



HAL
open science

The Effect of Design Patterns on (Present and Future) Cookie Consent Decisions: Supplemental Materials

Nataliia Bielova, Laura Litvine, Anysia Nguyen, Mariam Chammat, Vincent
Toubiana, Estelle Hary

► **To cite this version:**

Nataliia Bielova, Laura Litvine, Anysia Nguyen, Mariam Chammat, Vincent Toubiana, et al.. The Effect of Design Patterns on (Present and Future) Cookie Consent Decisions: Supplemental Materials. USENIX 2024 - 33rd USENIX Security Symposium, Aug 2024, Philadelphia, United States. pp.1-9. hal-04235032

HAL Id: hal-04235032

<https://inria.hal.science/hal-04235032>

Submitted on 10 Oct 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

The Effect of Design Patterns on (Present and Future) Cookie Consent Decisions: Supplemental Materials

Nataliia Bielova*

Inria research centre at Université Côte d’Azur

Anysia Nguyen

Behavioural Insights Team (BIT)

Interministerial Directorate for Public Transformation (DITP)

Vincent Toubiana†

Commission Nationale de l’Informatique et des Libertés (CNIL)

Laura Litvine

Behavioural Insights Team (BIT)

Mariam Chammat

Estelle Hary‡

RMIT University

This document provides supplemental materials directly cited in the proceedings of the USENIX Security Symposium 2024 entitled “The Effect of Design Patterns on (Present and Future) Cookie Consent Decisions” by Nataliia Bielova, Laura Litvine, Anysia Nguyen, Mariam Chammat, Vincent Toubiana and Estelle Hary.

A Consent banners design variants

Figure 1 shows designs of all banners in our experiment. While banners used in the study were in French language, here we provide English translation for all banners.

B Screenshots of the task

When participants land on the fictitious e-commerce website, they first see a cookie banner they’d have to interact with before being able to continue to the website. Figure 2 presents screenshots of examples of what the participants would see for one of the three fictitious websites offering to buy Bluetooth speakers.

C Identifying behavioral levers

Table 1 shows 18 potential designs to be tested, together with the results of the voting described in Section 3.2 of the main paper.

D User demographics

Socio-demographic data such as age, gender and professional status was automatically collected through the Cint panel

*The work was primary carried out while Nataliia Bielova was a Senior Privacy Fellow at the LINC lab of the CNIL in 2021-2022.

†The views and opinions expressed in this paper do not necessarily reflect the views of the CNIL or any individual Commissioner.

‡The work was carried out while Estelle Hary was a designer at the LINC lab of the CNIL before May 2023.

provider before participants enter the survey itself. This allowed us to better qualify the population participating in the survey and ensure that it is as similar as possible to adult users residing in France (see Section 3 of the main paper). Table 2 provides an overview of demographics of our participants.

E Results of all survey questions

We provide all the results of the survey questions presented in Appendix A of the main paper. Below is the mapping of the survey questions to the resulting tables:

- Q1: Table 3
- Q2: Table 4
- Q3: Table 5, first line
- Q4: Table 5, second line
- Q5: Table 6
- Q6: Table 7
- Q7: because of small sample size (only 66 participants have chosen to personalise), the collected data are not exploitable and interpretable and we therefore omit to present the results here.
- Q8: Table 8
- Q9: Table 9
- Q10: Table 10
- Q11: Table 11
- Q12: Table 12
- Q13: Table 13
- Q14: Table 14

Figure 1: Designs of all six consent banners evaluated in this study, translated into English.

Your cookie preferences

Our site and our partners use cookies that are placed on your device.

Some of these cookies are said to be **essential** and are strictly necessary for the proper technical functioning of the site. They include tracers that **enable audience measurement**.

If you consent, **non-essential** cookies may also be placed (you may withdraw your consent at any time). They are used to:

- accurately measure your interactions with the site in order to improve our services;
- display multimedia content from other sites;
- display personalised advertising based on your profil and browsing history;
- share content on the social networks included on our site (e.g. Facebook).

Accept all

Decline all

[Customise my choices](#)

(a) *Control banner.*

Your cookie preferences

Our site and our partners use cookies that are placed on your device.

Some of these cookies are said to be **essential** and are strictly necessary for the proper technical functioning of the site. They include tracers that **enable audience measurement**.

If you consent, **non-essential** cookies may also be placed (you may withdraw your consent at any time). They allow:

- to accurately measure your interactions with the site in order to improve our services;
- display multimedia content from other sites;
- display personalised advertising based on your profil and browsing history;
- share content on the social networks included on our site (e.g. Facebook).

