

# Lecture 10: Tracking, Surveillance, and Data-Driven Inference

CMSC 25910

Winter 2026

The University of Chicago



THE UNIVERSITY OF  
CHICAGO

Chartbeat

Google

facebook

crimeo

amazon

Quantcast

comscore

2 New Relic

bluekai



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New Relic

bluekai



# Online Tracking

- Advertisers want to show you advertisements targeted to your interests and demographics

## How your ads are personalized

Ads are based on personal info you've added to your Google Account, data from advertisers that partner with Google, and Google's estimation of your interests. Choose any factor to learn more or update your preferences. [Learn more](#)

 Accounting & Finance Jobs	 Action & Adventure Films
 Action & Platform Games	 Adventure Games
 Android OS	 Autos & Vehicles
 Banking	 Bars, Clubs & Nightlife
 Beaches & Islands	 Blues
 Bollywood & South Asian Film	 Books & Literature
 Business & Productivity Software	 Business News

## Ads Preferences

Ads on Search and Gmail

Ads on the web

Opt out

Ads on the web

Make the ads you see on the web more interesting

Many websites, such as news sites and blogs, partner with us to show ads to their visitors. To see ads that are more related to you and your interests, edit the categories below, which are based on sites you have recently visited. [Learn More](#)

Your interests are associated with an advertising cookie that's stored in your browser. If you don't want us to store your interests, you can opt out below. Your ads preferences only apply in this browser on this computer. They are reset if you delete your browser's cookies.

[Watch a video: Ads Preferences on GDN explained](#)

### Your categories

Below you can review the interests and inferred demographics that Google has associated with your cookie. You can [remove](#) or [edit](#) these at any time.

Arts & Entertainment

Computers & Electronics

Computers & Electronics - Consumer Electronics - Gadgets & Portable Electronics - PDAs & Handhelds

Internet & Telecom

Internet & Telecom - Mobile & Wireless - Mobile Phones - Smart Phones

Law & Government

Science

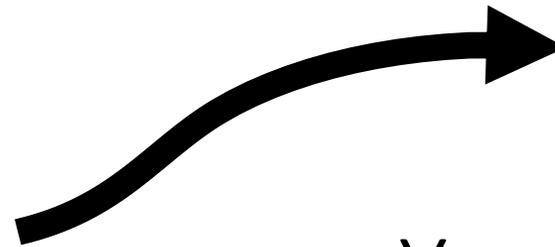
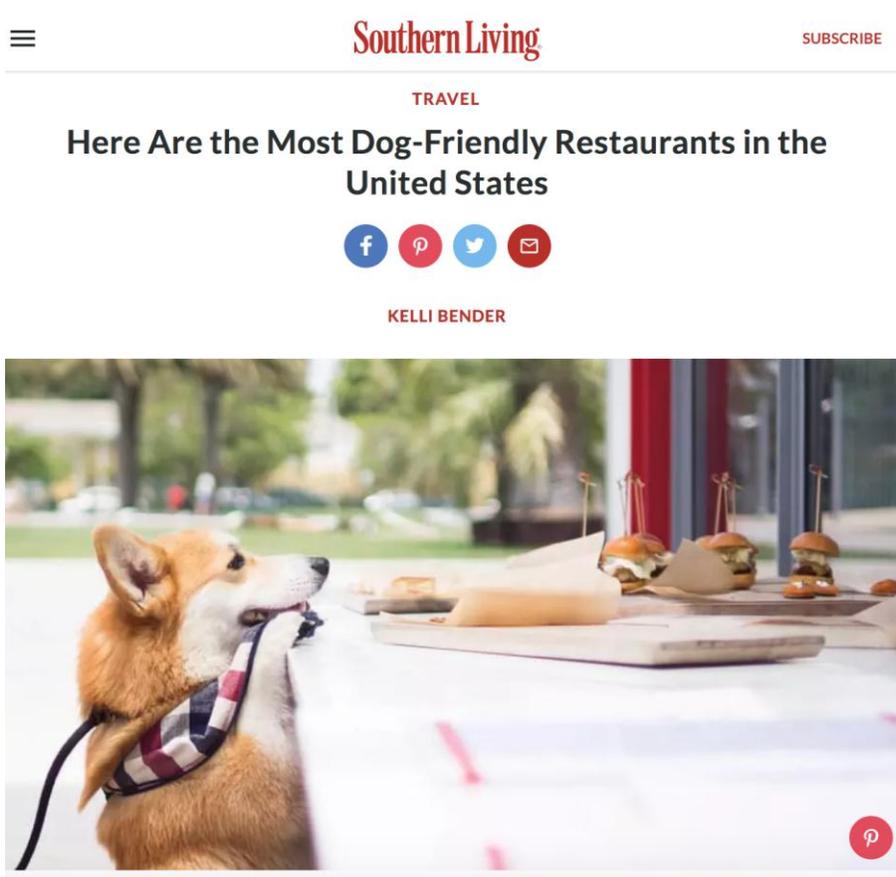
### Your demographics

We infer your age and gender based on the websites you've visited. You can [remove](#) or [edit](#) these at any time.

Age: 35-44

Gender: Male

# Data-Driven Inferences



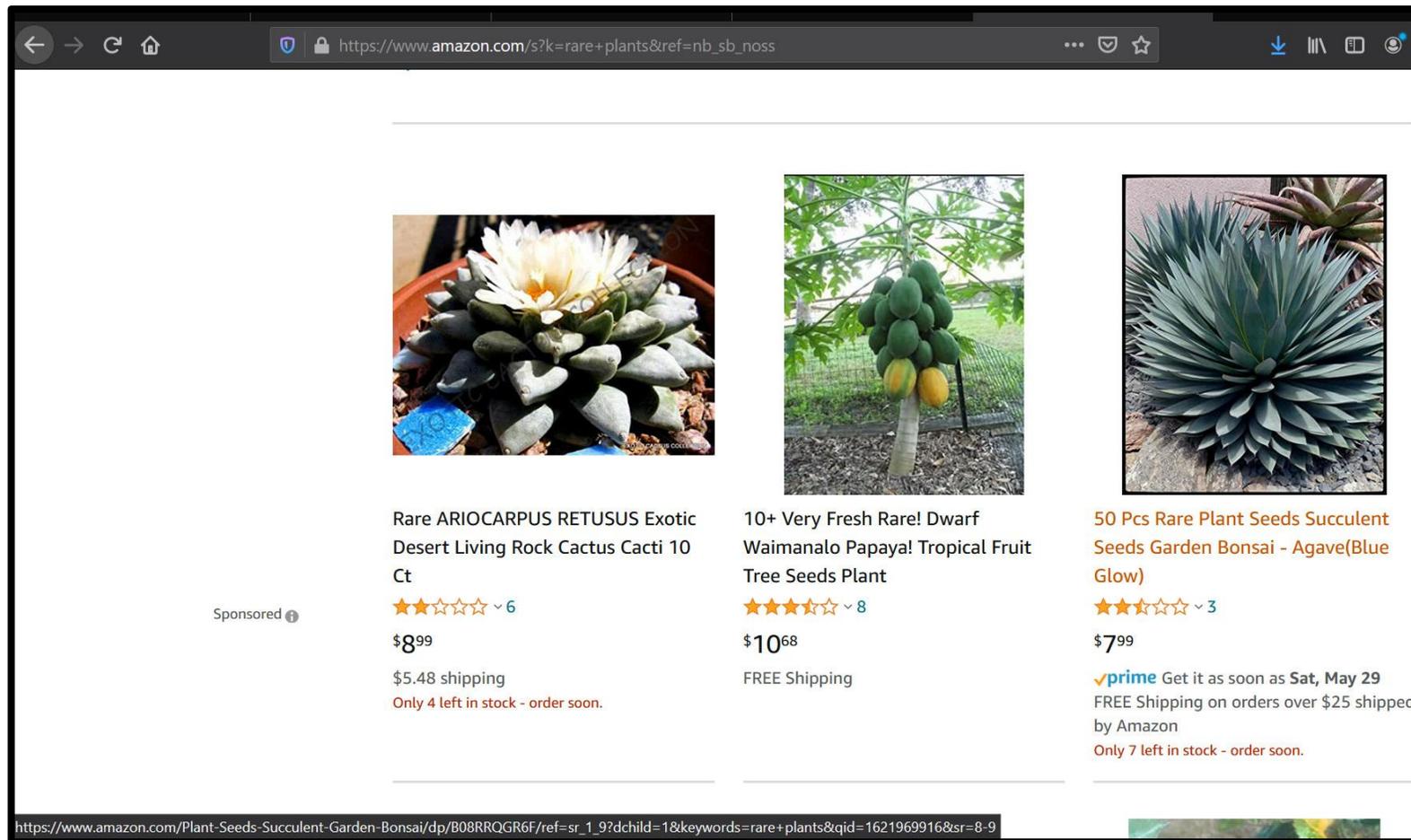
You might like dogs!

# Online Tracking

- First party = the site you are visiting (address is in the URL bar)
- Third party = other sites (i.e., origins) contacted as a result of your visit to the first party
- First-party tracking (on search engines, shopping sites)
- Third-party tracking (ads on lots of sites)

# Mechanics of First-Party Online Tracking

- Use cookies, JavaScript, URL parameters to track



The screenshot shows a web browser window with the URL [https://www.amazon.com/s?k=rare+plants&ref=nb\\_sb\\_noss](https://www.amazon.com/s?k=rare+plants&ref=nb_sb_noss). The page displays three sponsored product listings for plants and seeds. Each listing includes a product image, a title, a star rating, a price, and shipping information.

**Product 1:** Rare ARIOCARPUS RETUSUS Exotic Desert Living Rock Cactus Cacti 10 Ct. Price: \$8<sup>99</sup>. Shipping: \$5.48. Stock: Only 4 left in stock - order soon.

**Product 2:** 10+ Very Fresh Rare! Dwarf Waimanalo Papaya! Tropical Fruit Tree Seeds Plant. Price: \$10<sup>68</sup>. Shipping: FREE Shipping.

**Product 3:** 50 Pcs Rare Plant Seeds Succulent Seeds Garden Bonsai - Agave(Blue Glow). Price: \$7<sup>99</sup>. Shipping: FREE Shipping on orders over \$25 shipped by Amazon. Stock: Only 7 left in stock - order soon.

At the bottom of the page, the URL [https://www.amazon.com/Plant-Seeds-Succulent-Garden-Bonsai/dp/B08RRQGR6F/ref=sr\\_1\\_9?dchild=1&keywords=rare+plants&qid=1621969916&sr=8-9](https://www.amazon.com/Plant-Seeds-Succulent-Garden-Bonsai/dp/B08RRQGR6F/ref=sr_1_9?dchild=1&keywords=rare+plants&qid=1621969916&sr=8-9) is visible.

# Mechanics of First-Party Online Tracking

<p>Sponsored ⓘ</p>	<p>Desert Living Rock Cactus Cacti 10 Ct</p> <p>★★★★☆ ∨ 6</p> <p>\$8<sup>99</sup></p> <p>\$5.48 shipping</p> <p>Only 4 left in stock - order soon.</p>	<p>Waimanalo Papaya! Tropical Fruit Tree Seeds Plant</p> <p>★★★★☆ ∨ 8</p> <p>\$10<sup>68</sup></p> <p>FREE Shipping</p> <p>Seed Glow</p> <p>★★</p> <p>\$7<sup>99</sup></p> <p>✓prime</p> <p>FREE by An</p> <p>Only 7</p>
<p><a href="https://www.amazon.com/Plant-Seeds-Succulent-Garden-Bonsai/dp/B08RRQGR6F/ref=sr_1_9?dchild=1&amp;keywords=rare+plants&amp;qid=1621969916&amp;sr=8-9">https://www.amazon.com/Plant-Seeds-Succulent-Garden-Bonsai/dp/B08RRQGR6F/ref=sr_1_9?dchild=1&amp;keywords=rare+plants&amp;qid=1621969916&amp;sr=8-9</a></p>		

# Mechanics of Third-Party Online Tracking

The screenshot displays the UChicago News website interface. At the top, the browser address bar shows the URL <https://www.uchicago.edu> with a 67% zoom level. The main heading is "UChicago News", followed by a sub-header: "- Visit the **UChicago Forward website**, for the University's COVID-19 health protocols, campus guidelines, and other Spring Quarter information."

Below the header, there are three news article thumbnails:

- Thumbnail 1:** A photograph of a memorial service with many people gathered around a table covered with flowers. Below it, the text reads: "What Americans are thinking a year after George Floyd's death".
- Thumbnail 2:** A photograph of several small white houses on stilts against a blue sky. Below it, the text reads: "Big Brains podcast: Why You're Likely Paying An Unfair Share of Property Taxes".
- Thumbnail 3:** A photograph of a modern building with a large tree in bloom. Below it, the text reads: "University announces COVID-19 vaccine requirement for all students".

To the right of these thumbnails is a "Latest News" section with the text: "Founded at UChicago, nonprofit Climate Vault proposes new solution for carbon reduction". A "MORE NEWS >" link is located at the bottom right of this section.

At the bottom of the page, there is a video player for "Explore Chicago: Discover the Global City UChicago...". The video player includes a "Watch later" button and a "Share" button. The video content shows a street scene with a large building and the text "A WORLD-CLASS UNIVERSITY". A "Watch on YouTube" button is visible in the bottom left corner of the video player. To the right of the video player is an "Explore Chicago" section with the text: "Discover the global city UChicago calls home—filled with inspiration, innovation, and countless opportunities to explore." and a "VISIT UCHICAGO >" link.

