

# Designing Consent: Choice Architecture & Consumer Welfare in Data Sharing

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[joint work with Andrey Fradkin (Boston U. and MIT IDE) and Tesary Lin (Boston U.)]

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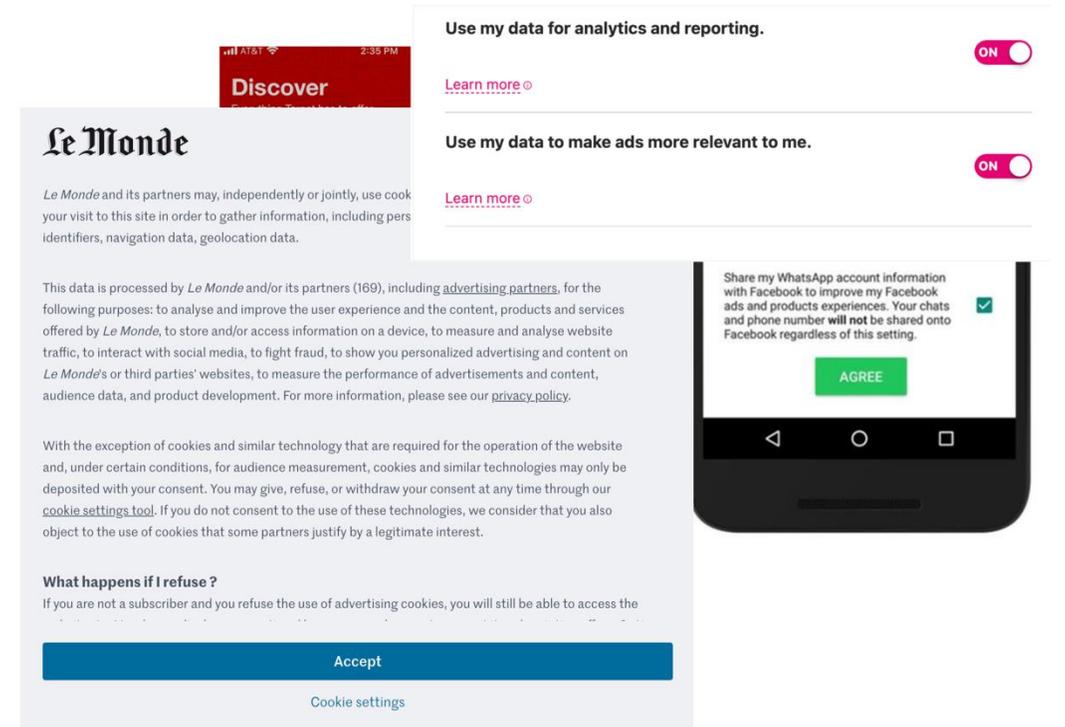
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# Consumer data as asset

- Consumer data is a valuable input to firms' production functions.
  - Chen et al. (2023), Sun et al.(2022), Demirer et al. (2024), and many more.
- Consumer data includes very personal information.
  - Can be used inappropriately (Kao et al., 2023a and 2023b).
- Privacy regulation (GDPR, CCPA) and corporate privacy efforts (Privacy Sandbox, ATT).
  - Increase entry barriers and reduction in competition (Johnson et al., 2023a and 2023b, Aridor et al. (2024)).

# Consent requirements are controversial

1. Use of choice architecture (“dark patterns”) to prevent consumers from making preferred choice.
2. Requiring consent frequently is disruptive.
3. Risks of benefiting large and prominent firms.



# Research questions

- What are consumers' preferences for data sharing and how does choice architecture affect their choices?
  - Role of consumer beliefs about defaults.
  - Role of firm prominence.
- What is the optimal choice architecture for consumers?
  - Frequency
  - Banner design
  - Default

# Research Design:

- Experiment using a customized browser extension.
- Randomize assignment of cookie consent banners at a user by website level.
- Analyze choices during structured and organic browsing.
- Structural model of consumer data sharing choices.

# Roadmap:

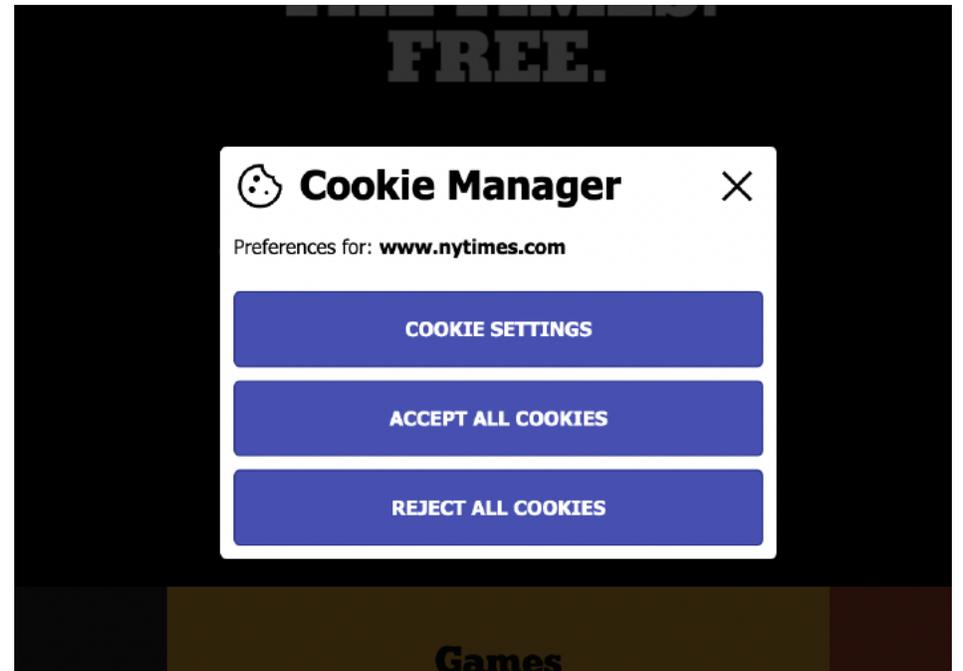
1. Experimental design
2. Reduced-form results
3. Welfare
4. Conclusion

# The Cookie Manager browser extension

A browser extension and cloud server infrastructure that can:

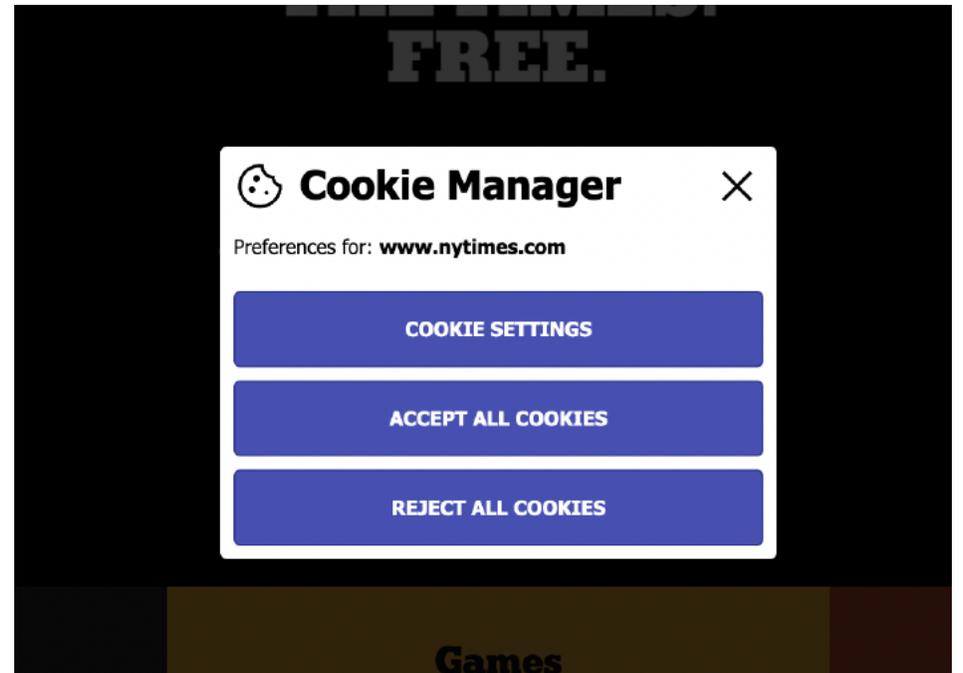
- Manipulate your browsing experience;
- Track your browsing behavior;
- Prompt you to complete additional tasks.

Based on webmunk.org, which other researchers (e.g., Alcott et al., '25) and econ consulting are using.



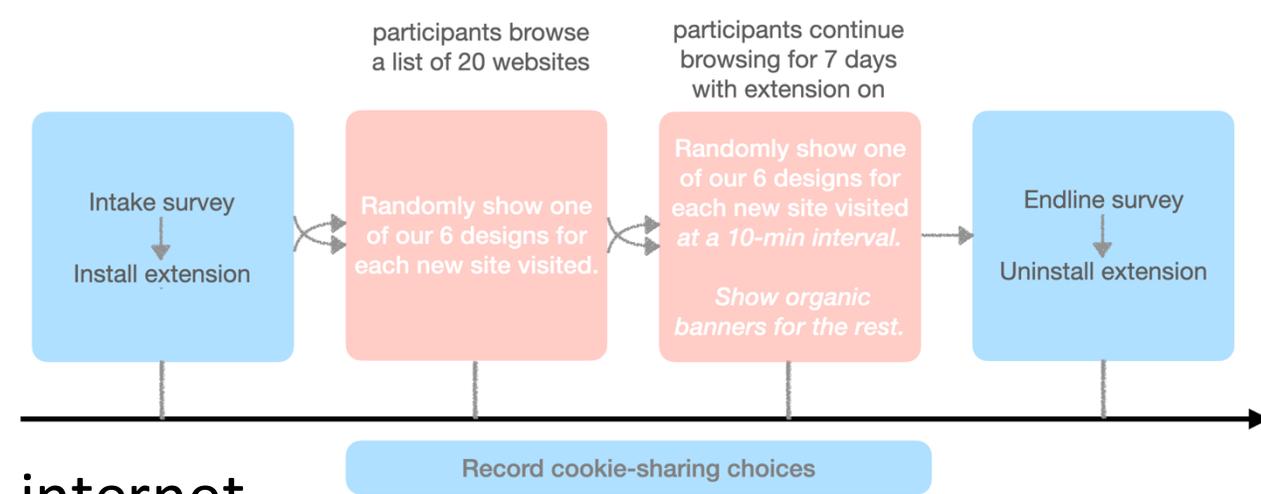
# Cookie Manager's Capabilities

- Create a cookie consent pop-up as users browse the internet.
- When possible, enforce the choices users make by acting on organic pop-up if it exists.
- Prompt users to finish surveys and uninstall extension.
- Record browsing and cookie interactions.