Accept all

[Customise my choices](#)

(b) *No decline banner.*

Your cookie preferences

Our site and our partners use cookies that are placed on your device.

Some of these cookies are said to be **essential** and are strictly necessary for the proper technical functioning of the site. They include tracers that **enable audience measurement**.

If you consent, **non-essential** cookies may also be placed (you may withdraw your consent at any time). They are used to:

- accurately measure your interactions with the site in order to improve our services;
- display multimedia content from other sites;
- display personalised advertising based on your profil and browsing history;
- share content on the social networks included on our site (e.g. Facebook).

Accept all

Decline all

[Customise my choices](#)

(c) *Highlighted accept banner.*

Your cookie preferences

Our site and our partners use cookies that are placed on your device.

Some of these cookies are said to be **essential** and are strictly necessary for the proper technical functioning of the site. They include tracers that **enable audience measurement**.

If you consent, **non-essential** cookies may also be placed (you may withdraw your consent at any time). They are used to:

- accurately measure your interactions with the site in order to improve our services;
- display multimedia content from other sites;
- display personalised advertising based on your profil and browsing history;
- share content on the social networks included on our site (e.g. Facebook).

Decline all

Accept all

[Customise my choices](#)

(d) *Highlighted decline banner.*

Your cookie preferences

Our site and our partners use cookies that are placed on your device.

Some of these cookies are said to be **essential** and are strictly necessary for the proper technical functioning of the site. They include tracers that **enable audience measurement**.

If you consent, **non-essential** cookies may also be placed (you may withdraw your consent at any time). They are used to:

- accurately measure your interactions with the site in order to improve our services;
- display multimedia content from other sites;
- display personalised advertising based on your profil and browsing history;
- share content on the social networks included on our site (e.g. Facebook).

Accept to be traced

Continue without being traced

[Customise my choices](#)

(e) *Consequences banner.*

Your cookie preferences

Our site and our partners use cookies that are placed on your device.

Some of these cookies are said to be **essential** and are strictly necessary for the proper technical functioning of the site. They include tracers that **enable audience measurement**.

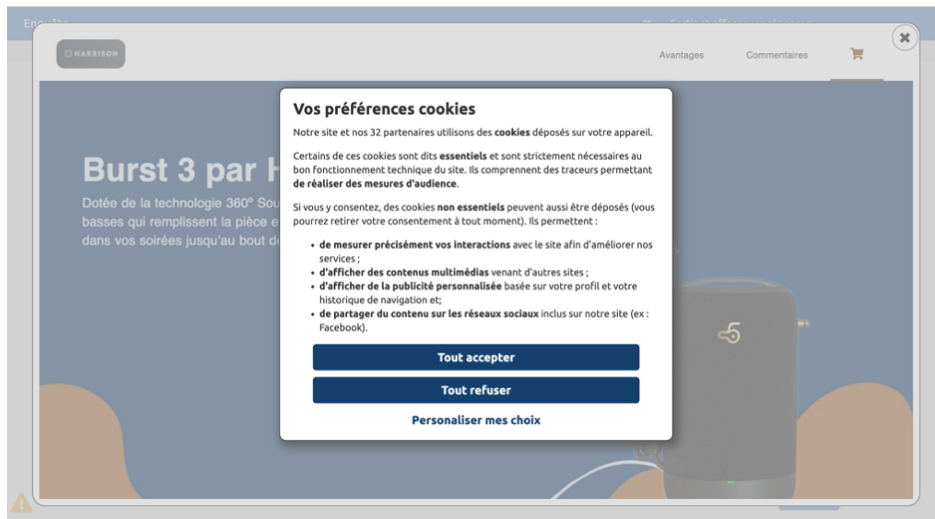
If you consent, **non-essential** cookies may also be placed (you may withdraw your consent at any time). They are used to:

- accurately measure your interactions with the site in order to improve our services;
- display multimedia content from other sites;
- display personalised advertising based on your profil and browsing history;
- share content on the social networks included on our site (e.g. Facebook).