# Details of HTTP Request

```
▼ Request Headers (735 B) Raw   
GET / HTTP/2  
Host: www.uchicago.edu  
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:88.0) Gecko/20100101 Firefox/91.0  
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8  
Accept-Language: en-US,en;q=0.5  
Accept-Encoding: gzip, deflate, br  
DNT: 1  
Connection: keep-alive  
Cookie: uchicago-prod_last_visit=1306604446; uchicago-prod_last_activity=1621964446;  
Upgrade-Insecure-Requests: 1  
If-Modified-Since: Tue, 25 May 2021 17:40:36 GMT  
TE: Trailers
```

# Details of HTTP Request



```
▼ Request Headers (735 B) Raw   
GET / HTTP/2  
Host: www.uchicago.edu  
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:88.0) Gecko/20100101 Firefox/88.0  
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8  
Accept-Language: en-US,en;q=0.5  
Accept-Encoding: gzip, deflate, br  
DNT: 1  
Connection: keep-alive  
Cookie: uchicago-prod_last_visit=1306604446; uchicago-prod_last_activity=1621964446;  
Upgrade-Insecure-Requests: 1  
If-Modified-Since: Tue, 25 May 2021 17:40:36 GMT  
TE: Trailers
```

# Details of HTTP Cookies



# Details of HTTP Request

```
▼ Request Headers (735 B) Raw   
GET / HTTP/2  
Host: www.uchicago.edu  
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:88.0) Gecko/20100101 Firefo  
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8  
Accept-Language: en-US,en;q=0.5  
Accept-Encoding: gzip, deflate, br  
DNT: 1  
Connection: keep-alive  
Cookie: uchicago-prod_last_visit=1306604446; uchicago-prod_last_activity=1621964446;  
Upgrade-Insecure-Requests: 1  
If-Modified-Since: Tue, 25 May 2021 17:40:36 GMT  
TE: Trailers
```

# Details of HTTP Response

▼ Response Headers (1.078 KB)

Raw

```
HTTP/2 200 OK
date: Tue, 25 May 2021 18:00:35 GMT
content-type: text/html; charset=UTF-8
server: Apache
x-frame-options: SAMEORIGIN
expires: Mon, 26 Jul 1997 05:00:00 GMT
pragma: no-cache
vary: Accept-Encoding
set-cookie: uchicago-prod_last_visit=1306605629; expires=Wed, 25-May-2022 18:00:29 G
set-cookie: uchicago-prod_last_activity=1621965629; expires=Wed, 25-May-2022 18:00:2
set-cookie: uchicago-prod_tracker=%7B%220%22%3A%22index%22%2C%22token%22%3A%2226944a
set-cookie: uchicago-prod_csrf_token=deleted; expires=Thu, 01-Jan-1970 00:00:01 GMT;
set-cookie: uchicago-prod_csrf_token=86d47d8690aa7646e1628dd095cd5b464db16bd3; expir
last-modified: Tue, 25 May 2021 18:00:29 GMT
content-encoding: gzip
x-varnish: 10696657 9201444
age: 5
via: 1.1 varnish (Varnish/5.2)
accept-ranges: bytes
X-Firefox-Spdy: h2
```

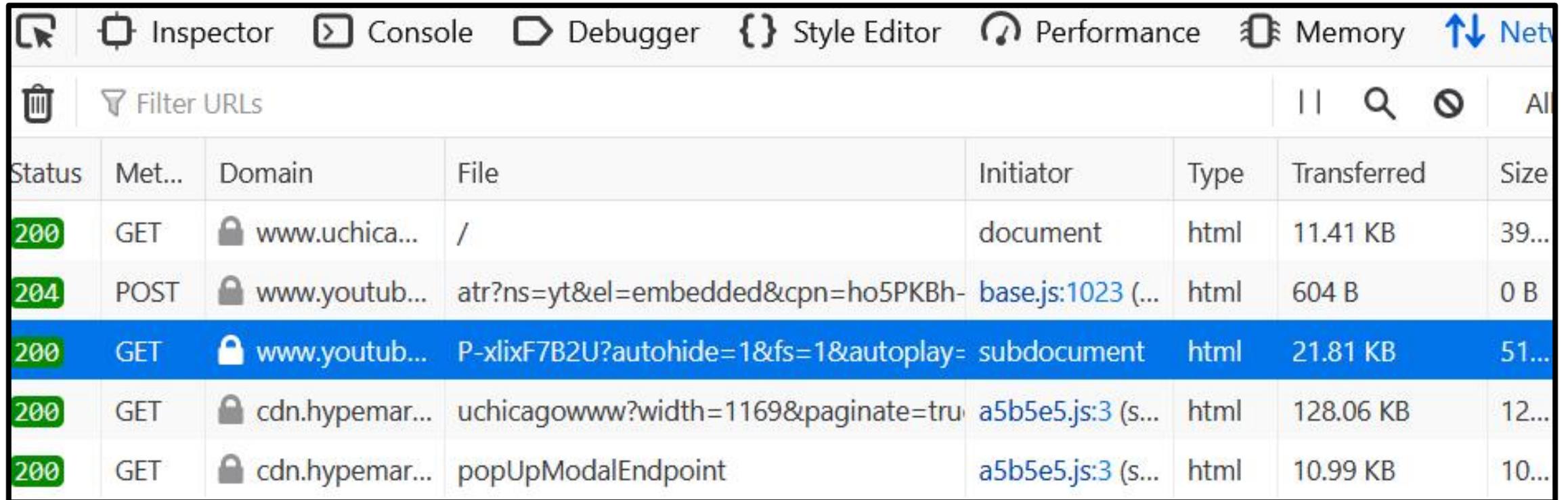
# Details of HTTP Response

▼ Response Headers (1.078 KB) Raw

```
HTTP/2 200 OK
date: Tue, 25 May 2021 18:00:35 GMT
content-type: text/html; charset=UTF-8
server: Apache
x-frame-options: SAMEORIGIN
expires: Mon, 26 Jul 1997 05:00:00 GMT
pragma: no-cache
vary: Accept-Encoding
set-cookie: uchicago-prod_last_visit=1306605629; expires=Wed, 25-May-2022 18:00:29 G
set-cookie: uchicago-prod_last_activity=1621965629; expires=Wed, 25-May-2022 18:00:2
set-cookie: uchicago-prod_tracker=%7B%220%22%3A%22index%22%2C%22token%22%3A%2226944a
set-cookie: uchicago-prod_csrf_token=deleted; expires=Thu, 01-Jan-1970 00:00:01 GMT;
set-cookie: uchicago-prod_csrf_token=86d47d8690aa7646e1628dd095cd5b464db16bd3; expir
last-modified: Tue, 25 May 2021 18:00:29 GMT
content-encoding: gzip
x-varnish: 10696657 9201444
age: 5
via: 1.1 varnish (Varnish/5.2)
accept-ranges: bytes
X-Firefox-Spdy: h2
```



# Headers (uchicago.edu → youtube.com)



The screenshot shows the Chrome DevTools Network tab with a list of network requests. The interface includes a toolbar with icons for Inspector, Console, Debugger, Style Editor, Performance, Memory, and Network. Below the toolbar is a search bar labeled 'Filter URLs' and a table of requests. The table has columns for Status, Method, Domain, File, Initiator, Type, Transferred, and Size. The third request is highlighted in blue.

Status	Met...	Domain	File	Initiator	Type	Transferred	Size
200	GET	www.uchica...	/	document	html	11.41 KB	39...
204	POST	www.youtub...	atr?ns=yt&el=embedded&cpn=ho5PKBh-	base.js:1023 (...	html	604 B	0 B
200	GET	www.youtub...	P-xlixF7B2U?autohide=1&fs=1&autoplay=	subdocument	html	21.81 KB	51...
200	GET	cdn.hypemar...	uchicagowww?width=1169&paginate=tru	a5b5e5.js:3 (s...	html	128.06 KB	12...
200	GET	cdn.hypemar...	popUpModalEndpoint	a5b5e5.js:3 (s...	html	10.99 KB	10...

# Headers (uchicago.edu → youtube.com)

## ▼ Request Headers (621 B)

Raw

```
GET /embed/P-xlixF7B2U?autohide=1&fs=1&autoplay=0&rel=0&modestbranding=1&showinfo=0&hd=1&e
Host: www.youtube.com
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:88.0) Gecko/20100101 Firefox/88.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate, br
DNT: 1
Alt-Used: www.youtube.com
Connection: keep-alive
Referer: https://www.uchicago.edu/
Cookie: VISITOR_INFO01_LIVE=dACtKPaJViQ; PREF=tz=America.Chicago&f4=4000000; YSC=p2jSvxCMel
Upgrade-Insecure-Requests: 1
TE: Trailers
```

# Headers (uchicago.edu → youtube.com)

▼ Request Headers (621 B)

Raw

```
GET /embed/P-xlixF7B2U?autohide=1&fs=1&autoplay=0&rel=0&modestbranding=1&showinfo=0&hd=1&e
Host: www.youtube.com
```

```
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:88.0) Gecko/20100101 Firefox/88.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate, br
DNT: 1
Alt-Used: www.youtube.com
Connection: keep-alive
Referer: https://www.uchicago.edu/
Cookie: VISITOR_INFO01_LIVE=dACtKPaJViQ; PREF=tz=America.Chicago&f4=4000000; YSC=p2jSvxCMel
Upgrade-Insecure-Requests: 1
TE: Trailers
```

# Headers (uchicago.edu → youtube.com)

```
▼ Request Headers (621 B) Raw   
GET /embed/P-xlixF7B2U?autohide=1&fs=1&autoplay=0&rel=0&modestbranding=1&showinfo=0&hd=1&e  
Host: www.youtube.com  
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:88.0) Gecko/20100101 Firefox/88.0  
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8  
Accept-Language: en-US,en;q=0.5  
Accept-Encoding: gzip, deflate, br  
DNT: 1  
Alt-Used: www.youtube.com  
Connection: keep-alive  
Referer: https://www.uchicago.edu/  
Cookie: VISITOR_INFO01_LIVE=dACtKPaJViQ; PREF=tz=America.Chicago&f4=4000000; YSC=p2jSvxCMeI  
Upgrade-Insecure-Requests: 1  
TE: Trailers
```

# Putting It Together

- (Unless browser is blocking it) third party gets its cookies
- (Unless browser is blocking it) third party sees “referrer” [sic]
- First party can choose to send info to third party via URL parameters (not a violation of Same Origin Policy!)
- Third party sees this information for **many** first parties

# Mechanics of Cookie Syncing

- JavaScript / images from advertising networks loaded as part of your page
  - In iframes
  - Or sometimes not
  - Why does this matter?
- Let's discuss: what can an ad network learn, and how?

# Mechanics of Cookie Syncing

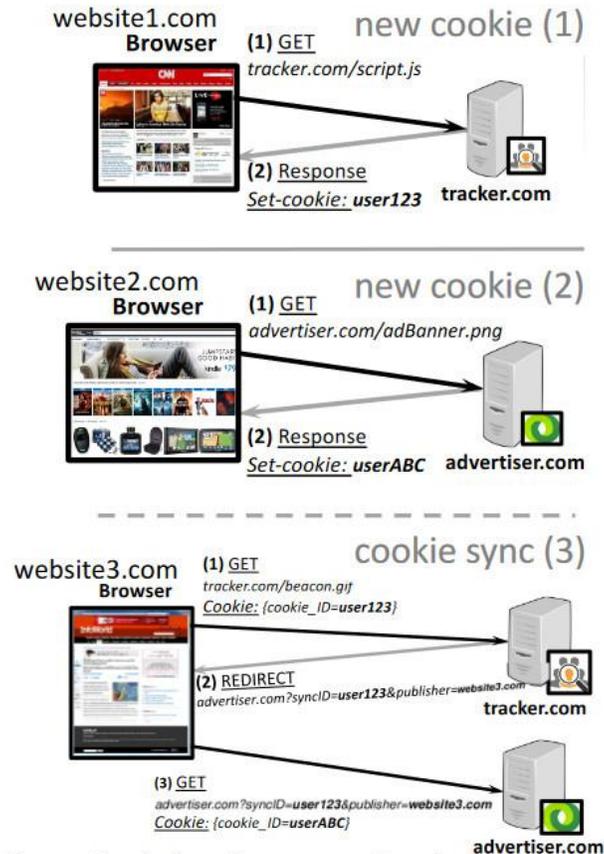


Figure 1: Example of advertiser.com and tracker.com synchronizing their cookieIDs. Interestingly, and without having any code in website3, advertiser.com learns that: (i) cookieIDs userABC==user123 and (ii) userABC has just visited the given website. Finally, both domains can conduct server-to-server user data merges.

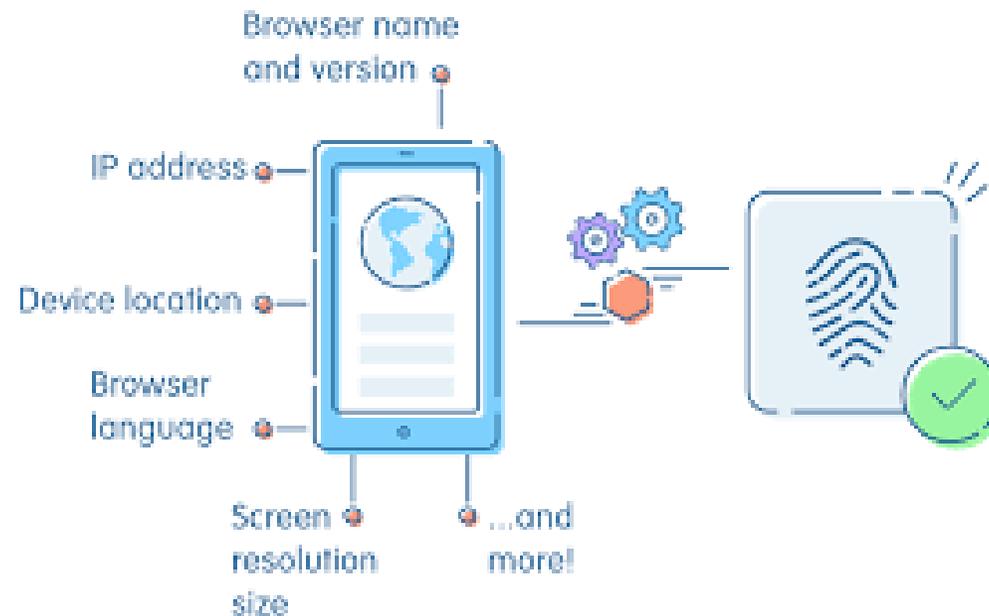
From Papadopoulos et al. "Cookie Synchronization: Everything You Always Wanted to Know But Were Afraid to Ask," in *Proc. WWW*, 2019.

