



# Transparency or Information Overload?

## Evaluating Users' Comprehension and Perceptions of the iOS App Privacy Report

**Xiaoyuan (Owen) Wu**, Lydia Hu, Eric Zeng, Hana Habib, and Lujo Bauer



# Conveying Data Collection & Handling to Users

# Conveying Data Collection & Handling to Users



Filter by: ⓘ

Sign in with Google (14) ✓ Access to Any account access (4) ✕

- Calendly
- Kaggle
- Zoom
- Zoom for G Suite

Any account access (4)

Calendar (3)

Contacts (2)

Gmail (1)

Other account access (4)

# Conveying Data Collection & Handling to Users



Filter by: ⓘ

Sign in with Google (14) ✓ Access to Any account access (4) ✕

- Calendly
- Kaggle
- Zoom
- Zoom for G Suite

Any account access (4)

Calendar (3)

Contacts (2)

Gmail (1)

Other account access (4)



### Review your app and service data

App and service activity Activities: 640

Activity data includes info about what apps and services you use and how you use them, and might be saved to your Microsoft account when you use a Microsoft product.

Search

|  |             |  |
|--|-------------|--|
| OneDrive<br>Microsoft Corporation        | Feb 5, 2025 |  |
| Microsoft Excel<br>Microsoft Corporation | Feb 4, 2025 |  |

# App Privacy Report



## App Privacy Report

App Privacy Report shows how often apps use the permission you've granted to access your data, like your location or microphone. It also includes a breakdown of each app's network activity, website network activity, and the most frequently contacted domains.

[Learn more...](#)

[Turn On App Privacy Report](#)

# App Privacy Report

“Helps give [users] a more complete picture of how the apps [they] use treat [their] data.”

— Apple<sup>1</sup>



## App Privacy Report

App Privacy Report shows how often apps use the permission you've granted to access your data, like your location or microphone. It also includes a breakdown of each app's network activity, website network activity, and the most frequently contacted domains.

[Learn more...](#)

[Turn On App Privacy Report](#)

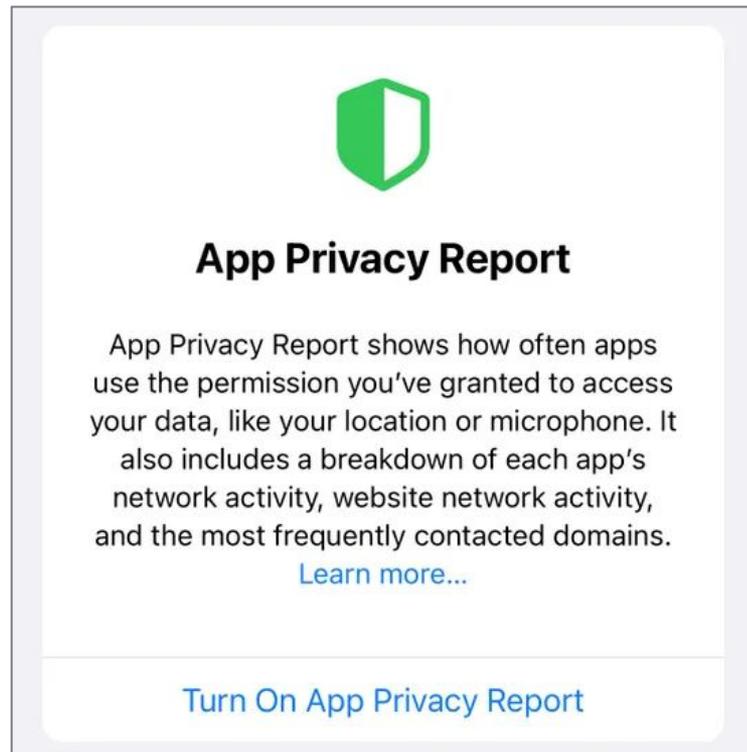
<sup>1</sup> <https://support.apple.com/en-us/102188>

# App Privacy Report

“Helps give [users] a more complete picture of how the apps [they] use treat [their] data.”

— Apple<sup>1</sup>

Shows two types of information:

A screenshot of the App Privacy Report interface. At the top center is a green shield icon with a white outline. Below the icon, the text "App Privacy Report" is displayed in a bold, black font. Underneath, a paragraph explains that the report shows how often apps use permissions like location or microphone, and includes a breakdown of network activity and frequently contacted domains. A blue link "Learn more..." is positioned below the paragraph. At the bottom of the interface, a blue button labeled "Turn On App Privacy Report" is visible.

**App Privacy Report**

App Privacy Report shows how often apps use the permission you've granted to access your data, like your location or microphone. It also includes a breakdown of each app's network activity, website network activity, and the most frequently contacted domains.

