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**DIRECTORATE-GENERAL FOR JUSTICE and CONSUMERS** 

Directorate E: Consumers

Unit E3: Consumer enforcement and redress

Request for Specific Services JUST/2021/PR/SRED/CONS/0127 for the implementation of the Framework Contract no CHAFEA/2019/CP/01 for the provision of a

Behavioural study testing the commitments and change of practices requested from traders by the Consumer Protection Cooperation Network

# 4. Cookie Banner: Two online experiments

Submitted by Open Evidence, London School of Economics, Brainsigns, and SGS









# **Report Summary**

The first objective of the studies is to test the efficacy of different cookie banners, defined as the capacity to allow consumers to make choices in line with their preferences. Put simply, an optimal banner design should enable consumers to make choices that are consistent with their individual preferences.

The second objective of the studies is to assess the level of general recall and comprehension of the banner text, as well as the implications of user choices on the cookie banner (e.g., the impact of selecting "Accept all" on personal data use), and how different cookie banners are effective in grabbing consumers visual attention.

To address the study objectives, consumers participate in two behavioural online experiments in addition to an eye-tracking experiment. The experiments include the evaluation of six distinct banner variations: three tailored for a retailer website and three designed for a publisher website. These banners exhibit differences in two key aspects: (i) the description of the business model and (ii) the presentation of the consent buttons.

To gather a deeper understanding of how the different elements are effective in attracting users' visual attention, the study included eye-tracking measurements on an additional limited sample of consumers. This allowed determining which parts of the cookie banner for the Publisher are the most looked at by the user and how the visual attention is distributed over the banner.

Overall, results show that the positioning of buttons within banners influences user attention, with left-side buttons receiving more focus especially when dark patterns are present. Additionally, the vertical disposition of buttons directed visual attention to the buttons placed on the top compared to the bottom ones.

The cookie banner version featuring more informative text and a granular choice with three buttons, proved to be the most effective strategy in empowering users to make choices in line with their preferences. This banner performed significantly better compared to the other banners tested. In addition, in terms of users' understanding of cookie consent implications, we found that this banner increases understanding between  $\sim 5\%$  and  $\sim 10\%$  compared to the other banners tested.

When examining preferences for cookie consent frequency, most users opposed the practice of granting consent on every website visit. They favoured a model where cookie settings were saved at the browser level, reducing the need for repeated consent.

Cookie fatigue emerged as a significant concern, with a substantial proportion of users expressing frustration with frequent consent requests. Privacy concerns were evident, but practical behaviour revealed that users often disregarded consent messages for convenience.

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# 1 Introduction

This report presents the results of two online experiments, the fourth and fifth of a series of behavioural studies testing the commitments and change of practices requested from traders by the Consumer Protection Cooperation Network (CPCN). For these cases, the initiative aims to empower consumers to make informed decisions about tracking-based advertising models within the broader initiative Cookie Banner Pledge.

The primary objective of these two behavioural experiments is to provide DG JUST with empirical evidence regarding the impact of different cookie banners on consumers' ability to make informed choices about tracking-based advertising models.

These experiments explored two key variables: (1) the influence of the information provided in the banner concerning tracking-based advertising models and (2) the impact of dark patterns embedded in the buttons within the banner. Additionally, the study assessed users' comprehension of the banner text explaining how their data is handled and conducted a general survey to gauge consumers' attitudes toward the existing state of cookie banners in their online experiences and present some metrics on how users interact with the cookie banners.

To complement this research, eye-tracking recordings on an additional subsample were employed to collect insights into which banner designs were most effective in capturing users' visual attention and how users allocated their visual attention across the text and buttons displayed.

This report presents the findings of the two behavioural studies and of the eye-tracking recordings, conducted online from September to October 2023, spanning three European countries: Italy, Germany, and Poland. The studies involved more than 4,000 participants and focused on two distinct types of websites, namely, retailers and publishers.

The report's structure is as follows: Chapter 2 outlines the studies' methodology, encompassing the approach taken, the experimental protocol, and the stimuli employed, as well as the eye-tracking metrics considered. Chapter 3 provides a detailed analysis of the findings, while Chapter 4 offers a concise summary of the study's primary conclusions.

# 2 Methodology

# 2.1 General behavioural approach

This report includes the results of two behavioural experiments and an additional eye-tracking experiment. These studies and the triangulation of their findings, serve a dual purpose. Firstly, they aim to assess the effectiveness of alternative banner designs in empowering online users to make informed decisions regarding tracking-based advertising models. Therefore, the studies explore these designs for their efficacy in meeting this criterion, including their ability to capture users' visual attention and participants' interaction with the banners. Secondly, they seek to gather insights about participants' understanding of the banners, especially within the context of the business models employed, and to obtain information about their attitudes toward the current state of the banners. This includes assessing if users feel overwhelmed or fatigued by the constant need to make cookie choices, among other factors.

Behavioural Experiment 1 was conducted exclusively in Germany while Behavioural Experiment 2 was conducted in Germany, Italy, and Poland. In addition, we included a separate sample that took part in only the eye-tracking experiment. The integration of the different findings allows us to capture navigation metrics and generate an understanding of the effects of the different banners tested, both from a behavioural perspective and also from a User Experience (UX) point of view. The additional eye-tracking experiment complements the two behavioural experiments by providing valuable insights into users' visual attention and gaze patterns as they interact with the cookie banners and navigate through the websites. This eye-tracking data offers a deeper understanding of how users process and engage with the banners and the website content, shedding light on elements that capture their attention and potential areas of improvement in terms of cookie design.

## 2.1.1 Effectiveness of alternative banners

The first objective of the studies is to test the efficacy of the different banners, defined as the capacity to allow consumers to make choices in line with their preferences. Put simply, an optimal banner design should enable consumers to make choices that are consistent with their individual preferences. Our approach, known as the "transaction test," was initially developed in the context of the "Behavioural Study on Unfair Commercial Practices in the Digital Environment: dark patterns and manipulative personalisation." Although the circumstances were different, we faced a comparable challenge. In the following section, we provide a detailed explanation of our approach and experimental design.

In addition, we measured the **visual attention of users** through eye-tracking methodology, which was captured by three different metrics (see Section 2.3) As we explain in the box below, the perception alone cannot measure the efficacy of the proposed labels. However, if the eye-tracking metrics are triangulated with the above measurements, they can reinforce the results.

# A note on the efficacy of banners

Measuring efficacy through a perception test alone is not sufficient. Simply evaluating perception - even with advanced techniques like eye-tracking - does not provide enough information about consumers' actual behaviour. While perception is an important factor to consider, it cannot be the sole metric for assessing the effectiveness of banner designs. To gain a comprehensive understanding of effectiveness, we need to go further and assess how these perceptions influence user behaviour.