# Browser Fingerprinting

- Use features of the browser that are relatively unique to your machine
  - Fonts
  - GPU model anti-aliasing (Canvas fingerprinting)
  - User-agent string
  - *(Often not) IP address (Why not?)*

# Browser Fingerprinting

- Use combination of device features as an identifier
- <https://coveryourtracks.eff.org/>

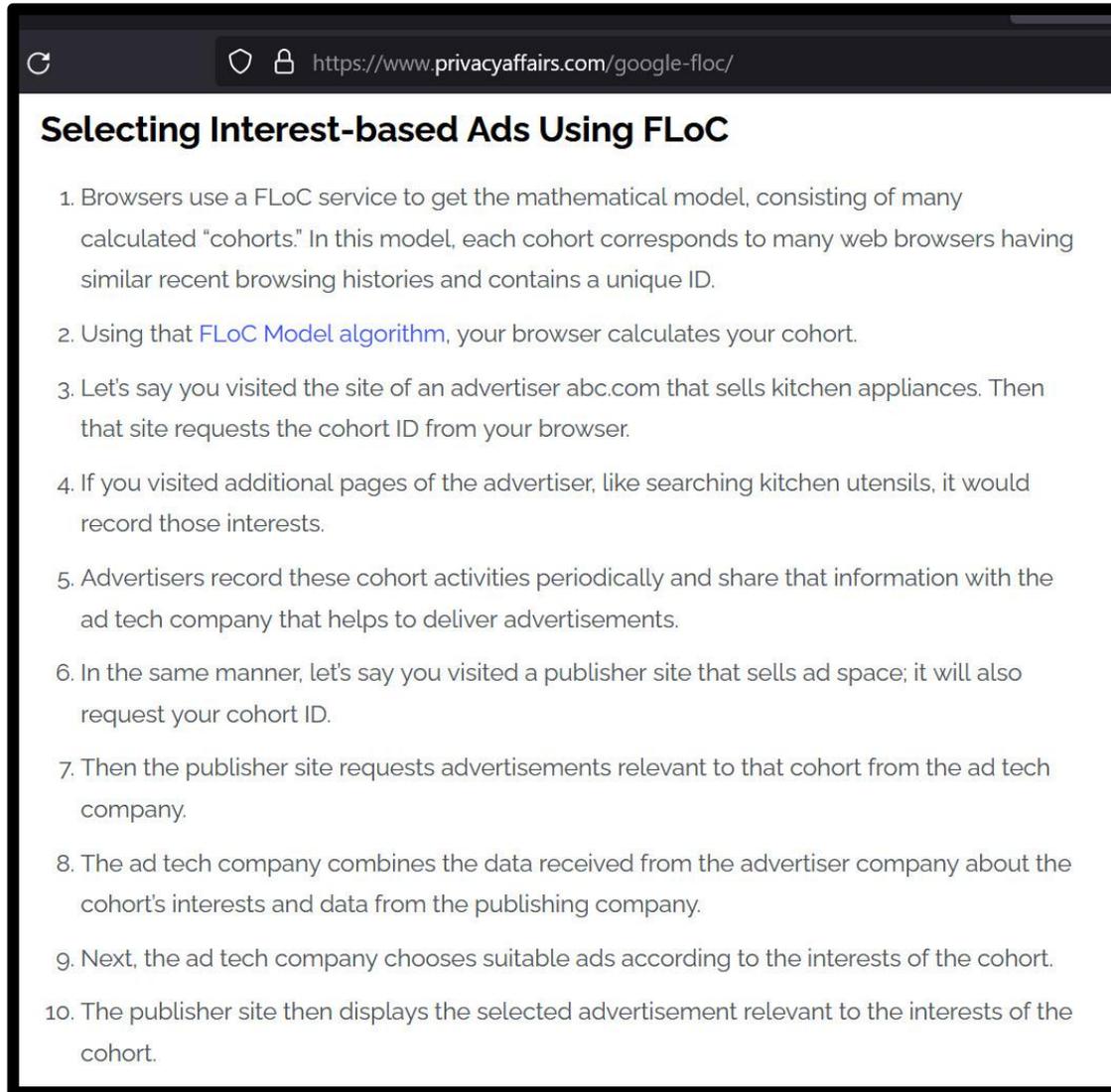


# Alternatives to Cookies for Tracking / Profiling

# Google's FLoC

- Federated Learning of Cohorts
- Clusters users based on their browsing activity and assigns a cohort ID
  - Uses SimHash for clustering
  - Clusters *intended to* contain 1,000s of users
- Criticisms include fingerprintability, ability to tie cohort to PII, and collapse of different browsing contexts
- **(Abandoned in early 2022)**

# Google's FLoC



https://www.privacyaffairs.com/google-floc/

## Selecting Interest-based Ads Using FLoC

1. Browsers use a FLoC service to get the mathematical model, consisting of many calculated "cohorts." In this model, each cohort corresponds to many web browsers having similar recent browsing histories and contains a unique ID.
2. Using that [FLoC Model algorithm](#), your browser calculates your cohort.
3. Let's say you visited the site of an advertiser abc.com that sells kitchen appliances. Then that site requests the cohort ID from your browser.
4. If you visited additional pages of the advertiser, like searching kitchen utensils, it would record those interests.
5. Advertisers record these cohort activities periodically and share that information with the ad tech company that helps to deliver advertisements.
6. In the same manner, let's say you visited a publisher site that sells ad space; it will also request your cohort ID.
7. Then the publisher site requests advertisements relevant to that cohort from the ad tech company.
8. The ad tech company combines the data received from the advertiser company about the cohort's interests and data from the publishing company.
9. Next, the ad tech company chooses suitable ads according to the interests of the cohort.
10. The publisher site then displays the selected advertisement relevant to the interests of the cohort.

# Google's FLoC



EFF  
ELECTRONIC  
FRONTIER  
FOUNDATION

About Issues Our Work Take Action Tools Donate Q

## Google's FLoC Is a Terrible Idea

BY BENNETT CYPHERS | MARCH 3, 2021



*Update, April 9, 2021: We've launched [AmIFLoCed](#), a new site that will tell you whether your Chrome browser has been turned into a guinea pig for Federated Learning of Cohorts or FLoC, Google's latest targeted advertising experiment.*

The third-party cookie is dying, and Google is trying to create its replacement.

No one should mourn the death of the cookie as we know it. For more than two decades, the third-party cookie has been the lynchpin in a shadowy, seedy, multi-billion dollar [advertising-surveillance industry on the Web](#); phasing out

**Join Our Newsletter!**  
Email updates on news, actions, events in your area, and more.

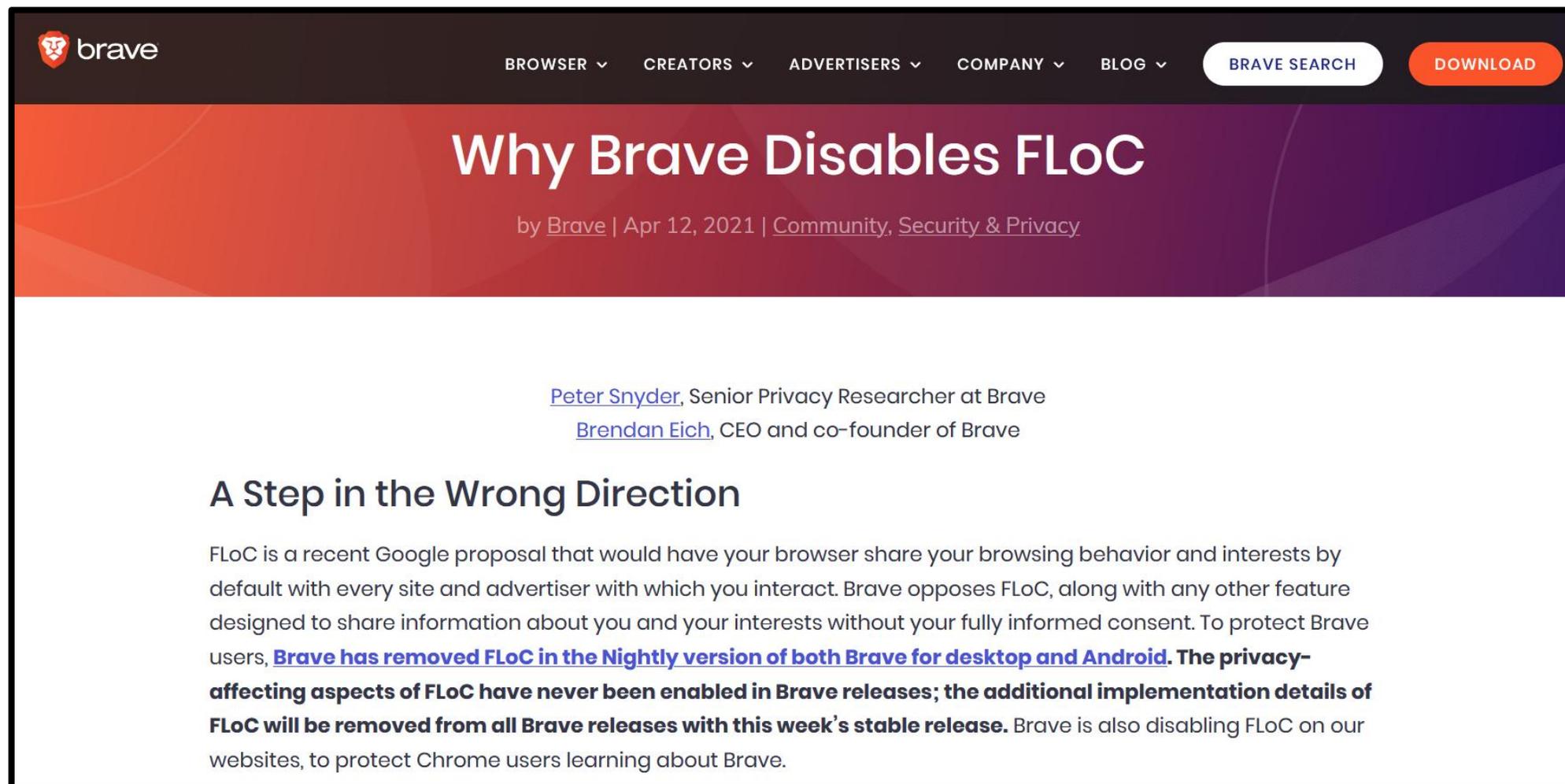
Email Address

Postal Code (optional)

Anti-spam question: Enter the three-letter abbreviation for Electronic Frontier Foundation:

Image taken from <https://www.eff.org/deeplinks/2021/03/googles-floc-terrible-idea>

# Google's FLoC (Brave's Perspective)

The image is a screenshot of a web browser displaying an article on the Brave website. The browser's address bar is not visible, but the page content is clearly shown. At the top left is the Brave logo. The navigation menu includes links for BROWSER, CREATORS, ADVERTISERS, COMPANY, and BLOG. There are also buttons for BRAVE SEARCH and DOWNLOAD. The article title is 'Why Brave Disables FLoC' in large white text on a dark purple background. Below the title is the author information: 'by Brave | Apr 12, 2021 | Community, Security & Privacy'. The author's name, Peter Snyder, is listed as 'Senior Privacy Researcher at Brave', and Brendan Eich is listed as 'CEO and co-founder of Brave'. The main heading of the article is 'A Step in the Wrong Direction'. The first paragraph explains that FLoC is a Google proposal to share browsing behavior and interests by default with every site and advertiser. It states that Brave opposes FLoC because it shares information without informed consent. A key point is highlighted in bold: 'Brave has removed FLoC in the Nightly version of both Brave for desktop and Android. The privacy-affecting aspects of FLoC have never been enabled in Brave releases; the additional implementation details of FLoC will be removed from all Brave releases with this week's stable release.' The paragraph concludes by stating that Brave is also disabling FLoC on its own websites to protect Chrome users learning about Brave.

**brave**

BROWSER ▾ CREATORS ▾ ADVERTISERS ▾ COMPANY ▾ BLOG ▾

BRAVE SEARCH DOWNLOAD

## Why Brave Disables FLoC

by Brave | Apr 12, 2021 | Community, Security & Privacy

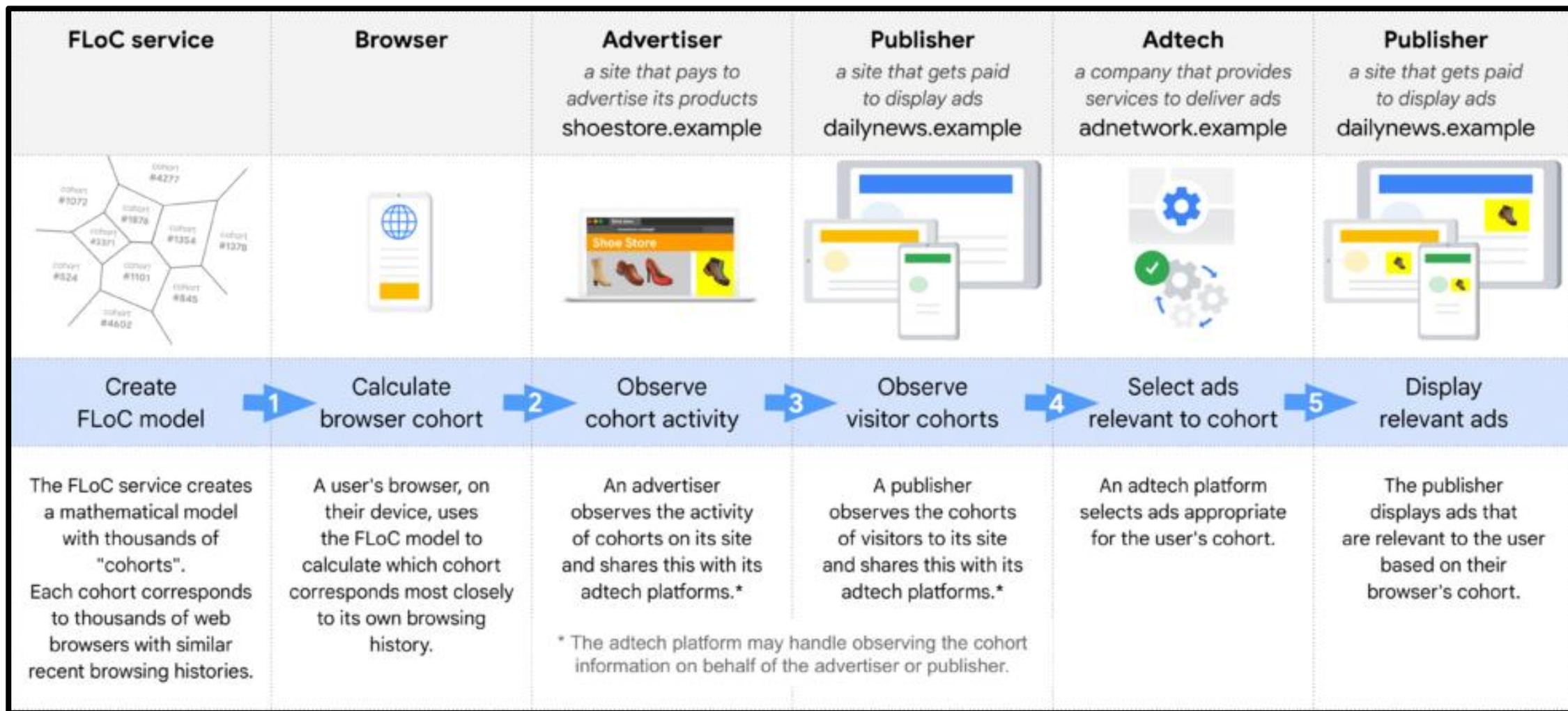
[Peter Snyder](#), Senior Privacy Researcher at Brave  
[Brendan Eich](#), CEO and co-founder of Brave

### A Step in the Wrong Direction

FLoC is a recent Google proposal that would have your browser share your browsing behavior and interests by default with every site and advertiser with which you interact. Brave opposes FLoC, along with any other feature designed to share information about you and your interests without your fully informed consent. To protect Brave users, **Brave has removed FLoC in the Nightly version of both Brave for desktop and Android. The privacy-affecting aspects of FLoC have never been enabled in Brave releases; the additional implementation details of FLoC will be removed from all Brave releases with this week's stable release.** Brave is also disabling FLoC on our websites, to protect Chrome users learning about Brave.