[Learn more...](#)

[Turn On App Privacy Report](#)

<sup>1</sup> <https://support.apple.com/en-us/102188>

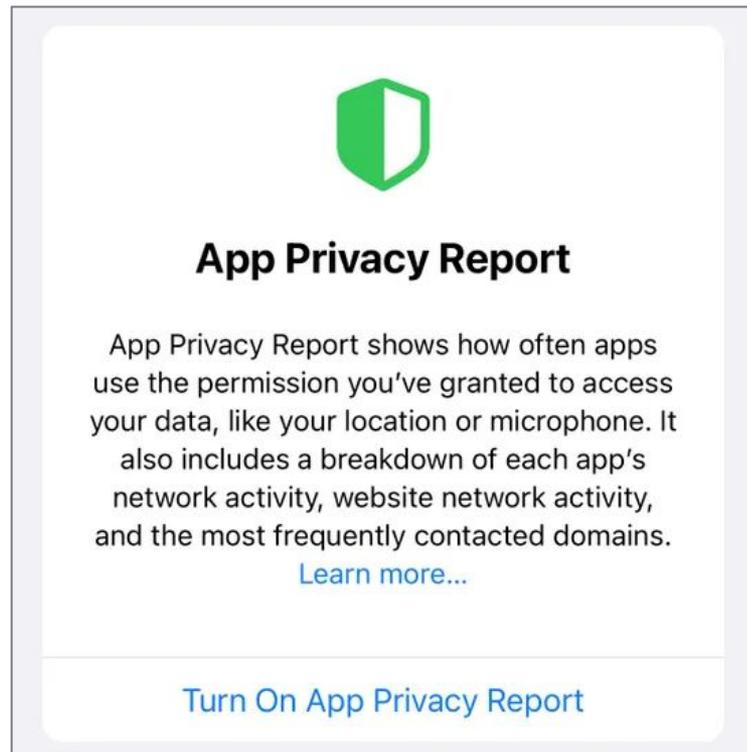
# App Privacy Report

“Helps give [users] a more complete picture of how the apps [they] use treat [their] data.”

— Apple<sup>1</sup>

Shows two types of information:

- Data & Sensor Access

A screenshot of the App Privacy Report interface. At the top center is a green shield icon with a white outline. Below the icon, the text "App Privacy Report" is displayed in a bold, black font. Underneath, a paragraph explains that the report shows how often apps use permissions like location or microphone, and includes a breakdown of network activity and frequently contacted domains. A blue link "Learn more..." is positioned below the paragraph. At the bottom of the interface, a blue button labeled "Turn On App Privacy Report" is visible.



## App Privacy Report

App Privacy Report shows how often apps use the permission you've granted to access your data, like your location or microphone. It also includes a breakdown of each app's network activity, website network activity, and the most frequently contacted domains.

[Learn more...](#)

[Turn On App Privacy Report](#)

<sup>1</sup> <https://support.apple.com/en-us/102188>

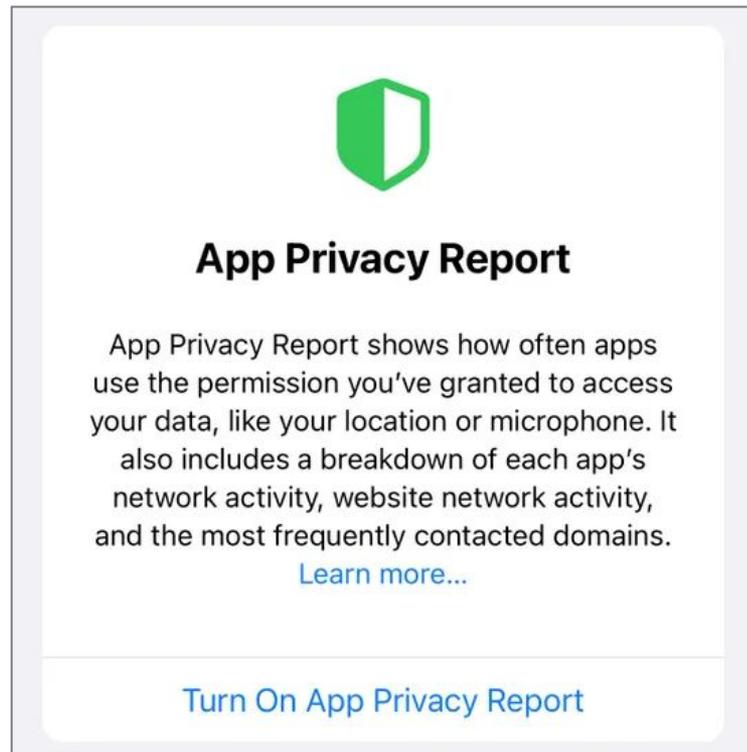
# App Privacy Report

“Helps give [users] a more complete picture of how the apps [they] use treat [their] data.”

— Apple<sup>1</sup>

Shows two types of information:

- Data & Sensor Access
- Network Activity

A screenshot of the App Privacy Report interface. At the top center is a green shield icon with a white outline. Below the icon, the text "App Privacy Report" is displayed in a bold, black font. Underneath, a paragraph explains that the report shows how often apps use permissions like location or microphone, and includes a breakdown of network activity and frequently contacted domains. A blue link "Learn more..." is positioned below the paragraph. At the bottom of the interface, a blue button labeled "Turn On App Privacy Report" is visible.



## App Privacy Report

App Privacy Report shows how often apps use the permission you've granted to access your data, like your location or microphone. It also includes a breakdown of each app's network activity, website network activity, and the most frequently contacted domains.

[Learn more...](#)

[Turn On App Privacy Report](#)

<sup>1</sup> <https://support.apple.com/en-us/102188>



**RQ 1**  
**Understanding**

Does the privacy report help users identify privacy risks?



**RQ 1**  
**Understanding**

Does the privacy report help users identify privacy risks?

**RQ 2**  
**Attitudes**

What do users think about what they learn?



**RQ 1**  
**Understanding**

Does the privacy report help users identify privacy risks?

**RQ 2**  
**Attitudes**

What do users think about what they learn?

**RQ 3**  
**Behavior Change**

Do users want to change their behavior and why?



**RQ 1**  
**Understanding**

Does the privacy report help users identify privacy risks?

