces with different properties. Some allow users to opt-in to using cookies; some allow users to decline cookies; others simply notify users that cookies are being used without providing choice [15, 32, 38]. Interface design and behavior may vary with user location [5, 14, 39]. Many interfaces have features meant to influence user decisions, including nudging, pre-selection, and emphasized buttons to accept cookies [26, 27, 38].

A number of previous studies have identified design factors that impact user behavior. The consent options presented in the initial notice have the largest effect. Habib et al [17] and Bouma-Sims et al. [12] found that users who encountered consent interfaces where specific cookie choices were replaced with a “cookie preferences” button or link leading to a secondary interface with these choices were more likely to accept all cookies. Similarly, Utz et al. [38] found that users who are shown confirmation-only cookie notices or banners with a binary choice were more likely to consent to cookies than those shown banners with more granular choices.

Santos et al. [33] identified requirements for cookie consent to comply with GDPR: the consent interface should allow users to separately consent to cookies of different types, the consent must be informed, consent must be unambiguous, users should be able to revoke their consent at any time, and, most relevant to our present

study, the banner should be easy for users to understand. Research suggests that upwards of 50% of cookie consent interfaces do not meet standards imposed by GDPR [5, 9, 26, 32, 34, 38].

Many regulatory agencies have issued guidelines on consent interface design in order to limit the use of manipulative design patterns [8]. For example, the French Data Protection Authority (CNIL) issued guidance on obtaining consent for data collection via cookies or other trackers that went into effect on April 1, 2020 [1]. Among other guidelines, they recommend that consent interfaces provide both cookie acceptance and rejection options in the initial banner and that consent banners avoid using default or pre-selected options. These guidelines and others from various data protection authorities across the EU generally require that consent interfaces clearly communicate the purposes of data collection; however, there is a lack of consensus around which cookie categories should be used [8]. This motivates our research to provide more evidence on users' understanding of different cookie categories.

Rather than independently develop consent experiences, online services often rely on CMPs to meet regulatory requirements. While the specifics vary, CMPs may provide the design of consent interfaces, detection of cookies and other tracking technologies, and integration with third parties. Due to their central role in the consent process, CMPs are often responsible for defining and explaining cookie categorizations. While many CMPs exist [19], a small number currently dominate the market. For example, OneTrust has become one of the largest CMPs since the adoption of the CCPA in 2020 [4, 18]. Other commonly-used CMP providers include Osano, Cookiebot, and CookieYes [4].

Although CMPs make it easy to quickly design and implement consent experiences, they do not guarantee compliance. For example, Hills et al. [18] examined 414 sites that used OneTrust as a CMP, and found that over 60% implemented non-GDPR-compliant cookie interfaces that required only a single click to accept all cookies but several clicks to make a more granular choice. Other research has also observed non-compliant designs created with CMPs [15, 28, 37].

Research suggests that users and service providers have difficulty understanding cookie categories. Both Habib et al. [17] and Bouma-Sims et al. [12] found that users struggled to select the correct definition for functional and performance cookie categories, even when prompted to re-review the consent interface. In both studies, less than 25% of participants initially selected the correct definition for functional cookies from four multiple choice options. This result is worse than chance, suggesting that the term actually misleads users about what functional cookies do. Moreover, Bouma-Sims et al. [12] evaluated cookie consent interfaces that included definitions of cookie categories in the initial cookie banner. However, participants who saw these notices did not perform significantly better at identifying the correct category definitions. Site operators also struggle to assign cookies to the correct category. Bollinger et al. [9] found that 36.4% of the approximately 30,000 websites they investigated had at least one cookie with an incorrectly assigned category. In a 23-participant interview study, Kyi et al. explored European users' perceptions of six cookie categories (not exactly aligned with the ICC Cookie Guide) and found category names did not clearly convey their purposes [23]. All of these results suggest that more intuitive category names are needed.

## 2.3 Nomenclature

Names are very important to give items used in our day-to-day life meaning. Willoughby [41] writes about naming conventions and semantics used in technology, mentioning the importance of semantics in the technological space and how it affects the way technology is adopted and used by the general public. He explains that "in the sphere of technology, good semantics can lead to good practice and, conversely, poor semantics can lead to poor practice." According to Willoughby, language is said to have "good semantics" if the nomenclature used has consistent definitions that can clearly describe various scenarios. "Good practice" in this context refers to technology that serves its purpose without producing negative impacts on its users, invalidating its original purpose. In the context of cookie consent, good category names are necessary to ensure users are able to quickly make decisions about the type of data collection they want to allow and to assist service providers in accurately describing their practices. However, as demonstrated by Habib et al. [17] and Bouma-Sims et al. [12], we see that users fail to distinguish between these categories and are unable to make informed decisions about cookie preferences.

Shibata et al. [35] recommend that terminology that is established to describe general categories of items must "capture the essence" of its definition. The word(s) used to describe a certain entity or category must be easy to use, as users may be uncomfortable with terms that involve too many words or long phrases consisting of heavily technical terms. They also note that users may implicitly derive meaning from some terms that go beyond their literal meaning. They refer to this as the "touch" of the word. For example, the terms "warm" and "hot" can mean the same thing but have different effects while being used to refer to something: "warm" has a "soft touch" whereas the term "hot" has a more "strong and urgent touch." Following this approach, we see that the cookie category terms "functional" and "strictly necessary," as well as a proposed alternative term "essential" all can communicate the idea of "allowing the website to perform basic functions." We need to find alternative terms that more clearly distinguish the functions that go beyond those that are considered essential according to cookie category definitions (but not necessarily users).

## 3 SURVEY 1: CROWDSOURCING NEW COOKIE TERMINOLOGY

We first conducted an exploratory survey ( $n = 50$ ) to surface new labels for the categories based on the definitions in the ICC Cookie Guide. We removed suggestions based on a number of heuristics (e.g., biased language, difficult to understand, etc.). We added additional terms through discussion among the research team. The results of this survey were the basis of subsequent surveys.

### 3.1 Methods

Participants were recruited through the Prolific crowd-working platform. We utilized Prolific's gender-balance feature to ensure that our participants were roughly evenly split between men and women. Participants had to be fluent in English and at least 18 years old. The demographics of our participants are summarized in Table 10. The full survey can be found in Appendix A.3. We presented each participant with definitions of the four cookie categories from

the ICC Cookie Guide [2] and asked them what they would call each cookie. The mean completion time was 7 minutes, 18 seconds and we compensated each participant \$1.82.

## 3.2 Results

**3.2.1 Term selection.** We received a myriad of suggestions for each category from the 50 participants. Some participants gave more than one suggestion for some categories. In total, we received 46 unique suggestions for the strictly necessary cookie category, 57 unique suggestions for the performance cookie category, 56 unique suggestions for the functional cookie category, and 43 unique suggestions for the targeting/advertising cookie category.

To create a set of candidate terms, we eliminated participant suggestions based on the following criteria:

- (1) **Biased language:** Some suggestions seemed to potentially nudge users to accept or reject a cookie. For example, the term “guardian angel,” suggested for the strictly necessary cookie category, may bias users towards accepting a cookie. The targeting/advertising category was especially susceptible to nudges towards cookie rejection, with participants suggesting terms like “nasty,” “suspicious,” “spam,” and “spy.”
- (2) **Difficult to connect to cookie definition:** A few of the proposed terms seemed irrelevant or difficult to connect to the cookie category definition. For example, we received suggestions like “sponges,” “crumbs,” and “chewy” for various cookie categories. We believed that these terms would not convey relevant meaning to users.
- (3) **Does not represent the full definition:** We discarded suggestions that seemed to explain only part of the definition. For example, “secure” was suggested by five participants as a replacement for “strictly necessary” cookies. While this may be representative of authentication or session cookies, it does not convey other types of cookies that may fall into this category.
- (4) **Easy to confuse with another cookie category:** We wanted to avoid terms that could easily be confused with another category. For example, “custom tailor” was suggested for targeting/advertising cookies. However, we realized that “custom tailor” could be confused with the functional cookie category, since functional cookies are used to provide a more personalized experience to users.
- (5) **Longer than two words.** We were interested in terms that were concise, so we eliminated any terms that were longer than two words. For example, for performance cookies, a participant suggested “track your website movement for improvement.”

Three of the researchers examined every suggested term and came to a unanimous conclusion on which terms to eliminate based on the criteria above. Once we eliminated suggested terms that had one or more of the above attributes, we were left with four alternative terms for strictly necessary cookies, three alternative terms for performance cookies, three alternative terms for functional cookies, and three alternative terms for targeting/advertising cookies:

- **Strictly Necessary:** Essential, Necessary, Required, Essential Function

- **Performance:** Analytics, Anonymous Analytics, Anonymous Metrics
- **Functional:** Personalization, Preferences, Customization
- **Targeting/Advertising:** Marketing, Personalized Advertising, and Targeted Advertising

We also brainstormed two additional terms for the functional cookies category (“Basic Function” and “Enhanced Function”) through discussions within the research team. At the end of this process, we had 23 candidate terms to test, including the four original terms and 19 alternative terms.

## 4 SURVEY 2: DEFINITION-BASED COMPREHENSION

We next conducted a within-subjects survey ( $n = 402$ ) to measure how well people were able to understand each of the candidate terms and determine whether any of the terms were perceived negatively. The results from this study were used to narrow down our list of candidate terms to a reasonable number for testing.

### 4.1 Methods

Participants were recruited and compensated in the same manner as Survey 1 (see Section 3.1). A complete list of questions asked in the survey can be found in Appendix A.4. The survey began with a series of demographic and screening questions. Participants were next presented with a subset of the candidate terms and asked to choose a definition for each term from a list of ten short definitions created by Habib et al. [17]. To control for potential order effects, question order was randomized. Due to the large number of terms, we divided the candidate terms for each category into two groups and participants were asked about one group of candidate terms along with all the ICC Cookie Guide terms.

In order to gauge user sentiment regarding each category name, we next asked participants whether they were likely to allow cookies of the type described by each of the terms for which they had selected a definition. The answer format was a three point Likert scale that included “I would always or usually reject this type of cookie (1),” “I would sometimes accept and sometimes reject this type of cookie depending on what website was asking (2),” “I would always or usually accept this type of cookie (3),” and “I do not know.”

At the end of the survey, we showed participants the definition from the ICC Cookie Guide for each cookie category (without the name of the cookie) and asked if they would accept the cookie based on this explanation. These questions helped display any contrasting sentiment from participants towards cookie terms versus their sentiment towards the complete definitions.

The study took most participants 5-6 minutes to complete and we compensated them \$1.75.

To determine whether a participant was significantly better at defining a candidate term than the original term, we used a one-sided, paired t-test to compare the mean accuracy for each candidate term against the original term ( $p \leq \alpha = 0.05$ ). For sentiment questions, we used the McNemar-Bowker Test to determine whether participants’ likelihood of always accepting, sometimes accepting, or always rejecting each term was significantly different than the

distribution for the definition ( $p \leq \alpha = 0.05$ ). For this analysis, participants who stated that they were not sure whether they would accept or reject the term or definition were excluded. The Bonferroni method was used to correct for multiple hypothesis testing. This analysis approach has some limitations. The McNemar-Bowker test does not account for the ordinality of the sentiment scale. Moreover, the sample size (and thus power) of the test varied between terms since different numbers of participants saw each term variation.

## 4.2 Results

**4.2.1 Comprehension.** Table 1 shows the complete results for the comprehension questions where participants were asked to select the correct definition for a given cookie category.

**Table 1: Proportions of correct answers for original terms and candidate terms, and the results of hypothesis tests comparing the correct proportion of each candidate term to the original term. Values with \* next to them indicate statistical significance at  $p < .05$ .**

Term	Flag	$\mu_{Flag}$	$p$ -value
<b>Strictly Necessary</b>	S	0.661	n/a
Required	A	0.786	1.000
Necessary	A	0.791	0.028*
Essential Function	A	0.676	1.000
Basic Function	A	0.667	1.000
Essential	A	0.751	0.243
<b>Performance</b>	S	0.238	n/a
Analytics	A	0.527	1.000
Anonymous analytics	A	0.671	<2e-16*
Aggregated analytics	A	0.617	4.6e-15*
Anonymous metrics	A	0.537	1.000
Statistics	A	0.567	1.000
<b>Functional</b>	S	0.069	n/a
Personalized Experience	A	0.676	<2e-16*
Preferences	A	0.592	<2e-16*
Customization	A	0.721	<2e-16*
Personalization	A	0.736	<2e-16*
Enhanced Function	A	0.139	0.284
<b>Advertising</b>	S	0.840	n/a
Targeting	A	0.363	<2e-16*
Marketing	A	0.892	0.012*
Targeted advertising	A	0.851	1.000
Personalized Advertising	A	0.806	0.797

Participants selected the correct definition for the original term “strictly necessary” cookies only 66% of the time, while they selected the correct definition of the candidate term “necessary” 79% of the time ( $p = 0.028$ ). None of the other candidate terms performed significantly better than “strictly necessary.”