# Research Design

- Recruitment through Prolific.
- Eligibility: use chrome to browse the internet.
- Install extension.
- Clear cookies.
- Visit 20 websites:
  - {news, e-commerce, entertainment/social media, search} X {large x small}.
  - E.g., Amazon v. Poppin; Google v. DuckDuckGo.
  - Make cookie preference selections for each of the 20 websites.
  - We enforce selection to the extent possible (~ Consent-O-Matic).
- Keep extension for following week:
  - Make cookie preferences when prompted to do so.
  - Random pop-up frequency: 10 min vs. 60 min.



# Survey-Prompted Visits

- Visit 20 websites:

{news, e-commerce,  
entertainment/social media,  
search} X {large x small}.

E.g., Amazon v. Poppin; Google v.  
DuckDuckGo.

- Ask about site familiarity after click.

Please use Chrome to navigate to [twitter.com](https://twitter.com). Search for a topic of your choice.

You haven't clicked on the link

Do you normally visit Twitter?

Yes

No

# Treatment banner design

 **Cookie Manager** ×

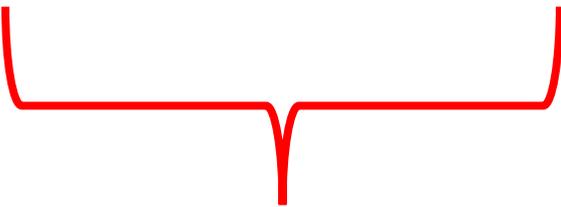
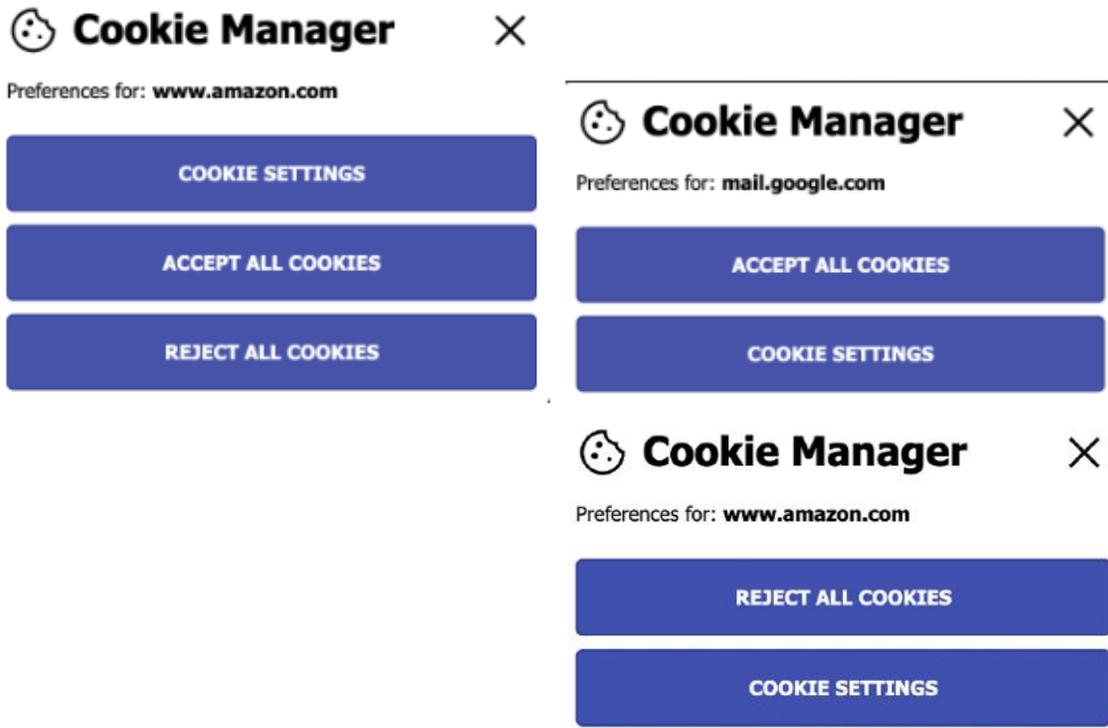
Preferences for: [www.amazon.com](https://www.amazon.com)

COOKIE SETTINGS

ACCEPT ALL COOKIES

REJECT ALL COOKIES

# Treatment banner design



Deliberate Obstruction

# Treatment banner design

 **Cookie Manager** ×

Preferences for: [www.amazon.com](http://www.amazon.com)

COOKIE SETTINGS

ACCEPT ALL COOKIES

REJECT ALL COOKIES

 **Cookie Manager** ×

Preferences for: [mail.google.com](mailto:mail.google.com)

ACCEPT ALL COOKIES

COOKIE SETTINGS

 **Cookie Manager** ×

Preferences for: [hbsp.harvard.edu](http://hbsp.harvard.edu)

ACCEPT ALL COOKIES

REJECT ALL COOKIES

COOKIE SETTINGS

 **Cookie Manager** ×

Preferences for: [www.amazon.com](http://www.amazon.com)

REJECT ALL COOKIES

COOKIE SETTINGS

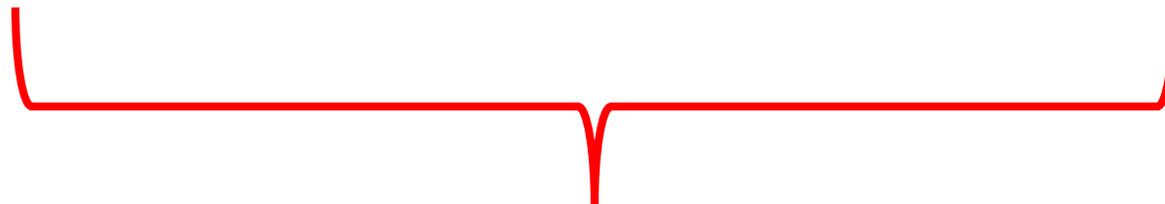
 **Cookie Manager** ×

Preferences for: [www.goodreads.com](http://www.goodreads.com)

REJECT ALL COOKIES

ACCEPT ALL COOKIES

COOKIE SETTINGS



Reorder Options

# Treatment banner design

 **Cookie Manager** ×

Preferences for: [www.amazon.com](http://www.amazon.com)

COOKIE SETTINGS

ACCEPT ALL COOKIES

REJECT ALL COOKIES

 **Cookie Manager** ×

Preferences for: [mail.google.com](mailto:mail.google.com)

ACCEPT ALL COOKIES

COOKIE SETTINGS

 **Cookie Manager** ×

Preferences for: [hbsp.harvard.edu](http://hbsp.harvard.edu)

ACCEPT ALL COOKIES

REJECT ALL COOKIES

COOKIE SETTINGS

 **Cookie Manager** ×

Preferences for: [www.etsy.com](http://www.etsy.com)

ACCEPT ALL COOKIES

REJECT ALL COOKIES

COOKIE SETTINGS

 **Cookie Manager** ×

Preferences for: [www.amazon.com](http://www.amazon.com)

REJECT ALL COOKIES

COOKIE SETTINGS

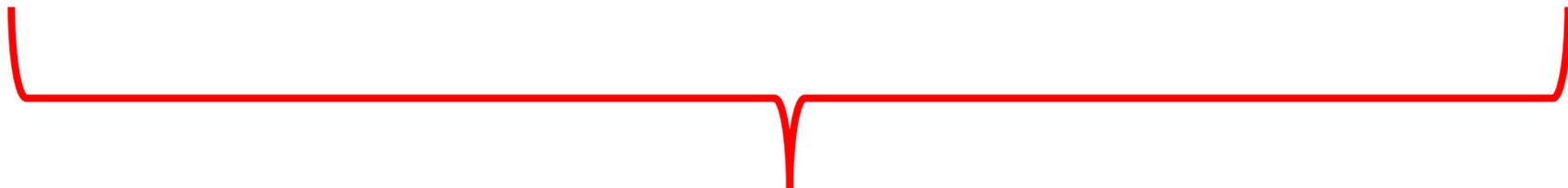
 **Cookie Manager** ×

Preferences for: [www.goodreads.com](http://www.goodreads.com)

REJECT ALL COOKIES

ACCEPT ALL COOKIES

COOKIE SETTINGS



Differential Salience

# Treatment banner design

 **Cookie Manager** ×

Preferences for: **www.amazon.com**

**COOKIE SETTINGS**

**ACCEPT ALL COOKIES**

**REJECT ALL COOKIES**

 **Cookie Manager** ×

Preferences for: **mail.google.com**

**ACCEPT ALL COOKIES**

**COOKIE SETTINGS**

 **Cookie Manager** ×

Preferences for: **hbsp.harvard.edu**

**ACCEPT ALL COOKIES**

**REJECT ALL COOKIES**

**COOKIE SETTINGS**

 **Cookie Manager** ×

Preferences for: **www.etsy.com**

**ACCEPT ALL COOKIES**

**REJECT ALL COOKIES**

**COOKIE SETTINGS**

Preferences for: **www.etsy.com**

**ACCEPT ALL COOKIES**

**REJECT ALL COOKIES**

**COOKIE SETTINGS**

- [D] Information Storage and Access
- [A] Preferences and Functionality
- [B] Performance and Analytics
- [E] Content selection, delivery, and reporting
- [F] Ad selection, delivery, and reporting
- [X] Other Purposes
- Select All**