Image taken from <https://brave.com/why-brave-disables-floc/>

# Google's FLoC



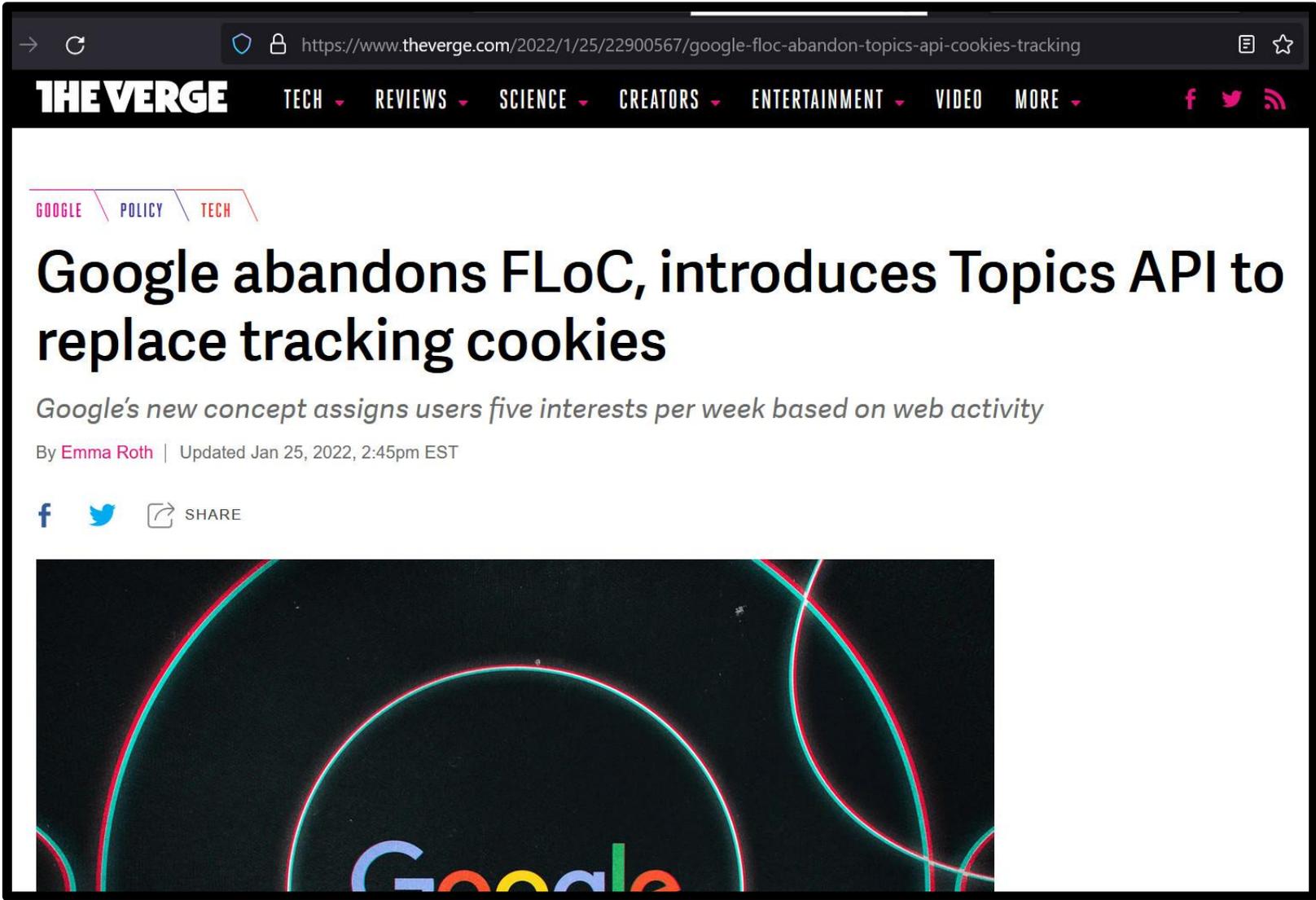
# Google's FLoC

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10. The publisher site then displays the selected advertisement relevant to the interests of the cohort.

Image taken from <https://www.privacyaffairs.com/google-floc/>

# Google's Topics API



The screenshot shows a web browser window with the URL <https://www.theverge.com/2022/1/25/22900567/google-floc-abandon-topics-api-cookies-tracking>. The page features the The Verge logo and a navigation menu with categories: TECH, REVIEWS, SCIENCE, CREATORS, ENTERTAINMENT, VIDEO, and MORE. Social media icons for Facebook, Twitter, and RSS are also present. The article title is "Google abandons FLoC, introduces Topics API to replace tracking cookies". A sub-headline reads "Google's new concept assigns users five interests per week based on web activity". The author is Emma Roth, and the article was updated on Jan 25, 2022, at 2:45pm EST. Below the text is a social sharing section with icons for Facebook, Twitter, and a "SHARE" button. At the bottom, there is a partial view of a graphic with the Google logo and overlapping circles.

→ ↻  <https://www.theverge.com/2022/1/25/22900567/google-floc-abandon-topics-api-cookies-tracking>  

**THE VERGE** TECH ▾ REVIEWS ▾ SCIENCE ▾ CREATORS ▾ ENTERTAINMENT ▾ VIDEO MORE ▾   

GOOGLE POLICY TECH

## Google abandons FLoC, introduces Topics API to replace tracking cookies

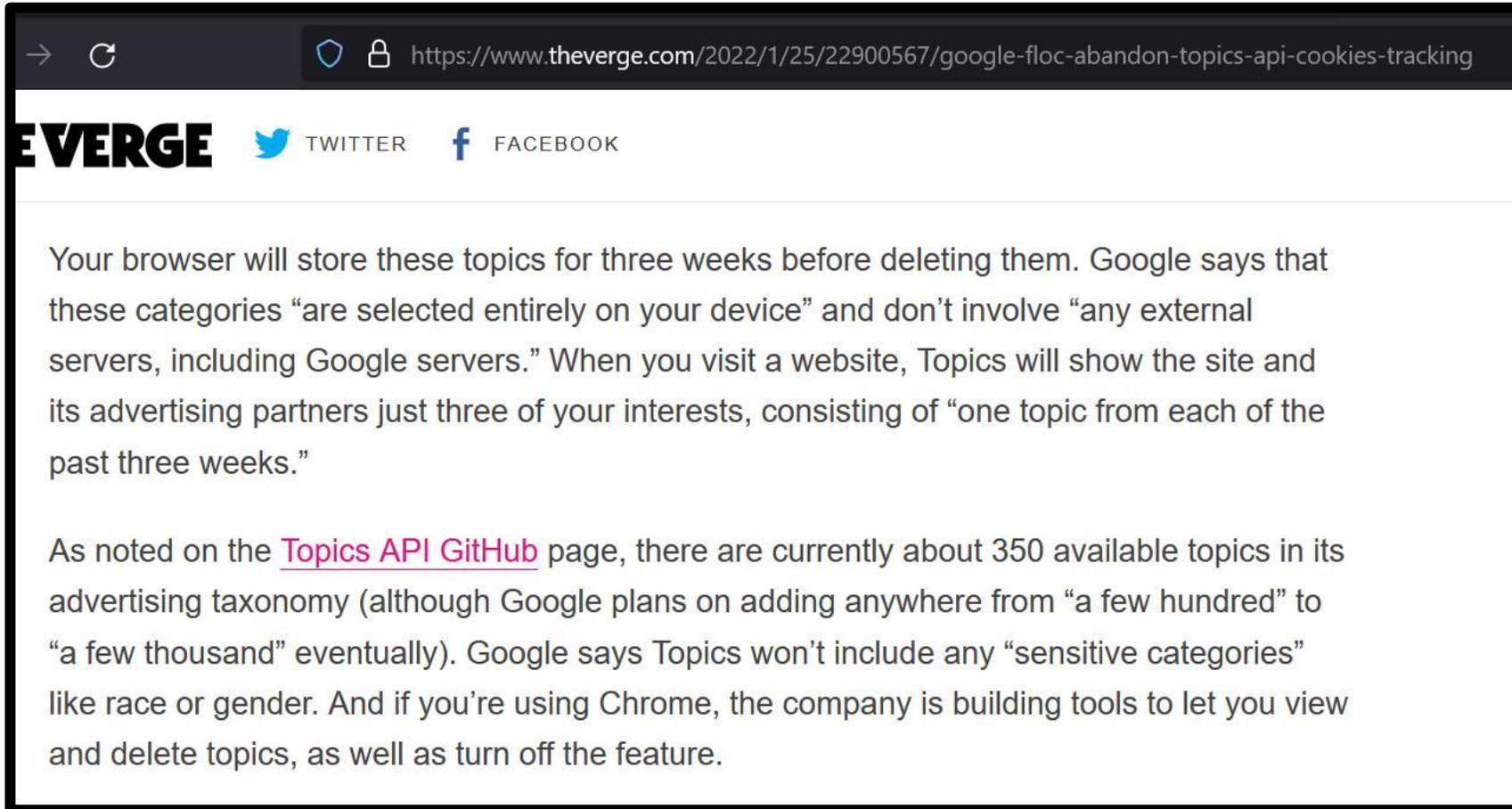
*Google's new concept assigns users five interests per week based on web activity*

By [Emma Roth](#) | Updated Jan 25, 2022, 2:45pm EST

   SHARE



# Google's Topics API



The screenshot shows a web browser window with the address bar displaying the URL: <https://www.theverge.com/2022/1/25/22900567/google-floc-abandon-topics-api-cookies-tracking>. The page header includes the "THE VERGE" logo, a Twitter icon with the text "TWITTER", and a Facebook icon with the text "FACEBOOK".

Your browser will store these topics for three weeks before deleting them. Google says that these categories “are selected entirely on your device” and don’t involve “any external servers, including Google servers.” When you visit a website, Topics will show the site and its advertising partners just three of your interests, consisting of “one topic from each of the past three weeks.”

As noted on the [Topics API GitHub](#) page, there are currently about 350 available topics in its advertising taxonomy (although Google plans on adding anywhere from “a few hundred” to “a few thousand” eventually). Google says Topics won’t include any “sensitive categories” like race or gender. And if you’re using Chrome, the company is building tools to let you view and delete topics, as well as turn off the feature.

# **Studying User Reactions to (Future) Hyper-Targeting**

# Study: Banner Ads



**Treat yourself  
this week.**

*Use SUPEReats.co to reserve a restaurant near  
you for a deal!*

[www.SUPEREATS.co](http://www.SUPEREATS.co)

The banner features a blue background with several white paper trays of golden french fries scattered around. The text is centered in white, with the main headline in a larger, bold font. At the bottom, there are icons for a website, an app, and a play button, followed by the website URL.

Generic



**Taylor, treat Ryan  
to a date night this week  
in Memphis.**

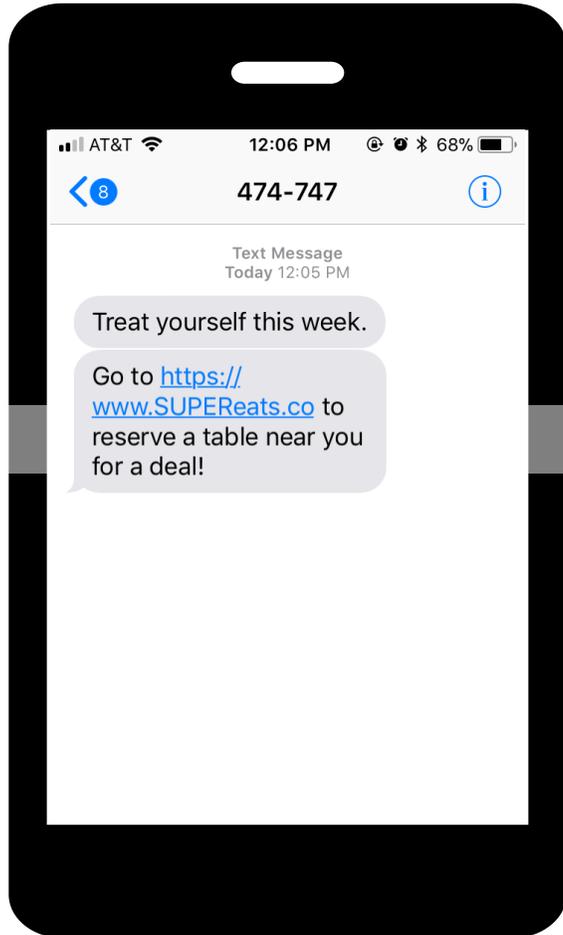
*We know you LOVE Thai restaurants.  
Use SUPEReats.co to reserve a table at one of  
the 7 near you for a deal!*

[www.SUPEREATS.co](http://www.SUPEREATS.co)

The banner features a blue background with several white square plates of Thai food, including what looks like a stir-fry with chicken and vegetables, scattered around. The text is centered in white, with the main headline in a larger, bold font. At the bottom, there are icons for a website, an app, and a play button, followed by the website URL.