Evaluating efficacy solely by measuring changes in behaviour, such as the percentage of consumers accepting or rejecting all cookies, falls short of addressing the core concern. A mere increase in the share of "reject all" or "accept all" choices is somewhat empty, as the key objective is to empower users to align their decisions with their individual preferences. In essence, an ideal banner design should facilitate choices that resonate with users' unique preferences, making it imperative to go beyond simply tracking shifts in behaviour.

## 2.1.2 Banner understanding

The second objective of the studies is to assess the level of general recall and comprehension of the banner text, as well as the implications of user choices on the cookie banner (e.g., the impact of selecting "Accept all" on personal data use). The experiment evaluated the following dependent variables:

- **Correct recall of the banner text**, which measures the likelihood of consumers accurately remembering whether they clicked on "Allow" or "Don't allow" in response to the appearing popup banner.
- Correct understanding of the choices in the popup banner, which gauges the likelihood of consumers accurately grasping the consequences of selecting a specific button on the banners in terms of personal data use.

## 2.2 Experimental protocol

The main research questions that motivate the experimental design of the two experiments are the following:

- 1. **Preference consistency**: Can any of the proposed banner designs increase the likelihood that consumers make choices in line with their preferences?
- 2. **Visual attention**: Can any of the proposed banner designs increase the deployment of visual attention of the users on the text and buttons shown, measured by the eye-tracking metrics?
- 3. **Recall**: Do users correctly remember how they behave on the popup window (e.g., whether they click on "Accept all" or "Reject all")?
- 4. **Understanding**: Do users correctly understand the meaning of the text shown, and the implications of the buttons clicked on the banner in terms of data usage?
- 5. **General attitude**: What are the general attitudes that consumers have regarding the current state banner implementation?

To address these research questions, consumers participate in two online experiments with their laptops or tablets where we assess the impact of six variations of the cookie banner: three for a retailer website and three for a publisher website. Alongside a series of questions designed to measure factors such as consumer preferences regarding their data usage and their general attitudes towards the cookie banners, consumers complete three distinct tasks: a realistic online navigation task, a recall task, and an understanding task. In the following sections, we initially delineate the various banners under examination and describe the

<sup>&</sup>lt;sup>1</sup> For the retail website, we recreated a prototype similar to a well-known e-commerce platform, while for the distinguished publisher website, our model resembled a renowned online news outlet.

principal tasks of the study. Furthermore, we collect eye-tracking metrics to determine how these divergent banners perform in capturing participants' visual attention and how participants visually inspect the banner text (for detailed information, refer to Section 2.3).

## 2.2.1 Stimuli: Cookie Banner tested

The experiments include the evaluation of six distinct banner variations: three tailored for a retailer website and three designed for a publisher website (refer to Figure 1 below for visual illustrations). These banners exhibit differences in two key aspects: (i) the description of the business model and (ii) the presentation of the consent buttons.

## 2.2.1.1 Text description variations

The banners present two variations in terms of text presented:

 Baseline text: This text version seeks to mirror the current descriptions prevalent in the online sphere. It offers general information at a high level, without delving into the details of the websites' business models or the various types of cookies involved. It's essential to note that this baseline text is of a general nature and does not pertain to any specific website.

## o <u>Text used for Publisher</u>:

"If you want to continue the navigation, you have to accept cookies that will collect your navigation data and your preferences. Cookies allow us and our partners to display to you personalised ads."

## Text used for Retailer:

"We use cookies to enhance your experience on our website, and we respect your privacy.

If you agree and click "Accept all", we will store cookies on your device and use similar technologies to collect and use your personal data for advertising personalisation, measurement and analytics.

If you reject cookies, you can continue navigating but with random advertisements."

2. New text: This particular text variation is designed to offer a more comprehensive and informative alternative to the existing descriptions found in the online domain. It furnishes a more detailed and specific text, including information about (1) the business models adopted by the websites and (2) the various types of cookies in use. It's important to emphasize that these texts represent proposals and have not been implemented in the online domain as of yet.

## o <u>Text used for Publisher:</u>

"To grant you free access to this website, we obtain revenues from advertising. To this effect, you can choose the types of cookies we are allowed to place on your device:

Marketing cookies: we use and share your navigation data with third parties to present you with personalized Ads based on your profile.

Analytical cookies: we track your navigation to improve the content and features of our website and the performance of the Ads that you will see on our website but these Ads will not be based on your profile.

Do you prefer not to be tracked? Please pay a subscription of 3€ per month, check our offers on the subscription page."

## Text used for Retailer:

"We would like to collect data about your navigation. You can choose which type of cookies we are allowed to place on your device:

Marketing cookies: we use and share your navigation data with third parties to present you with personalized Ads based on your profile.

Analytical cookies: we track your navigation to improve the content and features of our website and the performance of the Ads that you will see on our website but these Ads will not be based on your profile.

No tracking"

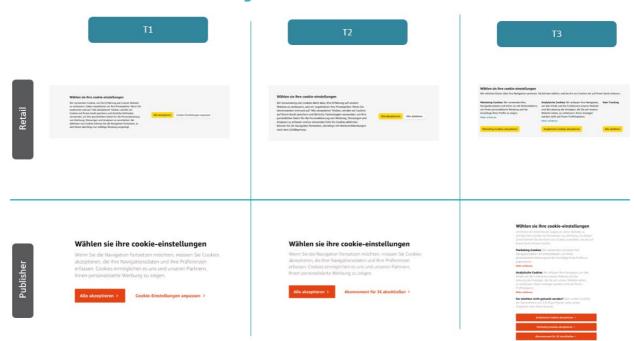
## 2.2.1.2 Consent buttons variation

The banners present three variations in terms of buttons:

- 1. **Strong Dark Pattern Present**: The inclusion of a strong dark pattern in this version is attributed to two key factors. First, the use of an attention-grabbing orange colour for the "Accept All" button creates a visual hierarchy that draws users' attention. Second, the introduction of the "Accept All" and "Other Info" options on the first layer, with the necessity of clicking on "Other Info" to access alternatives (i.e., "Reject All" for Retailer or "Subscribe" for the Publisher website), deliberately adds complexity to the decision-making process. This intentional complexity may steer users towards selecting "Accept All" due to the lack of clear and straightforward alternatives. This strong dark pattern design attempts to influence user choices in favour of accepting all cookies.
- 2. **Soft Dark Pattern Present**: In this version, the banner offers both "Accept All" and "Reject All" (or "Subscribe" for the Publisher website) options in the primary layer, removing the strong dark pattern elements from Treatment 1. While there's still a visual emphasis on "Accept All," the absence of the additional layer and complexity makes it a softer dark pattern, as users have more accessible alternatives.
- 3. **No Dark pattern + specific choice on the type of cookies**: This version, free from dark patterns, provides participants with three distinct buttons in the same layer. It is like the second version in terms of accessibility of the relevant buttons on the first layers, but additionally, users can now select the specific type of cookies they wish to accept, choosing from options like "Marketing Cookies," "Analytical Cookies," or "Reject All" (or "Subscribe" in the case of the Publisher website).