**RQ 2**  
**Attitudes**

What do users think about what they learn?

**RQ 3**  
**Behavior Change**

Do users want to change their behavior and why?

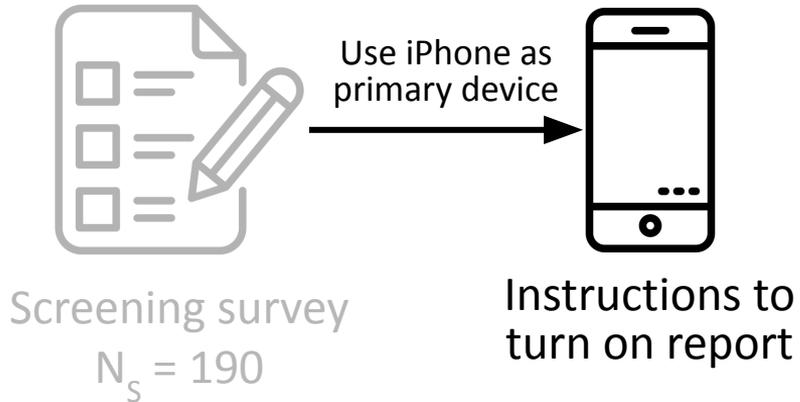
# Study Procedure



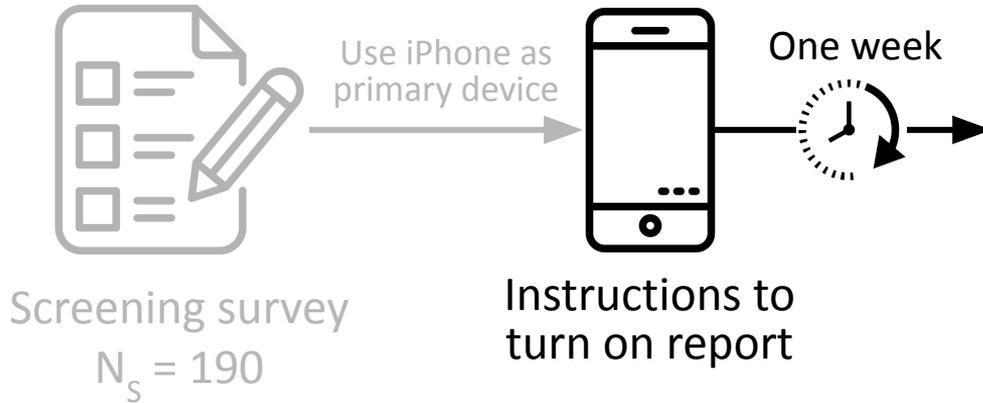
Screening survey

$N_s = 190$

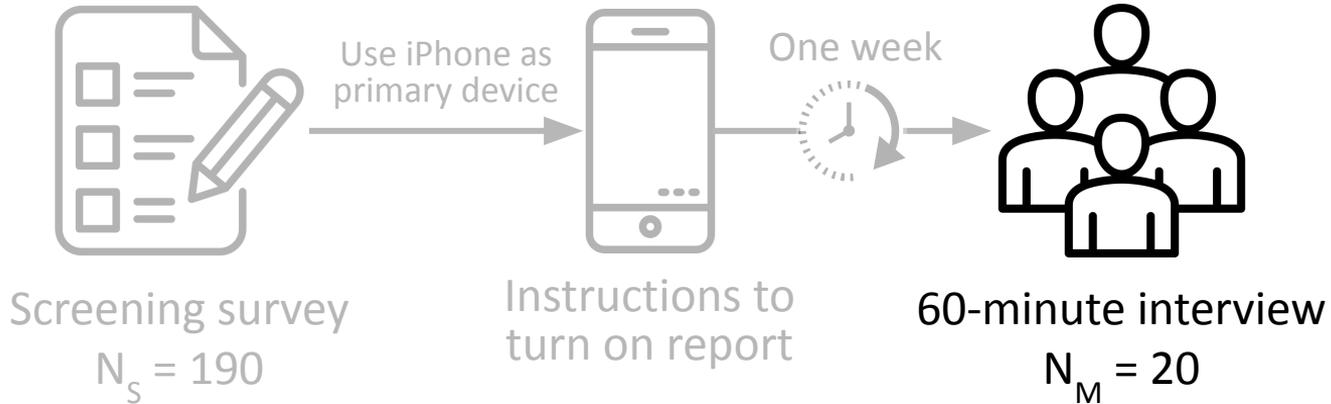
# Study Procedure



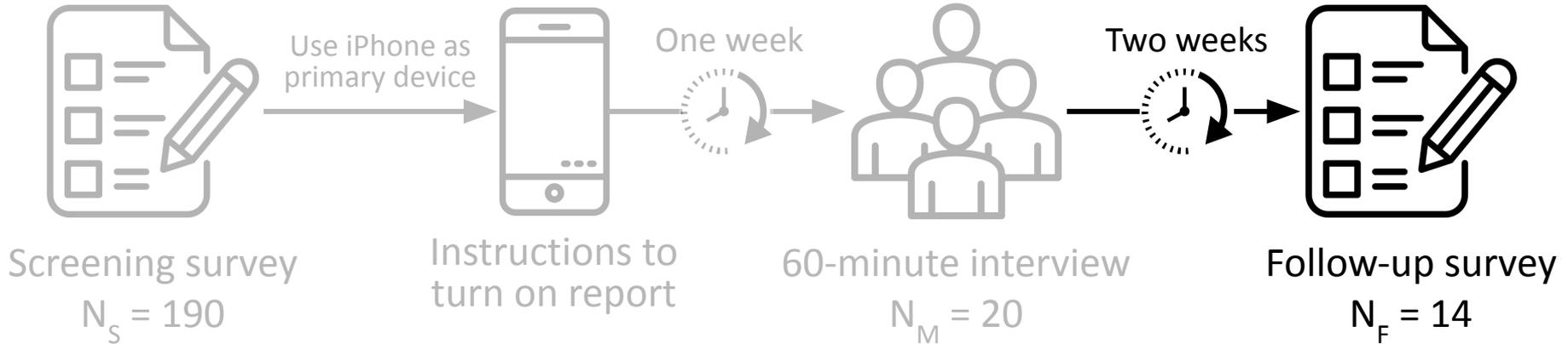
# Study Procedure



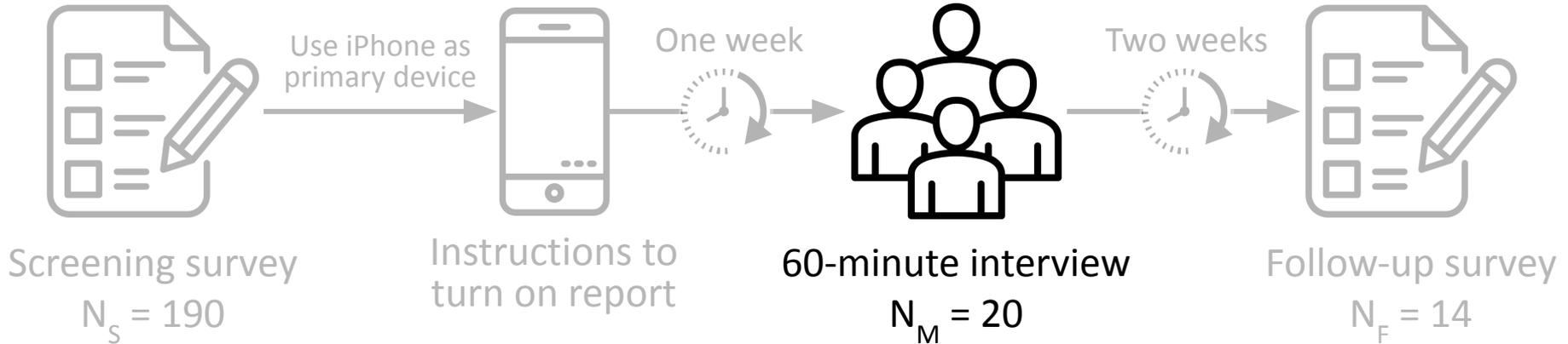
# Study Procedure



# Study Procedure



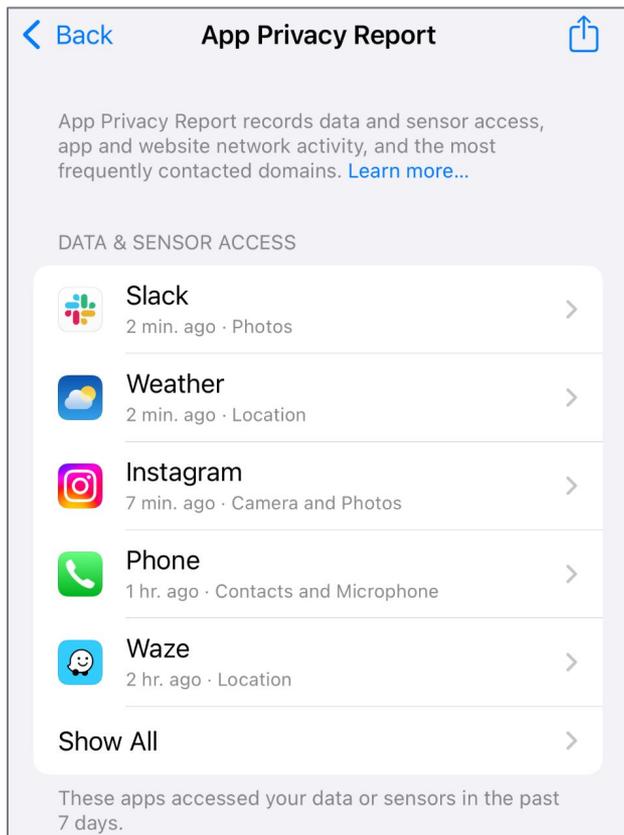
# Study Procedure



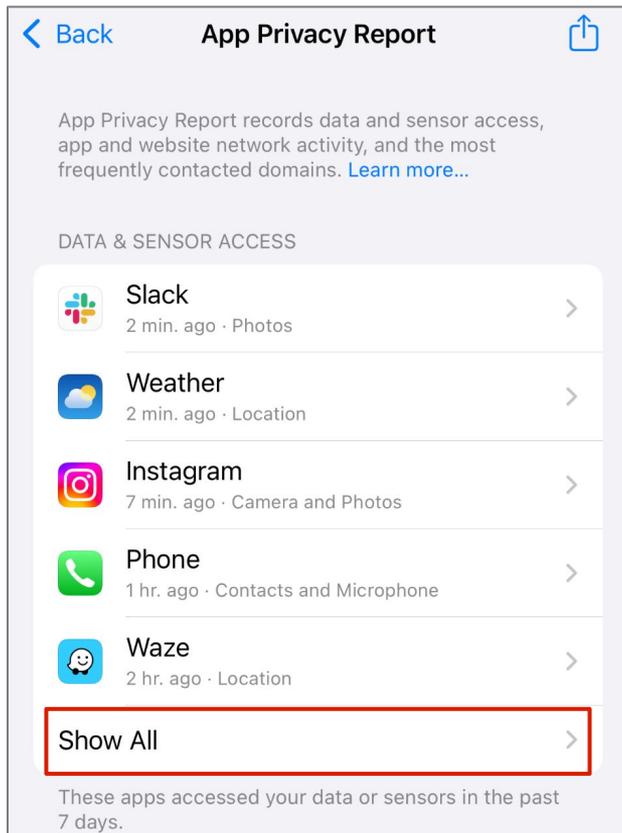


# Data & Sensor Access – App Privacy Report Interface

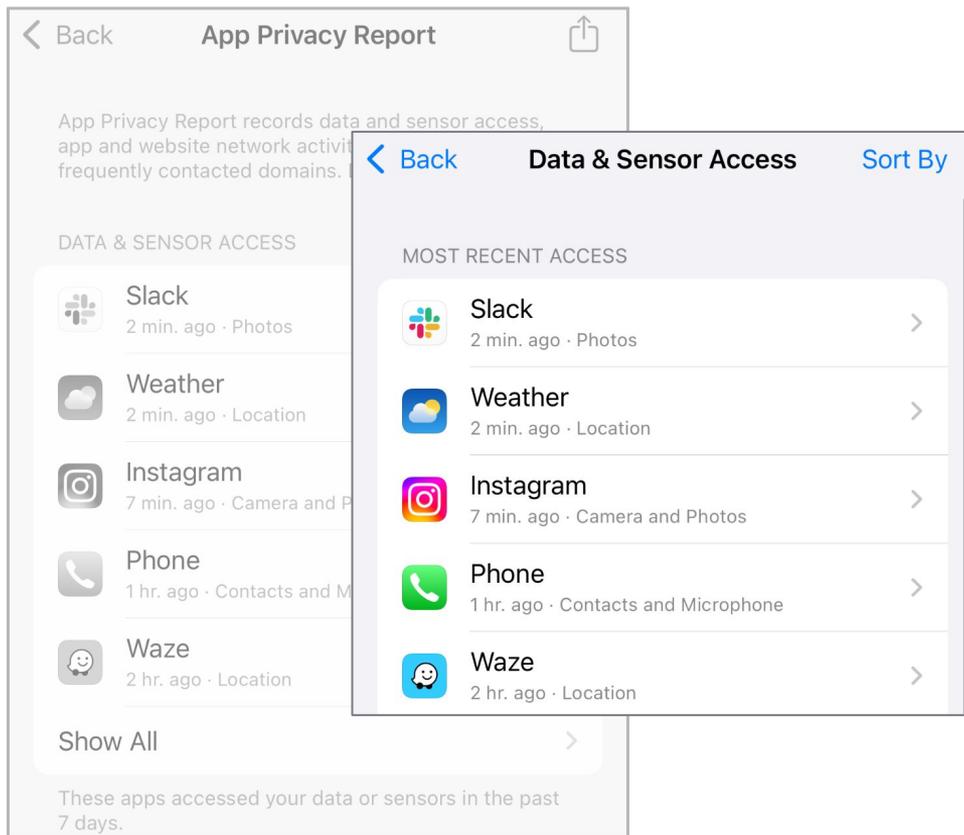
# Data & Sensor Access: Interface



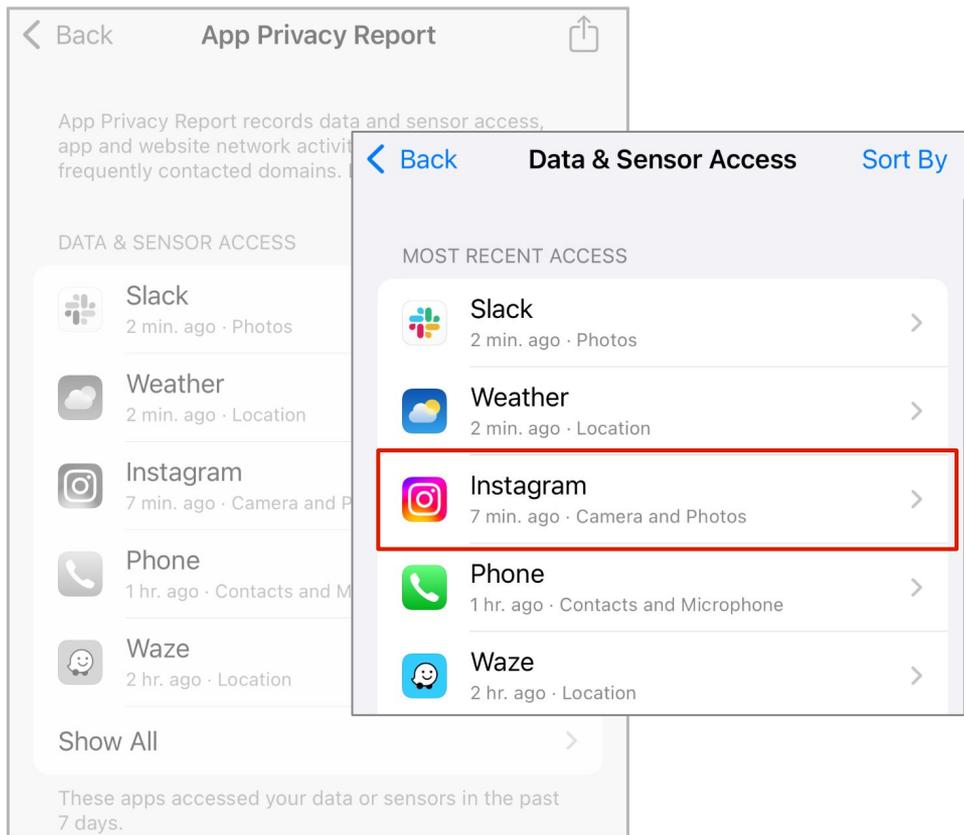
# Data & Sensor Access: Interface



# Data & Sensor Access: Interface



# Data & Sensor Access: Interface



# Data & Sensor Access: Interface

The image displays three overlapping screenshots of an iOS 'App Privacy Report' interface. The top-most screenshot shows the 'App Privacy Report' header with a 'Back' button and a share