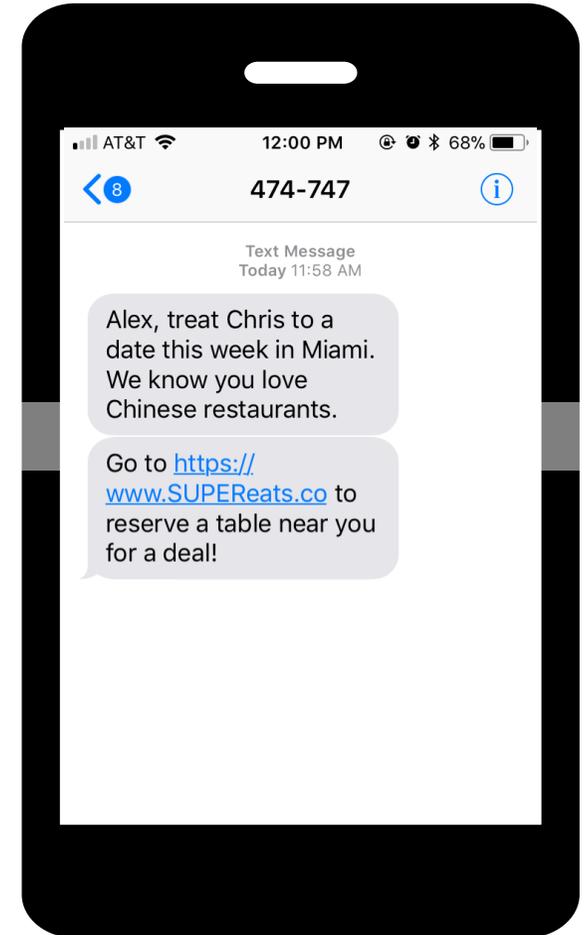
Personalized

# Study: Robotext Ads



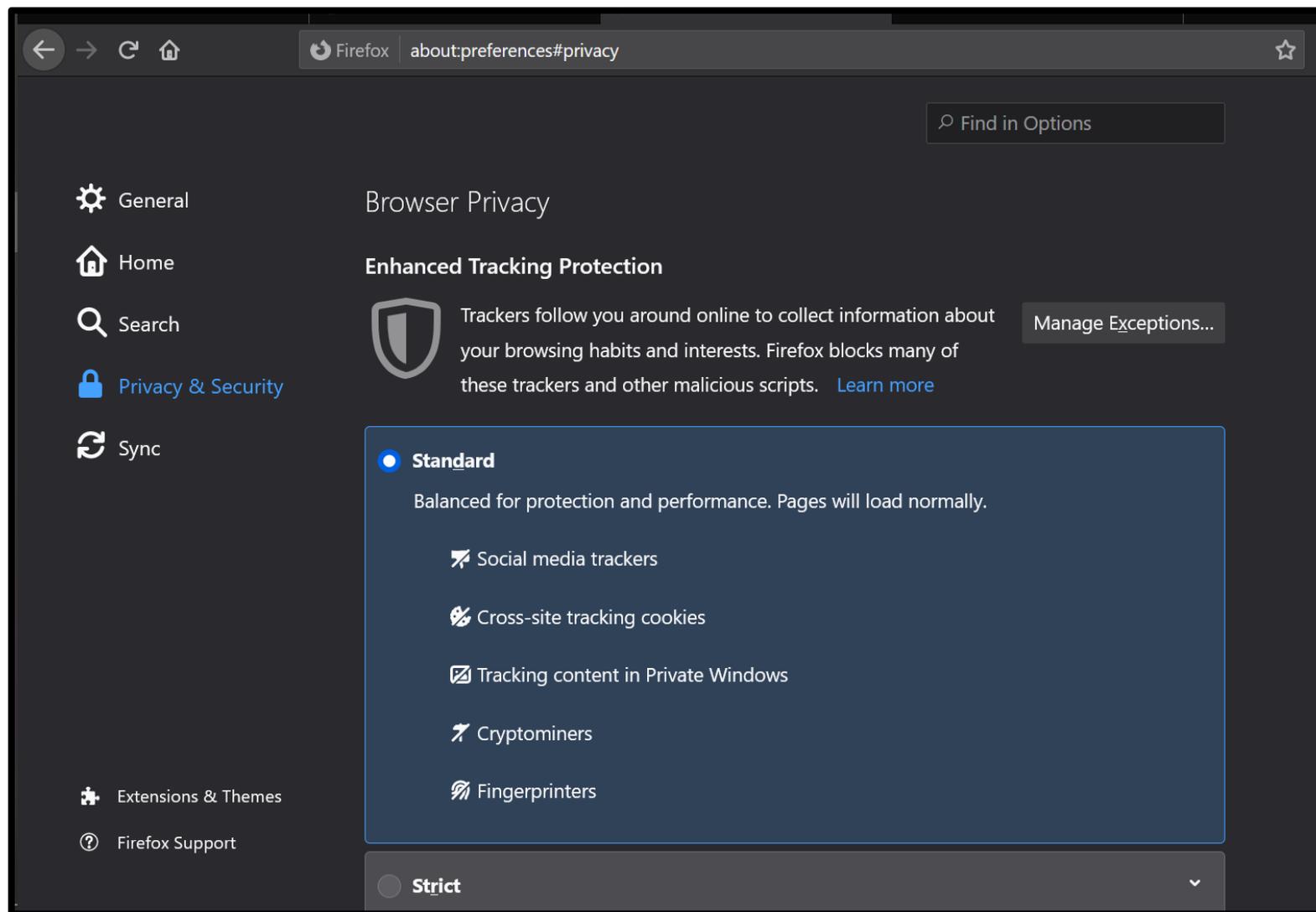
Generic

Personalized

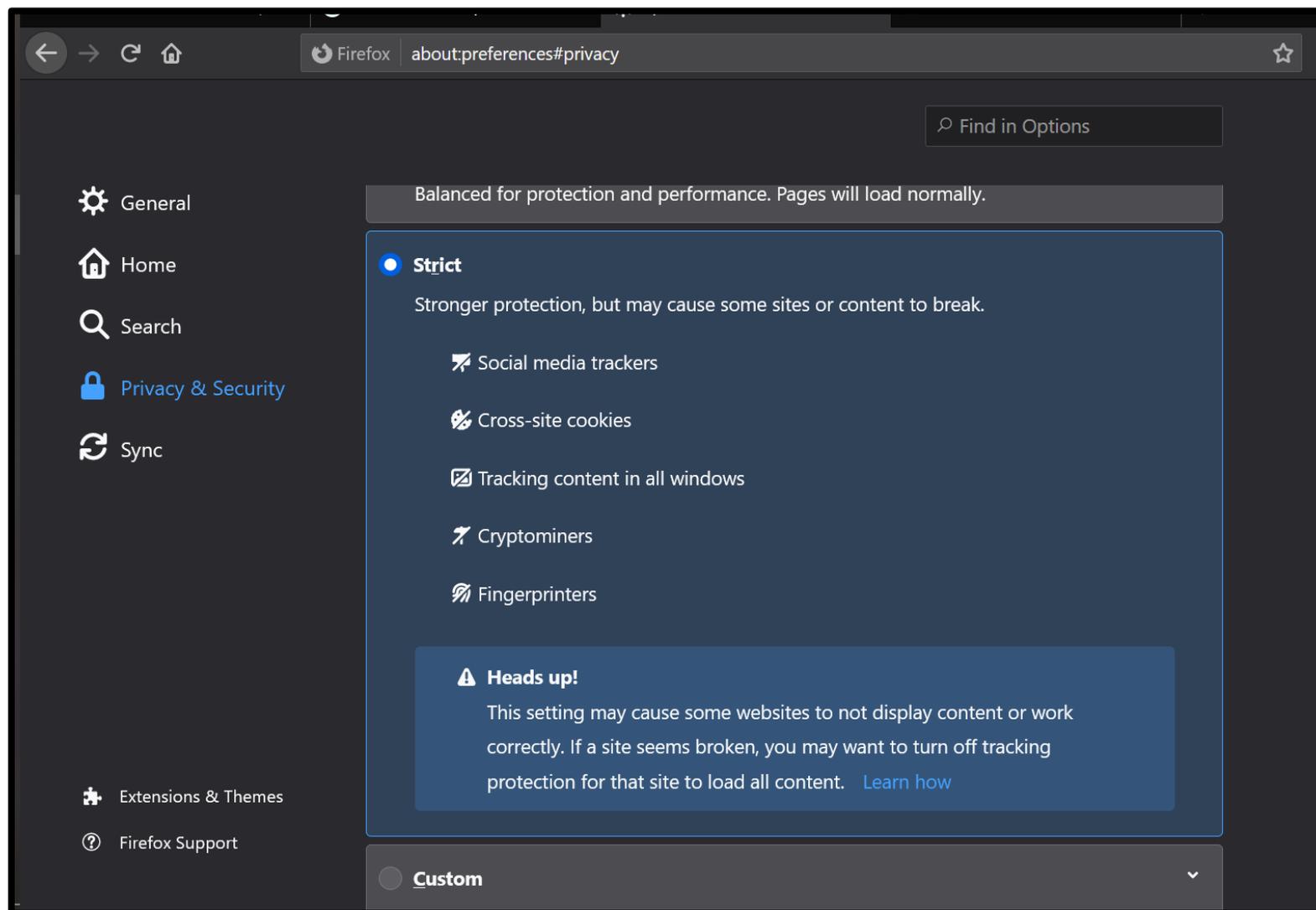


# **Anti-Tracking Tools**

# Firefox Browser Default Settings

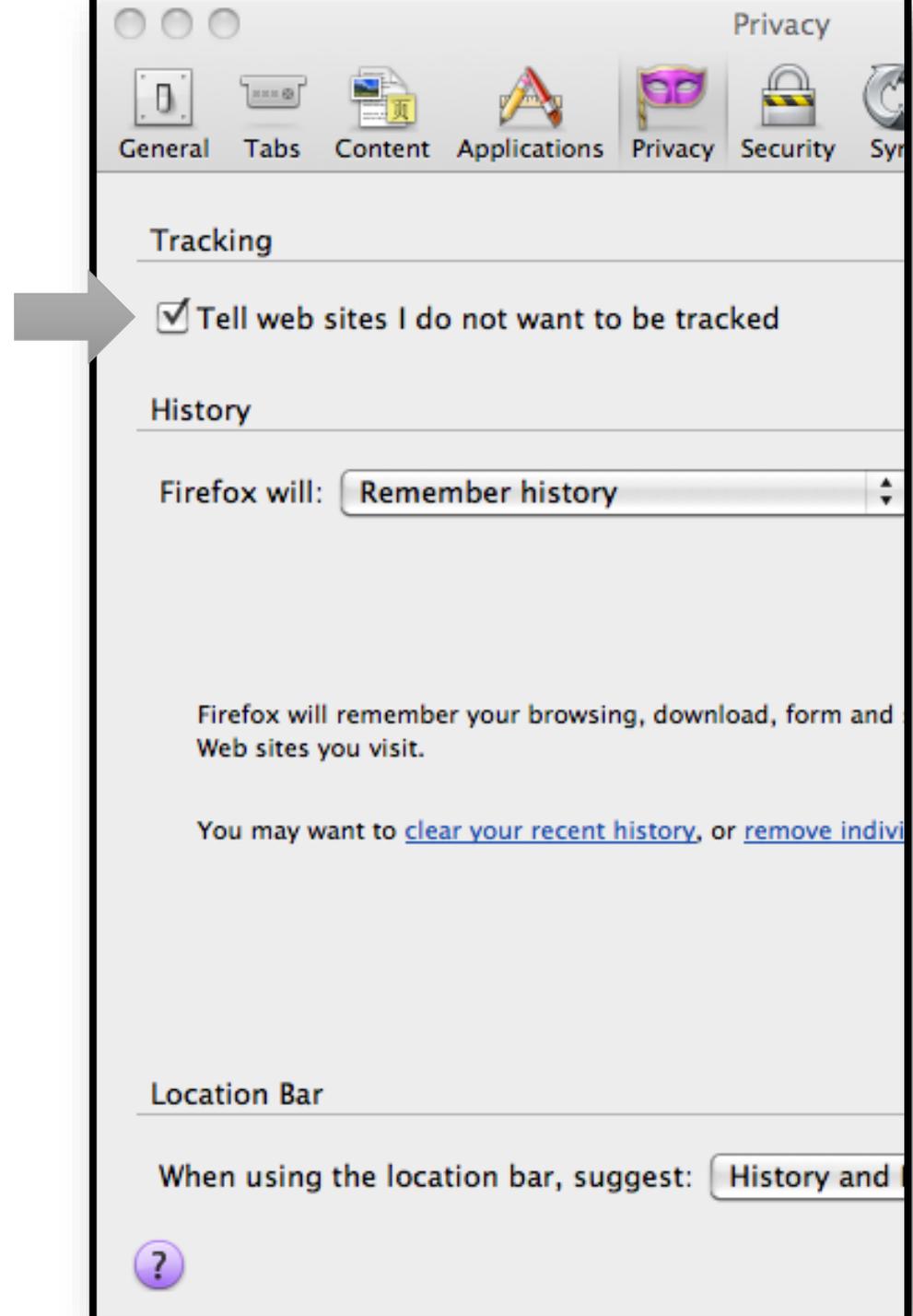


# Firefox Browser Strict Settings



# Do Not Track

- W3C standard
- User checks a box
- Browser sends a “do not track” header to website
- Website stops “tracking”
- W3C working group tried to define what “stopping tracking” meant
- **Now mostly deprecated**



# Global Privacy Control (GPC)



- Sec-GPC: 1
  - No extensibility by design
- `navigator.globalPrivacyControl = True`
- Implemented by Firefox, Brave, DuckDuckGo Private Browser
- A few states (e.g., California) legally require that businesses honor GPC signals

# Are Tools to Stop Tracking Effective?

- Browser privacy settings
  - Cookie blocking
  - P3P
  - Tracking Protection Lists
  - Do Not Track
- Browser add-ons
- Opt-out cookies
- Digital Advertising Alliance (DAA) AdChoices icon and associated opt-out pages



# **Transparency Tools**

# Current Transparency Tools

## Privacy-Focused Browser Extensions



## Browsers' Built-in Tools



## Companies' Privacy Dashboards



# Oh, the Places You've Been!

User Reactions to Longitudinal Transparency About  
Third-Party Web Tracking and Inferencing



## BY

Ben Weinshel

Miranda Wei

Mainack Mondal

Eurim Choi

Shawn Shan

Claire Dolin

Michelle L. Mazurek

Blase Ur



# Current Tools Provide High-Level Information



# Current Tools Provide High-Level Information

The screenshot displays the Ghostery browser extension interface. The top navigation bar includes the Ghostery logo, a 'Simple View' tab, a 'Detailed View' tab, and user profile icons. A green banner at the top left encourages an 'Upgrade to Plus'. The main content area is split into two panels. The left panel shows a circular progress indicator with the number '25' in the center, representing the number of trackers blocked. Below this, the website 'www.rottentomatoes.com' is identified. Summary statistics are provided: 'Trackers Blocked: 11' (in red), 'Requests Modified: 6' (in blue), and 'Page Load: -'. At the bottom of this panel are three control buttons: 'Trust Site' (with an off radio button), 'Restrict Site' (with an on radio button), and 'Pause Ghostery' (with a dropdown arrow). The right panel, titled 'TRACKERS', lists individual tracking services. The first entry is 'Advertising', which is expanded to show '8 TRACKERS' and '5 BLOCKED'. Below it, several trackers are listed with their status: 'BlueKai' (on), 'Google Publisher Tags' (off), 'Adobe Audience Manager' (off), 'Adobe Test & Target' (off), and 'Facebook Custom Audience' (off). Each tracker entry has a red 'X' icon indicating its status. At the bottom of the interface, there are three icons: a shield for 'List View', a line graph, and a gift icon.

# Current Tools Provide High-Level Information

The screenshot displays the Ghostery browser extension interface. On the left, a circular progress indicator shows 25 trackers blocked. Below it, the website URL is www.rottentomatoes.com. Statistics include 11 trackers blocked, 6 requests modified, and a page load status. Control buttons for 'Trust Site', 'Restrict Site', and 'Pause Ghostery' are visible, along with status indicators for 'OFF', 'ON', and 'ON'. The right panel, titled 'TRACKERS', lists various trackers under the 'Advertising' category. The 'BlueKai' tracker is highlighted with a red box. Other trackers listed include 'Google Publisher Tags', 'Adobe Audience Manager', 'Adobe Test & Target', and 'Facebook Custom Audience'. A 'Block All' button is located at the top right of the tracker list.