As in both Habib et al. [17] and Bouma-sims et al. [12], participants performed poorly at selecting a correct definition for performance and functional cookies. Only 24% of participants correctly selected the definition of the original term “performance” cookies, while 67% selected the correct definition for the candidate term “anonymous analytics” ( $p < 2 \times 10^{-16}$ ) and 54% selected

the correct definition for the candidate term “anonymous metrics” ( $p = 4.6 \times 10^{-15}$ ). None of the other candidate terms perform significantly better than “performance.”

Only 7% of participants were able to correctly identify the definition for the original term “functional” cookies. Four of the candidate terms we tested performed significantly better. 67% of participants selected the correct definition for “personalized experience” ( $p = 2 \times 10^{-16}$ ), 59% selected the correct definition for “preferences” ( $p = 2 \times 10^{-16}$ ), 72% selected the correct definition for “customization” ( $p = 2 \times 10^{-16}$ ), and 73% selected the correct definition for “personalization” ( $p = 2 \times 10^{-16}$ ).<sup>4</sup>

In the advertising/targeting category, the ICC Cookie Guide [2] provides two terms: “targeting” or “advertising.” We looked at both the terms and since “advertising” did significantly better than targeting ( $p < 2 \times 10^{-16}$ ), we used “advertising” as the standard term in the subsequent parts of the study. Only 36% of participants correctly selected the definition for “targeting” cookies, while 84% of participants correctly selected the definition for “advertising” cookies. When “advertising” is the standard term, only “marketing” is significantly better ( $p = 0.012$ ), with 89% of participants correctly selecting the definition.

**4.2.2 Sentiment.** Figure 1 provides the complete breakdown of the likelihood of whether participants would accept or reject cookies when shown just the cookie category term and when provided the full definition. All percentages refer to the proportion of participants who did not state that they were unsure about whether they would accept or reject the cookie category.

In the strictly necessary category, when shown the definition, an overwhelming majority of participants (80.8%) indicated that they would always accept the cookie. Most terms performed similarly to the definition. Only “required” (74.9% always accepting) and “essential function” (74.8% always accepting) varied significantly from the definition. In both cases, the effect is small.

In the performance cookie category, there was much more variation in the rate of acceptance between terms. When presented with the definition, 48.2% of participants stated that they would always accept the cookie. The terms “anonymous analytics” (30.2% always accepting), “aggregated analytics” (32.0% always accepting), and “analytics” (33.7% always accepting) each had rates of acceptance that significantly varied from the definition. These three terms all include the word “analytics,” so there may be something about it that makes users more negatively disposed towards a type of cookie.

There was also considerable variation in the functional category. 38.4% of participants indicated that they would always accept the cookie when presented with the definition. The terms “functional” (59.4% always accepting), “preferences” (38.9% always accepting), and “customization” (39.7% always accepting) varied significantly with respect to the definition. The term “functional” may have been accepted so often because of users’ misconceptions about what the term meant.

<sup>4</sup>After we ran this survey we realized that the original ICC Cookie Guide uses the term “functionality” rather than “functional,” which is used by OneTrust. We re-ran the survey with 210 participants to evaluate functionality against the other candidate terms for that category. We found no significant differences in comprehension between “functional” and “functionality” ( $p = 0.1537$ ).

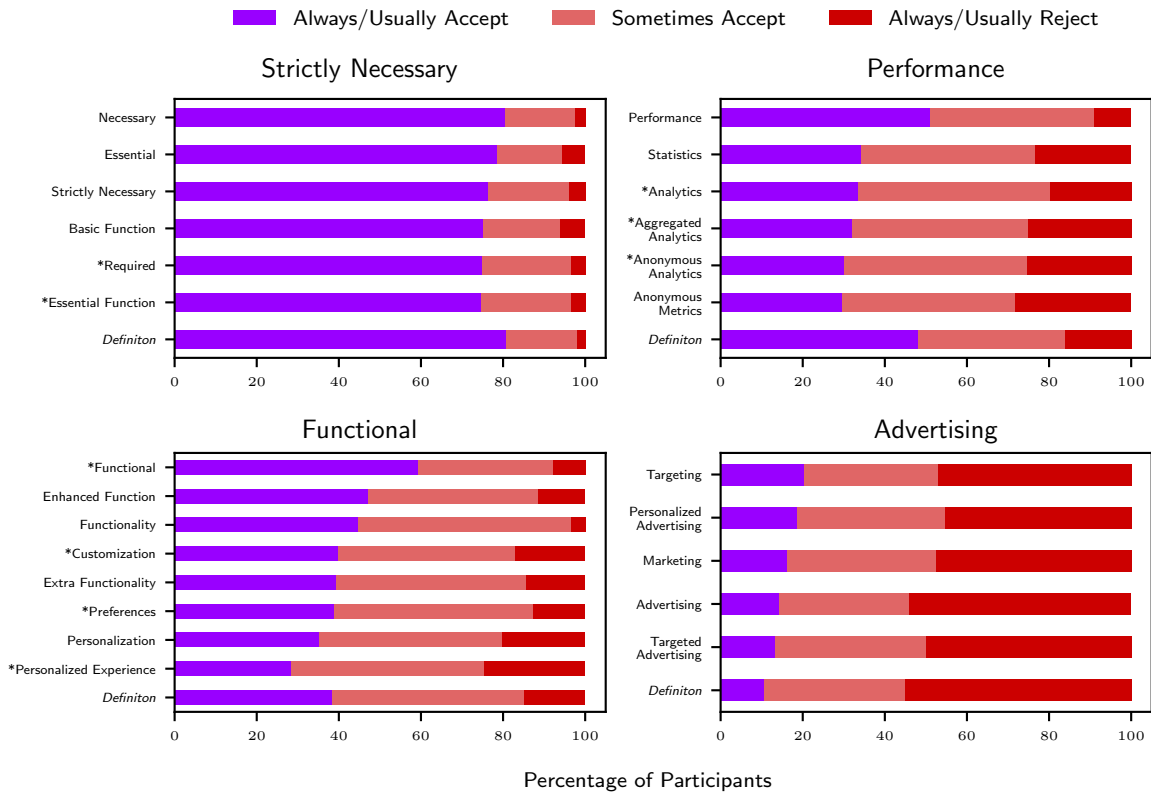


Figure 1: What participants said they would do when encountering each cookie type, excluding those who responded “I do not know” (Survey 2 sentiment questions). Results that are significantly different from the definition ( $p \leq 0.05$ ) are indicated with \*. All bars other than the definition are sorted by the percentage of participants who would always/usually accept the cookie.

Terms in the advertising category all performed similarly. Only 10.7% of participants indicated that they would accept the cookie based on the definition alone.

## 5 SURVEY 3: SCENARIO-BASED COMPREHENSION

For the third study, we ran two cookie terminology comprehension surveys in which users were presented with scenarios and asked to identify the type of cookie that was relevant to each situation.

### 5.1 Methods

We used the data from Survey 2 to eliminate candidate terms that did not significantly improve comprehension over the original terms. For our first iteration of Survey 3, we evaluated the following 15 terms:

- **Strictly Necessary:** Strictly Necessary, Necessary
- **Functional:** Functional, Personalization, Personalized Experience, Customization, Preferences
- **Performance:** Performance, Anonymous Analytics, Aggregated Analytics
- **Advertising or Targeting:** Advertising, Targeting, Marketing, Personalized Advertising, Targeted Advertising

We developed nine cookie-related scenarios that users would likely encounter in their daily life, based on cookie category descriptions and examples presented in the 2012 ICC Cookie Guide [2] and other sources such as the OneTrust Cookie Banner Guide [3]. The complete scenarios and survey questions can be found in Appendix A.5. We summarize these scenarios here:

- *Scenario S3\_SN1:* Cookies that store the items added to an online shopping cart (strictly necessary category)
- *Scenario S3\_SN2:* Cookies that help the website remember users’ cookie preferences (strictly necessary category)
- *Scenario S3\_FNC1:* Cookies that enable product reviews on a website (functional category)
- *Scenario S3\_FNC2:* Cookies that enable chatbot features on a website (functional category)
- *Scenario S3\_FNC3:* Cookies that store whether tutorials have been completed on a website (functional category)
- *Scenario S3\_PF1:* Cookies that record website visits anonymously (performance category)
- *Scenario S3\_PF2:* Cookies that record error messages encountered on a website (performance category)
- *Scenario S3\_AD1:* Cookies that track interactions with specific ads (advertising or targeting category)

- *Scenario S3\_AD2*: Cookies that track interactions with content to deliver relevant ads (advertising or targeting category)

For each participant, we randomly selected one term from the list of terms to be evaluated for each of the four categories. Then, for each scenario, we asked that participant to identify the type of cookie used, choosing from the four choices we had selected for them. To avoid potential order effects, we randomized the order of the scenarios. This is an example of how Scenario S3\_SN1 was presented to participants, with a set of randomly selected answer choices:

*Question*: Imagine that you are browsing an online clothing store for the first time. You see a couple of pieces of clothing that you are interested in, which you start adding to your shopping cart without creating an account on the website. Which of the following cookies do you believe helps the website remember the contents of your online shopping cart?

*Answer choices*: (a) Necessary, (b) Extra Functionality, (c) Anonymous Analytics, (d) Advertising

We recruited 300 participants in the same manner as in Survey 1 (see Section 3.1). We compensated participants with \$2.50. The average completion time was 5 minutes and 13 seconds.

For each scenario question, we computed a selection percentage for each term based on the number of times the term was selected by a participant divided by the number of times that term was among the answer choices offered. These percentages allowed us to analyze how often the terms were chosen correctly and incorrectly. We looked for terms that were frequently chosen correctly and infrequently chosen incorrectly.

In our first iteration of this study, none of the candidate terms for the functional category performed well: they were seldom chosen correctly for the three functional category scenarios and frequently chosen incorrectly for the two strictly necessary scenarios. To help distinguish the strictly necessary and functional cookie categories, we introduced two new candidate terms: “functionality” and “extra functionality.” We introduced “functionality” because this was recommended in the ICC Cookie Guide (websites that use OneTrust tend to use “functional”). The authors conjectured that “extra functionality” might better define the functional category by denoting that this category includes only those cookies that are not part of the core functionality of the website. We also eliminated the following under performing terms: “essential,” “required,” “essential function,” “analytics,” “anonymous metrics,” “marketing,” and “targeted advertising.”

We ran the survey again, testing the following terms with 161 participants:

- **Strictly Necessary**: Strictly Necessary, Necessary
- **Functional**: Functional, Functionality, Extra Functionality, Personalization, Personalized Experience, Customization, Preferences
- **Performance**: Performance, Anonymous Analytics
- **Advertising or Targeting**: Advertising, Personalized Advertising

In addition to the scenario-based questions, this time we also asked participants to briefly explain why they chose a particular

cookie term for that scenario. Again, participants were compensated \$2.50. The mean completion time was 10 minutes, 45 seconds.

To analyze free-response questions, we performed qualitative coding. Three of the research team members first individually reviewed the data to identify themes relevant to each category as well as themes applicable to all cookie categories.

The three team members then came together to discuss and finalize the code book (detailed in Table 9). The researchers then independently coded the first 10 records for each of the nine scenario questions. They then met to discuss and resolve any differences and update the code book accordingly. The code for each response was finalized when the three researchers reached a consensus on the corresponding code. With the final code book established, each researcher was assigned three scenario questions. Each researcher coded the rest of the responses for their assigned scenarios and identified statements that reflected a participant’s thought process and sentiment while selecting the cookie term to match a scenario.

Table 6 and 7 present the number of participants who were exposed to each term from the four cookie categories in run 1 and 2 of the survey. We ensured that each term within a category was seen a similar number of times.