icon. Below the header, there is a brief description: 'App Privacy Report records data and sensor access, app and website network activity, and frequently contacted domains.' The main content area is titled 'DATA & SENSOR ACCESS' and lists several apps with their respective access types and times: Slack (2 min. ago - Photos), Weather (2 min. ago - Location), Instagram (7 min. ago - Camera and Photos), Phone (1 hr. ago - Contacts and Microphone), and Waze (2 hr. ago - Location). A 'Show All' button is at the bottom of this list, with a note: 'These apps accessed your data or sensors in the past 7 days.'

The middle screenshot, titled 'Data & Sensor Access', shows a 'Back' button and a 'Sort By' option. It displays a 'MOST RECENT ACCESS' section with the same list of apps as the top screenshot: Slack (2 min. ago - Photos), Weather (2 min. ago - Location), Instagram (7 min. ago - Camera and Photos), Phone (1 hr. ago - Contacts and Microphone), and Waze (2 hr. ago - Location). Each entry has a right-pointing chevron.

The bottom-most screenshot, titled 'Instagram', shows a 'Back' button and a 'PAST 7 DAYS' section. It lists two access events: 'Photos' (7 minutes ago) and 'Camera' (6 days ago), each with a right-pointing chevron.

# Data & Sensor Access: Interface

The image displays three overlapping screenshots of an iOS 'App Privacy Report' interface. The top-most screenshot shows the 'App Privacy Report' title and a list of apps that accessed data or sensors in the past 7 days. The middle screenshot shows the 'Data & Sensor Access' screen for the selected app, listing the most recent access events. The bottom-most screenshot shows the 'Instagram' app's specific access details for the past 7 days, with the 'Camera' access event highlighted by a red box.

**App Privacy Report**

App Privacy Report records data and sensor access, app and website network activity, and frequently contacted domains.

DATA & SENSOR ACCESS

- Slack 2 min. ago · Photos
- Weather 2 min. ago · Location
- Instagram 7 min. ago · Camera and Photos
- Phone 1 hr. ago · Contacts and Microphone
- Waze 2 hr. ago · Location

Show All >

These apps accessed your data or sensors in the past 7 days.