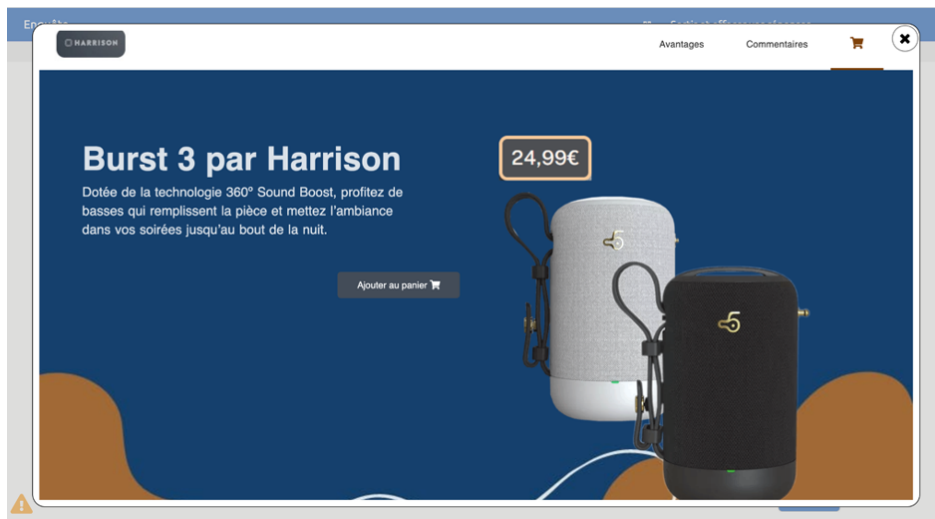
Decline all **Customise my choices** **Accept all**

(f) *Tricolor banner.*

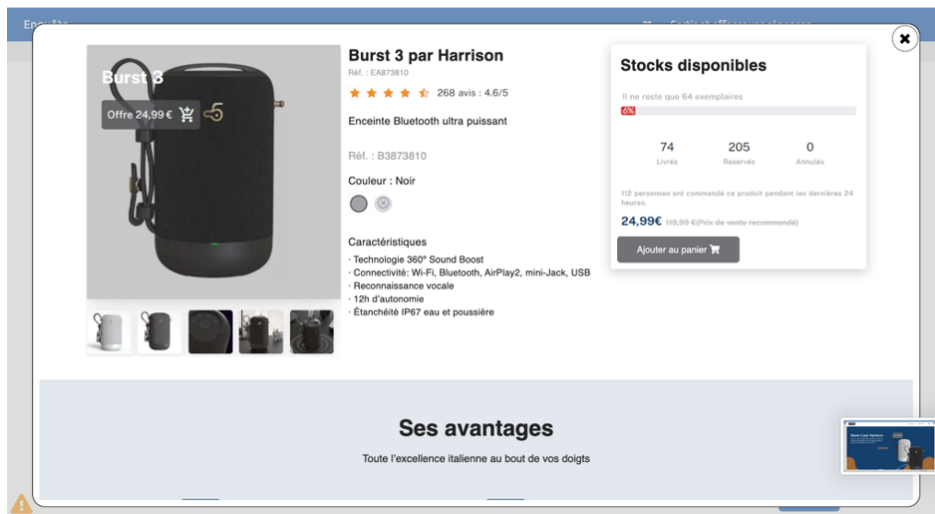
Figure 2: Three steps of interaction on a fictitious e-commerce website.



(a) Before interacting with the cookies banner.



(b) After interacting with the cookie banner.



(c) Example of information participants can find on the website.

Objective	Intervention	Ranking following the vote
Improve the knowledge of Web users		
Simplify	Shorten, summarise, clarify text / include an FAQ	3
	Use rule of thumbs to simplify decision	13
	Use images, emojis, infographics	1
	Use visual aids that can be used as heuristics (e.g. traffic lights)	7
Make refusing / personalising attractive	Renew banners regularly	17
	Increase feeling of importance and urgency to interact with the banner	14
	Use personalised feedback to explain to users the implications of their choice	12
	Highlight consequences of their choice	2
Make it social	Encourage web designers to display disadvantages and not only advantages of accepting	11
	Use social norms	18
Make it timely	Prevent all interactions with the website until users make their choice	16
	Introduce a pop-up that checks whether users really want to accept cookies	8
Improve access to refusal option		
Simplify refusal	Display both refuse and accept option similarly	9
	Make refusing more visible and attractive to choose	5
	Recommend that consent be asked every 6 months, independently of their past choices	10
	Promote plug-ins that automatically deal with consent banners	15
Make decline an option by default	Pre-select "Refuse all"	4
	Put "Refuse all" on the first layer, and "Accept all" on the second	6

Table 1: 18 potential designs to be tested, together with the results of the voting.

F Regression tables

We provide results for all regression variables in Tables 15 for consent decisions on the first website, Table 16 for average decision time on the first website, and Table 17 for consent decisions on the third website.

G Consent decisions for desktop vs. mobile

Table 18 presents the decline/personalise rate for desktop and mobile participants.