## 2.2.1.3 Cookie banners visual example

The variations in the text presented and the buttons available resulted in 6 different banners that were tested in the experiments, three for a Retailer website and three for a Publisher website. The figure below shows a visual illustration of the resulting six banners in the German version.



**Figure 1 Banners tested** 

## 2.2.2 Task 1: Online navigation task and preference consistency

In the Online navigation task, consumers first completed an instrumental part in which they replied to a series of questions aimed at **measuring their preferences in terms of data recording and usage in their online experience**. More specifically, consumers answer two specific questions at the beginning of the experiment, among other distractor questions:

- 1. Are you generally willing to enable tracking of your activity on a website and to share your browsing data with third parties, for the purpose of receiving personalized advertisements?<sup>2</sup> [Yes vs No]
- 2. Considering a newspaper that has a large readership and a good reputation, how much would you be willing to pay monthly to access all the content of a news website without shares?³ [Consumers can choose an interval e.g., "Less than €1; between €1 and €3; etc]

In the main part of this task, consumers were presented with a series of "missions" (see below for details" and received an additional bonus payment if they selected the button on the cookie banner that, among the ones presented, was the one that aligned with their stated preference. For instance, if a participant had responded "Yes" to the first question, indicating a willingness to enable tracking for personalized advertisements, a consistent behaviour would be to choose

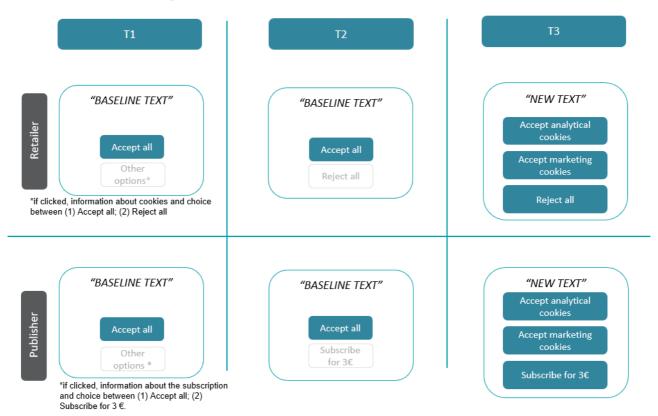
<sup>&</sup>lt;sup>2</sup> Additional description provided to participants while answering to this question: "Many websites use a business model that involves tracking tools that record users' behavior and browsing patterns and share that data with third parties for advertising purposes. For customers, this model has a cost in terms of privacy but an advantage in terms of receiving personalized advertisements that match their interests and preferences, determined by their online behavior."

<sup>&</sup>lt;sup>3</sup> Additional description provided to participants while answering to this question: "Many online publishers, such as newspapers and websites, often use a business model that involves offering their content to users for free, but on the condition that they accept tracking technologies that record their behavior and browsing patterns and share these data with third parties for advertising purposes. Alternatively, if users refuse to accept cookies, they are asked to pay a subscription fee to access the content, without having to share their data."

the button on the cookie banner that allows such tracking, e.g., "Accept All." An inconsistent behaviour would involve selecting the "Reject All" option, contradicting their stated preference. Similarly, if a participant had indicated a willingness to pay a specific monthly fee to access content without ads, a consistent behaviour in the mission would be to choose the option on the cookie banner that allows for a personalized, ad-free experience, as long as it aligns with or is less than the amount they are willing to pay.

Doing this task accurately implies that consumers can understand the main implication of selecting a given button **and make a decision in line with their preferences**.

The task comprises three distinct treatments, each featuring variations in text and buttons as described in the previous section. These treatments are administered to consumers in a **between-subjects manner**, meaning that each consumer encounters only one of the three treatments. See the figure below for a summary of the treatments.



**Figure 2 Cookie banner - Treatment variations** 

To gather a comprehensive dataset and thoroughly examine individual responses, we include **within-subject variations**, allowing us to capture diverse experiences and preferences within each participant. Specifically, within each treatment:

- Each consumer is presented with a series of six "missions," with three missions designed for a retailer website and three for a publisher website.
- The order in which these missions are presented is counterbalanced across participants, with a specific order for each type of website.
- In each mission, consumers are required to perform a specific action on the website, closely mirroring a real online experience. Participants are presented with realistic replicas of both a retailer's website and a publisher's website. When a mission begins, the cookie banner appears. It is crucial to note that while the missions serve as

instrumental tasks, our primary focus lies in understanding consumer behaviour regarding the cookie banner. Examples of missions include, but are not limited to:

- explore the news provider's website to find the latest news on a specific topic or within a particular menu.
- o pretend to have a question or issue with a product and search for customer support options, such as live chat, FAQs, or contact forms, to seek assistance.
- o change the website to another language.
- To explore how the consumers interact with the cookie banner include the following procedural variations between the retailer's and the publisher's website:
  - o For the retailer website participants can proceed with the mission without interacting with the cookie banner. For the publisher's website, participants must choose the cookie banner before continuing with their mission (i.e., making a cookie consent selection using the available buttons).
  - Additionally, the positioning and layout of the cookie banner differ between the two types of websites. On the retailer's, the cookie banner is located at the bottom of the page, with buttons arranged horizontally. In contrast, on the publisher's website, the cookie banner is centred on the page, and the buttons are organized vertically.

## 2.2.3 Task 2: Recall

In the Recall task, consumers were asked, whether they remembered what button they clicked on the banner in the last mission performed. Consumers were paid if they answered correctly.

# 2.2.4 Task 3: Understanding of the cookie banner and implication of button selection

In the Understanding task, consumers were first asked what they thought the implications of selecting that button would be. Consumers were paid if they answered correctly.

Secondly, consumers were asked several comprehension questions about the banner knowing that they would receive a bonus payment if they answered correctly; this task was structured so that consumers viewed a screenshot of the cookie banner while responding to the questions. This setup allowed us to determine if consumers could accurately grasp the meaning of the banner's text while having it readily accessible. Each consumer encountered six different banner variations, with three designed for the retailer's website and three for the publisher's websites. Participants were presented with multiple-choice incentivized questions, focusing on the consequences of selecting "Accept all" for T1 and T2, and the implications of choosing "Accept marketing cookies" in T3 (refer to Figure 1 for details).