**ACCEPT SELECTED COOKIES**



# Roadmap:

1. Experimental design
2. Reduced-form results
3. Welfare
4. Conclusion

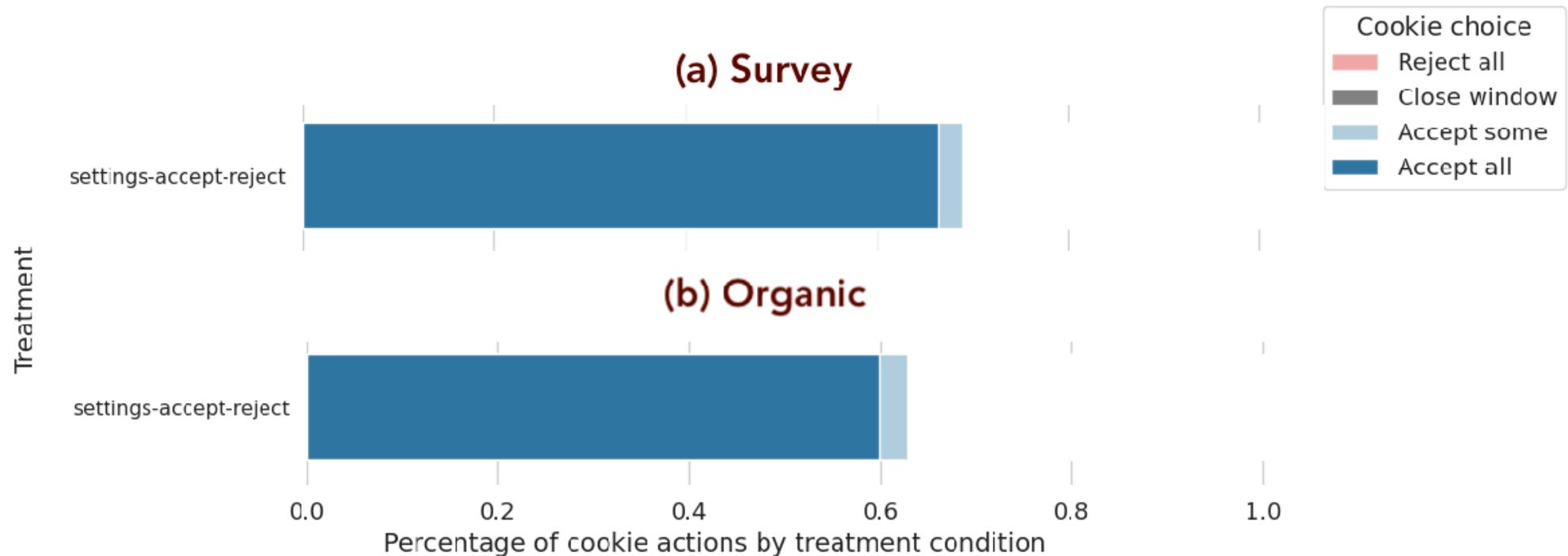
# Sample description

- 1,227 users started the process.
- 563 users in final sample (combination of eligibility, experiment compliance, attrition).

		Mean
During Survey	Unique Domains in Prior Week	53.27
	Domains w. Banner	19.67
Post-Survey	Domains w. Banner	22.40
	Unique Domains Visited	53.45
	Unique URLs	653.93
	End Survey Completed	0.86
Demographics	Age	37.97
	Female	0.45
	Bachelor's or Above	0.52
	Income > \$75,000	0.44

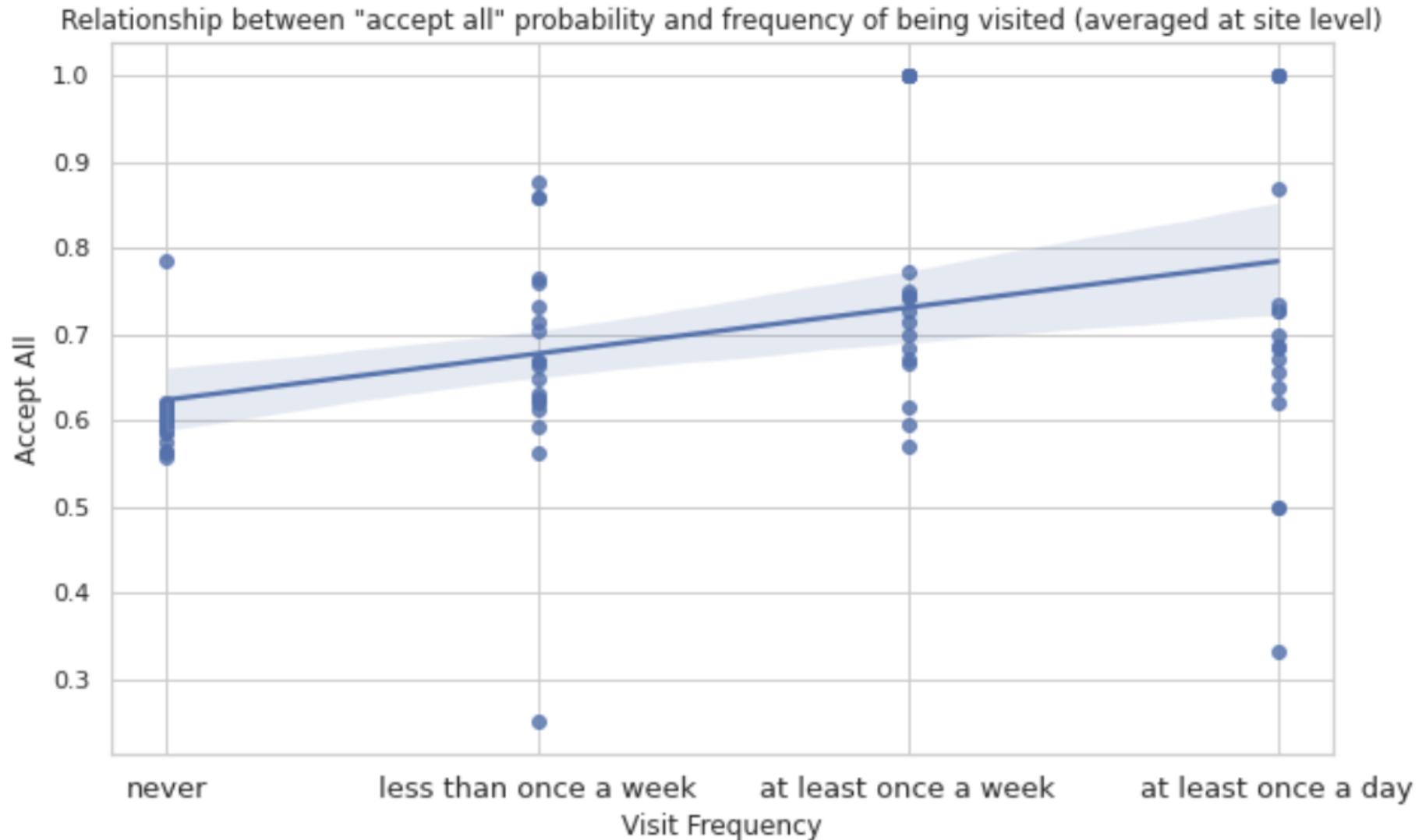
# Absent Nudges, “Accept All” is Frequent

66% in survey; 60% in organic visits

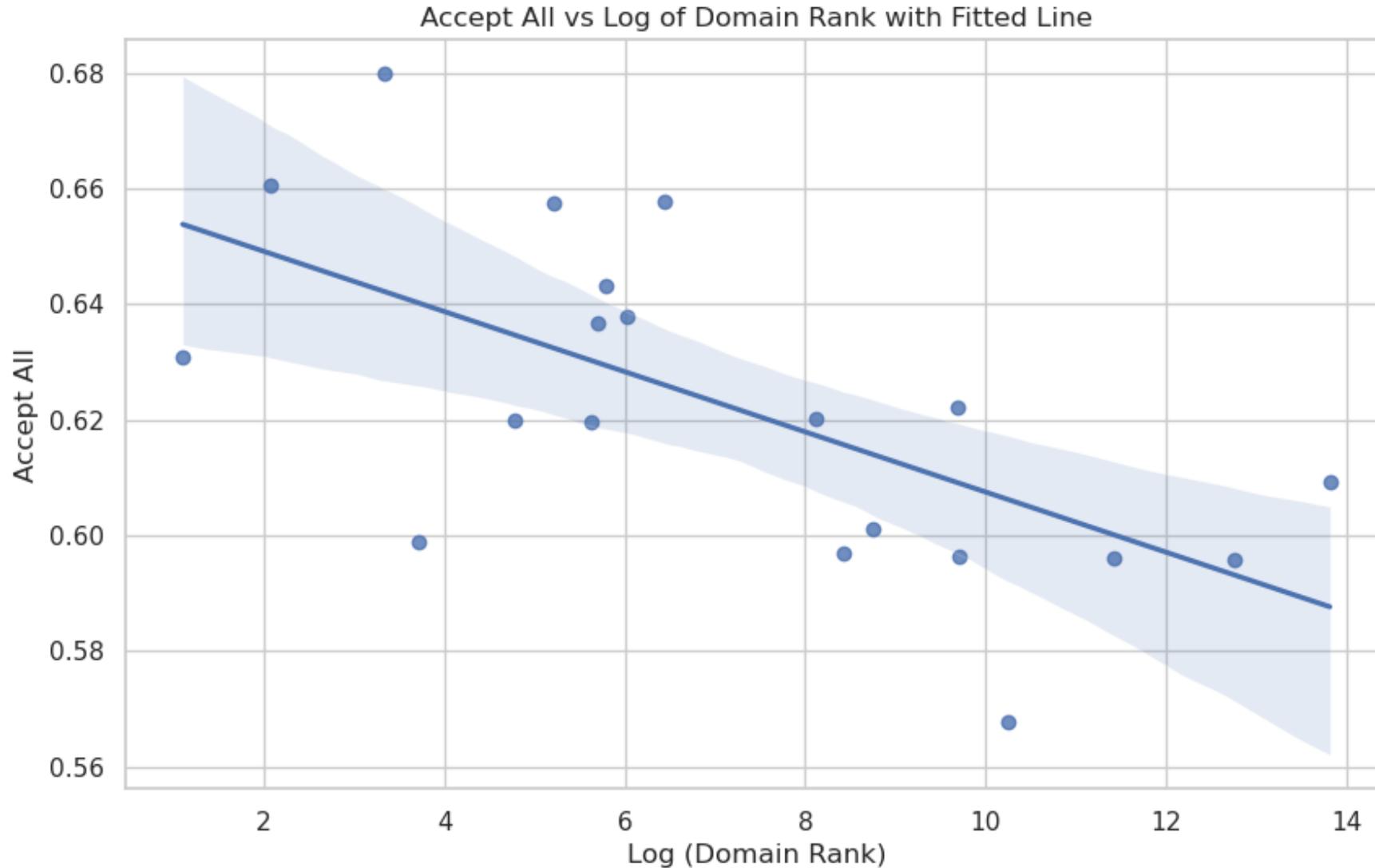


Existing lab studies found higher consent rates under neutral condition: 75% (Duque 2024)- 83% (Bielova et al. 2024)