Table 2: Summary of participant demographics.

Characteristics	Percent (%)
Gender	
Women	52%
Age	
18-30	24%
31-49	34%
50+	42%
Education	
>Bac + 3	33%
Annual household revenue	
>40 000€	65%
Employment status	
Employed	71%
Retired	15%
Student	6%
Unemployed	5%
Other	2%
Urban-Rural	
Rural	35%
Sub-urban	22%
Urban	43%

Table 3: Participants' level of comfort with sharing data ($N = 4,026$).

Level of comfort	Percentage
Comfortable even without knowing how it is used	52%
Not comfortable in any given case	31%
Comfortable only if knowing how it is used	17%

Table 4: Participants' high level of comfort (comfortable/very comfortable) regarding sharing various types of data ($N = 4,026$).

Type of data	Cumulative percentage for "comfortable" and "very comfortable" level
Past product purchases	74%
Email address	47%
Browsing history	46%
Postal address	45%
Social media	43%
Geolocation	42%
Phone number	36%
Contacts	36%
Bank data	14%

Table 5: Participants' recall of choice and banners. One star indicates that this value is significantly different from the highest value at least to the 5% level.

	Overall	Control	Dark Pattern		Behavioral Lever		
			No reject	Highlighted accept	Consequences	Tricolor	Highlighted decline
Remembers their choice	85%	86%*	87%	87%*	84%*	90%	74%*
Remembers seeing different/ similar banners	36%	47%*	27%*	20%*	41%*	59%	24%*
<i>N</i>	4,026	690	693	672	660	641	670

Table 6: Participants' reasons for refusing consent on the first website. One star indicates that this value is significantly different from the highest value at least to the 5% level.

	Overall	Control	Dark Pattern		Behavioral Lever		
			No reject	Highlighted accept	Consequences	Tricolor	Highlighted decline
Avoid being tracked	57%	62%	N/A	57%*	71%	48%*	43%*
Avoid targeted advertising	46%	57%	N/A	52%	44%*	41%*	44%*
Out of habit	37%	43%	N/A	51%	27%*	38%*	38%*
The fastest option	7%	7%*	N/A	4%*	4%*	8%*	13%
No accept option available	3%	1%	N/A	0%*	3%	4%	3%
Clicked randomly	4%	1%*	N/A	0%*	3%*	3%*	8%
<i>N</i>	978	110	N/A	114	306	230	218

Table 7: Participants' reasons for accepting consent on the first website. One star indicates that this value is significantly different from the highest value at least to the 5% level.

	Overall	Control	Dark Pattern		Behavioral Lever		
			No reject	Highlighted accept	Consequences	Tricolor	Highlighted decline
Out of habit	50%	50%	47%	51%	50%	53%	50%
Fear for not being able to access the website	35%	35%	32%*	35%	40%	33%*	39%
The fastest option	33%	34%	32%*	37%	30%*	31%*	33%
Option to refuse not available	9%	5%*	20%	7%*	6%*	3%*	5%*
To receive personalised advertisement	10%	11%	9%	10%	12%	9%	11%
Clicked randomly	5%	5%	5%	5%	5%	3%*	7%
<i>N</i>	2,982	574	666	551	351	395	445

Table 8: Participants' reported satisfaction with the choice they made. One star indicates that this value is significantly different from the highest value at least to the 5% level.

	Overall	Control	Dark Pattern		Behavioral Lever		
			No reject	Highlighted accept	Consequences	Tricolor	Highlighted decline
Satisfied by 1st banner choice	56%	54%*	44%*	55%*	64%	64%	58%*
Dissatisfied	44%	46%*	56%	45%*	36%*	36%*	42%*
Equally satisfied	16%	18%	20%	17%	12%*	13%*	14%
<i>N</i>	4,026	690	693	672	660	641	670

Table 9: Reported opinion on the banner seen on the first and second website. One star indicates that this value is significantly different from the highest value at least to the 5% level.

	Overall	Control	Dark Pattern		Behavioral Lever		
			No reject	Highlighted accept	Consequences	Tricolor	Highlighted decline
Navigating the banner is simple	85%	84%*	81%*	86%	87%	88%	87%
Information easy to understand	82%	79%*	77%*	82%	84%	83%	85%
Choices presented with my best interest in mind	68%	68%*	64%*	70%	67%*	73%	69%*
Easy control the level of data protection	72%	71%*	64%*	74%	76%	77%	73%*
More websites should use this banner format	80%	78%*	72%*	82%	82%	84%	81%
<i>N</i>	4,026	690	693	672	660	641	670

Table 10: Participants' responses in percentage regarding data collected by cookies ($N = 4,026$).