# 2.3 Eye tracking method and metrics

To provide evidence concerning how various banner designs attract the visual attention of participants, we conducted online eye-tracking measurements with a select group of individuals. The complete sample size available for the comprehensive eye-tracking analysis comprised a total of 35 consumers whose visual attention was recorded via their laptop webcam while they viewed a screenshot of the cookie banner, each displayed for 5 seconds, with the publisher's website in the background.

Our primary emphasis was on three key eye-tracking metrics:

- **Eyeball (%)**: Percentage of subjects viewing a specific area of interest (AOI). If the eyeball is equal to 0, it means that the AOI was not seen, while if the eyeball is equal to 100, it means that the AOI was seen. Thanks to this method, it is possible to obtain the "Percentage of subjects viewing a specific area of interest (AOI)".
- **Time spent (%):** Time spent observing an area of interest compared to the total time of exposure to the stimulus. If the TS is equal to 100% sec, it means that the AOI drew the user's attention for the entire duration of the stimulus exposure.
- Time to first fixation (TTFF): Indicates the amount of time in seconds that it took a participant to look at a specific AOI from stimulus onset. If the TTFF is equal to 1 sec, it means that the AOI was seen after 1 sec, while if the TTFF is equal to 10, it means that the AOI was seen after 10 sec. This method allowed us to obtain the "amount of time in seconds that it takes a participant to look at a specific AOI from stimulus onset".

# 2.4 Hypotheses

The experimental design generates clear testable hypotheses relative to the main dependent variables. We expect that different banners have a different impact on:

- 1. The level of participants' **choice consistency, recall, and understanding.** That is, choice consistency, correct recall and understanding increase when dark patterns are removed, and more information is provided. Thus, choice consistency, recall and understanding should increase from T1 to T2, and from T2 to T3.
- 2. The deployment of **visual attention** by the consumers measured by the eye-tracking metrics as a proxy of the banner saliency. That is, consumers' attention is more likely to be grabbed when dark patterns are removed, and more information is provided. Thus, visual attention should increase from T1 to T2, and from T2 to T3.

# 3 Results

The following section summarizes the main findings of the two experiments, describing the main outcomes and their interpretation. To provide a comprehensive and detailed analysis, the results include and triangulate the findings from the different experiments (i.e., two behavioural experiments, and the online eye tracking experiment)

The total sample included a total of 4,350 consumers who completed the two behavioural experiments in their entirety divided into three European countries between 16 and 65 years old), in addition to 35 participants who only took part in the eye tracking survey. The table below summarizes the descriptive statistics for the consumers who participated in the two behavioural experiments. Below we also show a breakdown of the summary of Behavioural experiment 1 and Behavioural experiment 2, respectively.

		Germany	Italy	Poland	Total
Gender	Male	1226	600	497	2323 (52.69%)
	Female	1074	418	503	1995 (45.36%)
	N-binary	13	8	1	22 (0.66%)
	Other/prefer not to say	9	1	0	10 (0.29%)

**Table 1 Sample overall summary Behavioural experiments** 

Total	2322	1027	1001	4,350 (100%)
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The first behavioural experiment included 1,000 consumers in Germany.

**Table 2 Sample Experiment 1** 

		Germany
Gender	Male	528 (52.80%)
	Female	461 (46.10%)
	N-binary	5 (0.50%)
	Other/prefer not to say	6 (0.60%)
	Total	1,000 (100%)

The second behavioural experiment included around 1000 consumers in three European countries: Germany, Italy, and Poland.

**Table 3 Sample Experiment 2** 

		Germany	Italy	Poland	Total
Gender	Male	698	600	497	1795 (53.58%)
	Female	613	418	503	1534 (45.8%)
	N-binary	8	8	1	17 (0.51%)
	Other/prefer not to say	3	1	0	4 (0.12%)
	Total	1322	1027	1001	3,350 (100%)

The main results are presented in this section, indicating also whether they are statistically significant or not. In the Annex (Section 5.3) we included the results of the regression models conducted, which corroborate with statistical analysis the results presented in the main text.

## 3.1 Visual attention

In this section, we report the different **eye-tracking metrics** collected regarding the visual attention deployed over the different cookie banners.

We considered different areas of interest (AOIs). Specifically, for each treatment, we included in the analysis the following AOIs:

- 1. The area of the banner.
- 2. The title of the cookie banner.
- 3. The different paragraph present in the cookie banner (i.e., one paragraph in T1 and T2, and 4 different paragraphs in T4);
- 4. The buttons present (i.e., two buttons in T1 and T2, and three buttons in T3).
- 5. The area outside of the banner.

The figure below shows the *eye ball* metric, divided by the different treatment groups. This metric shows the percentage of users viewing the specific area of interest. If the eye ball is

equal to 0, it means that the AOI was not seen, while if the eye ball is equal to 100, it means that the AOI was seen by everyone.

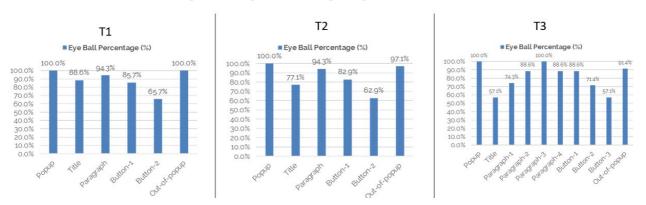


Figure 3 Eye Tracking - Eye ball metrics

The findings indicate that the **title within the cookie banner receives relatively less visual attention when compared to other Areas of Interest (AOIs)**. Notably, when we focus on Treatments 1 and 2 (T1 and T2), the positioning of the buttons appears to influence the distribution of visual attention. Specifically, **the button located on the right (Button 2) receives less visual engagement than the button placed on the left (Button 1).** 

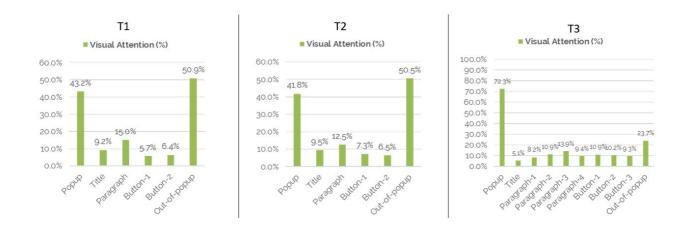
For Treatment 3 (T3), we observe distinct patterns in visual attention. The title and the paragraphs located at the top of the banner are less likely to attract attention compared to the paragraph positioned below, with the third paragraph capturing the majority of viewers' gaze. Furthermore, the vertical alignment of buttons in T3 also impacts eye-tracking metrics, as we note that the button closer to the centre of the banner (Button 1) receives more attention than the one at the very bottom (Button 3). These insights provide a detailed perspective on how visual attention is distributed across different elements of the cookie banners and how design choices influence this distribution.