# “Accept All” More Frequent with Familiar Sites

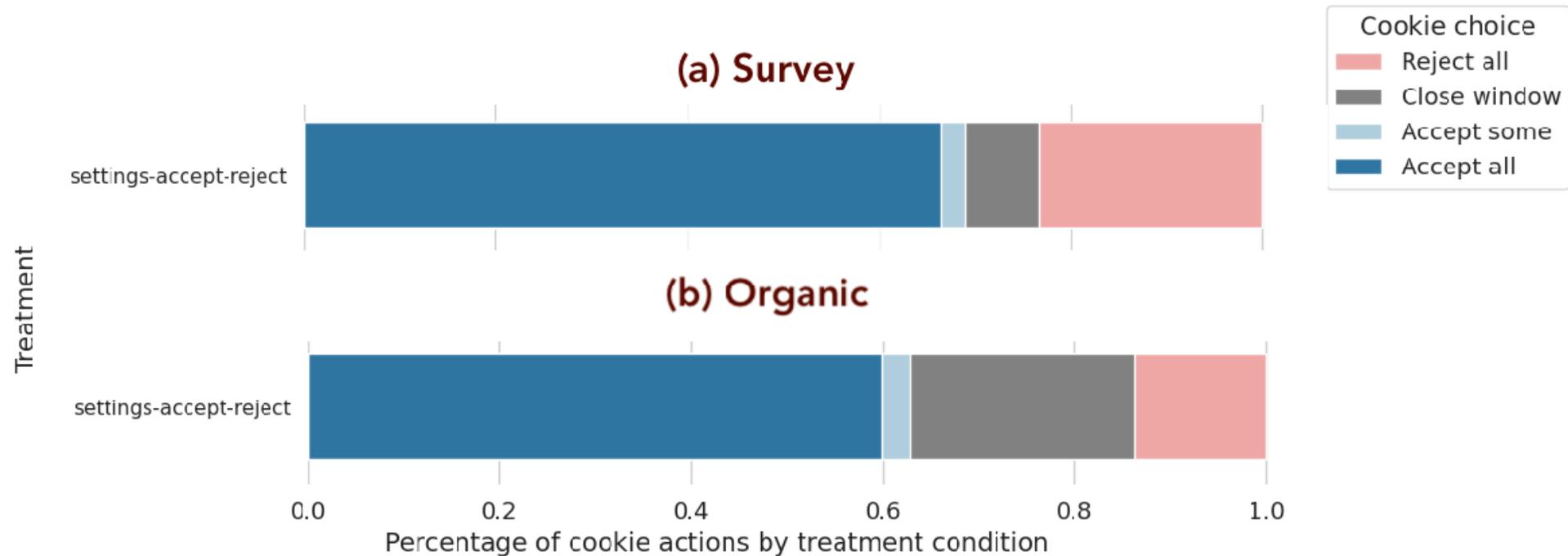


# “Accept All” More Frequent with Familiar Sites



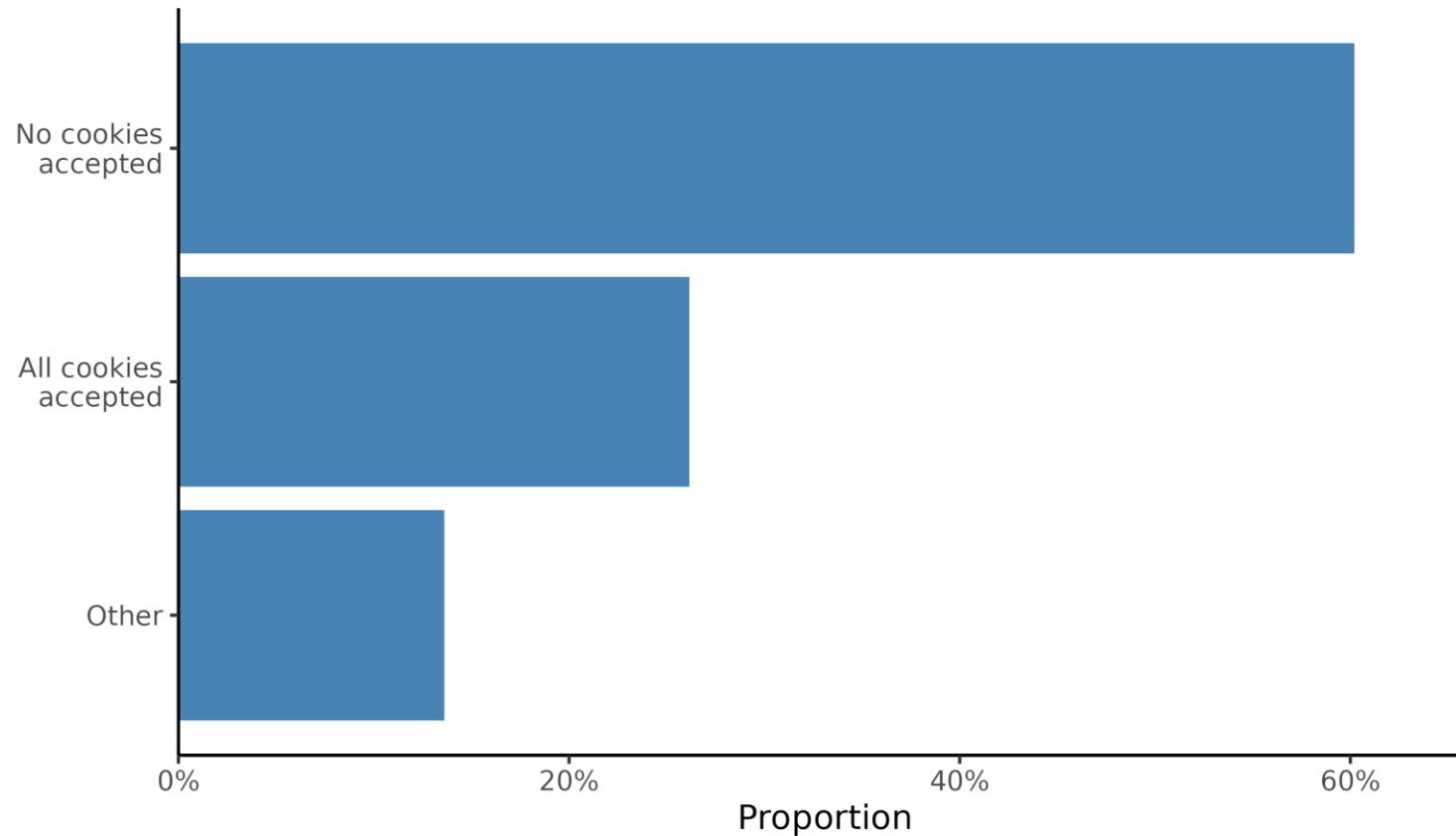
# “Close Window” Increases in Organic Browsing

"Close window": 8% survey -> 23% organic visits



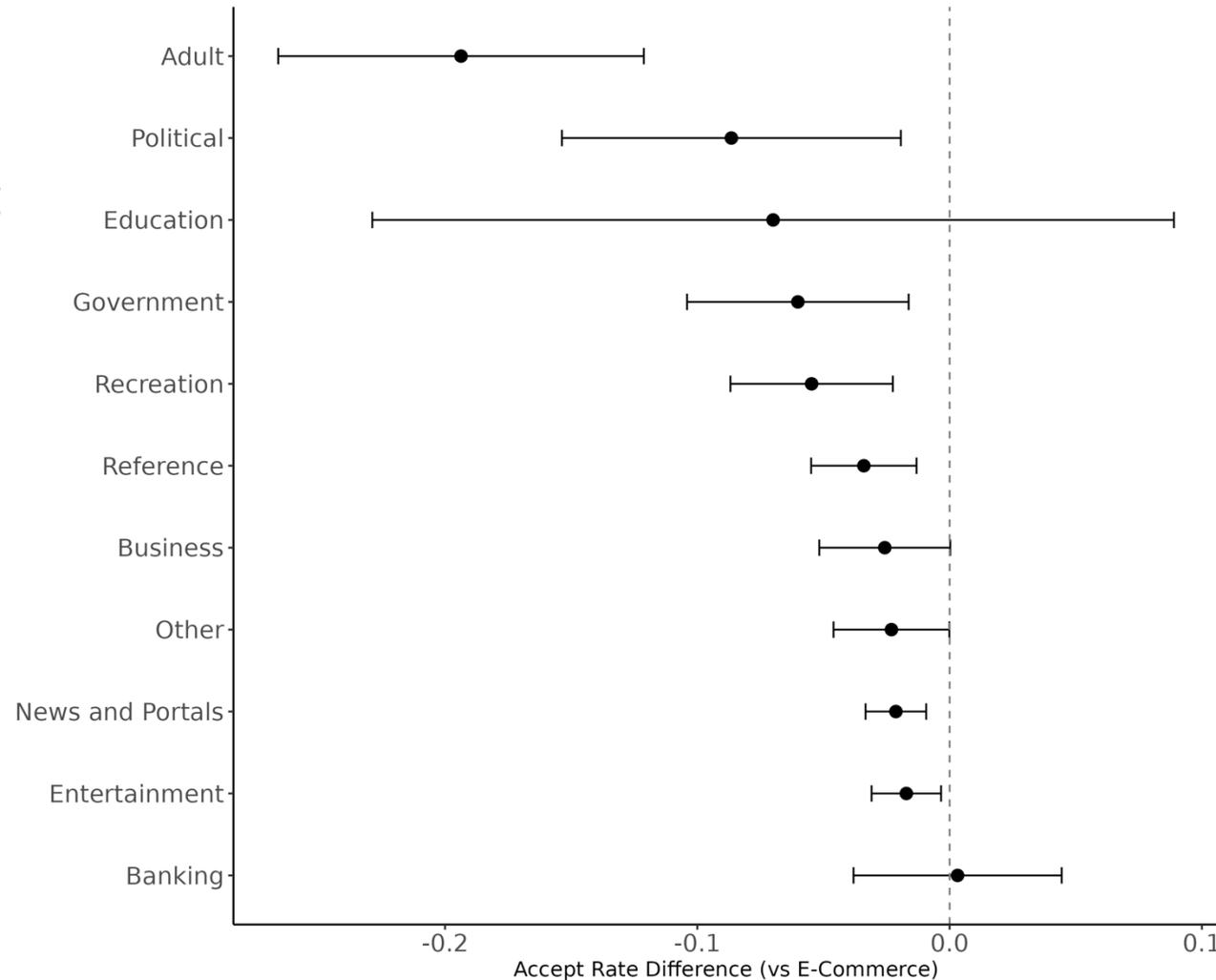
60% consumers believe closing window = rejecting cookies; 26.2% believe closing window = accepting cookies.