Type of data collected	Percentage
Browsing history	62%
Past product purchases	58%
Geolocation	57%
Information shared on my social network	36%
Postal address	30%
Phone number	29%
Email sent and received	28%
Contacts	23%
Bank data	13%
None	6%
All	4%

Table 11: Participants' responses in percentage regarding reasons for which data is collected via cookies ($N = 4,026$).

Reasons	Percentage
Decide which ads to show me	61%
Resell my data to third parties	48%
Subscribe to newsletter and send me marketing emails	42%
Improve my user experience on the website	36%
Adjust prices or sales to researched products	29%
Adapt language and display to my geolocation	24%
Allow to view media content (e.g. YouTube video) on the website	22%
Ensure security on the website	17%
Report user data to the government	12%

Table 12: Participants' responses in percentage on the means with which cookies collect data ($N = 4,026$).

Cookies collect data by ...	Percentage
Tracking what I do online (browsing history, services and products purchased)	74%
Tracking information I actively share (e.g. on social media)	44%
Tracking information that others have shared about me (e.g. on social media)	35%
Listening to what I say through the microphones on my computer and phone	15%

Table 13: Participants' willingness to use browser extension to automatically accept or refuse cookies ($N = 4,026$).

Willingness	Percentage
Yes, definitely	24%
Yes, probably	38%
No, probably not	6%
No, definitely not	3%
Not sure	29%
Banking	33%

Table 14: Types of websites on which participants are somewhat comfortable/very comfortable to accept cookies ($N = 4,026$).

Type of website	Cumulative percentage for "comfortable" and "very comfortable" level to accept cookies
E-commerce	55%
Information	51%
Government	51%
Health	51%
Social media	41%
Banking	33%

Table 15: Participants' reported consent decisions on the consent banners of the first website ($N = 3,947$). Three stars (***) indicate a significant difference with the decision made when seeing the control ($p < 0.001$). Estimates are calculated using odds ratio from a logistic regression controlling for age, gender, education, and employment status of participants.

	Treatment	% non-acceptance (personalize or reject)	95% CI
Dark pattern	No-decline	3.90***	2.54; 5.87
	Highlighted-accept	18.00	14.19; 22.57
Behavioral Lever	Highlighted-decline	33.58***	27.71; 39.18
	Consequences	46.73***	40.20; 52.85
	Tricolor	38.38***	32.08; 44.23
Control	Control	16.81	

Table 16: Participants' average decision time ($N = 3,947$) in their interactions with the consent banners on the first website. Three stars (***) indicate a significant difference with the time spent when seeing the control ($p < 0.001$). Estimates are calculated using coefficients from a linear regression controlling for age, gender, education, and employment status of participants. The variable for "time spent" was winsorized at the top (1%) to deal with outliers, which most likely corresponds to participants leaving their computer and coming back to the experiment later.

	Treatment	Average decision time (seconds)	95% CI
Dark pattern	No-decline	4.03	3.33; 4.52
	Highlighted-accept	3.78	2.94; 4.13
Behavioral Lever	Highlighted-decline	4.24	3.80; 4.99
	Consequences	5.70***	4.72; 6.68
	Tricolor	5.72***	4.74; 6.70
Control	Control	4.10	

Table 17: Participants' reported consent decisions ($N = 3,947$) when facing the Control banner upon visiting the third website. Three stars (***) indicate a significant difference ($p < 0.001$) with participants having seen the Control banner on the first and second website (control group). Estimates are calculated using odd ratio from a logistic regression controlling for age, gender, education, and employment status of participants.

	Treatment	% who personalise or reject	95% CI personalise or reject
Dark pattern	No-decline	9.66***	7.17; 12.79
	Highlighted-accept	20.09	16.31; 25.15
Behavioral Lever	Highlighted-decline	29.7***	24.33; 34.99
	Consequences	35.81***	30.13; 41.75
	Tricolor	27.31***	22.49; 32.91
Control	Control	18.84	

Table 18: Non-acceptance (decline/personalise) rate depending on device used. One star indicates that this value is significantly different from the highest value at least to the 5% level.

	Control	Dark Pattern		Behavioral Lever		
		No reject	Highlighted accept	Consequences	Tricolor	Highlighted decline
Desktop	27%	4%	29%	54%	36%	35%
Mobile	14%	4%	15%	45%	39%	33%
<i>N</i>	690	691	672	658	640	669