## 5.2 Run 1 Results

Table 2 shows that strictly necessary cookie category terms were often confused with functional cookie terms. The strictly necessary terms were selected incorrectly in two of the functional scenarios more often than they were selected correctly in the strictly necessary scenarios. Similarly, some of the functional terms were selected incorrectly in the strictly necessary scenarios more often than they were selected correctly in the functional scenarios. While “personalized experience” was chosen as the correct answer 81.3% of the time for S3\_FNC3, it was also chosen incorrectly more than half of the time it was shown as a choice for the strictly necessary scenario questions. Similarly, “functional” performed well for the functional scenario questions, but was chosen incorrectly 47.4% of the time for S3\_SN1 and chosen incorrectly 37.2% times for S3\_SN2. We reran the survey with two new functional category terms in the hopes of clearing up participant confusion between the functional and strictly necessary categories.

The other categories each had a number of promising terms. Examining the performance cookie scenarios, we noticed that the “anonymous analytics” term was chosen correctly 84.4% and 68.6% of the time for the two performance scenarios, and was rarely chosen incorrectly in any scenario. For the advertising/targeting cookie category, we observed that all of the original and candidate terms performed fairly well, but “advertising” and “personalized advertising” performed slightly better than the other terms.

## 5.3 Run 2 Results

*Strictly Necessary Cookie Category*. From Table 3, we see that the terms from the strictly necessary cookie category performed much better compared to the first run, although they still performed worse than terms in other categories. We observed that the terms “personalized experience” and “personalization” were frequently chosen incorrectly for both the cookie preferences and shopping

**Table 2: Run 1 selection percentage for each term in each scenario. Correct selections are highlighted in bold.**

Term	S3_SN1	S3_SN2	S3_FNC1	S3_FNC2	S3_FNC3	S3_PF1	S3_PF2	S3_AD1	S3_AD2
Strictly Necessary	<b>17.3%</b>	<b>38.0%</b>	44.0%	33.3%	12.0%	24.0%	27.3%	4.6%	1.3%
Necessary	<b>20.8%</b>	<b>23.4%</b>	57.7%	63.0%	17.4%	20.1%	25.5%	2.6%	0.6%
Functional	47.4%	37.2%	<b>45.7%</b>	<b>64.6%</b>	<b>55.9%</b>	16.9%	13.5%	6.7%	3.3%
Personalization	46.6%	51.6%	<b>8.3%</b>	<b>31.6%</b>	<b>68.3%</b>	8.3%	5.0%	25.0%	18.3%
Preferences	47.5%	77.0%	<b>14.7%</b>	<b>24.5%</b>	<b>49.1%</b>	6.5%	4.9%	13.1%	1.6%
Personalized Experience	66.1%	49.1%	<b>25.4%</b>	<b>27.1%</b>	<b>81.3%</b>	11.8%	6.7%	18.6%	23.7%
Customization	36.6%	56.6%	<b>15.0%</b>	<b>33.3%</b>	<b>58.3%</b>	5.0%	13.3%	10.0%	6.6%
Performance	21.0%	7.0%	29.0%	25.0%	25.0%	<b>37.0%</b>	<b>65.0%</b>	2.0%	5.0%
Anonymous Analytics	9.1%	5.1%	8.1%	6.1%	7.1%	<b>84.8%</b>	<b>68.6%</b>	4.0%	3.0%
Aggregated Analytics	18.0%	14.0%	12.0%	11.0%	19.0%	<b>70.0%</b>	<b>50.0%</b>	4.0%	11.0%
Advertising	14.7%	4.9%	11.4%	1.6%	1.6%	4.9%	6.5%	<b>80.3%</b>	<b>81.9%</b>
Targeting	10.0%	10.0%	5.0%	1.6%	15.0%	3.3%	5.0%	<b>63.3%</b>	<b>71.6%</b>
Marketing	15.2%	5.0%	15.2%	1.6%	1.6%	3.3%	1.6%	<b>77.9%</b>	<b>84.7%</b>
Personalized Advertising	20.0%	3.3%	11.6%	1.6%	1.6%	5.0%	1.6%	<b>81.6%</b>	<b>91.6%</b>
Targeted Advertising	20.3%	6.7%	11.8%	1.6%	8.4%	5.0%	3.3%	<b>88.1%</b>	<b>79.6%</b>

**Table 3: Run 2 selection percentage for each term in each scenario. Correct selections are highlighted in bold.**

Term	S3_SN1	S3_SN2	S3_FNC1	S3_FNC2	S3_FNC3	S3_PF1	S3_PF2	S3_AD1	S3_AD2
Strictly Necessary	<b>27.2%</b>	<b>30.9%</b>	37.0%	28.4%	9.9%	14.8%	17.3%	3.7%	1.2%
Necessary	<b>31.3%</b>	<b>20.0%</b>	46.3%	45.0%	17.5%	22.5%	28.8%	3.8%	0.0%
Functional	48.2%	51.9%	<b>55.6%</b>	<b>63.0%</b>	<b>66.8%</b>	18.52%	29.6%	3.7%	3.7%
Functionality	54.6%	27.3%	<b>40.9%</b>	<b>36.4%</b>	<b>54.6%</b>	9.1%	36.4%	4.6%	4.6%
Extra Functionality	28.0%	28.0%	<b>44.0%</b>	<b>64.0%</b>	<b>48.0%</b>	8.0%	20.0%	8.0%	4.0%
Personalization	54.6%	77.3%	<b>9.1%</b>	<b>36.4%</b>	<b>81.8%</b>	4.6%	0.0%	9.1%	4.6%
Preferences	31.8%	68.9%	<b>13.6%</b>	<b>31.8%</b>	<b>45.5%</b>	4.6%	0.0%	18.2%	9.1%
Personalized Experience	71.4%	52.4%	<b>23.8%</b>	<b>38.1%</b>	<b>71.4%</b>	4.8%	4.8%	9.5%	19.1%
Customization	50.0%	50.0%	<b>9.1%</b>	<b>36.3%</b>	<b>63.6%</b>	0.0%	4.6%	4.6%	9.1%
Performance	11.5%	14.1%	34.6%	25.6%	23.1%	<b>51.3%</b>	<b>59.0%</b>	0.0%	1.3%
Anonymous Analytics	9.6%	14.5%	3.6%	8.4%	16.9%	<b>88.0%</b>	<b>62.7%</b>	8.4%	6.0%
Advertising	7.6%	8.9%	10.1%	2.5%	3.8%	3.8%	3.8%	<b>82.3%</b>	<b>88.6%</b>
Personalized Advertising	17.1%	11.0%	11.0%	1.2%	6.1%	3.7%	0.0%	<b>85.4%</b>	<b>87.8%</b>

cart scenarios. From our qualitative analysis we found that 6 participants out of the 27 who made this mistake for the shopping cart scenario (S3\_SN1) considered the shopping cart to be a “personalized feature.” One participant explained, “Shopping cart remembers what people like... including the cookies i have kept.” Another added, “These cookies aim to make my experience more personalized by remembering what I was looking at and wanted to buy.” On the other hand, a participant who correctly chose the “strictly necessary” term over the “personalized experience” term for the cookie preferences scenario (S3\_SN2) stated that “personalized experience cookies would have required an opt IN from the user.”

**Functional Cookie Category.** Three terms were chosen correctly at least 36% of the time for all three functional scenarios: “functional,” “functionality,” and “extra functionality.” However, “functional” and “functionality” were often incorrectly chosen in the strictly necessary and performance scenarios. While other candidate terms performed particularly well for one functional scenario, they performed poorly for the other two scenarios and were often

chosen incorrectly. Thus, “extra functionality” appears to offer the best balance of fairly high levels of correct selection and low levels of incorrect selection.

The most common reason for choosing “necessary” for the reviews scenario (S3\_FNC1) was that participants believed that reviews were an essential functionality of the website, with 39 participants mentioning this. One participant explained that “these (reviews) seem like a ‘necessary’ element of the page.” 18 of the participants chose the terms from the strictly necessary cookie category for the question on enabling website chatbots on similar grounds, with one participant claiming that “[necessary cookies] allow the most basic features of the website to work.” “Performance” was chosen incorrectly for the tutorial scenario (S3\_FNC3) by 18 participants because they believed that the cookie was responsible for recording the user’s performance during the tutorial or providing a smooth user experience. One participant commented, “You would utilize an initial visit and completion of tutorial which is a performance-based instance.” Another explained, “The tutorial



not being offered enhances the user experience via a performance cookie, meaning that the cookie performs a user-friendly function.”

**Performance Cookie Category.** Our results suggest that the “anonymous analytics” term is a good fit for the performance cookie category as it was chosen correctly more often than the original term “performance” for both performance scenarios. In addition, “anonymous analytics” was rarely chosen incorrectly. Participants’ explanations demonstrated that the term “anonymous analytics” fit both scenarios well. One participant wrote, “It is tracking data from a general standpoint not individually.” Terms from the other cookie categories were rarely chosen incorrectly for the performance scenarios. However, we did see that the terms “necessary,” “functional,” and “functionality” were incorrectly chosen for these scenarios somewhat more often. 16 out of the 39 participants who chose incorrectly with the above mentioned terms for scenario (S3\_PF1) all believed that the cookie helped run the website’s core functionality. On participant explained, “I think functionality cookies would be sending information about broken links and web pages that are not working because functions of the website are not displaying properly.”

**Advertising/Targeting Cookie Category.** We observed that both terms we tested in the advertising/targeting category were chosen correctly most of the time and rarely chosen incorrectly. The term “Personalized Advertising” was chosen incorrectly for the shopping cart scenario (S3\_SN1) 17.1% of the time. In addition, the term “preferences” was chosen incorrectly for the S3\_AD1 scenario 18.2% of the time. One of the participants who incorrectly chose “preferences” in the S3\_AD1 scenario explained, “I think that preference cookies would keep them from knowing what you like.” The term “personalized experience” was chosen incorrectly for the S3\_AD2 scenario 19.1%. One of these participants noted that “This personalizes the experience based on search.”

## 6 SURVEY 4 - TASK-BASED USER STUDY

For the final study, we conducted an online, between-subjects, behavioral experiment ( $n = 200$ ) to evaluate how the new cookie terms affected user experience in a realistic, e-commerce environment with cookie banners. Our methods were based on prior studies conducted by Bouma-Sims et al. [12] and Habib et al. [17]. The cookie banners we presented replicate the “baseline” condition in the Bouma-Sims et al. study.

### 6.1 Methods

Participants were recruited in the same manner as Survey 1 (see Section 3.1). Potential participants were directed to a screening survey that verified their eligibility and obtained digital informed consent. To evaluate whether the terms worked well in another English speaking context outside of the US, half of the sample was recruited from the US and half was recruited from the UK. Demographics can be found in Table 10.

After completing the informed consent form, participants were directed to the cupsnsuch.store website and asked to add a product to their shopping cart. When they first visited the website, they encountered a cookie consent interface that they were forced to interact with, implemented using the OneTrust CMP (version

202301.1.0). Participants were randomly assigned to view one of two cookie consent interfaces with different sets of category terms. The first cookie category set served as a control group and consisted of the original terms that are based on the ICC UK Cookie Guide and are currently widely used: “strictly necessary” cookies, “performance” cookies, “functional” cookies, and “advertising” cookies. The second cookie category set consisted of terms that performed well in other phases of our studies and seemed to be strong alternatives: “necessary” cookies, “anonymous analytics” cookies, “extra functionality” cookies, and “personalized advertising” cookies. Other than the difference in cookie terms, interfaces were identical (see Figure 2 for screenshots of the interfaces). Using instrumentation on the website, we recorded the amount of time participants spent on the website, the consent decision they made, all pages that they visited, and their user-agent string.

After participants added a product to their cart, they were redirected to complete a post-task survey to evaluate the usability of the consent experience and their comprehension of the category terms. Participants in both conditions saw the same survey, with the only difference being the labels given to the different types of cookies. The complete survey can be found in Appendix A.6. After a few questions assessing whether participants completed the required task (Q11 to Q14), they were asked questions to measure how aware they were of their consent decision (Q15 to Q24), including a question about what options they recall being available. For this question, we summed the number of options that the participant correctly identified as available or not available to calculate a single option recall score. They were then asked several Likert scale questions and one open-ended question meant to assess participants’ sentiment towards the consent experience (Q25 to Q27).

To assess how well participants understood the function of each cookie category, we next asked participants seven scenario questions, similar to those used in Survey 3 (Q28 to Q41). In each scenario, participants were asked which type of cookie might be responsible for a particular function of the e-commerce website they visited as part of the study. Participants were also asked to explain in a free response field why they selected a particular cookie for each scenario.