# Mixed Beliefs about “Close Window”



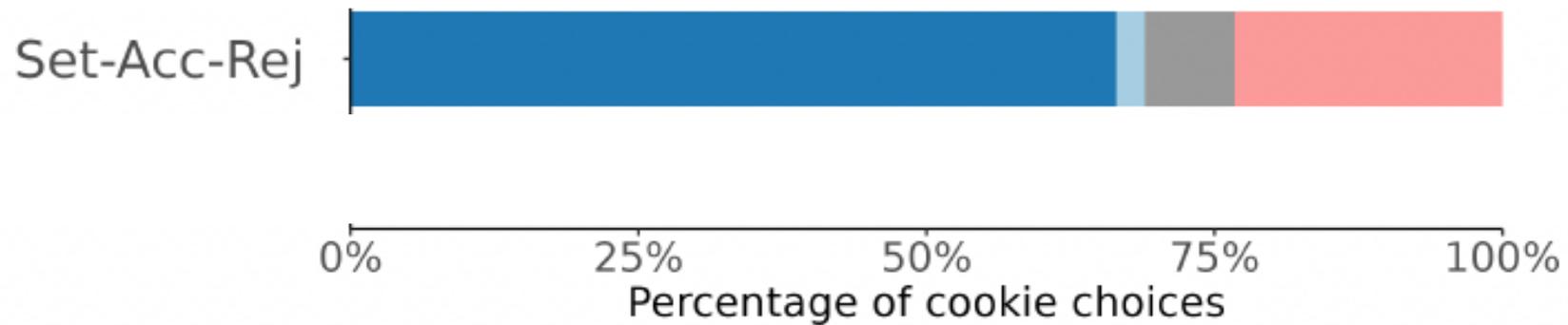
# Choices by Website Type

- Baseline is e-commerce.
- People are less likely to accept for:
  - Adult websites (by a lot).
  - Political and government websites.
- But tend to substitute to “close window” more than “reject all.”

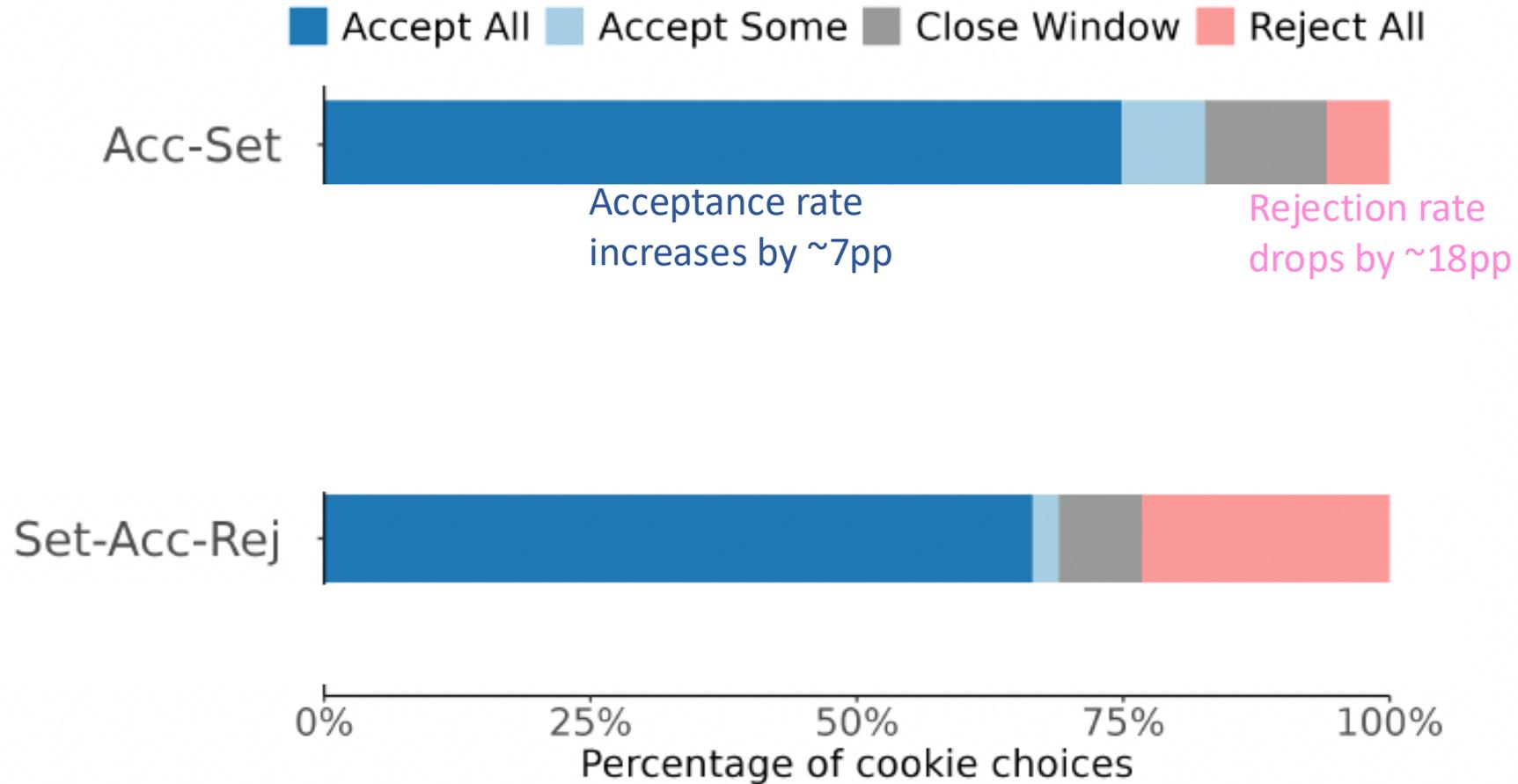


# Effects of “Dark Patterns”

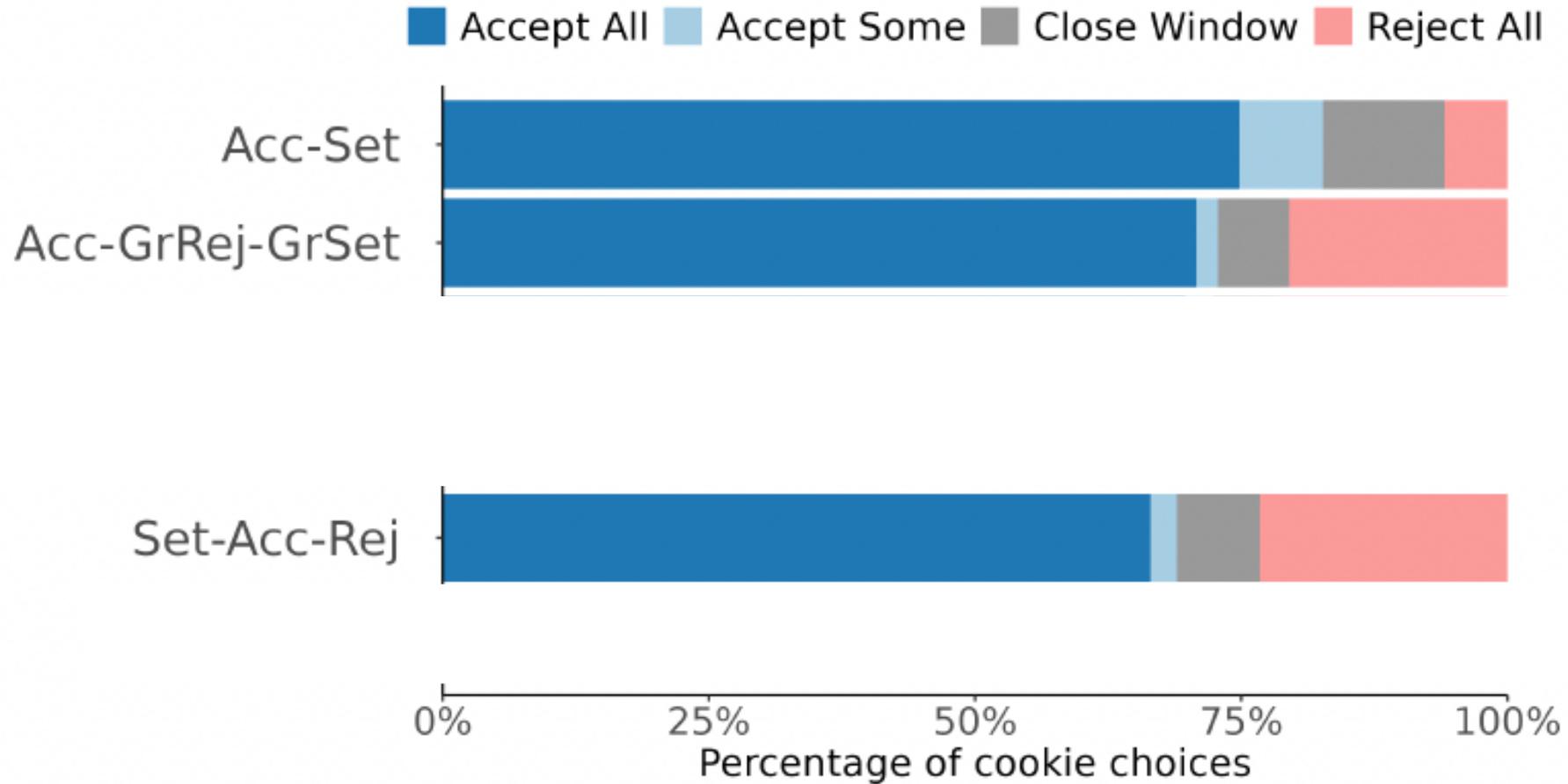
■ Accept All ■ Accept Some ■ Close Window ■ Reject All