**Data & Sensor Access**

MOST RECENT ACCESS

- Slack 2 min. ago · Photos
- Weather 2 min. ago · Location
- Instagram 7 min. ago · Camera and Photos
- Phone 1 hr. ago · Contacts and Microphone
- Waze 2 hr. ago · Location

**Instagram**

PAST 7 DAYS

- Photos 7 minutes ago >
- Camera 6 days ago >

# Data & Sensor Access: Interface

App Privacy Report records data and sensor access, app and website network activity, and frequently contacted domains.

DATA & SENSOR ACCESS

- Slack  
2 min. ago · Photos
- Weather  
2 min. ago · Location
- Instagram  
7 min. ago · Camera and Photos
- Phone  
1 hr. ago · Contacts and Microphone
- Waze  
2 hr. ago · Location

Show All

These apps accessed your data or sensors in the past 7 days.

Back Data & Sensor Access Sort By

MOST RECENT ACCESS

- Slack  
2 min. ago · Photos
- Weather  
2 min. ago · Location
- Instagram  
7 min. ago · Camera and Photos
- Phone  
1 hr. ago · Contacts and Microphone
- Waze  
2 hr. ago · Location

Back Instagram

PAST 7 DAYS

- Photos
- Camera

Instagram Camera

Anytime this app accesses your iPhone's camera, it will be recorded here.