The figure below shows the heatmap summarizing the deployment of visual attention over the different treatments. As illustrated in the figure, **the dark pattern present in T1 and T2**, characterized by the "Accept all" button being prominently displayed in orange while other options are in grey, **appears to be notably effective in directing consumer attention towards the "Accept all" option**. In contrast, when examining T3, consumer attention seems to be more evenly distributed across the Areas of Interest (AOIs) located at the bottom of the banner where the buttons are present, compared to the title and the first paragraph positioned toward the top of the banner.

Figure 4 Eye tracking heatmaps, by treatment

The figure below shows the *Time spent* metric (TS), divided by the treatments. This metric shows the time spent observing an area of interest compared to the total time of exposure to the stimulus. The results indicate that within the banner, the visual attention is distributed for more time to read the paragraphs, relative to the other AOIs.

Figure 5 Eye tracking - Cookie banners - Total time view



The figure below shows the *Time to first fixation* (TTFF), divided by treatment. This metric indicates the amount of time in seconds that it took a participant to look at a specific AOI from stimulus onset. If the TTFF is equal to 1 sec, it means that the AOI was seen after 1 sec.

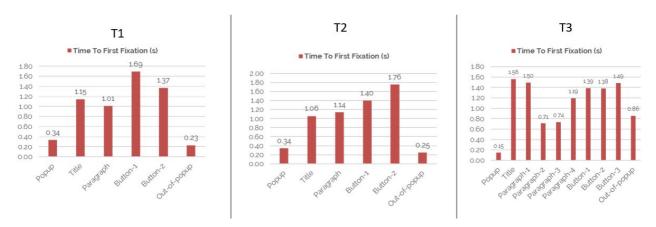


Figure 6 Eye tracking - Cookie Banners - Time to first fixation

The results show that **the paragraphs are generally viewed sooner than the other AOIs**. In T3, the AOIs that first grab visual attention are paragraphs 2 and 3, placed at the centre of the banner.

# 3.2 Understanding of the banners' text

To assess consumers' level of understanding of the implication of accepting cookies, we present here their accuracy in answering understanding questions showing the results divided by types of websites (i.e., retailer and publisher) and treatments.

The next figure shows the level of understanding of the implication of selecting "Accept all" for T1 and T2, and of accepting "Marketing cookies" for T3 for Retailer's website. The correct answers are indicated by the yellow boxes.

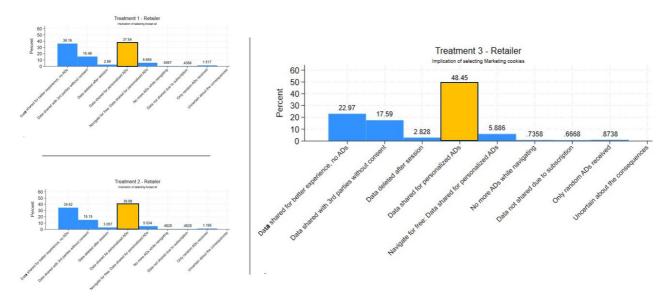


Figure 7 Banner Text understanding - Retailer website

The findings reveal that consumers generally do not understand the meaning of the shown text on the popup, as performance consistently falls below 50% in all treatments for the Retailer's website. However, **Treatment 3 has the highest performance** at 48.85%, exceeding by  $\sim 10\%$  Treatment 2 at 39.98% and Treatment 1 at 37.54% (chi-squared test, p values <0.001).

The overall results are similar also when considering the Publisher's website (see image below). In this case, the correct answers are associated with "Accept all" cookies in Treatments 1 and 2, and with "Accept Marketing cookies" in Treatment 3. The level of understanding is the highest in Treatment 3 (55.85%) compared to Treatment 2 (51.52%) and Treatment 1 (50.72%) (chi-squared test, p values <0.001).

These results suggest that introducing the new proposed text, which explains the business model and describes the use of cookies, helps consumers comprehend the implications of accepting cookies, both for the Retailer and for the Publisher websites.<sup>4</sup> Moreover, it is important to note that having the banner readily available and being in an experimental setting, where correct responses are rewarded, likely represents a higher level of understanding. In real-life scenarios, individuals may pay less attention to such notices.

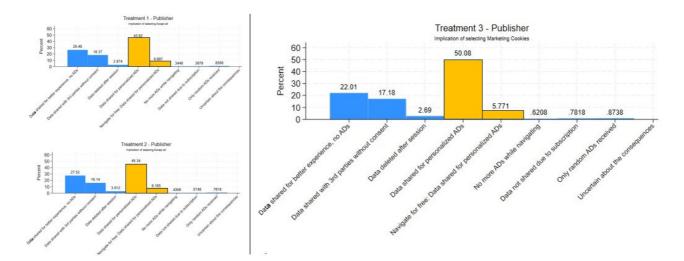


Figure 8 Banner Text understanding - Publisher website

## 3.3 Choices on the banners

The figures below provide a descriptive summary of button selection, categorizing it by website type and treatments. It's important to emphasize that this analysis serves as a description of the distribution of choices and does not constitute a test of the banners' effectiveness in empowering online users to make informed decisions regarding tracking-based advertising models. The horizontal axis displays the different buttons available, while the vertical axis represents the level of percentage associated with the clicks.

#### 3.3.1 Button selection Retailer website

The figure below illustrates the button selection for the Retailer website. In Treatment 1, the percentage of users selecting "Reject all" is lower at 17.33% compared to Treatment 2 (25.58%) and Treatment 3 (37.76%) (chi-squared test comparison across all treatments, all p values <0.001).

<sup>&</sup>lt;sup>4</sup> We note here that selecting "Accept Marketing cookies" in T3, has the same effect that selecting "Accept All" in T1, and T2.

