ECSS · PORTO · WORKSHOP ON DARK PATTERNS

Analysis of Dark Patterns in Cookie Consent Banners

Do cookie banners really give us a choice?

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Main findings

Consent can weaken at three distinct stages

STAGE 1

Before the choice

Do trackers already fire before anyone clicks anything?

STAGE 2

At the choice

Is refusing as easy as accepting, or is the banner nudging us?

STAGE 3

After the choice

Does clicking Reject really reduce the tracking that follows?

We tested all three on 1,060 websites across 8 sectors.

SAMPLE

Why these 1,060 websites

1 · BREADTH

Many sectors

News, Education, Finance, Entertainment, Health, Technology, Travel and E-commerce, so banner design can be compared across contexts.

2 · BALANCE

Even results

We wanted even results across sectors, not findings driven by a handful of sites.

3 · SCALE

Beyond earlier work

Previous research worked on fewer websites. A larger sample gives stronger evidence.

OUTCOME

1,060 websites visited, 581 scorable banners. Every site was visited the same way, from one German endpoint in June 2026.

METHOD

From 1,060 URLs to a manipulation score

COLLECT AND DETECT

1. 1,060 URLs
2. Playwright automated browser
3. Screenshot and HTML capture
4. Banner and control detection

MEASURE AND ANALYSE

5. MSI scoring
6. Baseline, Accept and Reject sessions
7. Tracker-domain matching
8. Statistical analysis

SETUP AND TOOLS

Measured in June 2026

1,060 websites visited

8 sectors

News, Education, Finance, Entertainment, Health, Technology, Travel, E-commerce

3 session types: baseline, accept, reject

TOOLS

Playwright · Python · pandas · SciPy · BeautifulSoup · matplotlib · Surfshark VPN · Tranco list

WHAT COUNTS AS A TRACKER

A request whose domain matches a curated list of known tracker domains.

MANIPULATION SEVERITY INDEX (MSI)

MSI: One score from five design features

Visual bias

Is Accept made more prominent than Reject?

Interaction friction

How many extra clicks does rejecting take?

Pre-ticked defaults

Are options already switched on for the user?

Opacity of wording

Does the language obscure what a choice means?

Interface obstruction

Does the layout get in the way of refusing?

How to read it

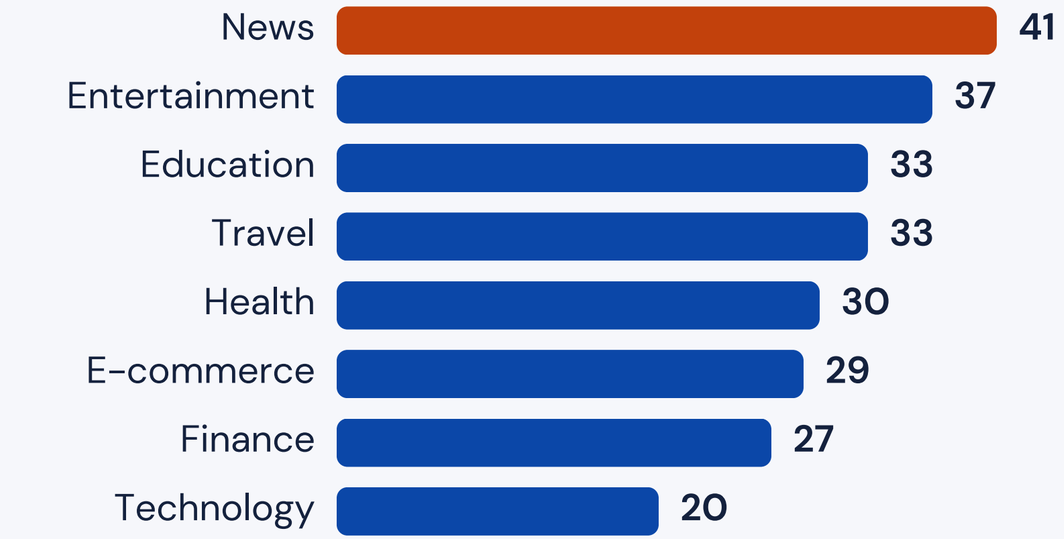
0 to 100. The higher the score, the more the design steers users toward Accept.

The five features are combined with weights that encode explicit design judgments.

MSI RESULTS

News banners score highest, Technology lowest

Mean MSI by sector, 581 scorable banners



OVERALL

Mean 32, median 20

IQR 5 to 60: many low scores, a sizeable high group.

SECTOR EXTREMES

News 40.8 vs Technology 20.1

SIGNIFICANCE

Sector differences are statistically significant: Kruskal-Wallis H = 29.7, p < 0.001.