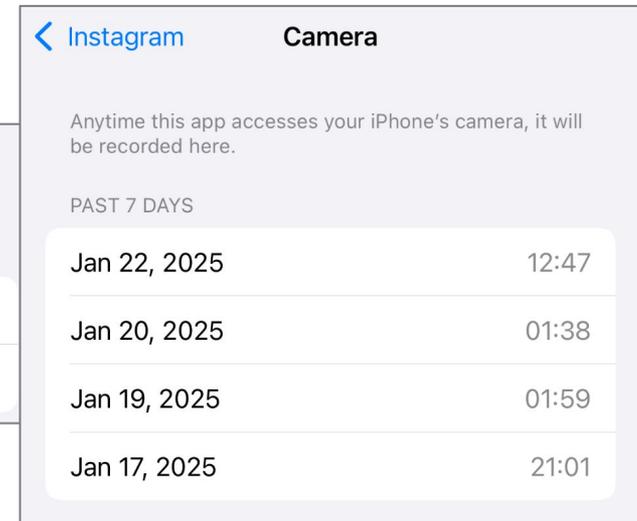
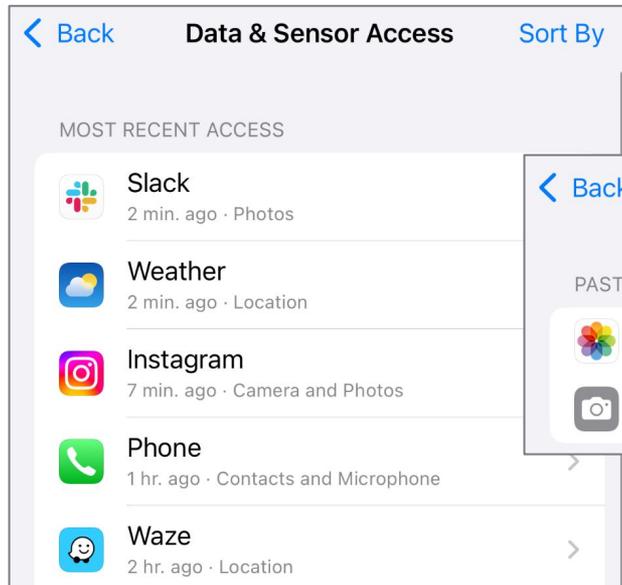
PAST 7 DAYS

|              |       |
|--------------|-------|
| Jan 22, 2025 | 12:47 |
| Jan 20, 2025 | 01:38 |
| Jan 19, 2025 | 01:59 |
| Jan 17, 2025 | 21:01 |

# Data & Sensor Access – Results

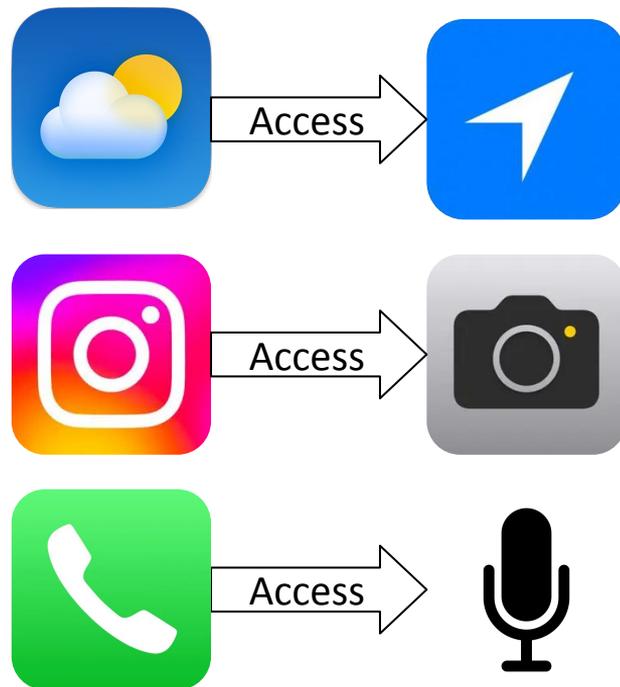
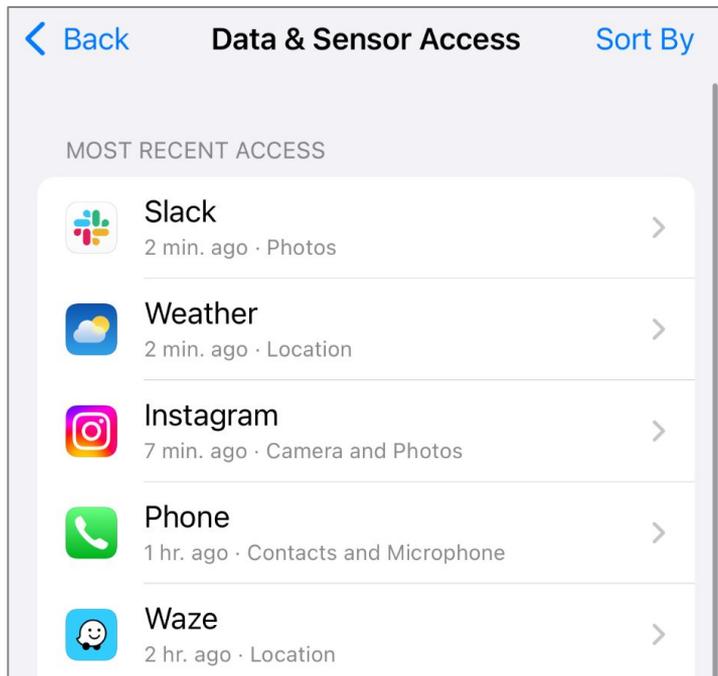
Participants identified...

# Data & Sensors Are Accessed by Apps



Participants identified...

# Data & Sensors Are Accessed by Apps

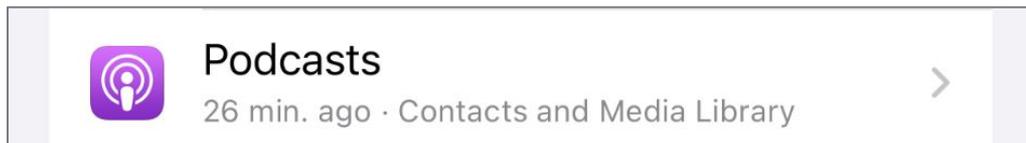


Participants were concerned about...

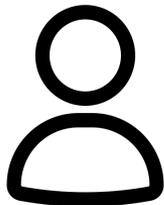
## Access They Could Not Relate to App Functionality

Participants were concerned about...