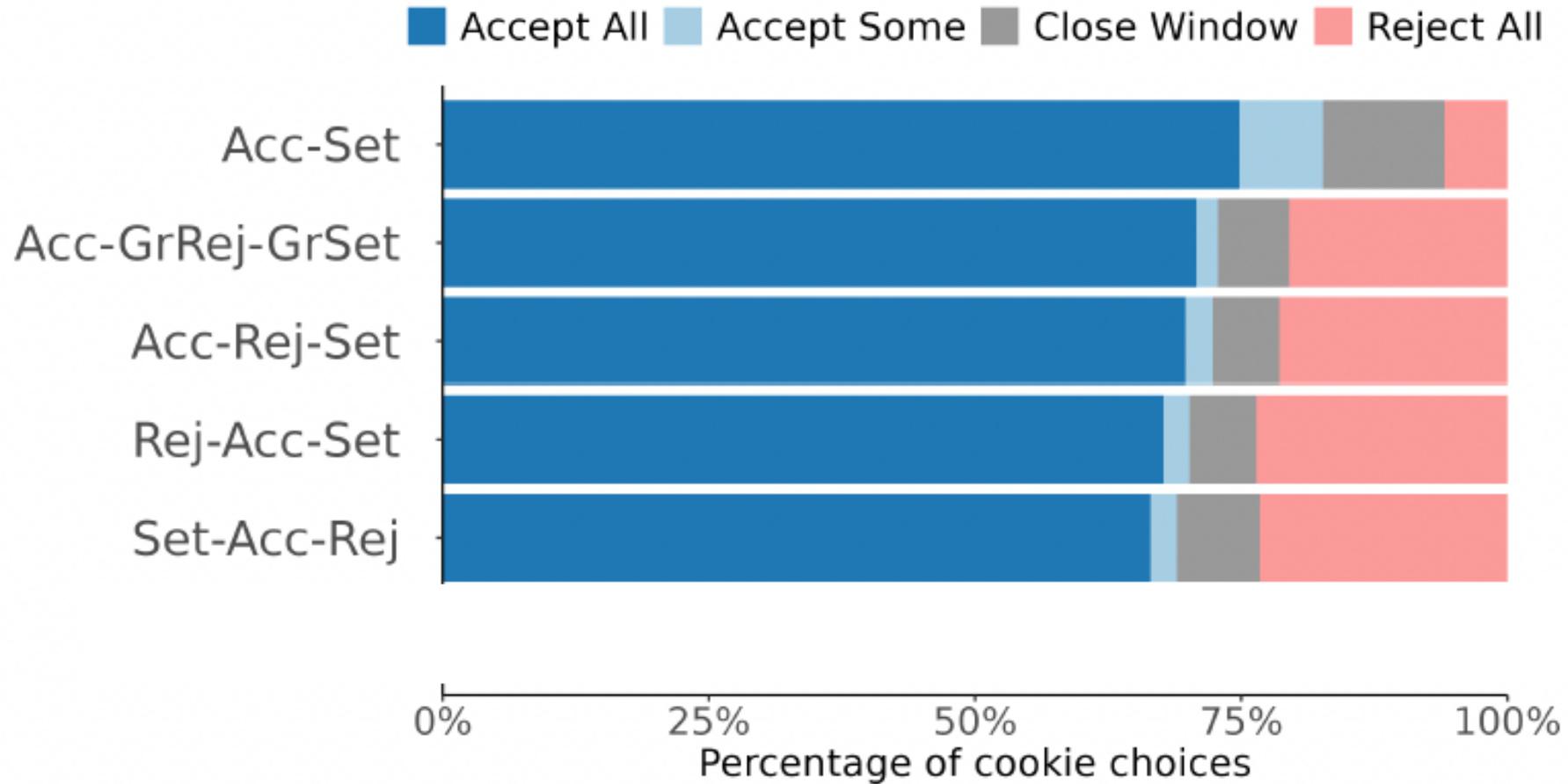
# Most Effective: Remove “Reject All”