Upgrade to *Plus*

25

www.rottentomatoes.com

Trackers Blocked: 11  
Requests Modified: 6  
Page Load: -

Trust Site

Restrict Site

Pause Ghostery

OFF ON ON

TRACKERS

Block All

Collapse All

Advertising 8 TRACKERS 5 BLOCKED

BlueKai

Google Publisher Tags

Adobe Audience Manager

Adobe Test & Target

Facebook Custom Audience

List View

# Current Tools Provide High-Level Information

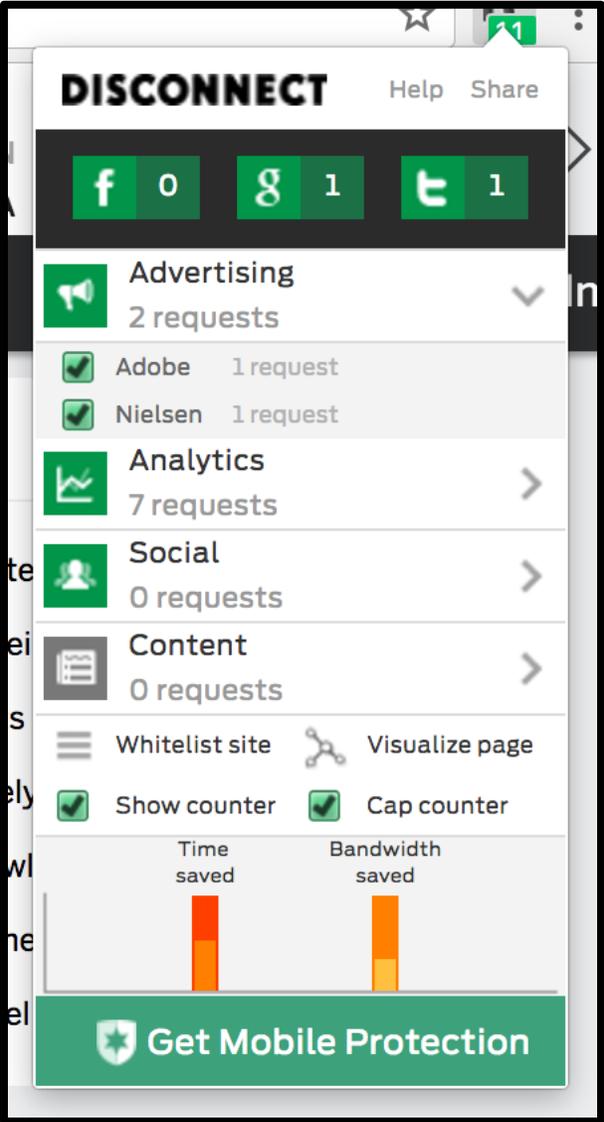
The screenshot displays the Ghostery browser extension interface. On the left, a circular progress indicator shows 25 trackers. Below it, the website URL is www.rottentomatoes.com. A red box highlights the text "Trackers Blocked: 11". Other metrics include "Requests Modified: 0" and "Page Load: -". Control buttons for "Trust Site", "Restrict Site", and "Pause Ghostery" are visible. At the bottom, there are three toggle switches labeled "OFF", "ON", and "ON".

On the right, the "TRACKERS" section is shown in "Simple View". It lists several trackers with their status:

- Advertising: 8 TRACKERS, 5 BLOCKED
- BlueKai
- Google Publisher Tags
- Adobe Audience Manager
- Adobe Test & Target
- Facebook Custom Audience

Each tracker entry has a red 'X' icon indicating it is blocked. The interface also includes a "Block All" button and a "Collapse All" option.

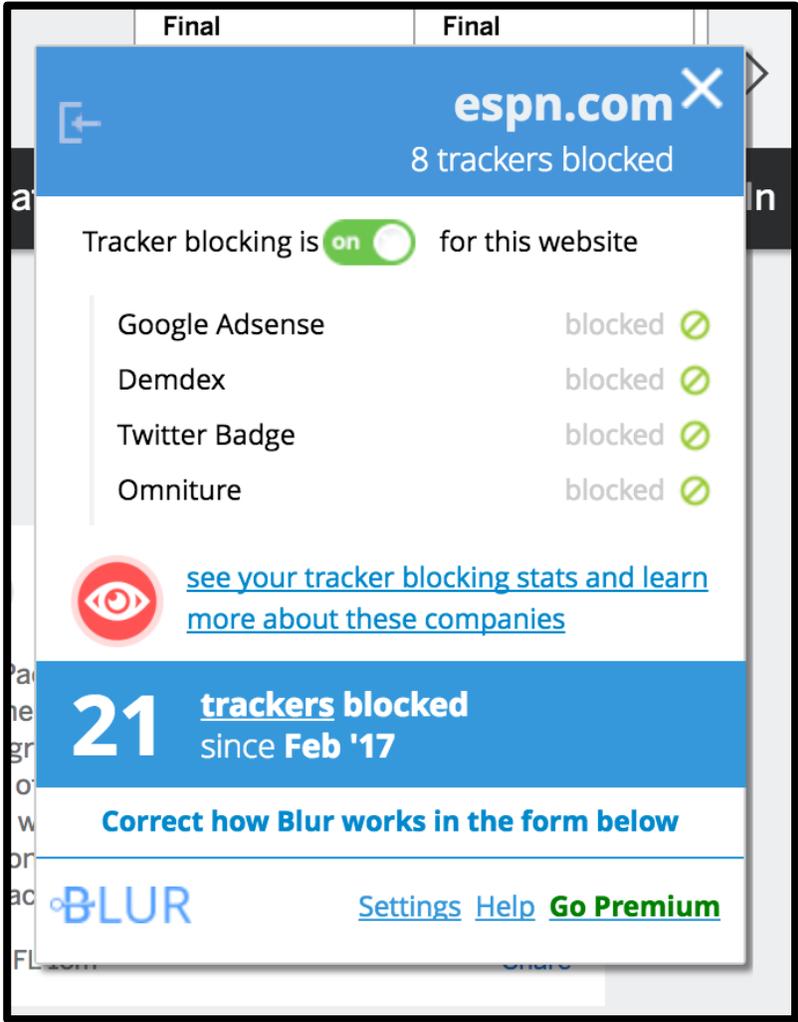
# Current Tools Provide High-Level Information



The screenshot shows the Disconnect browser extension interface. At the top, it says "DISCONNECT" with "Help" and "Share" links. Below this are social media sharing buttons for Facebook (0), Google+ (1), and Twitter (1). The main interface is divided into several categories, each with a request count and a dropdown arrow:

- Advertising**: 2 requests. Includes sub-items: Adobe (1 request) and Nielsen (1 request).
- Analytics**: 7 requests.
- Social**: 0 requests.
- Content**: 0 requests.

At the bottom, there are utility options: "Whitelist site" and "Visualize page" (both with icons), and "Show counter" and "Cap counter" (both checked). Below these are two bar charts labeled "Time saved" and "Bandwidth saved". At the very bottom is a green button that says "Get Mobile Protection".

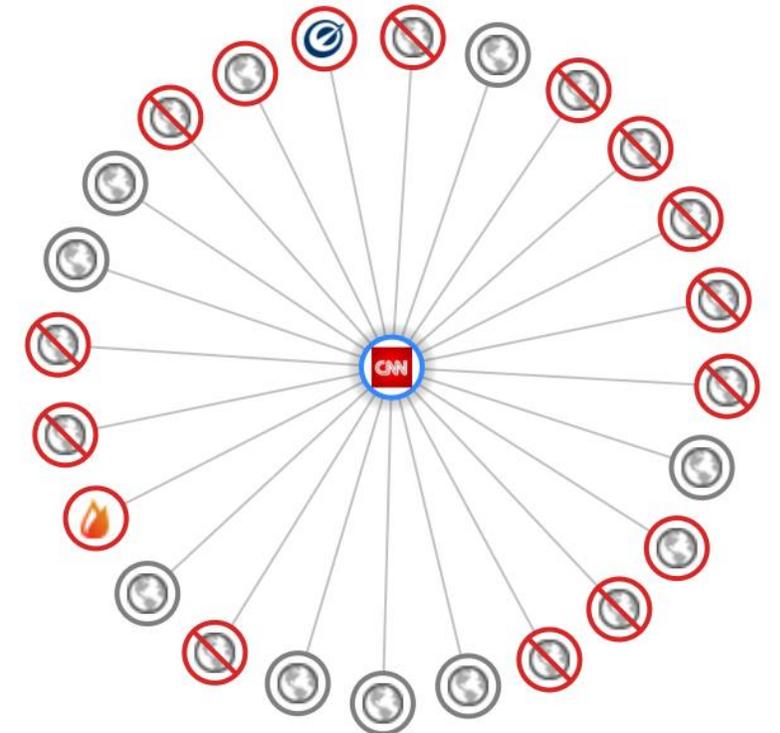
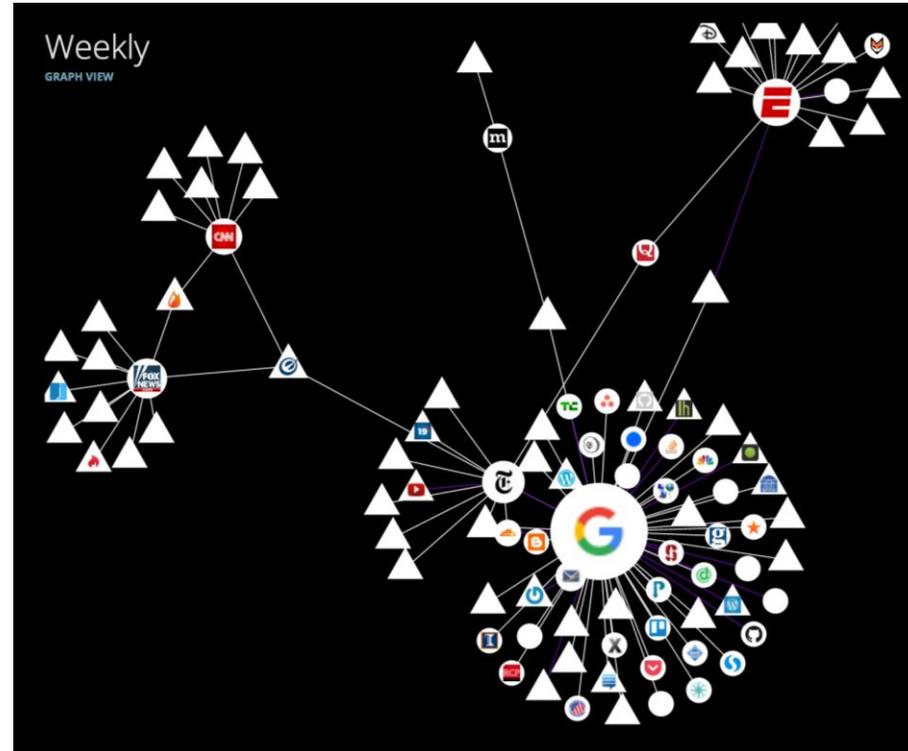
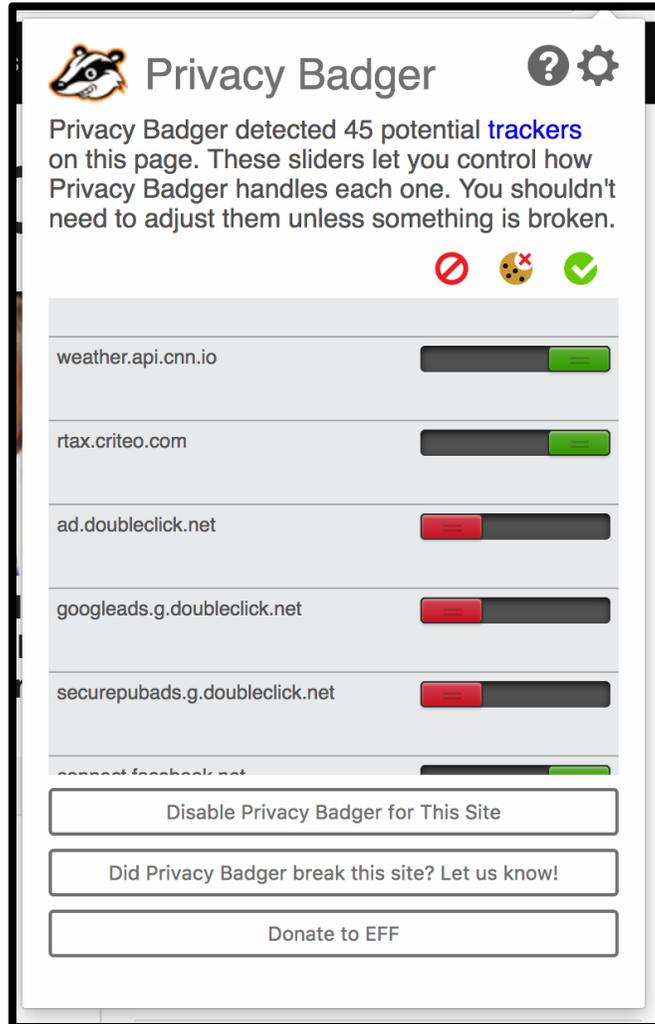


The screenshot shows the Blur browser extension interface. At the top, it says "Final" twice. Below this is a blue header with the "espn.com" logo and a close button, and the text "8 trackers blocked". The main interface shows "Tracker blocking is on" for this website, with a green toggle switch. Below this is a list of blocked trackers:

Google Adsense	blocked	🚫
Demdex	blocked	🚫
Twitter Badge	blocked	🚫
Omniure	blocked	🚫

Below the list is a red eye icon and a link: "see your tracker blocking stats and learn more about these companies". At the bottom, there is a blue banner that says "21 trackers blocked since Feb '17". Below this is a link: "Correct how Blur works in the form below". At the very bottom is the "BLUR" logo and links for "Settings", "Help", and "Go Premium".

# Current Tools Provide High-Level Information



# Current Tools Provide High-Level Information



The image shows a Google search results page with a white notification overlay. The overlay features a colorful illustration of cooking ingredients: a white bowl with a yellow spoon, green leafy vegetables, a red tomato slice, a purple onion, and a cracked egg. Below the illustration, the text reads 'Cooking & Recipes'. Underneath, the Google logo is followed by the text: 'Google estimates this interest, based on your activity on non-Google websites and apps while you were signed in. [Manage your activity](#)'. At the bottom right of the overlay are two buttons: 'Close' and 'Turn off'. The background of the page is dimmed, showing parts of search results and an advertisement.

Ads are based on your activity on Google, and your preferences.