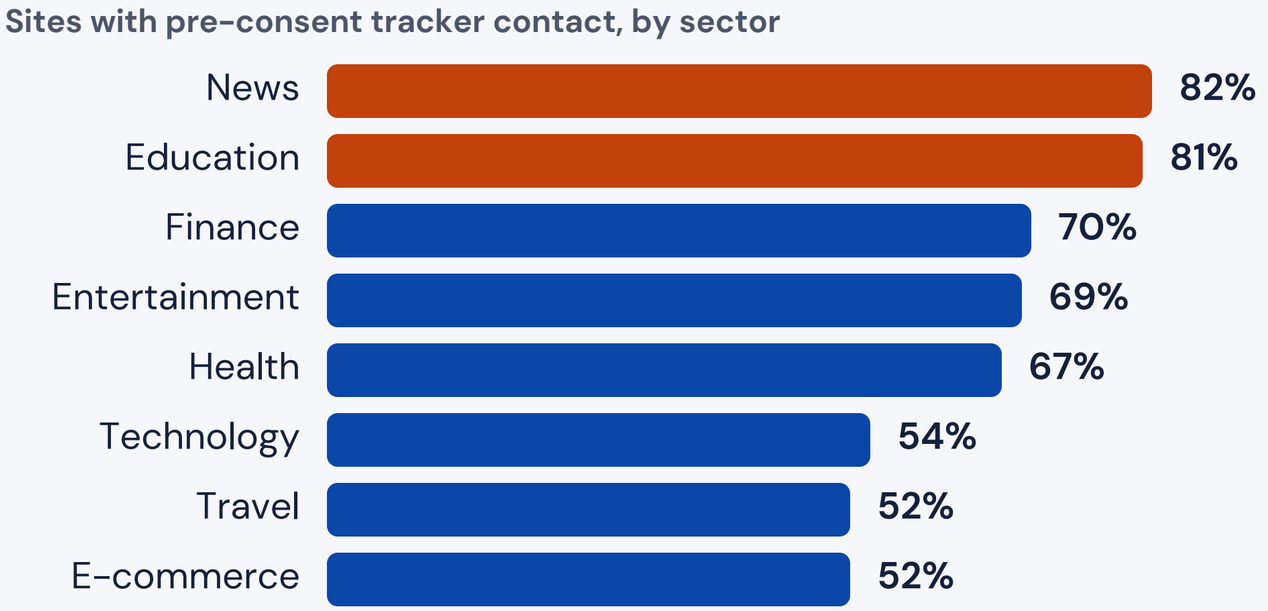
FINDING 1 · BEFORE THE CHOICE

Tracking starts before anyone clicks

67.6%

of all 1,060 sites contacted a known tracker in at least one baseline session, before anyone clicked anything.

Orange marks the two highest sectors.



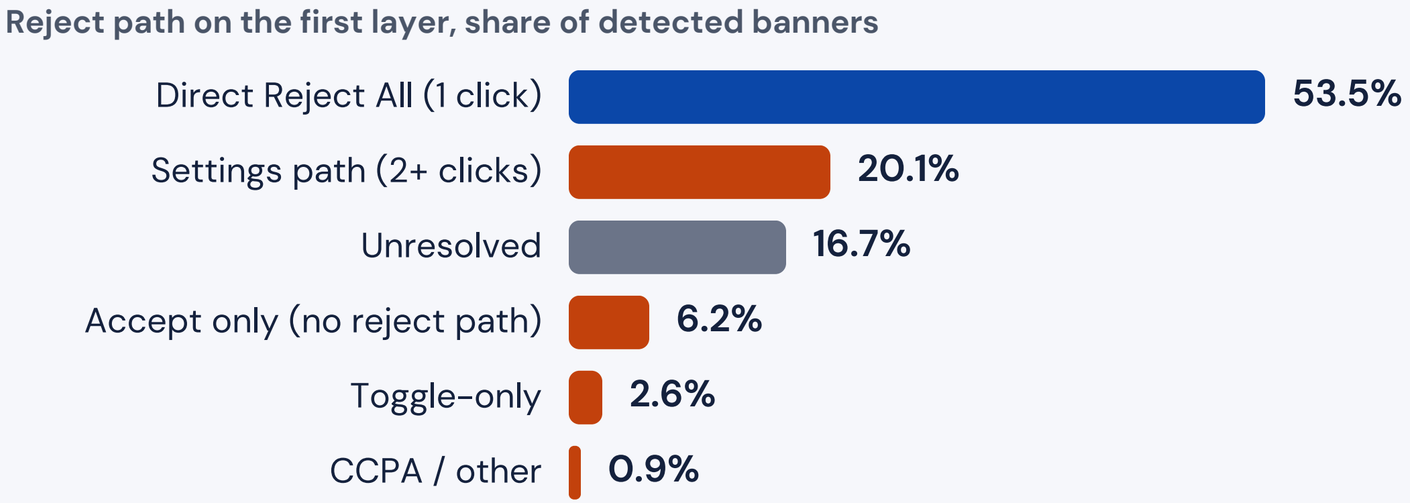
FINDING 2 · AT THE CHOICE

Rejecting is often harder than accepting

46.5%

of detected banners did not expose a direct one-click reject control. Only 53.5% had a Reject All button on the first layer.