This disparity suggests that the presence of dark patterns in the first two treatments tends to steer consumers toward choosing "Accept all" more frequently, especially prominent in Treatment 1, where the 'Reject all' button is only accessible after clicking on "Other information". Conversely, in Treatment 3, where all three buttons are readily available and presented with the same visual saliency, the buttons are more evenly selected.<sup>5</sup>

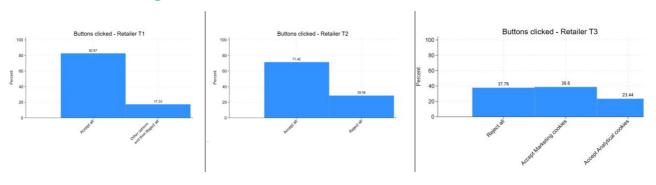


Figure 9 Button selection on the banners - Retailer

#### 3.3.2 Button selection Publisher website

For the Publisher website, the figure below shows that the percentage of users selecting "Subscribe" is lower in Treatment 1 (6.1%) compared to Treatment 2 (9.52%) and Treatment 3 (8.76%) (chi-squared test, p values <0.001). The share of "Subscribe" is similar between Treatment 2 and Treatment 3 (chi-squared test, p = 0.137). Overall, this pattern suggests that dark patterns in the first treatment push consumers toward selecting "Accept all" over "Subscribe", with Treatment 1 requiring users to navigate to the "Subscribe" button on a second

In Treatment 3, all three buttons are easily accessible, and consumers are notably more inclined to select "Accept Analytical cookies" compared to the other options.

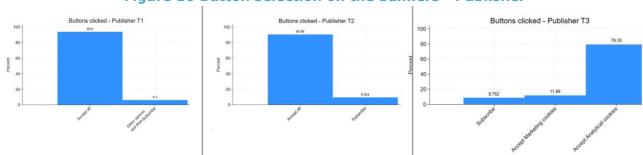


Figure 10 Button selection on the banners - Publisher

#### 3.3.3 Button selection in treatment 3

When comparing button selection in Treatment 3 between retailer and publisher, it is evident that the distribution is very different. One possible explanation is the button presentation. On the Retailer website, the buttons are placed on the same horizontal axis, with "Accept Marketing cookies" placed on the left and "Reject all" on the right. On the Publisher website,

<sup>&</sup>lt;sup>5</sup> We note however that this effect might also be driven by the presence of the "New text" in T3, compared to "Baselin text" used in T1 and T2.

the buttons are placed vertically on the banner, with "Accept Analytical cookies" at the very top, and "Subscribe" at the bottom. The vertical presentation of buttons on the Publisher website may be a contributing factor to the distinct button selection patterns observed. This layout positions 'Accept Analytical cookies' at the very top, which could potentially nudge consumers towards choosing this option by making it the most prominent and accessible. Vertical arrangements often draw attention to the uppermost element, and in this case, it may influence users to select 'Accept Analytical cookies' more frequently. While this is a speculative observation, it is also in line with the eye-tracking results presented in Section 2 showing that the visual attention is more likely to be directed to the top button in a vertical presentation.

# 3.4 Correct recall and beliefs on the implication

In the following subsections, we explore the participants' recall of their banner button selections and their understanding of the implications tied to those choices.

## 3.4.1 Correct recall button selections

The figure below illustrates the average recall of the button selected on the cookie banner during the participants' last mission. Notably, **correct recall is higher in Treatment 1 and 2 when compared to Treatment 3**. This outcome can be reasonably expected since in Treatment 3, there are three buttons as opposed to two in T1 and T2. Additionally, Treatment 3 features more text within the banner. Consequently, it's not surprising that participants are presented with more information, making it slightly more challenging for them to accurately recall their previous choices.

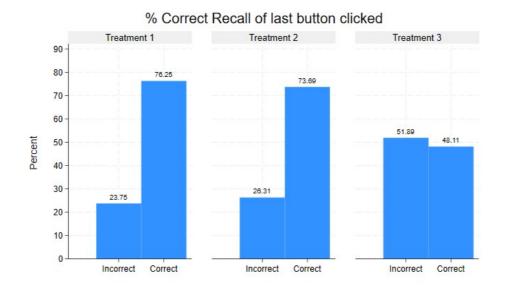


Figure 11 Recall of button selected, by treatments

# 3.4.2 Correct understanding of the implication of the button selected

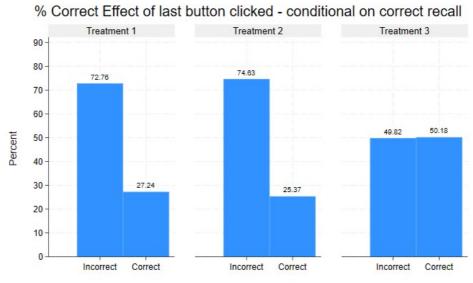
What holds greater significance is whether consumers truly grasp the implications of their chosen buttons. In this analysis, we concentrate on the button selection made during the last mission. The figure below reveals a striking finding: **participants in Treatment 3 demonstrate a considerably higher percentage of accurate comprehension regarding the implications of their last mission's button selection** (50.18%) compared to Treatment 1 (27.24%) and Treatment 2 (25.37%) (chi-squared test, p values <0.001). In

contrast, those in Treatment 1 and Treatment 2 exhibit similar levels of understanding (chi-squared test, p value=0.348).

This outcome underscores the role of Treatment 3 in enhancing participants' comprehension of their choices' consequences. The introduction of three buttons and additional text within the banner appears to have a positive impact, leading to a more comprehensive understanding of the implications associated with the selected buttons. It emphasizes the importance of clear and informative communication in these banner designs to ensure users make informed decisions.

It should be noted that this question was asked only to those participants that correctly answered the previous question (i.e., recall of the last button clicked).

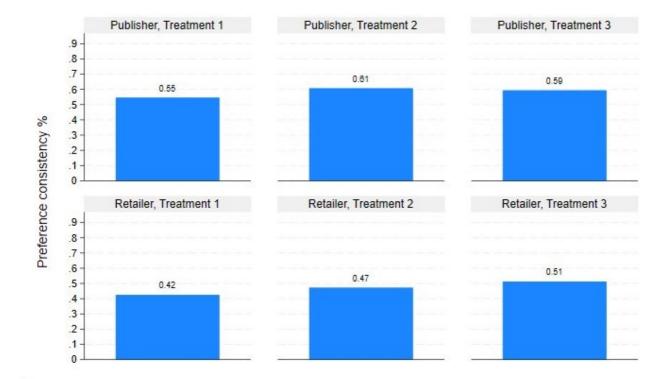
Figure 12 Correct understanding of the implication of button selection, by treatment



## 3.5 Preference consistency

To evaluate the level of consistency in consumers' choices, we assess their ability to select the button on the banner (such as "Accept all", or "Reject all") that is in line with their preferences. We use an indicator variable, which takes a value of one when the participant selects the button aligning with their stated preferences. Analysing variations observed across different cookie banners allows us to gauge the impact of these designs on preference consistency and thus determine which design is the most effective in empowering online users to make informed decisions regarding tracking-based advertising models.

The graph below depicts the average level of preference consistency among consumers across the various treatments. It uses three different banners on the horizontal axis and measures choice consistency on the vertical axis, which ranges from 0 (completely inconsistent) to 1 (perfectly consistent); results are presented divided by website type.