The next portion of the survey assessed participants’ ability to correctly define each cookie category term (Q42–Q46 or Q42 and Q47–Q50 depending on which condition the participant was in). We first asked participants to answer five multiple-choice questions about the definition of cookies and the cookie categories. We then directed participants back to the study website to review the cookie consent interface and answer the same comprehension questions with their previous answer choices filled in. We encouraged participants to review the cookie banner and website as they revisited their previous answers. The participants’ initial answers to the questions gave us insight into what information they acquired while initially interacting with the consent interface, while their revised answers provided insight into how well the terms and definitions conveyed information to users who took the time to review them. To distinguish between the two sets of questions, the responses prior to returning to the website are referred to as “recall comprehension,” and the responses after returning to the website are referred to as “focused comprehension.” For both recall and focused questions,

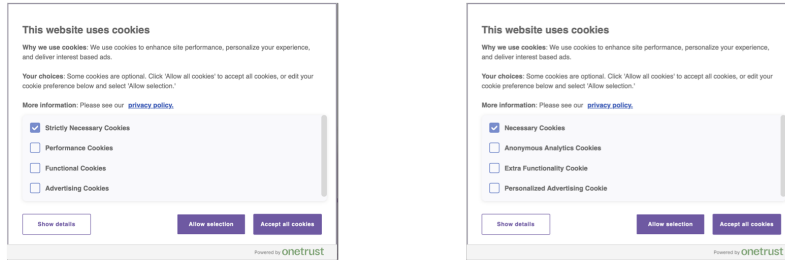


Figure 2: Left: Condition 1 cookie consent interface. Right: Condition 2 cookie consent interface.

we assigned participants a value of 1 if they correctly answered a particular question and a value of 0 otherwise.

The last set of questions (Q51 to Q55) gave participants the definition of each type of cookie and asked them to select a value on a 5-point Likert scale corresponding to which term best fits the definition: the term they saw or the term used in the other condition, with the terms fitting equally well as the middle value. Participants could also indicate that they felt neither term fit the definition. The survey concluded with an open-ended question asking for feedback on the experiment.

The average time taken for this study across the UK and US was roughly 19 minutes, 7 seconds. On average, participants spent 1 minute, 36 seconds completing the consent process and the shopping task. Participants were paid \$12.89.

## 6.2 Results

We report on the results of our quantitative and qualitative analysis here, focusing on scenario questions and comprehension. We summarize the main results of our quantitative analysis in Table 8 in the Appendix.

**6.2.1 Statistical Analysis.** For each datum collected via the post-task survey or website instrumentation (i.e., consent decision and time on website), we ran statistical tests to compare whether values varied significantly ( $p \leq \alpha = 0.05$ ) between conditions. To check for confounding effects, we also compared participants in the US and UK, male and female participants, participants in different age groups, and participants with and without previous experience in computing. We also verified that there was no significant difference in the distribution of age, gender, experience in computing, or country between the conditions. We analyzed categorical data, such as consent decisions, using Pearson’s chi-squared test or Fisher’s Exact Test.<sup>5</sup> Numerical data, such as comprehension scores, were compared using a two-sided t-test.<sup>6</sup> The Bonferoni correction was used to account for multiple hypothesis testing. This procedure is conservative, and may lead to more type II errors [40].

Through our statistical analysis, we observed that only the scenario questions and the comprehension questions varied significantly with condition. We will briefly summarize other results of

the study before focusing on the responses to the scenario and comprehension questions.

The most common consent decision was to accept only necessary cookies with 63.1% of participants selecting this option. 33.8% of participants accepted all cookies and only 1.5% of participants making a custom decision.<sup>7</sup> This result is comparable to that observed in Bouma-Sims et al.’s baseline condition, where accepting only strictly necessary cookies was also the most frequent choice [12]. While the majority (56.6%) of participants reported that they made a decision corresponding to their actual preferences, a significant proportion of participants (33.8%) indicated that they chose the easiest option to select to dismiss the banner. This is inline with prior results [12, 17], which suggest that many users interact with the banner only to get rid of it, rather than making an intentional privacy choice. As was observed by Bouma-Sims et al. [12], few participants opted to view the definitions: only 3.5% of participants clicked to open the Cookie Preference Center. This result confirms our expectation that the vast majority of users do not read cookie category definitions prior to making a consent decision.

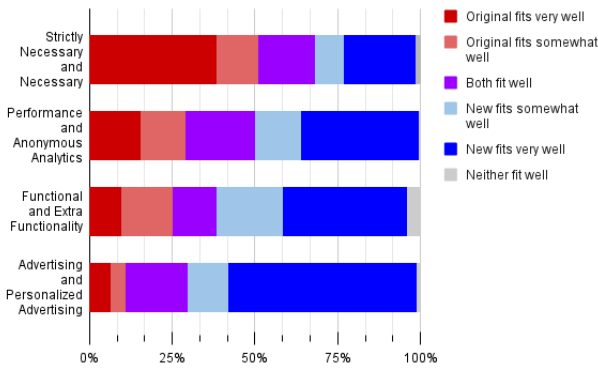
Most participants expressed positive or neutral sentiment towards the consent experience. For example, when asked to compare the consent interface to others they have seen, 40.4% of participants said that it was much or somewhat better, while 53.0% of participants said that the interface was neither better nor worse. Most participants also responded positively to a number of questions related to information in the interface. 85.9% of participants felt to an extreme or moderate extent that “text presented in the interface was clear and concise.” Similarly, 76.3% of participants reported that they felt extremely or moderately “informed about their choices related to cookies on [the study] website.” Finally, 59.6% of participants felt extremely or moderately “informed about the data being collected by cookies on the website,” while 30.3% of participants felt not at all informed. These results did not differ by condition and are generally comparable to prior work [12, 17].

We also asked participants whether they believed the original cookie term or the proposed alternative term fit the definition better. Most participants said that “strictly necessary” (51%), “extra functionality” (57.5%) and “personalized advertising” (69.5%) fit their respective definitions very well or somewhat well. This data is displayed in Figure 3.

<sup>5</sup>Fisher’s exact test was used if 20% or more of the expected values in the contingency table had less than 5 observations [22].

<sup>6</sup>We did not evaluate whether the normality or equal variance assumption held, as, the t-test is robust to violations of assumptions when dealing with large samples of approximately equal size [11].

<sup>7</sup>An additional 1.5% of participants made no decision. These participants likely configured their browser in some way that prevented the cookie consent banner from appearing (e.g., configuring an ad blocker to disable OneTrust’s JavaScript).



**Figure 3: How users felt about original terms versus new terms fitting the definition**

**6.2.2 Scenario Questions.** We found a significant difference between the old set of terms and the new terms in three cases. We saw that the alternative term performed better for S4\_SN1, S4\_SN2, and S4\_PF1. The statistical analysis results can be found in Table 4.

Breaking these results down further, we examined how many participants answered each scenario question correctly and why they chose specific answers. Figure 4 shows the percentage of participants who answered each scenario question with each term. To understand why they chose specific answers, we performed qualitative analysis through coding. We used the same codebook (found in Appendix A.9) and coding technique as we did in Survey 3 since the questions were similar. For Strictly Necessary Question

**Table 4: Results of Welch Two Sample t-test ran on scenario questions**

Question	$p$	Original Terms Condition Mean	Proposed Terms Condition Mean
S4_SN1	0.0007265	0.23	0.46*
S4_SN2	0.007533	0.22	0.48*
S4_FNC1	0.0935	0.40	0.28
S4_FNC2	0.09098	0.61	0.73
S4_PF1	$8.227 \times 10^{-12}$	0.36	0.82*
S4_PF2	0.3834	0.53	0.59
S4_AD1	0.0001129	1.00*	0.85

1 and 2, we noticed a trend of participants confusing the strictly necessary cookie category with the functional cookie category. For S4\_SN1, the shopping cart scenario, when we asked participants to explain why they chose their answer, many mentioned that they didn’t think a shopping cart was an essential feature of the website. One explained, “I’m not sure if it’s ‘necessary’ or ‘extra functionality’, but I’m leaning toward this one [extra functionality] since it seemed a bit extra to remember my shopping choices if I didn’t make an account.” Another participant who correctly chose strictly necessary explained that, “it seems like a basic function necessary to any e-commerce site.”

**Table 5: Percentage of participants who answered each comprehension question correctly in each condition. \* indicates that participants in the condition performed significantly better for a particular question as compared to those in the other condition. Complete question text can be found in Appendix A.6**

Comprehension Question	Recall		Focused	
	Old	New	Old	New
What is a cookie?	91.6%	96.1%	93.7%	99.0%*
Strictly Nec. cookies	86.3%	91.3%	90.5%	94.2%
Performance cookies	67.4%	88.4%*	79.0%	95.2%*
Functional cookies	42.1%	76.7%*	54.7%	84.5%*
Targeting cookies	99.0%	97.1%	100.0%	98.1%
Overall score	77.3%	90.0%	83.4%	94.2%

Participants also seemed to interpret “performance” in a different way than defined by the ICC UK Cookie Guide. Many participants believed that the performance cookies were used to enhance website performance. One participant explained, “I think performance cookies would be related to the performance of the website.”

**6.2.3 Comprehension.** For both recall and focused comprehension, participants were significantly better at identifying the correct definition for the performance cookie category when it was labeled as “anonymous analytics” cookies rather than “performance” cookies (Recall  $p = 3.83 \times 10^{-4}$ , Focused  $p = 7.745 \times 10^{-4}$ ). Similarly, participants performed significantly better at picking the correct definition when the functional cookies category was labeled as “extra functionality” cookies, rather than “functional” cookies (Recall  $p = 4.17 \times 10^{-7}$ , Focused  $p = 4.35 \times 10^{-6}$ ). These results support the hypothesis that these new terms are better able to intuitively convey the intended definition of the functional and performance cookie categories.

Participants who observed the new terms also performed significantly better at selecting the correct definition of cookies in the focused comprehension section, but the effect size is small ( $p = 0.0492$ ). As there is no difference in the explanation of cookies between the conditions, this result may be a type I error.

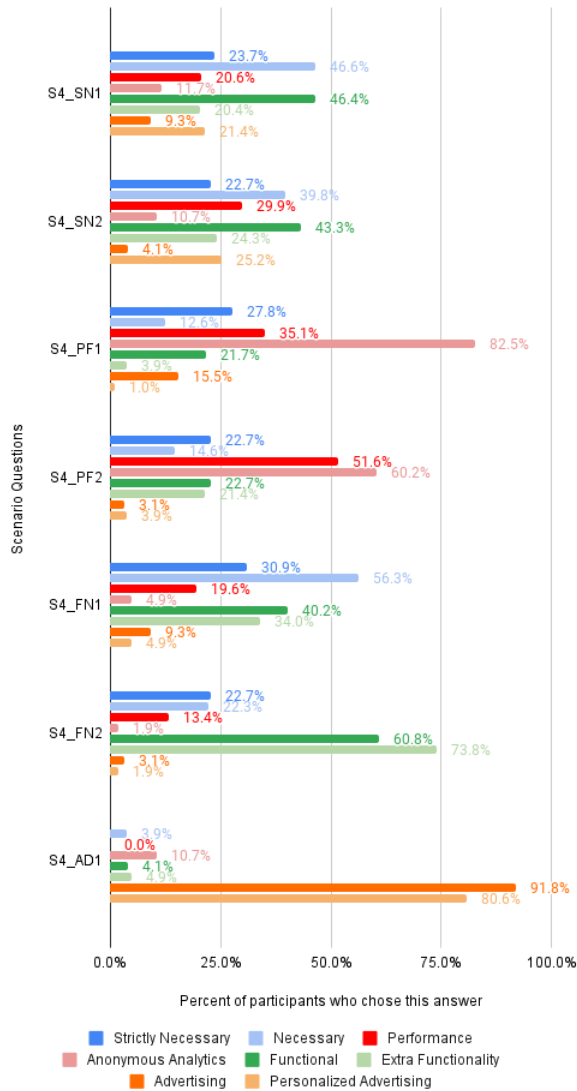
Participants performed well at identifying the strictly necessary and targeting categories, regardless of the label given to them. This is in line with prior results in which participants defined these categories with a high degree of accuracy [12, 17].

## 7 DISCUSSION

In this section, we discuss our results. We first outline the limitations of our methods and then describe recommendations that follow from our findings.