18

Cooking & Recipes

Google estimates this interest, based on your activity on non-Google websites and apps while you were signed in. [Manage your activity](#)

Close Turn off

maintain

your preference to opt out of personalized ads from Google, even if you've cleared your

# Current Tools Provide High-Level Information

## How your ads are personalized

Ads are based on personal info you've added to your Google Account, data from advertisers that partner with Google, and Google's estimation of your interests. Choose any factor to learn more or update your preferences. [Learn more](#)



18-24 years old



Female



Cooking & Recipes



Shopping

# Actual Targeting is Far More Specific

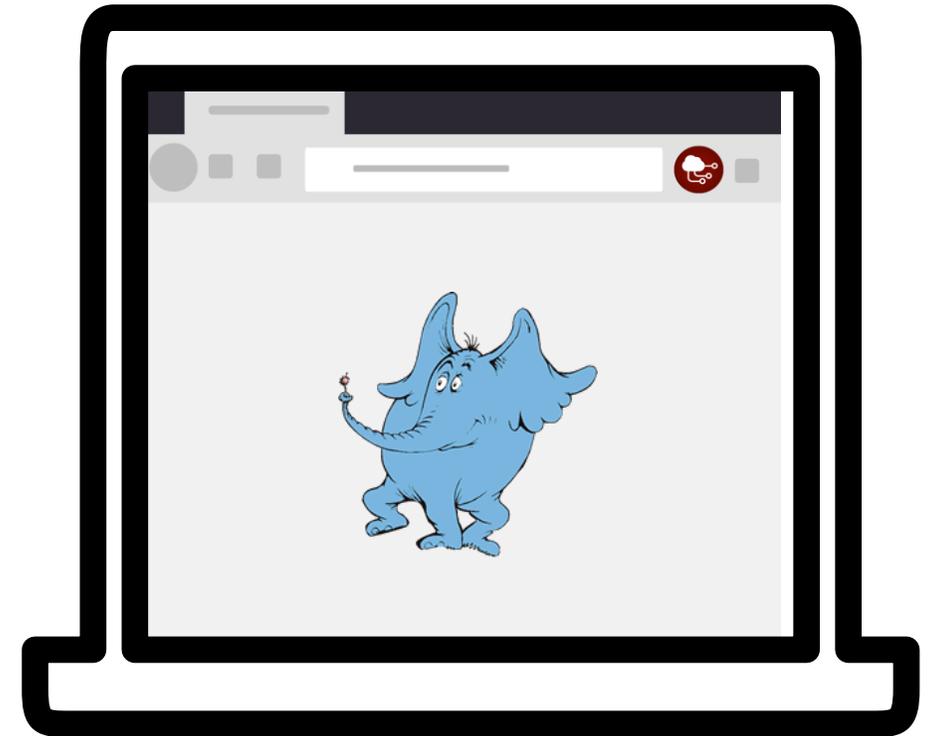
Hobbies & Leisure>Special Occasions>Holidays & Seasonal Events>Halloween & October 31st  
Hobbies & Leisure>Special Occasions>Holidays & Seasonal Events>Islamic Holidays  
Hobbies & Leisure>Special Occasions>Holidays & Seasonal Events>Jewish Holidays  
Hobbies & Leisure>Special Occasions>Holidays & Seasonal Events>New Year  
Hobbies & Leisure>Special Occasions>Holidays & Seasonal Events>Thanksgiving  
Hobbies & Leisure>Special Occasions>Holidays & Seasonal Events>Valentine's Day  
Hobbies & Leisure>Special Occasions>Weddings  
Hobbies & Leisure>Water Activities  
Hobbies & Leisure>Water Activities>Boating  
Hobbies & Leisure>Water Activities>Diving & Underwater Activities  
Hobbies & Leisure>Water Activities>Surf & Swim  
Home & Garden  
Home & Garden>Bed & Bath  
Home & Garden>Bed & Bath>Bathroom  
Home & Garden>Bed & Bath>Bedroom  
Home & Garden>Bed & Bath>Bedroom>Bedding & Bed Linens  
Home & Garden>Bed & Bath>Bedroom>Beds & Headboards  
Home & Garden>Bed & Bath>Bedroom>Mattresses  
Home & Garden>Domestic Services  
Home & Garden>Domestic Services>Cleaning Supplies & Services  
Home & Garden>Gardening & Landscaping  
Home & Garden>HVAC & Climate Control  
Home & Garden>Home Appliances  
Home & Garden>Home Appliances>Water Filters & Purifiers  
Home & Garden>Home Furnishings  
Home & Garden>Home Furnishings>Clocks  
Home & Garden>Home Furnishings>Lamps & Lighting  
Home & Garden>Home Furnishings>Rugs & Carpets  
Home & Garden>Home Furnishings>Sofas & Chairs  
Home & Garden>Home Improvement  
Home & Garden>Home Improvement>Construction & Power Tools  
Home & Garden>Home Improvement>Doors & Windows  
Home & Garden>Home Improvement>Flooring  
Home & Garden>Home Improvement>House Painting & Finishing  
Home & Garden>Home Improvement>Plumbing  
Home & Garden>Home Improvement>Roofing  
Home & Garden>Home Storage & Shelving



# Design of Tracking Transparency (Research)

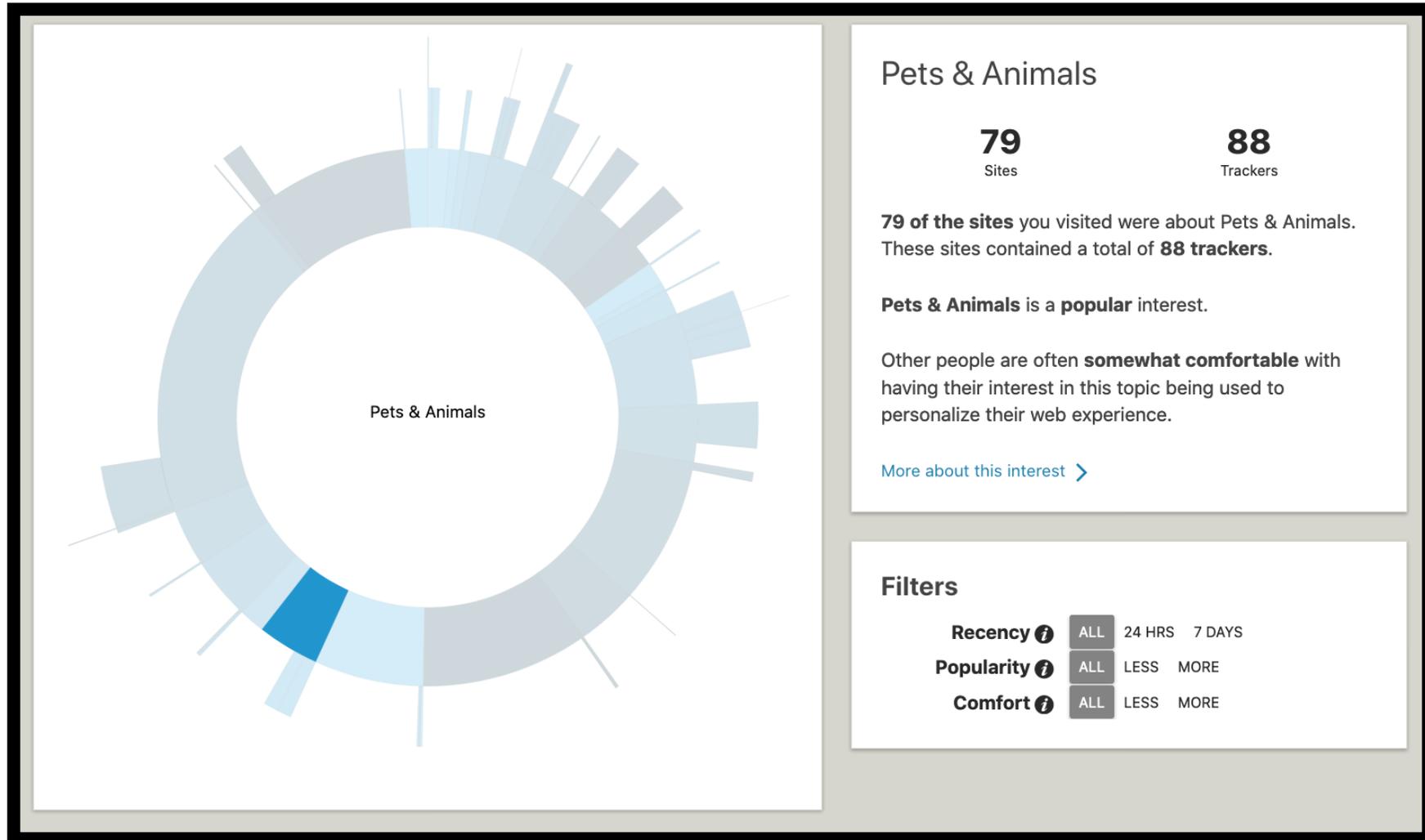


- Web browser extension
- *Locally* records tracking 
  - Page metadata, page contents, trackers
  - Profiles potential interests from that page



<https://git.io/trackingtransparency>

# Potential Interests



# Trackers

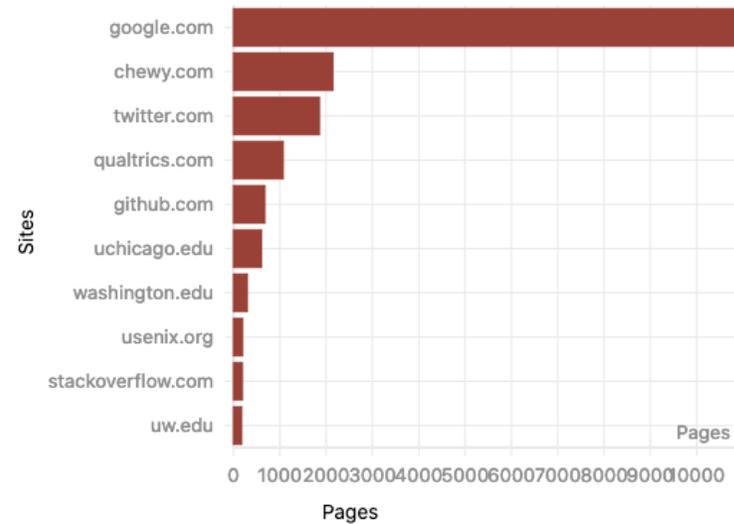
Based on your browsing, what would *Google* think your interests are?

Using a machine to assign categories to pages you visit, Google may have guessed that you are interested in **150 topics**.  
Click on a link in the wordcloud to learn more about each interest.



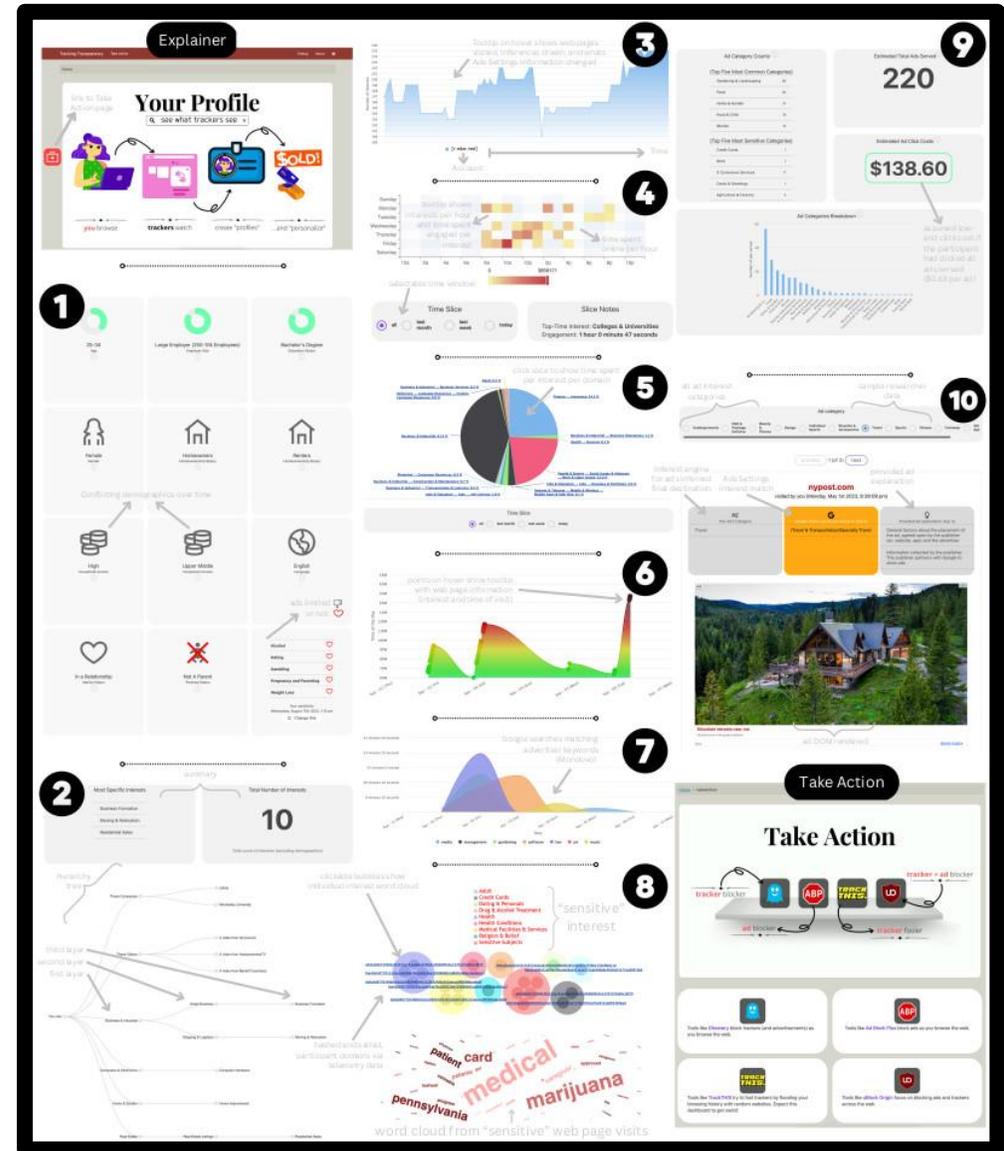
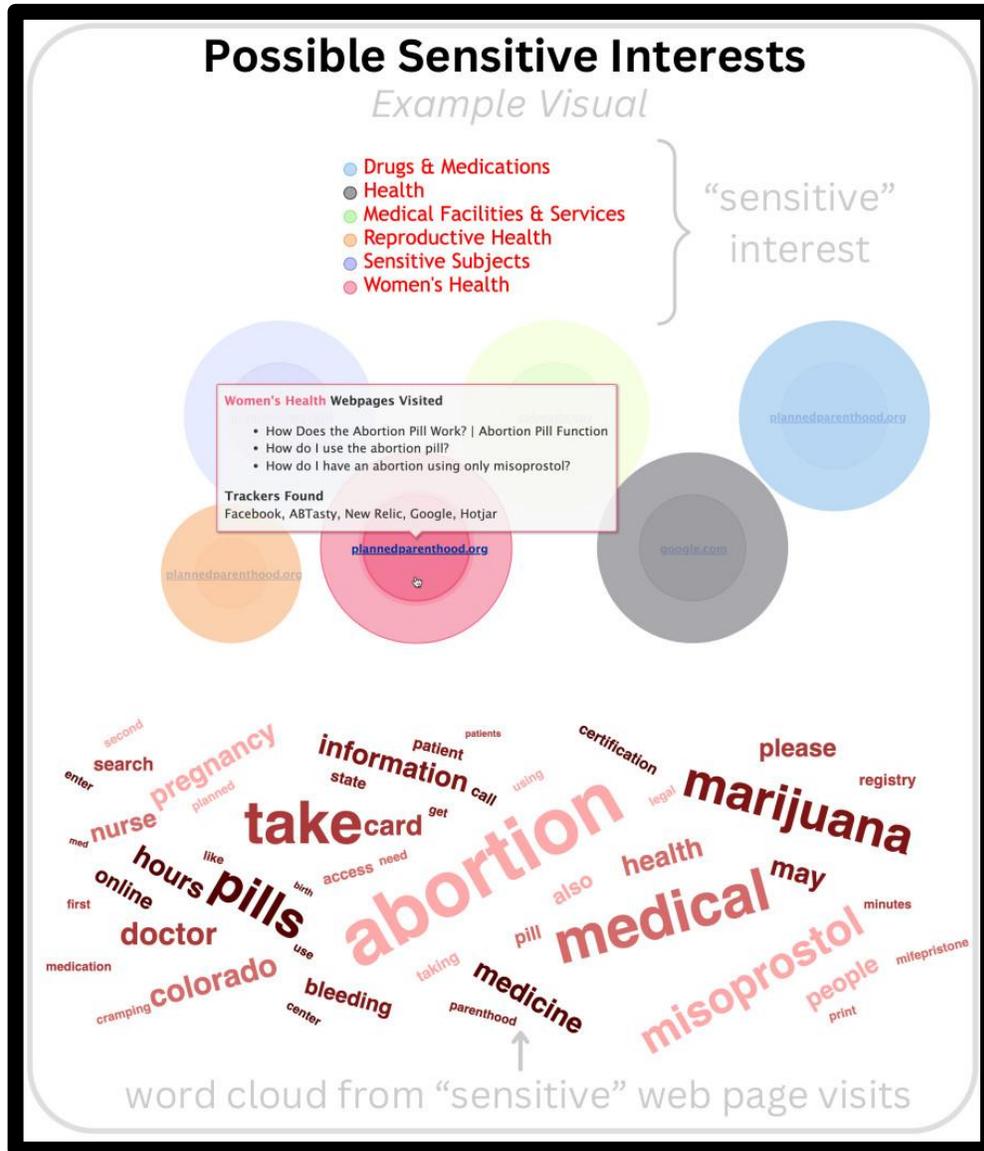
On which sites did *Google* track you?