**Figure 13 Preference consistency** 

The graph illustrates that the average level of choice consistency across all banners is between 42% and 61%. Overall, we detect that the lowest level of preference consistency is in Treatment 1. For the Publisher, Treatment 3 is the one that empowers consumers the most to make choices in the button selection that is the most aligned with their preferences, increasing preference consistency by 4% for Publisher and 9% for Retailer, respectively, compared to Treatment 1 (p values < 0.001). Relatively to Treatment 2, Treatment 3 increases preferences consistency for the Retailer case but not for the Publisher case (p value = 0.006 and p values = 0.605, respectively; see Table 4 in Annex for details).

This finding implies that the design of Treatment 1 is relatively less effective in facilitating online users to make choices that align with their preferences in the context of tracking-based advertising models. On the other hand, incorporating a more informative text along with a more granular choice, involving three buttons instead of just one, generally proves to be the most effective strategy for empowering users in this regard.

## 3.6 General attitude towards cookie banners

In this section, we present the results of self-reported attitudes towards cookie banners.

## 3.6.1 Self-reported cookie fatigue

Cookie fatigue, often referred to as "consent fatigue" or "privacy fatigue," is a term used to describe the weariness or apathy that individuals experience when repeatedly encountering and having to make choices about online tracking cookies and data privacy settings. In the digital landscape, where websites frequently request user consent for data collection and the use of cookies, individuals can become overwhelmed by the constant barrage of consent requests. As a result, they may become desensitized to these notices and quickly click "Accept" or "Agree" without fully considering the implications of their choices.

The figure below shows how much consumers agree or disagree with two statements that aimed at capturing their level of cookie fatigue.

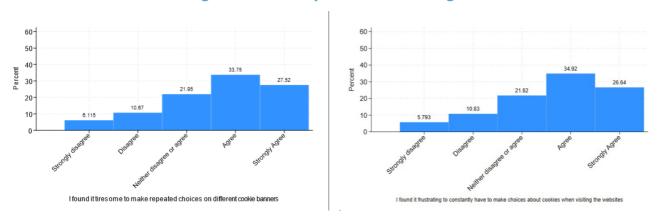


Figure 14 Self-reported cookie fatigue

The figures show a clear trend in consumer sentiment regarding the frequency of cookie consent choices when visiting websites. Results highlight that a significant proportion of consumers (more than 61%) express fatigue and frustration when faced with the necessity to make frequent cookie choices during their online interactions.

## 3.6.2 Self-reported privacy concerns and engagement with the cookie banners

This section explores the self-reported behaviours and attitudes of participants regarding cookie consent messages. We first focus on the self-reported concerns about data privacy.

The figure below shows that **most of the consumers are genuinely worried about the protection of their personal information**, with around 34% of consumers strongly disagreeing with the statement "I don't care if a website tracks my activity" and only around 5% agreeing with it.

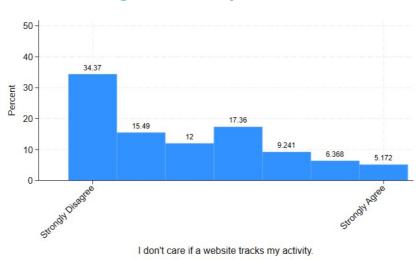


Figure 15 Privacy concerns

Despite the evident privacy concerns expressed by participants, the results shown below reveal interesting patterns in their practical behaviours when encountering cookie consent messages.

The figure below shows that a significant portion of participants (around 44% of consumers) concur with the statement that they often disregard cookie consent messages without giving them much thought. This behaviour highlights the challenge of effectively capturing user consent for data tracking, possibly due to the repetitive and often lengthy nature of these messages. Furthermore, a considerable number of participants also agree with the statement that they often accept all cookies to prevent further interruptions (46% of consumers). This preference for convenience, even at the cost of giving up some control over data privacy, highlights the significance of providing users with a more streamlined and privacy-conscious online experience.

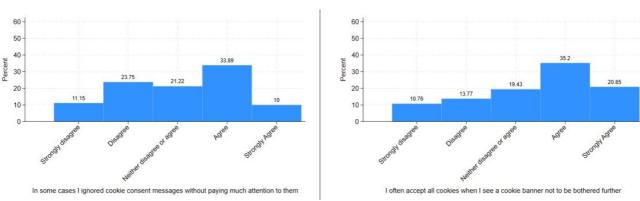


Figure 16 Self-reported engagement with the cookie banners

## 3.6.3 Preferences Regarding Frequency of Cookie Consent

This section examines user preferences regarding the frequency of providing consent for cookies. It explores consumers' attitudes and choices concerning how often they are comfortable with granting consent when encountering these consent requests.

The figure below illustrates that the majority of participants express their disagreement with a model that requests cookie consent every time they visit a website, with around 26% of consumers strongly disagreeing and only around 10% strongly agreeing. This significant preference for reducing the frequency of consent requests aligns with the earlier findings where users expressed frustration and fatigue with the recurring nature of cookie consent banners.

50 - 40 - 26.39 20 - 15.86 15.77 10.48 8.989 9.931

Figure 17 Cookie consent - Every visit

I prefer to be asked about my cookie preferences every time I visit a website.

The figures below present participants' preferences for different models of cookie consent. In the graph on the left, there is no strong consensus regarding a model where cookie settings are saved on each website for at least six months, without requiring consent every time, even though there is a slight tendency towards rejecting it (42.85% vs 40.44%).

In contrast, the graph on the right reveals a more **evident consensus in favour of a model** where cookie settings are saved at the browser level without the need for consent on **every website visit within that browser**, with around 35% of consumers strongly agreeing with such model, compared to only around 5% who disagree with it. This preference aligns with the intention to mitigate consent fatigue and frustration linked to repetitive consent requests, as discussed earlier.

The variance in results between the two questions may be influenced by two factors, which this current study is unable to disentangle: (1) the belief among consumers that making choices every six months is still too frequent, and/or (2) consumers favouring their preferences being preserved at the browser level in comparison to individual websites. Further research is needed to determine the consumer preferences over different cookie consent models.

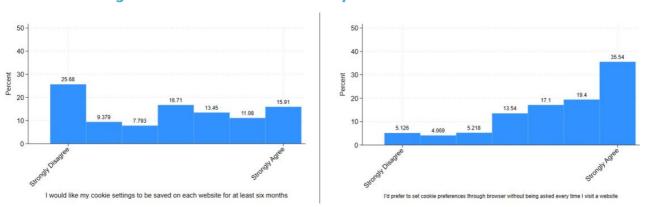


Figure 18 Cookie consent - Every six months or via browser

# 4 Conclusion

To address the study objectives, consumers participate in two online behavioural experiments, and an additional eye-tracking experiment to test the impact of three cookie banner variations that vary in the text displayed and the buttons available.