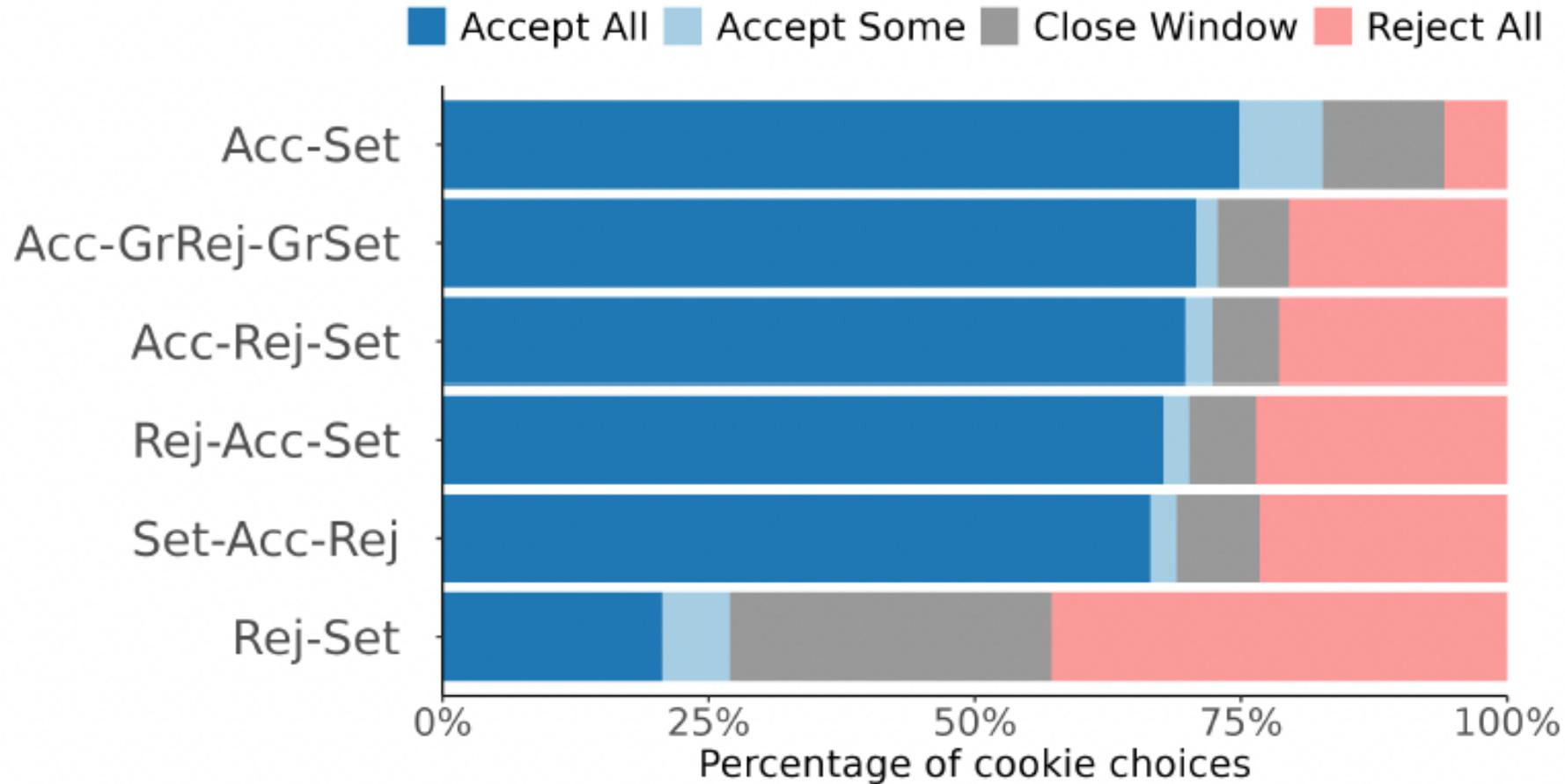
# Smaller Effect: Differential Salience



# Even Smaller Effects: Re-Ordering Options



# Most Drastic Change in Choices: Remove “Accept All”

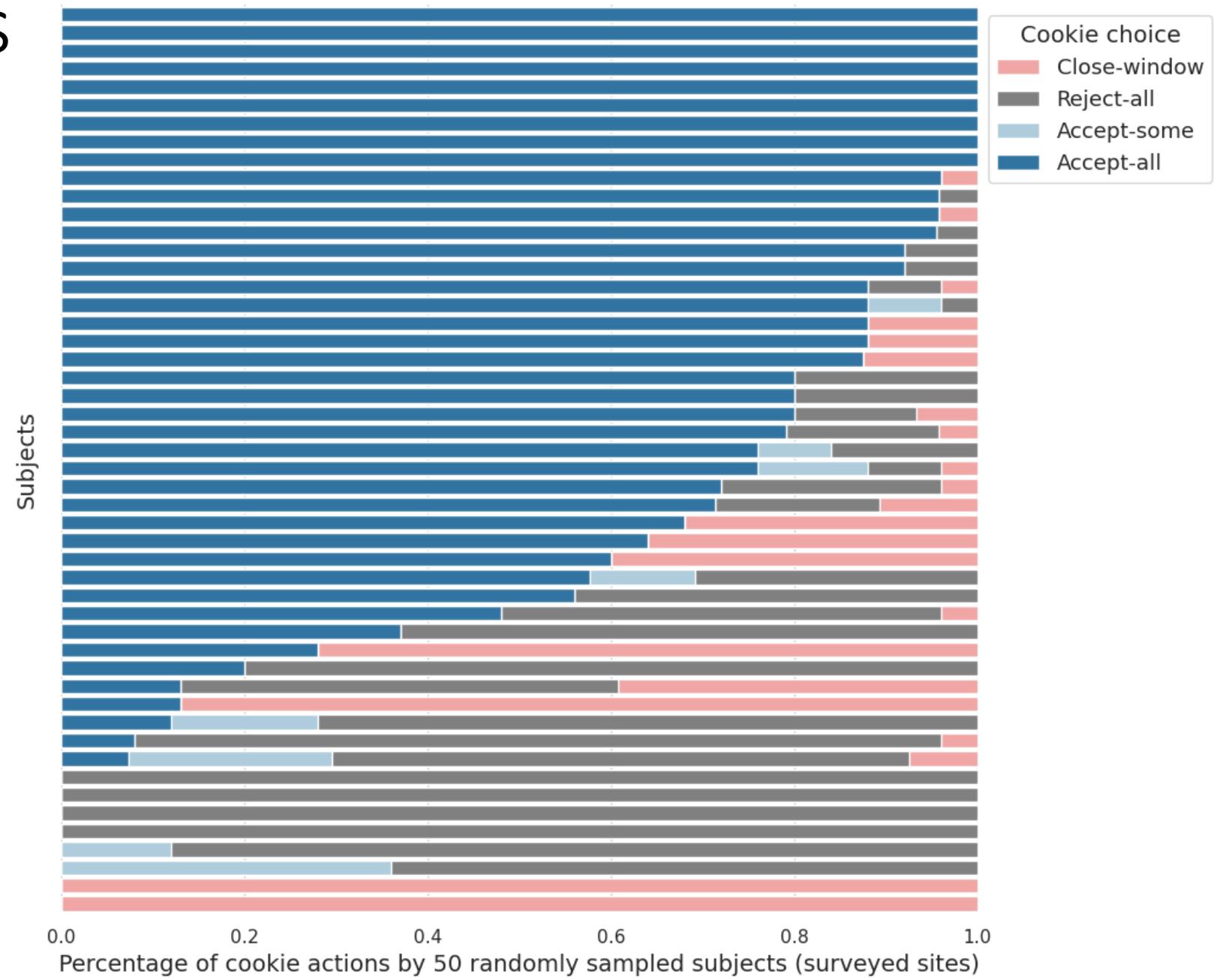


Acceptance rate  
drops by ~45pp

Close window rate  
increases by ~23pp

Rejection rate  
increases by ~19pp

# Variation across participants



# Roadmap:

1. Experimental design
2. Reduced-form results
3. Welfare
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# Structural Model - utility

A consumer (i) has 4 options (k) for any given site (j):

- Data sharing utility: Accept all ( $\theta_{acc}$ ), reject all (0), selected sharing ( $\theta_{set}$ ).
- Close window:
  - Decision utility (Kahneman and Thaler, 1991) based on stated beliefs, welfare utility based on actual defaults.
- Some choices require a click on settings, this click has a cost ( $C_{set}$ ).
- Two salience parameters  $\delta$  for ranking on top and being grayed out:
  - These affect the decision utility, not the welfare utility.

# Structural model - types

- We estimate a latent class model with three types ( $l$ ).
  - Why? To rationalize consumer heterogeneity in preferences.

$$P_{ijk} = \frac{\exp(u_{ik|design_{ij}})}{\sum_{k \in \{acc, rej, set, close\}} \exp(u_{ik|design_{ij}})}$$

- We allow likelihood of being each type to be a function of education and web activity.

$$s_{il} = \frac{\exp(\lambda_{il})}{\sum_{l' \in \{1,2,3\}} \exp(\lambda_{il'})}$$

- Estimate by maximum likelihood using both survey and organic choices.

# Preference Estimates:

- Acceptors (type 1):
  - 45% of users
  - High utility of accepting
- Rejectors (type 2):
  - 18% of users
  - High utility of rejecting
- Discerners (type 3):
  - 37% of users
  - Intermediate utility differences, likes coarse options.
- For all: Cost of click is high and salience parameters are small.

<u>Type-Specific Parameters</u>		<u>Type 1</u>	<u>Type 2</u>	<u>Type 3</u>
$\theta_{acc}$	Utility of accepting all	2.660*** (0.157)	-4.960*** (0.736)	1.210*** (0.085)
$\theta_{set}$	Utility of granular choice	0.407 (0.355)	-0.280* (0.118)	0.615*** (0.158)
$C_{set}$	Cost of clicking settings	2.900*** (0.200)	2.650*** (0.166)	1.660*** (0.116)
$\delta_{top}$	Effect of ranking on top	0.422*** (0.082)	0.029 (0.042)	0.076 (0.077)
$\delta_{gray}$	Effect of being grayed out	-1.610 (10.200)	-4.410 (5.030)	-0.041 (0.412)
Share of Users		0.454	0.176	0.369

# Counterfactuals with banners

1. **U.S. status quo:** An “acc-set” design, with websites defaulting to collect all cookies when the user does not make an explicit choice;
2. **EU norm:** An interface without deliberate nudging (“set-acc-rej”), with websites defaulting to no cookie tracking upon inaction;
3. **Optimal Banner Interface:** An interface without nudging (“set-acc-rej”), with the default set to collect all cookies upon inaction;
4. **Optimal Banner Interface with Correct Beliefs:** An interface without nudging (“set-acc-rej”), with the default set to collect all cookies upon inaction, and consumers with correct beliefs about the default settings;

# Key Challenge: from Utils to Dollars

- Data do not include consumer preferences in dollars.
- Solution: find a dollar equivalent for the cost of clicking settings:
  - Time spent clicking “settings” due to obstruction: +4.07 sec/domain, 53 domains per week.
  - Value of an hour: hourly wage of \$42 per hour.
  - Cost of  $C_{set} = \$2.6$ .

# Consumer surplus per week

Counterfactual	Average	Type 1 Acceptors	Type 2 Rejectors	Type 3 Discerners
U.S. Status Quo	2.03	2.69	-2.63	3.43
EU Norm	2.58	2.66	0.91	3.28
Optimal Banner Interface	2.65	2.92	-0.12	3.63
Optimal Banner Interface (with correct beliefs)	2.89	3.1	0.6	3.73

# Consumer surplus per week

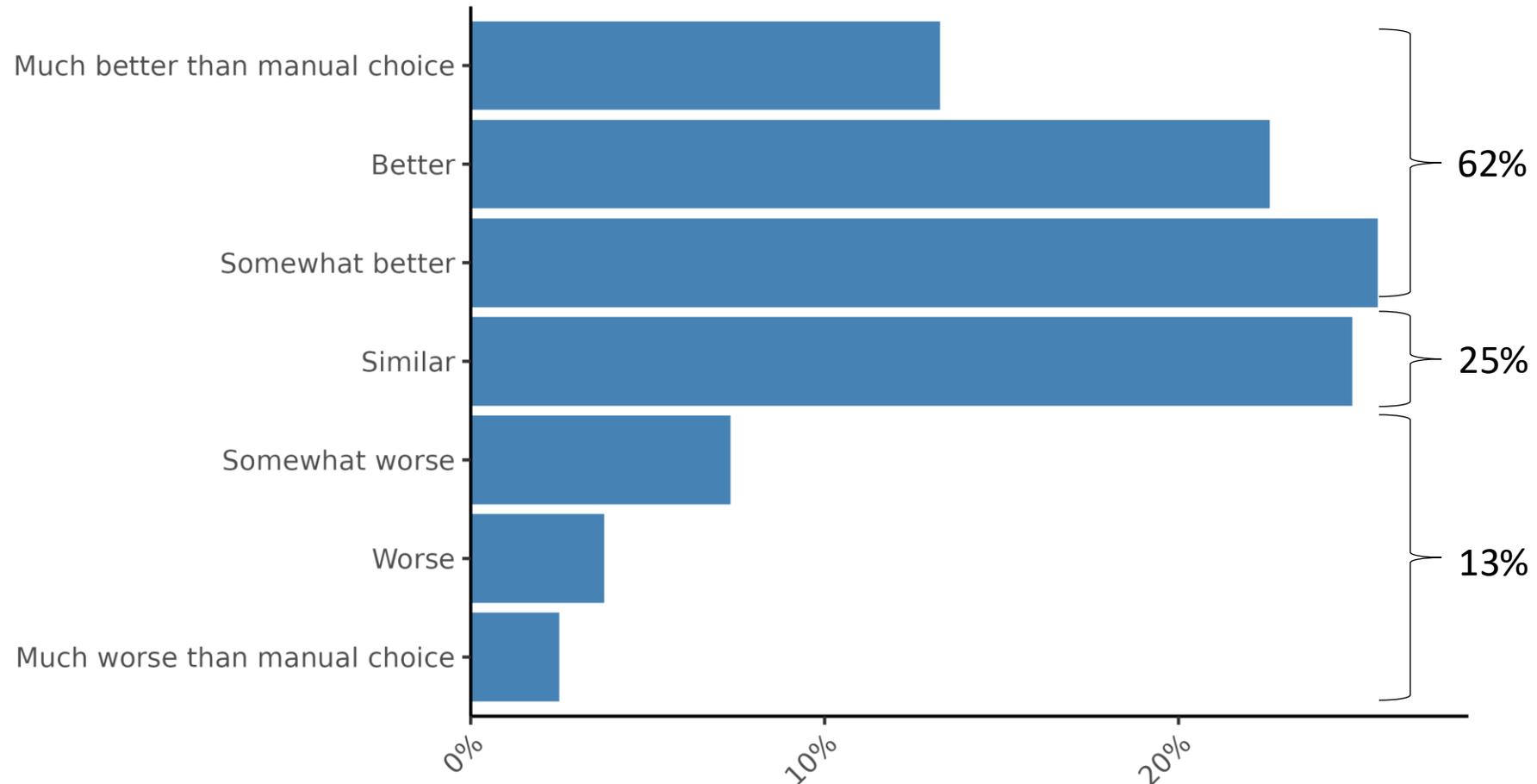
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# Browser level choice

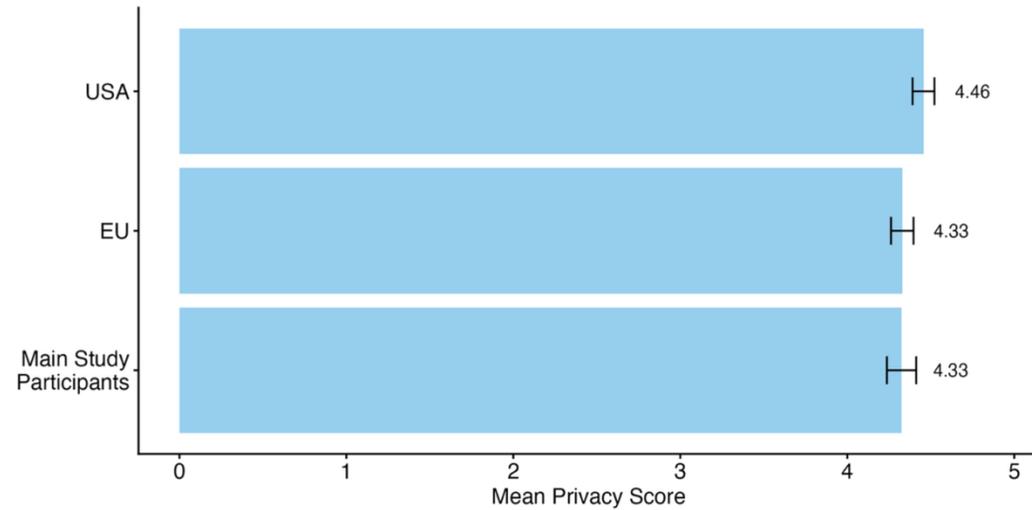
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Optimal Banner Interface (with correct beliefs)	2.89	3.1	0.6	3.73
Global Accept	5.81	6.94	0.37	7.01
Global Reject	4.98	4.76	5.03	5.24
Global Privacy Control	6.63	6.94	5.03	7.01