### 7.1 Limitations

We used Prolific to recruit participants, and our samples are not representative of the US or UK population. Prolific users tend to have a higher level of knowledge about security and privacy issues when compared to the general population [36]. We were able to test only a limited number of combinations of terms and other pairings



**Figure 4: Percentage of survey 4 participants who answered each scenario question with each term (note that participants were shown a set of four terms with only one term from each pair of terms)**

of terms may lead to different results. While our fourth survey should have higher ecological validity, all studies were conducted in a research environment that may lead users to behave differently than they normally would when encountering cookie consent interfaces. For example, some users in Bouma-Sims et al. [12] reported that they accepted all cookies to ensure that the study functioned correctly.

## 7.2 Recommendations

Based on the results of our four studies, we recommend changes to two of the four category terms used in the ICC Cookie Guide.

However, we recognize there are flaws in this categorization and recommend that these four categories should be revisited.

**7.2.1 Rename “Functional” to “Extra Functionality.”** In an attempt to create a stronger distinction between strictly necessary and functional cookie categories, we tested “extra functionality” in the second run of Survey 3. We observed that “extra functionality” was less often chosen as an answer incorrectly than other alternatives, reducing confusion between the strictly necessary and functional cookie terms.

We also observed that participants preferred “extra functionality” to “functional” in Survey 4 in many of our evaluation metrics. We saw that it performed statistically better than the original term in comprehension, participants felt it fit the definition very well, it was more often chosen when it was the right answer for one of the functional scenario questions, and it was less often chosen when it was an incorrect answer. In a functional category scenario question asking which cookies were responsible to enable the functionality of a chatbot, one participant explained why they chose extra functionality: “I think, in this case it’d be extra functionality. Not everyone would need the service, and it likely wouldn’t be considered necessary to function.”

We recommend that “extra functionality” should be used to describe the functional category based on the improved comprehension and sentiment we saw from participants.

**7.2.2 Rename “Performance” to “Anonymous Analytics.”** Similar to “extra functionality,” “anonymous analytics” is a term that outperformed the original category term. The results of the first and second runs of Survey 3 (Table 3) showed that participants were more likely to choose the alternate term “anonymous analytics” over the original term, “performance” when it was the correct answer. Additionally, in Survey 4, we saw that “anonymous analytics” performed better in comprehension questions, participants felt it fit the definition better, and it performed significantly better in the scenario questions.

An interesting insight here was that even when participants answered performance scenario questions correctly, their reasoning was sometimes incorrect. For example, in Survey 3, one of the performance scenario questions asks which cookies are responsible for recording error messages for broken pages. One participant who answered “performance cookies” explained their incorrect reasoning: “I think broken pages would fit under performance cookies because it isn’t showing up as it was intended.” This participant seemed to believe that performance cookies were responsible for a website’s performance, which we saw many other participants seemed to believe as well.

Because it led to better comprehension and more correct reasoning when they chose this answer, we recommend that “anonymous analytics” replace “performance” cookies.

**7.2.3 Retain “strictly necessary” and “advertising.”** Taken as a whole, our results across all surveys suggest that the names “strictly necessary” and “advertising” perform similarly to proposed alternatives. Therefore, we recommend retaining them, although arguments could be made for their replacement.

In Survey 2 “necessary” performed better than “strictly necessary,” but in both runs of Survey 3, “strictly necessary” was more

often correctly selected for scenario SN2 while “necessary” was more often correctly selected for SN1. In addition, “necessary” was more often incorrectly selected for all three of the functional scenarios. In Survey 4, “necessary” was chosen correctly more often in both scenarios, but it was also more often chosen as an incorrect answer for one of the functional scenario questions (see Figure 4). Lastly, more participants felt “strictly necessary” fit the cookie category definition better than “necessary” (see Figure 3). Thus, the alternative “necessary” does not appear to be a clear improvement, and in some cases it causes more confusion with functional cookies.

In Survey 2, 3, and 4, “advertising” and “personalized advertising” performed similarly to each other. In Survey 4 “advertising” was a correct answer more often in the advertising scenario and less often an incorrect answer in the strictly necessary scenarios. However, a majority of Survey 4 participants believed “personalized advertising” fit the category definition better than “advertising.” Despite its popularity with participants, “personalized advertising” does not appear to improve comprehension.

**7.2.4 Revisit strictly necessary and functionality cookie categories.** The EU Commission Opinion 04/2012 defines strictly necessary cookies as those which, if disabled, will cause a functionality explicitly requested by the user to fail. [31]. These cookies must not be multi-function cookies that enable tracking or third-party data collection. Similar guidance is offered by various data protection agencies (e.g., the Austrian data protection authority [7]<sup>8</sup> and the UK [29]).

Using this definition, some of the ICC cookie guide’s defined functionality cookies could be considered strictly necessary if they are not set until a user initiates an action. For example, a chatbot cookie could be strictly necessary if it is not placed until a user interacts with the chatbot and if the chatbot cookie is not used for other purposes.

Being able to differentiate between strictly necessary and functionality cookie categories seems to require a deeper technical knowledge than an average Internet user may have which makes it difficult for users to make informed decisions on which cookies to accept or reject. For example, during Survey 3, we asked participants which cookie category enabled functionality of a chatbot. The correct answer was the functional category, but the strictly necessary category terms were often incorrectly chosen as the answer. Participants sometimes explained that they considered the chatbot a core feature of the website and this cookie was needed for it to work. We also asked participants in this survey which cookies make a shopping cart remember added items, which is strictly necessary cookies. Participants more often chose functional category cookie terms than strictly necessary category terms, which were the correct answer, and expressed doubt while doing so.

Due to this difficulty for an average user to correctly differentiate between the two categories, we recommend that they be revisited and changed in a way that is clearer. If the important distinction is whether a cookie enables third-party tracking, perhaps the strictly necessary category could be broadened to allow cookies to be placed before a user initiates an interaction (for example, to allow product reviews to show up beneath a product image automatically before a user interacts with the reviews) as long as they don’t also

allow third-party tracking. Then the functional category might be eliminated and cookies that allow third-party tracking would be classified with advertising cookies. A more thorough review should be undertaken of how cookies in the functional category are being used in practice to find a solution that would help users protect their privacy and capture distinctions that users understand and find important.

### 7.3 Future Without Third-Party Cookies

Recently, the companies behind popular web browsers have been moving away from allowing third-party cookies, which will lead to changes in how cookies are used [6]. For example, Google has proposed a Privacy Sandbox where there are no third-party cookies and instead, publishers will use a combination of APIs to target users. However, site publishers are still required to ask for user consent to be tracked [25].

Informed user consent is still essential even without third-party cookies, so understandable categories of trackers are still needed. Additionally, first-party cookies, which are cookies placed by the website that a user is browsing, will still exist. Users should still have the chance to make educated decisions on which types of information they want to share on their browser whether the information is being collected from a first-party cookie or using a new type of technology.

## 8 CONCLUSION

We conducted a four-stage study with over 1,000 total participants to find alternative cookie terms, assess the comprehension of these terms in multiple ways, and recommended changes to the current cookie category terminology. We started off by crowd-sourcing cookie category terms, and used comprehension tests to see which terms should be evaluated further. Through additional quantitative and qualitative evaluation emerged a well-performing set of alternative terms, which we further tested, by tasking participants to visit an e-commerce website that had a cookie consent interface with the original terms or the alternative terms.

Our study has improved our understanding of how users interpret cookie category terms. We found that strictly necessary and functional categories are often confused for each other, so stronger distinctions need to be made there, or alternatively they should be redefined. We found that “extra functionality” performs as a better term for the functional category than “functional.” We also found that the term “performance” can be misconstrued by participants, and a term like “anonymous analytics” seems to be better understood.

It’s important for website operators to ensure that they clearly indicate the purposes of cookies on their websites so that users are able to make educated cookie consent decisions. Our recommendations will help website operators ensure that users are able to exercise their privacy rights.

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## A APPENDIX

### A.1 International Chamber of Commerce UK Cookie Guide Terms [2]

- **Strictly Necessary Cookies:** These cookies are essential in order to enable you to move around the website and use its features, such as accessing secure areas of the website. Without these cookies, services you have asked for, like shopping baskets or e-billing, cannot be provided.
- **Performance Cookies:** These cookies collect information about how visitors use a website, for instance which pages visitors go to most often, and if they get error messages from web pages. These cookies don't collect information that identifies a visitor. All information these cookies collect is aggregated and therefore anonymous. It is only used to improve how a website works.
- **Functionality Cookies:** These cookies allow the website to remember choices you make (such as your user name, language or the region you are in) and provide enhanced, more personal features. For instance, a website may be able to provide you with local weather reports or traffic news by storing in a cookie the region in which you are currently located. These cookies can also be used to remember changes you have made to text size, fonts and other parts of web pages that you can customise. They may also be used to provide services you have asked for such as watching a video or commenting on a blog. The information these cookies collect may be anonymized and they cannot track your browsing activity on other websites.
- **Targeting Cookies/Advertising Cookies:** These cookies are used to deliver adverts more relevant to you and your interests. They are also used to limit the number of times you see an advertisement as well as help measure the effectiveness of the advertising campaigns. They are usually placed by advertising networks with the website operator's permission. They remember that you have visited a website and this information is shared with other organizations such as advertisers. Quite often targeting or advertising cookies will be linked to site functionality provided by the other organization.

### A.2 Survey Recruitment Text (Prolific)

#### Survey 1:

We are Carnegie Mellon University researchers conducting a study to find new terms or phrases to describe different website cookies. Participants will be asked to complete a 10 minute survey. The survey will ask participants to read short blocks of text and suggest terms/phrases that best describe the text.

Participants must meet the following requirements to participate:

- Age 18 years or older.
- Can speak and understand English fluently.

If you wish to participate, the Google survey will be linked below. Thank you for your interest!

#### Survey 2:

Hello Everyone!

We are CMU researchers conducting a research study analyzing

the comprehension of new cookie categories that we have crowdsourced as part of our study at Carnegie Mellon University. Participants will be asked to complete a 7 minute survey for which they will be compensated \$1.75. The survey will ask participants questions about their understanding of some new cookie categories that the researchers have formulated as part of this study.

Participants must meet the following requirements to participate:

- Age 18 years or older.
- Can speak and understand English fluently.

Thank you for your interest!

#### Survey 3:

We are Carnegie Mellon University researchers conducting a study on how people understand website cookie categories based on certain scenarios presented to them. Participants will be asked to complete a 10 minute survey.

Participants must meet the following requirements to participate:

- Age 18 years or older.
- Can speak and understand English fluently.

If you wish to participate, the Qualtrics survey will be linked below: <Qualtrics link>

Thank you for your interest!

#### Survey 4:

We are inviting you to participate in a voluntary research study evaluating the usability of online interfaces related to e-commerce. Participants must be over the age of 18 and be fluent in English. This survey should take approximately 15 minutes to complete, and participants will be compensated \$3.75. During the study, you will be asked to interact with a prototype of a website and answer questions about your experience.

### A.3 Survey 1 Questions: Crowd sourcing Cookie Category Terms Survey

#### **Consent Questions**

- (1) I am age 18 or older
  - (a) Yes
  - (b) No
- (2) I have read and understood the consent form.
  - (a) Yes
  - (b) No
- (3) I want to participate in this research and continue with the task.
  - (a) Yes
  - (b) No

#### **Demographic and Background Questions**

- (4) What is your Prolific ID? (*free response*)
- (5) What is your age group? (*single choice*)
  - (a) 18 - 24
  - (b) 25 - 34
  - (c) 35 - 44
  - (d) 45 - 54
  - (e) 55 - 64
  - (f) 65 - 74
  - (g) 75 - 84
  - (h) 85 or older



- (6) Which is your gender? (*single choice*)
- Male
  - Female
  - Non-Binary
  - Prefer to self describe (*free response*)
  - Prefer not to say
- (7) What is the highest degree or level of schooling that you have completed? (*single choice*)
- Less than high school diploma
  - High school diploma or GED
  - Some college education but no degree
  - Associate's Degree
  - Bachelor's Degree
  - Master's Degree
  - Doctorate
  - Other (*free response*)
- (8) On a scale from 1 (Extremely Unfamiliar) to 5 (Extremely Familiar), please rate your familiarity with privacy concepts (such as web cookies). (*single choice options are displayed horizontally*)
- 1 (Don't understand at all)
  - 2
  - 3
  - 4
  - 5 (Understand very well)
- (9) Which industry do you work in? For example: retail, financial, healthcare, hospitality, etc. (minimum 2 characters) (*free response*)
- (10) Do you have a background in computer science or a related technical field? This could include an education and/or a career in software engineering, computer engineering, computing technology, information technology, or management of information systems. (*single choice*)
- Yes
  - No
  - Unsure
  - Prefer not to say

#### Cookie Category Terminology Comprehension Survey

- **Instructions:** When you visit websites, you're prompted to accept or reject certain cookies. We'd like to find names for these cookies to make it easier for people to understand their purpose.