Overall, results show that the positioning of buttons within banners influences user attention, with left-side buttons receiving more focus especially when dark patterns are present. Additionally, the vertical disposition of buttons directed visual attention to the buttons placed on the top compared to the bottom ones.

The design featuring more informative text and a granular choice with three buttons, proved to be the most effective strategy in empowering users to make choices in line with their preferences significantly increasing it compared to the other designs tested. In addition, in terms of users' understanding of cookie consent implications, we found that this design increase understanding between  $\sim 5\%$  and  $\sim 10\%$  compared to the other designs tested.

When examining preferences for cookie consent frequency, **most users disagreed with the idea of granting consent on every website visit.** They favoured a model where cookie settings were saved at the browser level, reducing the need for repeated consent.

Cookie fatigue emerged as a significant concern, with a substantial proportion of users expressing frustration with frequent consent requests. Privacy concerns were evident, but practical behaviour revealed that users often disregarded consent messages for convenience.

# 5 Annex

**5.1** Consumers preferences

The following two figures show the result of preference elicitation. First, we show how much consumers would be willing to pay monthly to access all the content of a news website (consumers were instructed to think about a newspaper that has a large readership and a good reputation) without sharing their data.<sup>6</sup> Results show that around 30% of consumers are not willing to pay, and an additional 25% of consumers are willing to pay no more than 1€.

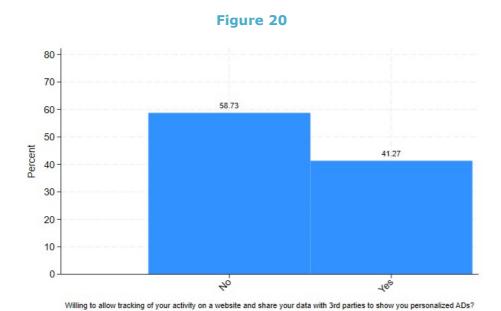
<sup>&</sup>lt;sup>6</sup> Participants also received this description: Many online publishers, such as newspapers and websites, often use a business model that involves offering their content to users for free, but on the condition that they accept tracking technologies that record their behaviour and browsing patterns and share these data with third parties for advertising purposes. Alternatively, if users refuse to accept cookies, they are asked to pay a subscription fee to access the content, without having to share their data.

60 50 40 Percent 30.37 30 25 39 21.27 20 14 05 10 6.82 2.105 More than Eld Act willing to pay 0 & . E10

Figure 19 WTP for accessing Publisher website without sharing data

WTP pay monthly for newspaper subscription if ensured access to content while protecting personal information

Second, we report whether consumers are generally willing to enable tracking of their activity on a website and to share their browsing data with third parties, to receive personalized advertisements.<sup>7</sup> Results show that most consumers (59%) are not willing to share their data to receive personalized advertisements.



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<sup>&</sup>lt;sup>7</sup> Participants also received this description: Many websites use a business model that involves tracking tools that record users' behaviour and browsing patterns and share that data with third parties for advertising purposes. For customers, this model has a cost in terms of privacy but an advantage in terms of receiving personalized advertisements that match their interests and preferences, determined by their online behaviour.

## 5.2 AOIs Banners

The figure below shows the AOIs used for computing the eye-tracking metrics for the different banners tested.

Figure 21 AOIs Banner T1

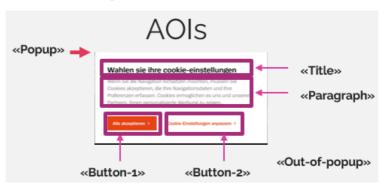
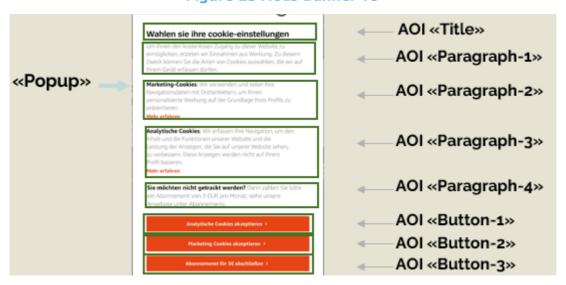


Figure 22 AOIs Banner T2



Figure 23 AOIs Banner T3



## 5.3 Regression models

To corroborate the results about preference consistency with additional analysis, we ran regression models. Regression models are useful because they allow us to test hypotheses about the relationship between variables and to estimate the size and direction of the effect of

one or more predictors on the outcome variable. They also provide a framework for controlling for other factors that might influence the outcome variable, which can help to isolate the effect of the predictor variable of interest. In the models, we use the banner design of Treatment 1 as the reference category and compare the effect of the alternative design against it.

# **5.3.1** Choice consistency

To table below shows the regression models that estimate the effect of the different banner on consumers' preference consistency, with the banner in Treatment 1 used as the reference category. Model (1) includes both websites, Model (2) the Retailer website, and Model (3) those the Publisher website. In each Model we control for sex, age, income, education, and concerns for data protection. Control variables in regression analysis are used to control for the effects of other factors that may be related to the outcome variable but are not of primary interest in the study. By including control variables in the regression model, the effects of the different banner can be estimated while holding constant the effects of the control variables.

The results from the regression models can be interpreted in percentage points: a coefficient of 0.01 means that a label is making the consumer 1 pp more likely to be consistent, and thus to correctly identify the videos. **Compared to Treatment 1**, we observe that preference consistency is higher in both Treatment 2 and 3, both for Retailer and for Publisher (p<0.001). Post test estimation also reveals that, relatively to Treatment 2, Treatment 3 increases preferences consistency for the Retailer case but not for the Publisher case (p value = 0.006 and p values = 0.605, respectively).

**Table 4 Preference consistency** 

	(1)	(2)	(3)
	Preference Consistency (Button selection) %	Preference Consistency (Button selection) %	Preference Consistency (Button selection) %
	Total	Retailer	Publisher
Treatment 2	0.05***	0.05***	0.06***
	(0.01)	(0.02)	(0.02)
Treatment 3	0.07***	0.09***	0.05***
	(0.01)	(0.01)	(0.02)
Constant	0.54***	0.36***	0.71***
	(0.03)	(0.04)	(0.05)
Observations	26,039	13,018	13,021
Controls	Yes	Yes	Yes

Random effect regression. Clustered (id) std err in parenthesis. \*p<0.1 \*\*p<0.05 \*\*\*p<0.01