Google has tracked you on **1412 sites**. Click on a bar to learn more.



> See all 1412 sites

# Tracking Transparency v2



# **The Politics of Transparency**

# The Politics of Transparency



## Ad Observer

By NYU Cybersecurity for Democracy

Who is paying for online advertising to target you? Who's showing you ads because you're married, or you're a liberal or work in the oil industry or some other category? Are they saying different things to different people? Help hold them accountable by installing our browser plugin, which sends us the ads you see on Facebook and YouTube, without compromising your privacy.

 [Install for Chrome](#)

 [Install for Firefox](#)

# The Politics of Transparency

## How it works

Ad Observer is a tool you add to your Web browser. It copies the ads you see on Facebook and YouTube, so anyone can see them in [our public database](#). (See documentation [here](#).) If you want, you can enter basic demographic information about yourself in the tool to help improve our understanding of why advertisers targeted you. However, we'll never ask for information that could identify you.

It doesn't collect your personal information. We take your privacy very seriously. [You can view the extension code on Github](#).

[See Mozilla privacy review](#).

## What we collect

- The advertiser's name and disclosure string.
- The ad's text, image, and link.
- The information Facebook provides about how the ad was targeted.
- When the ad was shown to you.
- Your browser language.

## What we don't collect

Anything personally identifying, including:

- Your Facebook ID number.
- Your name, birthday, friend list, etc.
- How you interacted with ads or anything else.

# The Politics of Transparency

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**TECH**

## Facebook Disables Access for NYU Research Into Political-Ad Targeting

Researchers say the data provided information on misinformation in political ads; Facebook says the work violated its terms of service



What Facebook Panel's Decision Means for Trump, Social Networks

Facebook's independent oversight board said in May that the company was justified when it banned former President Trump following the Jan. 6 Capitol attack, but gave Facebook six months to decide on a permanent ban. WSJ's Brad Reagan explains what comes next. Photo: Andre M. Chang/Zuma Press

By [Meghan Bobrowsky](#)  
Updated Aug. 4, 2021 5:54 pm ET

# Urban Surveillance

# Surveillance of Street Corners

**CCTV in operation** 

Images are being recorded and monitored for your safety and to prevent crime.

We will use CCTV images to aid successful prosecution.

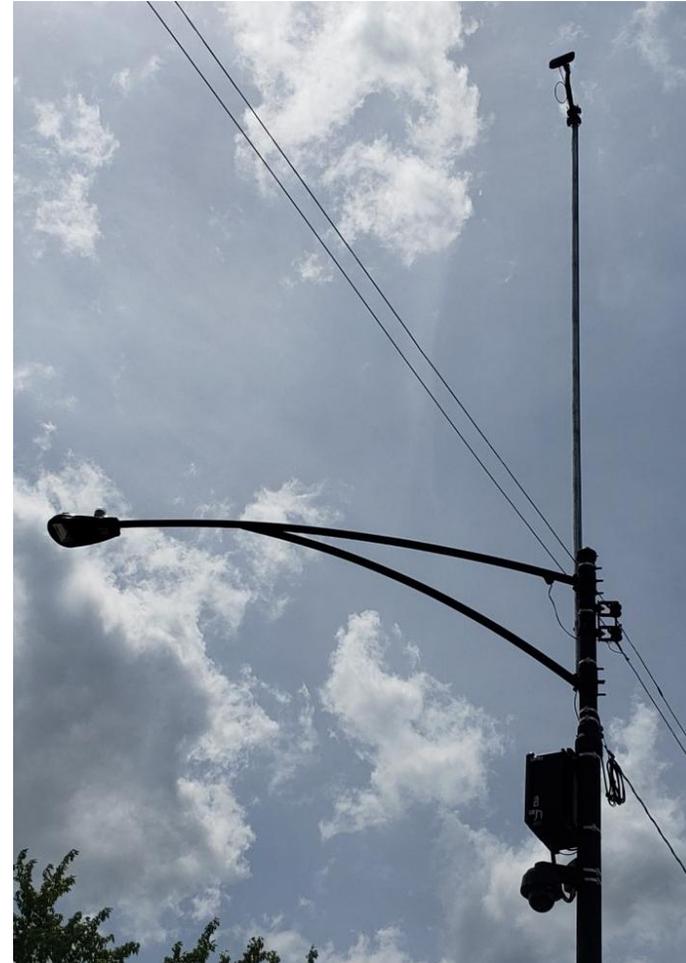
**This CCTV system is operated by Thameslink**

You can contact Thameslink at:  
Thameslink Customer Relations  
PO Box 10240  
ASHBY-DE-LA-ZOUCH  
LE65 9EB

To report a crime to the British Transport Police, call freephone 0800 40 50 40



# Surveillance of My Former Street Corner



# Surveillance (?) of Street Corners

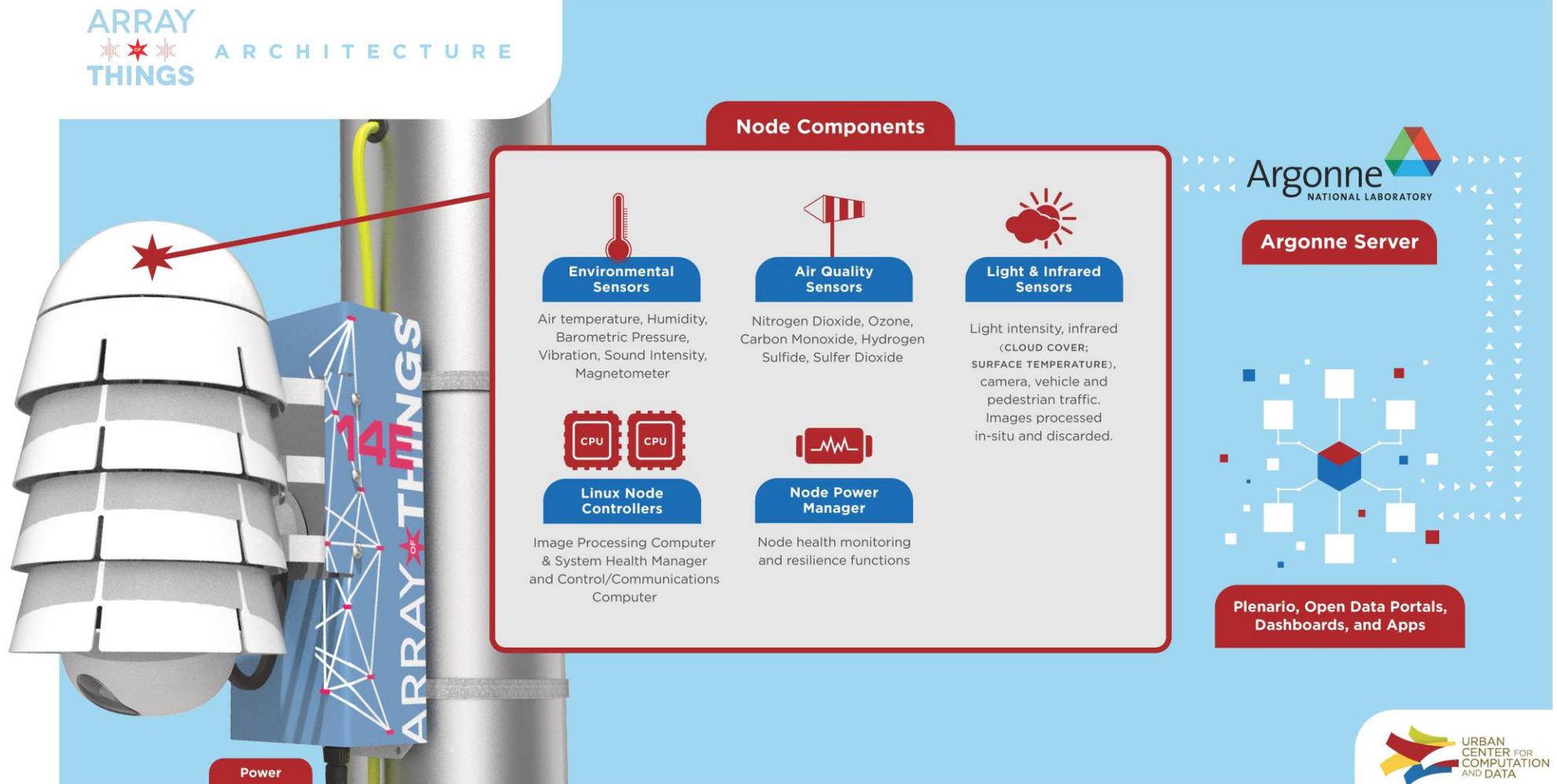


Image from <https://arrayofthings.github.io/>

# Surveillance (?) of Street Corners

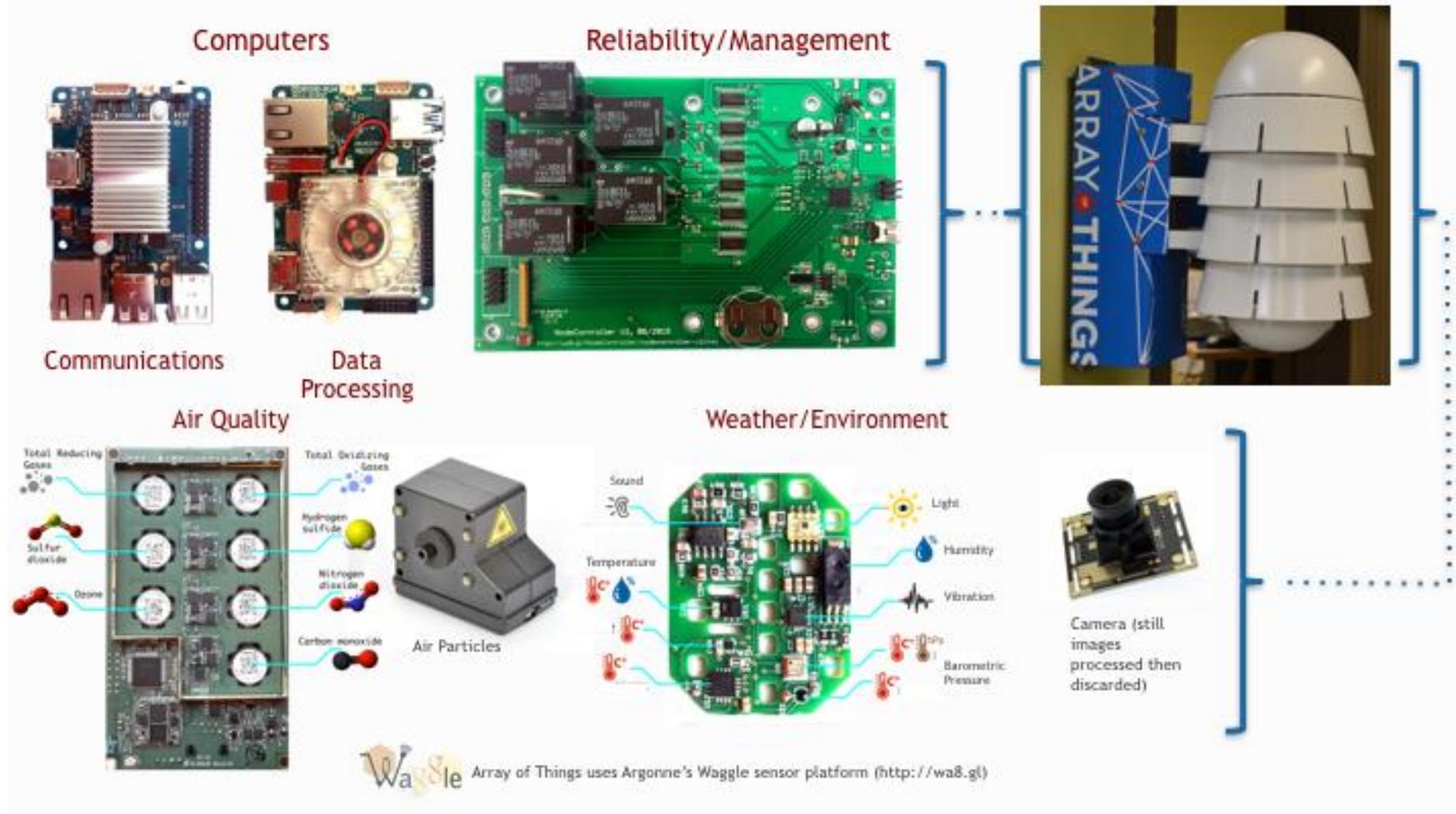


Image from <https://arrayofthings.github.io/>

# Amazon Ring Surveillance

Opinion  
Surveillance

Amazon's Ring is the largest civilian surveillance network the US has ever seen  
*Lauren Bridges*

Tue 18 May 2021 08.51  
EDT



2699 383

One in 10 US police departments can now access videos from millions of privately owned home security cameras without a warrant



# Amazon Ring Surveillance



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## Why Ring's feel-good Super Bowl ad freaked people out

A sweet story about finding lost dogs exposed growing fears about AI and monitoring, door bell cameras and policing

By **CK SMITH**  
Weekend Editor

PUBLISHED FEBRUARY 14, 2026 2:55PM (EST)



<https://www.salon.com/2026/02/14/why-rings-feel-good-super-bowl-ad-freaked-people-out/>