For the definition below write a term or a short phrase that you believe best reflects the cookie category definition. If you think of multiple words and short phrases, separate each word/phrase with a semi-colon (;). For example "alpha; beta cookie".

Please do not reveal any private or personally-identifiable information about yourselves OR others in your answers to the survey's open-ended questions.

#### Cookie Category Terminology

- (11) **Cookie A is defined as:** These cookies are essential in order to enable you to move around the website and use its features, such as accessing secure areas of the website. Without these cookies services you have asked for, like shopping baskets or e-billing, cannot be provided.

- What term/phrase would you suggest for cookie A?** (*free response*)
  - Explain why you wrote the term/phrase above for cookie A. (*free response*)
- (12) **Cookie B is defined as:** These cookies collect information about how visitors use a website, for instance which pages visitors go to most often, and if they get error messages from web pages. These cookies don't collect information that identifies a visitor. All information these cookies collect is aggregated and therefore anonymous. It is only used to improve how a website works.
- What term/phrase would you suggest for cookie B?** (*free response*)
  - Explain why you wrote the term/phrase above for cookie B. (*free response*)
- (13) **Cookie C is defined as:** These cookies allow the website to remember choices you make (such as your user name, language or the region you are in) and provide enhanced, more personal features. For instance, a website may be able to provide you with local weather reports or traffic news by storing in a cookie the region in which you are currently located. These cookies can also be used to remember changes you have made to text size, fonts and other parts of web pages that you can customize. They may also be used to provide services you have asked for such as watching a video or commenting on a blog. The information these cookies collect may be anonymized and they cannot track your browsing activity on other websites.
- What term/phrase would you suggest for cookie C?** (*free response*)
  - Explain why you wrote the term/phrase above for cookie C. (*free response*)
- (14) **Cookie D is defined as:** These cookies are used to deliver advertisements more relevant to you and your interests. They are also used to limit the number of times you see an advertisement as well as help measure the effectiveness of the advertising campaigns. They are usually placed by advertising networks with the website operator's permission. They remember that you have visited a website and this information is shared with other organizations such as advertisers. Quite often targeting or advertising cookies will be linked to site functionality provided by the other organizations.
- What term/phrase would you suggest for cookie D?** (*free response*)
  - Explain why you wrote the term/phrase above for cookie D. (*free response*)

## A.4 Survey 2 Questions: Comprehension of Cookie Category Terminology

### Consent Questions

- I am age 18 or older
  - Yes
  - No
- I have read and understood the consent form.
  - Yes
  - No

- (3) I want to participate in this research and continue with the task.
  - (a) Yes
  - (b) No

**Demographic and Background Questions**

- (4) What is your Prolific ID? (*free response*)
- (5) Which is your gender? (*single choice*)
  - (a) Male
  - (b) Female
  - (c) Non-Binary
  - (d) Prefer to self describe (*free response*)
  - (e) Prefer not to say
- (6) What is your age group? (*single choice*)
  - (a) 18 - 24
  - (b) 25 - 34
  - (c) 35 - 44
  - (d) 45 - 54
  - (e) 55 - 64
  - (f) 65 - 74
  - (g) 75 - 84
  - (h) 85 or older
- (7) What is the highest degree or level of schooling that you have completed? (*single choice*)
  - (a) Less than high school diploma
  - (b) High school diploma or GED
  - (c) Some college education but no degree
  - (d) Associate's Degree
  - (e) Bachelor's Degree
  - (f) Master's Degree
  - (g) Doctorate
  - (h) Other (*free response*)
- (8) On a scale from 1 (Extremely Unfamiliar) to 5 (Extremely Familiar), please rate your familiarity with privacy concepts (such as web cookies). (*single choice options are displayed horizontally*)
  - (a) 1 (Don't understand at all)
  - (b) 2
  - (c) 3
  - (d) 4
  - (e) 5 (Understand very well)
- (9) Which industry do you work in? For example: retail, financial, healthcare, hospitality, etc. (minimum 2 characters) (*free response*)
- (10) Do you have a background in computer science or a related technical field? This could include an education and/or a career in software engineering, computer engineering, computing technology, information technology, or management of information systems. (*single choice*)
  - (a) Yes
  - (b) No
  - (c) Unsure
  - (d) Prefer not to say

**Cookie Category Terminology Comprehension Survey**

- **Instructions** For the following questions, select the answer that seems the most correct. Please note that some cookie category terms that are stated in the questions are synonyms

for one another which means that you may get the same answer for multiple questions.

**Cookie Category Terminology - Cookies**

- (11) What are \_\_\_\_\_ cookies? (*single choice*)
  - (a) Cookies that are needed for the website to work properly
  - (b) Cookies that are needed for collecting certain metrics
  - (c) Cookies that are needed for determining your location
  - (d) Cookies that help personalize the website's services for you
  - (e) Cookies that are given lower priority than other cookies on the website
  - (f) Cookies that are given higher priority over other cookies on the website
  - (g) Cookies that help measure and improve website features
  - (h) Cookies that make the website run faster
  - (i) Cookies that are used for delivering personalized advertisements
  - (j) Cookies that help users navigate the website
  - (k) I don't know
- (12) Would you accept the above cookie while setting your cookie preferences on a website? (*single choice*)
  - (a) I would always or usually accept this type of cookie
  - (b) I would always or usually reject this type of cookie
  - (c) I would sometimes accept and sometimes reject this type of cookie depending on what website was asking
  - (d) I'm not sure

**Sentiment:** Please read each of the cookie definitions below and answer whether You would accept these cookies on a website that you are browsing.
- (13) These cookies are essential in order to enable you to move around the website and use its features, such as accessing secure areas of the website. Without these cookies services you have asked for, like shopping baskets or e-billing, cannot be provided. (*single choice*)
  - (a) I would always or usually accept this type of cookie
  - (b) I would always or usually reject this type of cookie
  - (c) I would sometimes accept and sometimes reject this type of cookie depending on what website was asking
  - (d) I'm not sure
- (14) These cookies collect information about how visitors use a website, for instance which pages visitors go to most often, and if they get error messages from web pages. These cookies don't collect information that identifies a visitor. All information these cookies collect is aggregated and therefore anonymous. It is only used to improve how a website works. (*single choice*)
  - (a) I would always or usually accept this type of cookie
  - (b) I would always or usually reject this type of cookie
  - (c) I would sometimes accept and sometimes reject this type of cookie depending on what website was asking
  - (d) I'm not sure
- (15) These cookies allow the website to remember choices you make (such as your user name, language or the region you are in) and provide enhanced, more personal features. For instance, a website may be able to provide you with local weather reports or traffic news by storing in a cookie the region in which you are currently located. These cookies can

also be used to remember changes you have made to text size, fonts and other parts of webpages that you can customize. They may also be used to provide services you have asked for such as watching a video or commenting on a blog. The information these cookies collect may be anonymized and they cannot track your browsing activity on other websites. (*single choice*)

- (a) I would always or usually accept this type of cookie
  - (b) I would always or usually reject this type of cookie
  - (c) I would sometimes accept and sometimes reject this type of cookie depending on what website was asking
  - (d) I'm not sure
- (16) These cookies are used to deliver advertisements more relevant to you and your interests. They are also used to limit the number of times you see an advertisement as well as help measure the effectiveness of the advertising campaigns. They are usually placed by advertising networks with the website operator's permission. They remember that you have visited a website and this information is shared with other organizations such as advertisers. Quite often targeting or advertising cookies will be linked to site functionality provided by the other organizations. (*single choice*)
- (a) I would always or usually accept this type of cookie
  - (b) I would always or usually reject this type of cookie
  - (c) I would sometimes accept and sometimes reject this type of cookie depending on what website was asking
  - (d) I'm not sure

## A.5 Survey 3 Questions: Cookie Category Terminology Comprehension using Scenarios

### Consent Questions

- (1) I am age 18 or older
  - (a) Yes
  - (b) No
- (2) I have read and understood the consent form.
  - (a) Yes
  - (b) No
- (3) I want to participate in this research and continue with the task.
  - (a) Yes
  - (b) No

### Demographic and Background Questions

- (4) What is your Prolific ID? (*free response*)
- (5) Which is your gender? (*single choice*)
  - (a) Male
  - (b) Female
  - (c) Non-Binary
  - (d) Prefer to self describe (*open box to describe*)
  - (e) Prefer not to say
- (6) What is your age group? (*single choice*)
  - (a) 18 - 24
  - (b) 25 - 34
  - (c) 35 - 44
  - (d) 45 - 54

- (e) 55 - 64
- (f) 65 - 74
- (g) 75 - 84
- (h) 85 or older

- (7) What is the highest degree or level of schooling that you have completed? (*single choice*)
  - (a) Less than high school diploma
  - (b) High school diploma or GED
  - (c) Some college education but no degree
  - (d) Associate's Degree
  - (e) Bachelor's Degree
  - (f) Master's Degree
  - (g) Doctorate
  - (h) Other (*free response*)
- (8) On a scale from 1 (Extremely Unfamiliar) to 5 (Extremely Familiar), please rate your familiarity with privacy concepts (such as web cookies). (*single choice options are displayed horizontally*)
  - (a) 1 (Don't understand at all)
  - (b) 2
  - (c) 3
  - (d) 4
  - (e) 5 (Understand very well)
- (9) Which industry do you work in? For example: retail, financial, healthcare, hospitality, etc. (minimum 2 characters) (*free response*)
- (10) Do you have a background in computer science or a related technical field? This could include an education and/or a career in software engineering, computer engineering, computing technology, information technology, or management of information systems. (*single choice*)
  - (a) Yes
  - (b) No
  - (c) Unsure
  - (d) Prefer not to say

**Cookie Scenarios Instructions:** For the following questions, select the type of cookie that you believe best fits the scenario. Please note that different questions may have the same answer choice.

### Scenario S3\_SN1

- (11) Imagine that you are browsing an online clothing store for the first time. You see a couple of pieces of clothing that you are interested in, which you start adding to your shopping cart without creating an account on the website. Which of the following cookies do you believe helps the website remember the contents of your online shopping cart? (*single choice; randomized candidate terms are shown for each of the categories*)
  - (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie

**Scenario S3\_SN2**

- (12) You visit a community events bulletin website for the first time and are greeted with a cookie banner. You can either allow or prevent the website from placing cookies on your browser. You decide to 'Decline' the website's request to set cookies and continue browsing the various events. The next week you return to the website to confirm the details of a particular event. You no longer see the cookie banner. Which of the following cookies do you think helps the website remember that you have already set your cookie settings? *(single choice; randomized candidate terms are shown for each of the categories)*
- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie

**Scenario S3\_FNC1**

- (13) You open an online shopping website and you select "Decline all cookies". You start looking at different products on the website, and notice that reviews aren't loading properly. Which cookies would allow for the reviews to load? *(single choice; randomized candidate terms are shown for each of the categories)*
- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie

**Scenario S3\_FNC2**

- (14) You are having trouble with your internet service provider and visit their web page to look for a solution. You see that they have the option of starting an online conversation with one of their agents through the website's chat bot feature. Which of the following cookies would you want to turn on so that you can access the chat bot on the page? *(single choice; randomized candidate terms are shown for each of the categories)*
- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie

**Scenario S3\_FNC3**

- (15) You visit a graphic design website to design posters for an event and accept all cookies on the website's cookie banner. The first time you visit the website you are greeted with an optional short tutorial that guides you on how to use the platform effectively. You step through the tutorial and dismiss it once you have completed it. After you are done working for the day, you close your browser window. When revisiting the website the next day, you see that the tutorial is no longer offered to you. Which cookie remembers that you have already seen the tutorial and knows not to offer it to you again? *(single choice; randomized candidate terms are shown for each of the categories)*
- (a) <Strictly Necessary> Cookie

- (b) <Functional> Cookie
- (c) <Performance> Cookie
- (d) <Advertising/Targeting> Cookie

**Scenario S3\_PF1**

- (16) Websites use cookies to understand how many users visit their websites during a day without uniquely identifying each user. Which of the following cookies do you think allows the website to use this feature? *(single choice; randomized candidate terms are shown for each of the categories)*
- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie

**Scenario S3\_PF2**

- (17) You've accepted all cookies on a website but notice that multiple pages on the website are broken and are showing you error messages. What type of cookies are recording these error messages and sending the information to the company without linking to your identity? *(single choice; randomized candidate terms are shown for each of the categories)*
- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie

**Scenario S3\_AD1**

- (18) While visiting a social media website, you see a website banner announcing a 40% price drop on a Caribbean cruise and click on the banner to learn more. After reading through the details on the cruise, you close the page for the cruise and go back to the social media website. Which cookie would you turn off to prevent the website from knowing that you're interested in a specific offer like the cruise? *(single choice; randomized candidate terms are shown for each of the categories)*
- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie

**Scenario S3\_AD2**

- (19) While browsing a travel website, you notice a pop-up promoting price drops of flights to France and click on it, which opens a new window with the details. After going back to the main travel website, you see multiple pop-ups and banners have appeared that show hotels and restaurants in Paris. Which cookie do you think is responsible for this? *(single choice; randomized candidate terms are shown for each of the categories)*
- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie

## A.6 Survey 4 Questions

### Consent Questions

- (1) I am age 18 or older
  - (a) Yes
  - (b) No
- (2) I have read and understood the consent form.
  - (a) Yes
  - (b) No
- (3) I want to participate in this research and continue with the task.
  - (a) Yes
  - (b) No

### Demographics

- (4) What is your Prolific ID? (*free response*)
- (5) Which is your gender? (*single choice*)
  - (a) Male
  - (b) Female
  - (c) Non-Binary
  - (d) Prefer to self describe (*free response*)
  - (e) Prefer not to say
- (6) What is your age group? (*single choice*)
  - (a) 18 - 24
  - (b) 25 - 34
  - (c) 35 - 44
  - (d) 45 - 54
  - (e) 55 - 64
  - (f) 65 - 74
  - (g) 75 - 84
  - (h) 85 or older
- (7) What is the highest degree or level of schooling that you have completed? (*single choice*)
  - (a) Less than high school diploma
  - (b) High school diploma or GED
  - (c) Some college education but no degree
  - (d) Associate's Degree
  - (e) Bachelor's Degree
  - (f) Master's Degree
  - (g) Doctorate
  - (h) Other (*free response*)
- (8) On a scale from 1 (Extremely Unfamiliar) to 5 (Extremely Familiar), please rate your familiarity with privacy concepts (such as web cookies). (*single choice options are displayed horizontally*)
  - (a) 1 (Don't understand at all)
  - (b) 2
  - (c) 3
  - (d) 4
  - (e) 5 (Understand very well)
- (9) Which industry do you work in? For example: retail, financial, healthcare, hospitality, etc. (minimum 2 characters) (*free response*)
- (10) Do you have a background in computer science or a related technical field? This could include an education and/or a career in software engineering, computer engineering, computing technology, information technology, or management of information systems. (*single choice*)
  - (a) Yes
  - (b) No
  - (c) Unsure
  - (d) Prefer not to say

### Task Completion

- (11) Which country are you located in? (*single choice*)
  - (a) United States
  - (b) United Kingdom
- (12) Were you able to successfully complete the task? (*single choice*)
  - (a) Yes, I added a product to my cart
  - (b) No, I skipped the task
  - (c) No, I had a technical problem (*free response*)
- (13) Which product did you select? (*If 'Yes, I added a product to my cart' was selected for previous question*) (*single choice*)
  - (a) Delicate Irish Coffee
  - (b) Insulated Espresso Bubble
  - (c) Lemon Chiller
  - (d) Stemware Essentials
  - (e) The Minimalist
  - (f) Bamboo Crystal Mug
  - (g) Hand Painted Tea
  - (h) Professional Sippy Cup
  - (i) Grandma's Diner Special
  - (j) Shinji
  - (k) I don't remember
- (14) How easy or difficult was it to shop on this website? (*single choice options are displayed horizontally*)
  - (a) Very Easy
  - (b) Somewhat Easy
  - (c) Neither Easy nor difficult
  - (d) Somewhat difficult
  - (e) Very difficult

### Awareness

- (15) Do you recall making any privacy-related decisions during your interaction with the cups n' such website? (*single choice*)
  - (a) Yes
  - (b) No
  - (c) Not sure
- (16) What was this decision about? (*If 'Yes' was selected for previous question*) (*single choice*)
  - (a) The use of cookies on the website
  - (b) The creation of a username and password for the website
  - (c) The visibility of credit card info on the website
  - (d) The use of location data while shopping on the website
  - (e) Other (*free response*)

### Awareness & Needs

- (17) When visiting cups n' such's website, you might have seen an interface related to the use of cookies. Which option(s) do you remember selecting? (*multiple choice*)
- (a) Accept all cookies
  - (b) Allow strictly necessary cookies
  - (c) Allow performance cookies
  - (d) Allow functional cookies
  - (e) Allow advertising cookies
  - (f) 'Save preferences' or 'allow selection' **without changing any options**
  - (g) Don't allow any cookies
  - (h) I didn't select any options related to the use of cookies
  - (i) I don't remember
- (18) What do you expect to happen since you selected **<displays selected option(s) from the previous question>** ? (*free response*)
- (19) What were you trying to achieve when you selected **<displays selected option(s) from the previous question>** ? (*free response*)
- (20) Why did you decide not to make a selection regarding the use of cookies on the website? (select all that apply)? (*If 'I didn't select any options related to the use of cookies' was not selected for question 17 displayed above*) (*single choice*)
- (a) I didn't notice there was a decision to make
  - (b) I didn't care what kind of cookies the website was using
  - (c) I assumed that if I didn't make a decision the website wouldn't use cookies at all
  - (d) I was in a hurry
  - (e) Other (please specify) (*free response*)
- (21) Which of the following best describes how you made your decision related to the use of cookies on the cups n' such website? (*single choice*)
- (a) I picked an option based on my actual cookie preferences
  - (b) I picked whichever option seemed easiest so the consent interface would go away
  - (c) I picked an option randomly
  - (d) Other (*free response*)
- (22) How carefully did you consider the options related to cookies on the cups n' such website? (*If 'I didn't select any options related to the use of cookies' was not selected for question 17 displayed above*) (*single choice*)
- (a) Not at all carefully
  - (b) Moderately carefully
  - (c) Extremely carefully
- (23) The cookie notice interface included some text. What did you do when you saw it? (*If 'I didn't select any options related to the use of cookies' was selected for question 17 displayed above*) (*single choice options are displayed horizontally*)
- (a) Skipped over it
  - (b) Skimmed it
  - (c) Read it carefully
- (24) What options related to cookies do you recall being available to you on this website? *Choose one for each option related to the cookie given below*
- Accept all cookies

- Allow only strictly necessary cookies
- Allow performance cookies
- Allow functional cookies
- Allow advertising cookies
- Don't allow any cookies

*Choices:*

- (a) Definitely not available
- (b) Probably not available
- (c) Not sure if available
- (d) Probably available
- (e) Definitely available

### Sentiment

- (25) To what extent do you feel... *Choose one for each sentiment given below*
- Informed about **the data being collected** by cookies on this website?
  - Text presented in the interface was **clear and concise**?
  - That this cookie consent interface **provides the choices you want** related to the use of your data?
  - Informed about **your choices related to cookies** on this website?
  - **Capable of making a decision** related to cookies on this website?
- Choices:*
- (a) Not at all
  - (b) Moderately
  - (c) Extremely
  - (d) Not sure
- (26) Compared to other cookie consent interfaces you may have seen, do you think this cookie consent interface is... (*single choice options are displayed horizontally*)
- (a) Much worse
  - (b) Somewhat worse
  - (c) Neither better nor worse
  - (d) Somewhat Better
  - (e) Much Better
  - (f) Not Sure
  - (g) I have not seen other cookie consent interfaces
- (27) Why do you feel that this cookie consent interface was **<displays selected option(s) from the previous question>** than other cookie consent interfaces you have seen? (*If 'I have not seen other cookie consent interfaces' OR 'Not Sure' was not selected for the previous question*) (*free response*)

**Cookie Scenario Instruction** For the following questions, select the type of cookie that you believe best fits the scenario. Please note that different questions may have the same answer choice. You should answer these questions without going back to the Cups N' Such website.

### Scenario S4\_SN1

- (28) Imagine that you are browsing the Cups N' Such website for the first time. You see a couple of cups that you are interested in, which you start adding to your shopping cart without creating an account on the website. Which of the following

cookies do you believe helps the website remember the contents of your online shopping cart? (*single choice; randomized candidate terms are shown for each of the categories*)

- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie
- (29) Briefly explain why you chose that type of cookie for the scenario above. (*free response*)

#### Scenario S4\_SN2

- (30) You visit the Cups N' Such website for the first time and are greeted with a cookie banner. You can either allow or prevent the website from placing cookies on your browser. You decide to accept all cookies and continue shopping for cups. The next week you return to the website to confirm the price of a cup. You no longer see the cookie banner. Which of the following cookies do you think helps the website remember that you have already set your cookie settings? (*single choice; randomized candidate terms are shown for each of the categories*)

- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie
- (31) Briefly explain why you chose that type of cookie for the scenario above. (*free response*)

#### Scenario S4\_FNC1

- (32) You open the Cups N' Such website and you select "Decline all cookies." You start looking at different products on the website, and notice that reviews aren't loading properly. Which cookies would allow for the reviews to load? (*single choice; randomized candidate terms are shown for each of the categories*)

- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie
- (33) Briefly explain why you chose that type of cookie for the scenario above. (*free response*)

#### Scenario S4\_FNC2

- (34) You have a question about the products on the Cups N' Such website and see that you have the option of starting an online conversation with the website's chat bot. Which of the following cookies would you want to accept so that you can access the chat bot on the page? (*single choice; randomized candidate terms are shown for each of the categories*)

- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie
- (35) Briefly explain why you chose that type of cookie for the scenario above. (*free response*)

#### Scenario S4\_PF1

- (36) Websites use cookies to understand how many users visit their websites during a day without uniquely identifying each user. Which of the following cookies do you think allows the website to use this feature? (*single choice; randomized candidate terms are shown for each of the categories*)

- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie
- (37) Briefly explain why you chose that type of cookie for the scenario above. (*free response*)

#### Scenario S4\_PF2

- (38) You've accepted all cookies on the Cups N' Such website but notice that multiple pages on the website are broken and are showing you error messages. What type of cookies are recording these error messages and sending the information to the company without linking to your identity? (*single choice; randomized candidate terms are shown for each of the categories*)

- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie
- (39) Briefly explain why you chose that type of cookie for the scenario above. (*free response*)

#### Scenario S4\_AD1

- (40) While visiting a social media website, you see a website banner announcing a 40% price drop on cups on the Cups N' Such website and click on the banner to learn more. After browsing the sale, you close the Cups N' Such page and go back to the social media website. Which cookie would you reject to prevent the website from knowing that you're interested in this specific sale on cups? (*single choice; randomized candidate terms are shown for each of the categories*)

- (a) <Strictly Necessary> Cookie
  - (b) <Functional> Cookie
  - (c) <Performance> Cookie
  - (d) <Advertising/Targeting> Cookie
- (41) Briefly explain why you chose that type of cookie for the scenario above. (*free response*)

#### Comprehension (recall):

Please select the definition that fits best for each of the following terms.