Blue: one-click reject. Orange: no direct reject. Grey: unresolved.



FINDING 3 · AFTER THE CHOICE

Rejecting cuts tracking, but not always enough

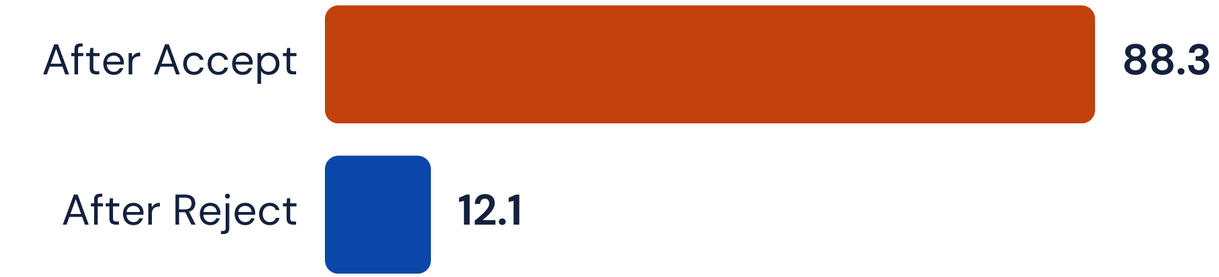
7.32×

more tracker requests after Accept than after Reject.

21.4%

of valid comparisons did not even reach a 50% reduction after rejection.

MEAN TRACKER REQUESTS PER SITE

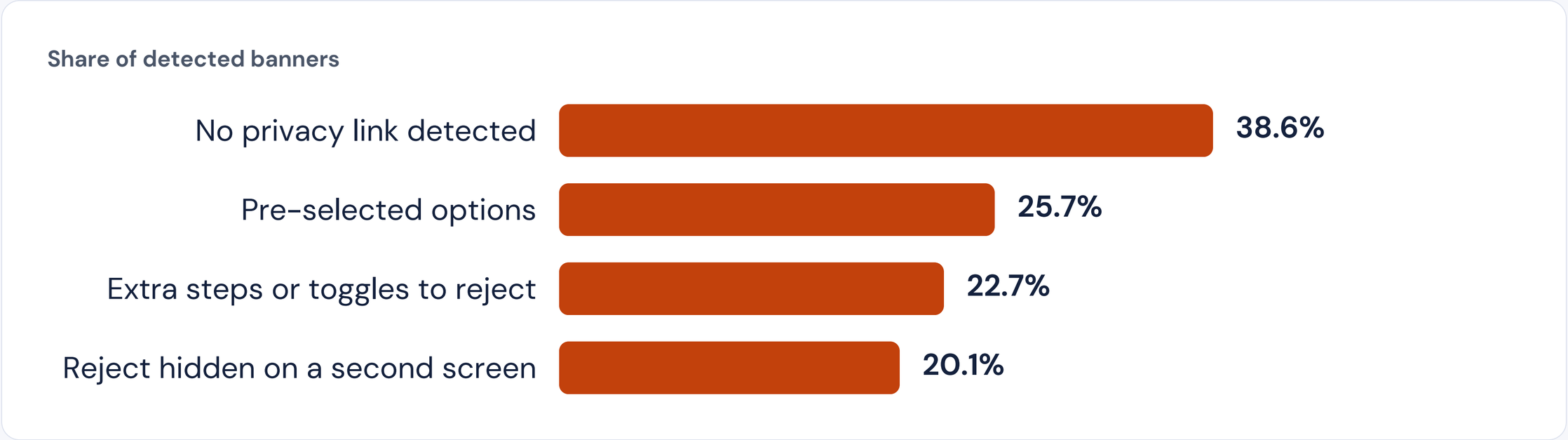


WHY IT MATTERS

Post-rejection network behaviour does not always reflect the visible decision.

COMMON BANNER DESIGN PATTERNS

Four patterns recur across banners



Patterns can overlap: one banner may contain several of these features.

CONCLUSION

A visible banner does not guarantee meaningful consent

BEFORE THE CHOICE

Tracking may be active before the user chooses.

AT THE CHOICE

Refusal is often less accessible than acceptance.

AFTER THE CHOICE

Network behaviour does not always match the visible decision.

This audit found consent weakened at three distinct stages.

LIMITATIONS

What the numbers can and cannot say

A lower bound

Tracker detection uses a curated domain list and captures only known trackers, so prevalence figures are a lower bound.

Observation, not verdict

A tracker request is a technical observation, not a legal determination of unlawful processing.

Automation limits

Automated banner interaction may miss shadow DOM elements, iframes, or region-gated controls.

A June 2026 snapshot

MSI weights encode design judgments, and all data reflect German-endpoint conditions in June 2026.

Thank You