# Counterfactuals consistent with stated preferences

Compare global privacy control to website-by-website consent

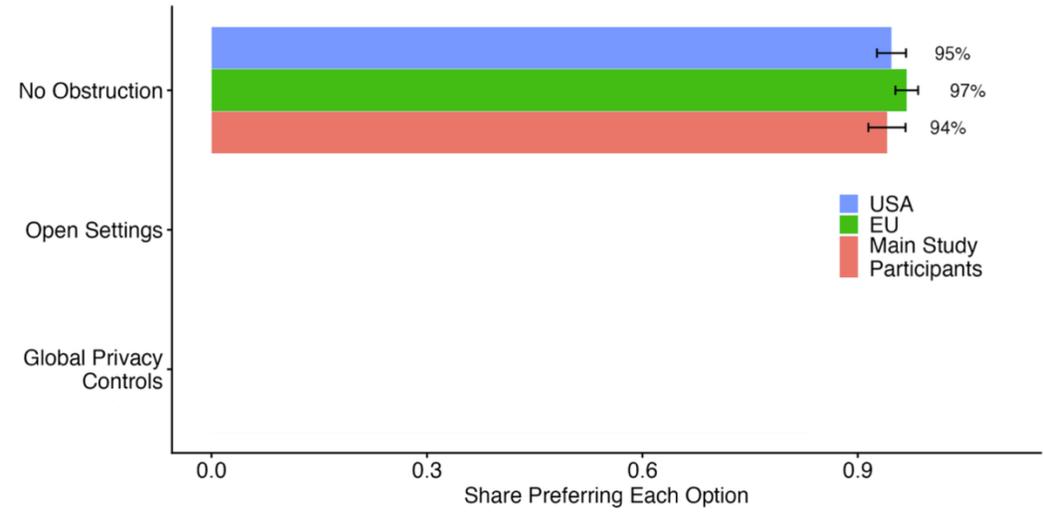
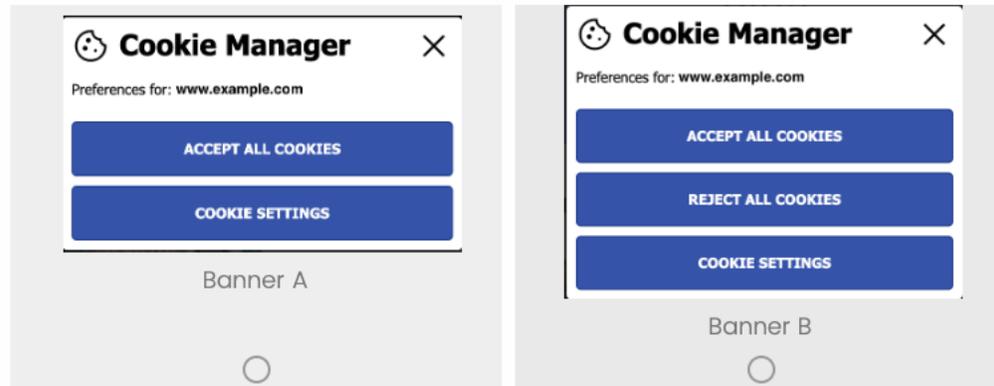


# How selected are our study participants?



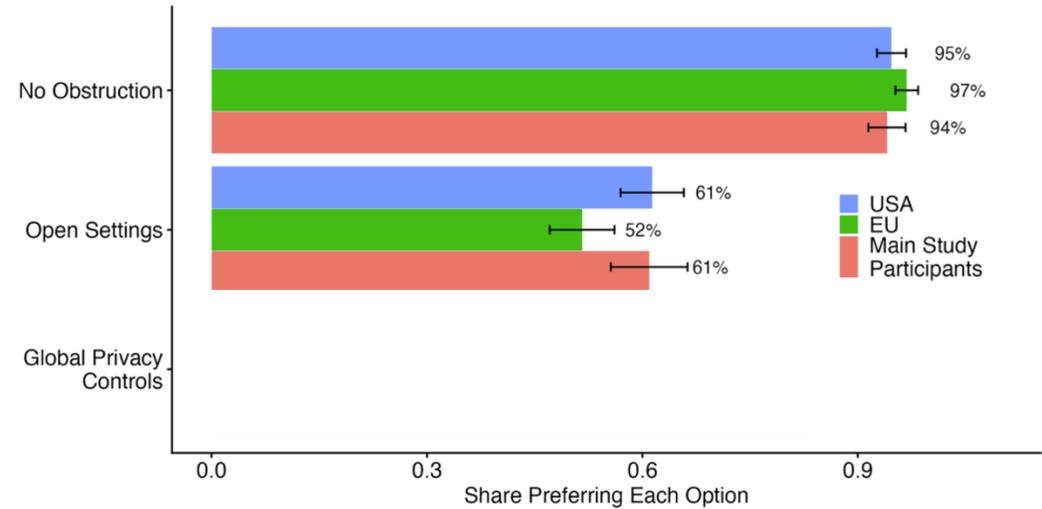
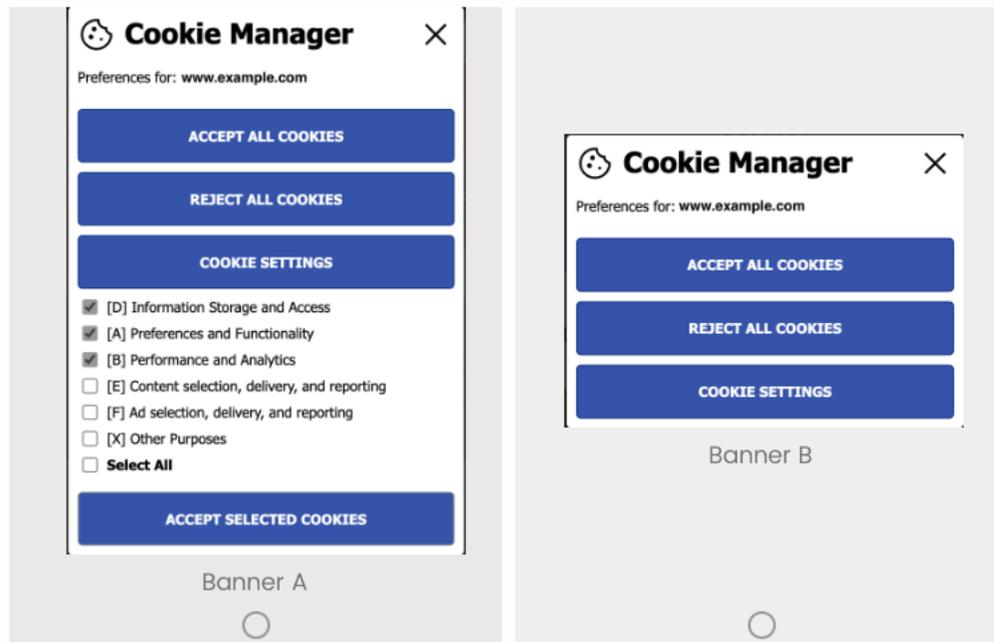
## A. Importance of Privacy

# How selected are our study participants?



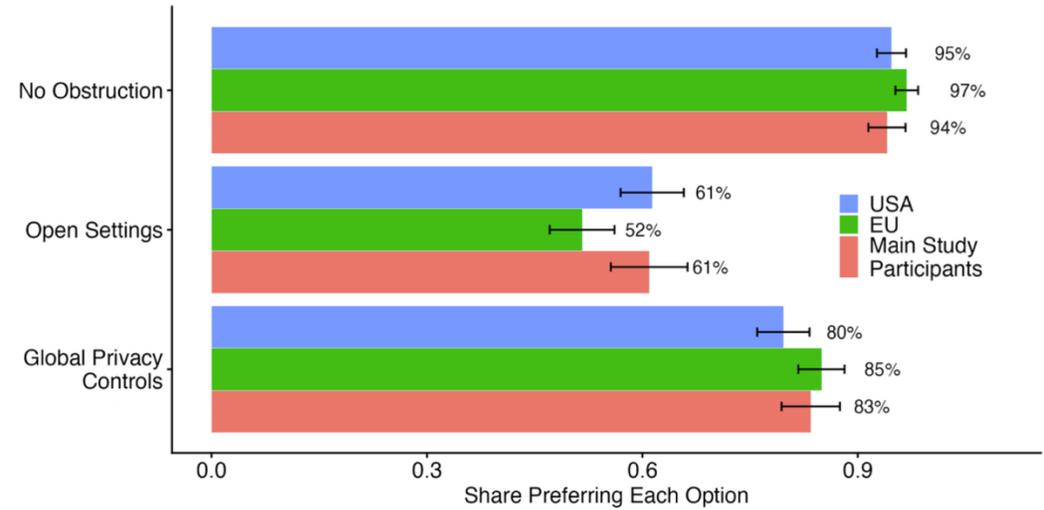
B. Privacy Preferences for Consent Designs

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B. Privacy Preferences for Consent Designs

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## B. Privacy Preferences for Consent Designs

# Roadmap:

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# Concluding Thoughts

- Evidence suggests that many consumers are happy to accept cookies.
- Defaults matter, especially since consumers often have incorrect beliefs about them.
- Having a browser level choice yields much higher welfare than forcing consumers to select sharing options site-by-site.
  - Even true for “discerners” who are selective about when to share.
- Policy implications: Clarify defaults, allow and encourage global choice of data sharing.

Thank you.