- (42) In the context of the web, what is a cookie? (*single choice*)
- (a) A security token for two-factor authentication
  - (b) A small piece of data stored on a computer to keep track of information such as logins or websites the user has visited previously
  - (c) A memorized secret used to confirm the identity of a user

- (d) A unique string of numbers separated by periods that identifies each computer using the Internet Protocol to communicate over a network
- (e) I don't know

For C0, Original Terms Control Group version of questions (42-45)

- (43) What are strictly necessary cookies? *(single choice)*
  - (a) Cookies that are needed for the website to work properly
  - (b) Cookies that are needed for collecting certain metrics
  - (c) Cookies that are needed for determining your location
  - (d) I don't know
- (44) What are performance cookies? *(single choice)*
  - (a) Cookies that help measure and improve website features
  - (b) Cookies that are given priority over other cookies on the website
  - (c) Cookies that make the website run faster
  - (d) I don't know
- (45) What are functional cookies? *(single choice)*
  - (a) Cookies that are needed for the website to work properly
  - (b) Cookies that help personalize the website's services for you or provides services you have asked for
  - (c) Cookies that are given lower priority than other cookies on the website
  - (d) I don't know
- (46) What are advertising cookies? *(single choice)*
  - (a) Cookies that are used for delivering personalized advertisements
  - (b) Cookies that help users navigate the website
  - (c) Cookies that are needed for determining your location
  - (d) I don't know

For C1, Testing Terms Group version of questions (46-49)

- (47) What are necessary cookies? *(single choice)*
  - (a) Cookies that are needed for the website to work properly
  - (b) Cookies that are needed for collecting certain metrics
  - (c) Cookies that are needed for determining your location
  - (d) I don't know
- (48) What are anonymous analytics cookies? *(single choice)*
  - (a) Cookies that help measure and improve website features
  - (b) Cookies that are given priority over other cookies on the website
  - (c) Cookies that make the website run faster
  - (d) I don't know
- (49) What are extra functionality cookies? *(single choice)*
  - (a) Cookies that are needed for the website to work properly
  - (b) Cookies that help personalize the website's services for you or provides services you have asked for
  - (c) Cookies that are given lower priority than other cookies on the website
  - (d) I don't know
- (50) What are personalized advertising cookies? *(single choice)*
  - (a) Cookies that are used for delivering personalized advertisements
  - (b) Cookies that help users navigate the website
  - (c) Cookies that are needed for determining your location
  - (d) I don't know

### Comprehension (review)

Open the website again in a new tab by clicking the link below and keep it open for the remainder of the survey.

<Link to website provide here>

Please answer the following questions after you review your options related to cookies.

Next, we are going to ask some of questions again with your previous answers marked. After reviewing the information provided about the use of cookies on the website, please edit your answers if you need to.

<Questions 41-49 are repeated with all the questions except 41 are displayed based on the version of website participant had interacted with earlier>

### Term Comparison

- (51) How easy or difficult was it to understand the cookie choices? *(single choice options are displayed horizontally)*
  - (a) Very easy
  - (b) Somewhat easy
  - (c) Neither easy nor difficult
  - (d) Somewhat difficult
  - (e) Very difficult
  - (f) Impossible

Please indicate which term better fits this definition:

These cookies help make a website usable by enabling basic functions like page navigation and access to secure areas of the website. The website cannot function properly without these cookies, so this category of cookies cannot be disabled. These cookies do not store any directly identifiable information.

- (52) Strictly Necessary vs. Necessary *(single choice options are displayed horizontally)*
  - (a) Strictly Necessary fits very well
  - (b) Strictly Necessary fits somewhat well
  - (c) Both Strictly Necessary and Necessary fit well
  - (d) Necessary fits somewhat well
  - (e) Necessary fits very well
  - (f) Neither Strictly Necessary nor Necessary fits well

Please indicate which term better fits this definition:

These are cookies used specifically for gathering data on how visitors use a website, which pages of a website are visited most often, or if they get error messages on web pages. These cookies monitor only the performance of the site as the user interacts with it. These cookies don't collect identifiable information on visitors, which means all the data collected is anonymous and only used to improve the functionality of a website.

- (53) Performance vs. Anonymous Analytics *(single choice options are displayed horizontally)*



- (a) Performance fits very well
- (b) Performance fits somewhat well
- (c) Both Performance and Anonymous Analytics fit well
- (d) Anonymous Analytics fits somewhat well
- (e) Anonymous Analytics fits very well
- (f) Neither Performance nor Anonymous Analytics fits well

Please indicate which term better fits this definition:

These cookies allow the provision of enhanced functionality and personalization. They may be set by the website or by third-party providers contracted by the website. They are anonymous and don't track browsing activity across other websites.

- (54) Functional vs. Extra Functionality (*single choice options are displayed horizontally*)
- (a) Functional fits very well
  - (b) Functional fits somewhat well
  - (c) Both Functional and Extra Functionality fit well
  - (d) Extra Functionality fits somewhat well
  - (e) Extra Functionality fits very well
  - (f) Neither Functional nor Extra Functionality fits well

Please indicate which term better fits this definition:

These cookies are used to display advertisements that a website or its advertising partners believe are relevant to you and your interests. These cookies may also be used to track your responses to particular ads. These cookies work by uniquely identifying your browser and device.

- (55) Advertising vs. Personalized Advertising (*single choice options are displayed horizontally*)
- (a) Advertising fits very well
  - (b) Advertising fits somewhat well
  - (c) Both Advertising and Personalized Advertising fit well
  - (d) Personalized Advertising fits somewhat well
  - (e) Personalized Advertising fits very well
  - (f) Neither Advertising nor Personalized Advertising fits well

### A.7 Survey 3 Term Counts

**Table 6: Counts of how many participants were shown each term for Run 1 of Survey 3**

Term	No. of Participants who viewed
Strictly Necessary	150
Necessary	149
Performance	100
Anonymous Analytics	99
Aggregated Analytics	100
Functional	59
Personalization	60
Preferences	61
Personalized Experience	59
Customization	60
Advertising	61
Targeting	60
Marketing	59
Personalized Advertising	60
Targeted Advertising	59

**Table 7: Counts of how many participants were shown each term for Run 2 of Survey 3**

Term	No. of Participants who viewed
Strictly Necessary	81
Necessary	80
Performance	78
Anonymous Analytics	83
Functional	27
Functionality	22
Extra Functionality	25
Personalization	22
Preferences	22
Personalized Experience	21
Customization	22
Advertising	79
Personalized Advertising	82

### A.8 Survey 4 Results

**Table 8: Comprehensive table of Survey 4 results. Percentages are bolded for the terms that were the correct answers.**

	Strictly Necessary	Necessary	Functional	Extra Functionality	Performance	Anonymous Analytics	Advertising	Personalized Advertising
Comprehension	No statistical difference	No statistical difference	Didn't perform statistically better	Performed statistically better	Didn't perform statistically better	Performed statistically better	No statistical difference	No statistical difference
Comparison	Fits very / somewhat well	Doesn't fit very nor somewhat well	Doesn't fit very nor somewhat well	Fits very / somewhat well	Doesn't fit very nor somewhat well	Fits very / somewhat well	Doesn't fit very nor somewhat well	Fits very / somewhat well
S4_SN1% Answered	<b>23.7%</b>	<b>46.6%</b>	46.4%	20.4%	20.6%	11.7%	9.3%	21.4%
S4_SN2% Answered	<b>22.7%</b>	<b>39.8%</b>	43.3%	24.3%	29.9%	10.7%	4.1%	25.2%
S4_FN1% Answered	30.9%	56.3%	<b>40.2%</b>	<b>34.0%</b>	19.6%	4.9%	9.3%	4.9%
S4_FN2% Answered	22.7%	22.3%	<b>60.8%</b>	<b>73.8%</b>	13.4%	1.9%	3.1%	1.9%
S4_PF1% Answered	27.8%	12.6%	21.7%	3.9%	<b>35.1%</b>	<b>82.5%</b>	15.5%	1.0%
S4_PF2% Answered	22.7%	14.6%	22.7%	21.4%	<b>51.6%</b>	<b>60.2%</b>	3.1%	3.9%
S4_AD1% Answered	4.1%	3.9%	4.1%	4.9%	0.0%	10.7%	<b>91.8%</b>	<b>80.6%</b>

## A.9 Code book for Surveys 3 and 4

Category	Code Name	Definition
All Categories	Good Quote	If the statement made by the participant gives a new and clear perspective behind their answer.
	Correct Term	If the participant chooses the correct answer.
	Incorrect term	If the participant chooses the incorrect answer.
	Correct reasoning	If the participant chooses the correct term and explained why the term fits in this scenario
	Incorrect reasoning	If the participant chooses the correct or incorrect term but their reasoning behind the choice is just wrong
	Unsure	If the participant is unsure of their answer
	Mismatch	If there is a mismatch between choice and reasoning
	Intuition	If the participant uses words such as 'intuition'/'seems'/'believes' in their reasoning. If they make a guess about their choice
	Sound & incorrect	If the participant's reasoning behind choosing the option makes sense but it's still incorrect/misinterpreting what the word means in a certain context
Explains functionality	Explains functionality	If the participant attempts to explain functionality of the cookie rather their own reasoning for choosing the term
Strictly Necessary Cookies Category	Necessary	If the participant expresses that the cookie is 'needed' for the website to work/function.
Performance Cookies Category	Metrics	If the participant explains that cookie is used for gathering metrics/data related to performance
	Anonymous	If the participant mentions the terms anonymous, anonymity or cookies that don't uniquely identify the individuals
Functionality Cookies Category	Function of site	If the participant explains that their reason for choosing the cookie was because it is relevant to the function/functionality of the site
	Personalized	If the participant explains that the cookie creates a personalized experience/has some personalization/remembers settings
	Optional	If the participant explains that the cookie seems to support an extra feature/ is optional/ is outside the scope of what is needed for the site to function
Advertising Cookies Category	Remembering likes	If the participant explains that the cookie remembers what you like/clicked on/browsed

**Table 9: Code book used for Qualitative Analysis of Survey 3 and Survey 4**

### A.10 Demographic Table for all Surveys

Attribute	Groups	Survey 1	Survey 2	Survey 2: Run for 'Functional'	Survey 3: Run 1	Survey 3: Run 2	Survey 4: US	Survey 4: UK
Age	18 - 24	30.0%	20.3%	21.1%	21.1%	21.7%	25.0%	17.0%
	25 - 34	40.0%	39.2%	35.7%	37.8%	42.3%	32.0%	32.0%
	35 - 44	12.0%	21.1%	21.6%	16.5%	14.9%	15.0%	23.0%
	45 - 54	10.0%	10.4%	10.3%	15.0%	8.7%	15.0%	15.0%
	55 - 64	6.0%	6.45%	9.4%	4.68%	8.07%	6.0%	11.0%
	65 - 74	2.0%	1.7%	1.9%	3.0%	4.3%	7.0%	2.0%
	75 - 84	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%
Gender	Man	50%	48.9%	46.5%	48.5%	46.6%	49.0%	49.0%
	Woman	50%	47.6%	48.4%	47.5%	50.8%	49.0%	50.0%
	Non-Binary	0.0%	2.7%	10.5%	2.0%	1.9%	1.0%	0.0%
	Other	0.0%	0.2%	2.2%	1.0%	0.0%	0.0%	0.0%
	Prefer not to say	0.0%	0.0%	9.1%	1.0%	0.6%	1.0%	1.0%
Education	Some high school	0.0%	1.7%	0.5%	1.7%	0.0%	0.0%	1.0%
	High school diploma or GED	22.0%	13.2%	12.2%	11.1%	10.6%	16.0%	19.0%
	Some college education but no degree	22.0%	28.8%	27.7%	24.1%	18.6%	25.0%	21.0%
	Associate's Degree	12.0%	9.4%	7.5%	13.7%	8.7%	10.0%	1.0%
	Bachelor's Degree	32.0%	34.7%	38.0%	31.8%	42.2%	31.0%	44.0%
	Master's Degree	10.0%	8.9%	10.8%	13.7%	15.5%	14.0%	10.0%
	Doctorate	2.0%	2.7%	2.3%	2.0%	4.4%	3.0%	1.0%
	Other	0.0%	0.5%	0.9%	1.1%	0.0%	0.0%	2.0%
Prefer not to say	0.0%	0.0%	0.0%	0.3%	0.0%	1.0%	1.0%	
Understanding of cookies	1:Don't understand at all	0.0%	4.2%	2.3%	1.7%	4.4%	8.0%	3.0%
	2	14.0%	14.2%	14.6%	13.0%	16.8%	12.0%	17.0%
	3	34.0%	45.8%	32.9%	40.5%	32.3%	35.0%	34.0%
	4	36.0%	27.5%	34.3%	33.4%	35.4%	30.0%	30.0%
	5: Understand very well	16.0%	8.3%	16.0%	11.4%	11.2%	15.0%	16.0%
Background in Tech/CS	Yes	22.0%	21.8%	26.8%	21.1%	16.8%	21.0%	20.0%
	No	78.0%	73.2%	69.0%	77.9%	74.5%	78.0%	75.0%
	Unsure	0.0%	4.0%	3.3%	4.0%	7.5%	0.0%	4.0%
	Prefer not to say	0.0%	1.0%	0.9%	0.3%	1.2%	1.0%	1.0%
<b>Total Participants</b>		50	402	210	300	161	100	100

Table 10: Participant demographics for all surveys.