## Access They Could Not Relate to App Functionality

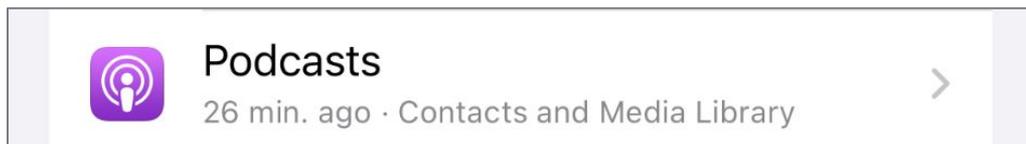


Why would Podcasts access my contacts? It's weird. I don't even listen to podcasts.

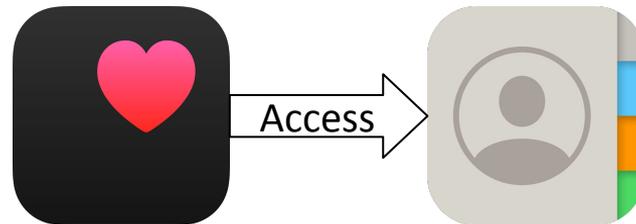
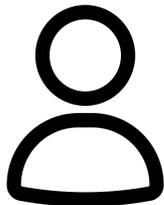


Participants were concerned about...

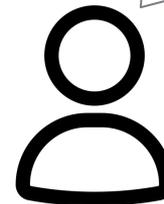
## Access They Could Not Relate to App Functionality



Why would Podcasts access my contacts? It's weird. I don't even listen to podcasts.

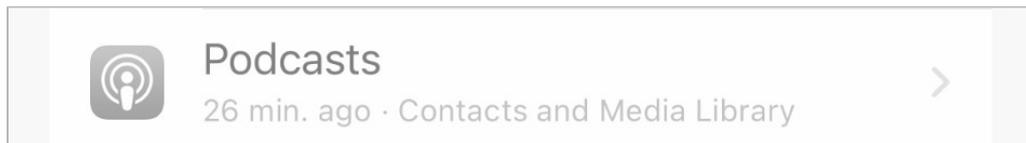


I didn't know Health needs to use your contacts.

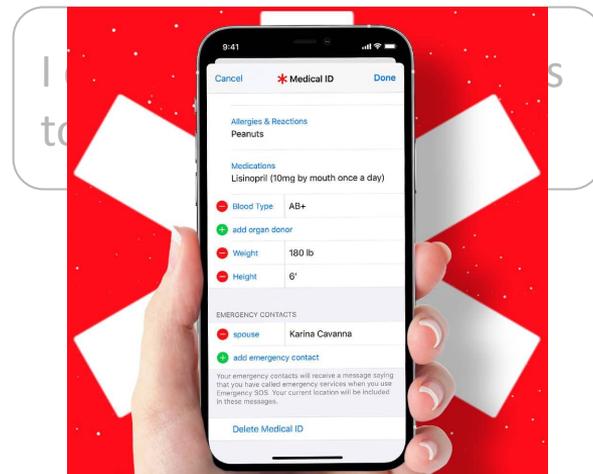
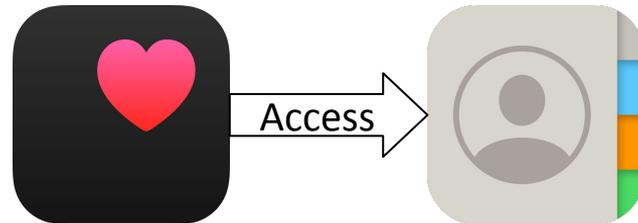


Participants were concerned about...

## Access They Could Not Relate to App Functionality



Why would Podcasts access my contacts? It's weird. I don't even listen to podcasts.



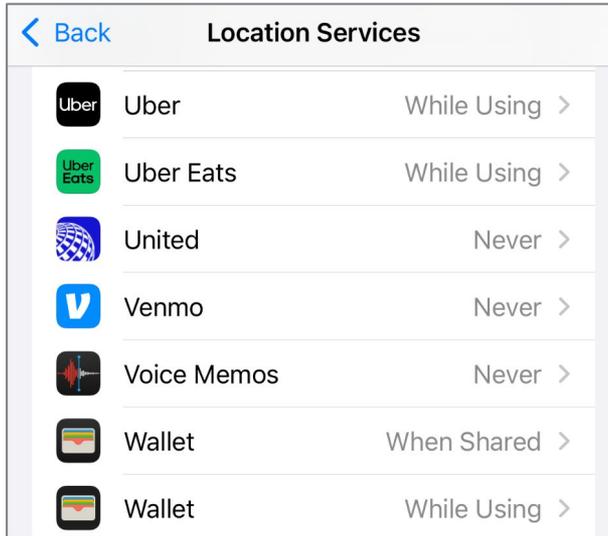
Participants found...

# Changing Permissions Difficult or Impossible

Participants found...

# Changing Permissions Difficult or Impossible

Location permission settings  
**outside** of the App Privacy Report



Participants found...

# Changing Permissions Difficult or Impossible

Location permission settings  
outside of the App Privacy Report

| Location Services   |             |               |
|---|-------------|---------------|
|  | Uber        | While Using > |
|  | Uber Eats   | While Using > |
|  | United      | Never >       |
|  | Venmo       | Never >       |
|  | Voice Memos | Never >       |
|  | Wallet      | When Shared > |
|  | Wallet      | While Using > |

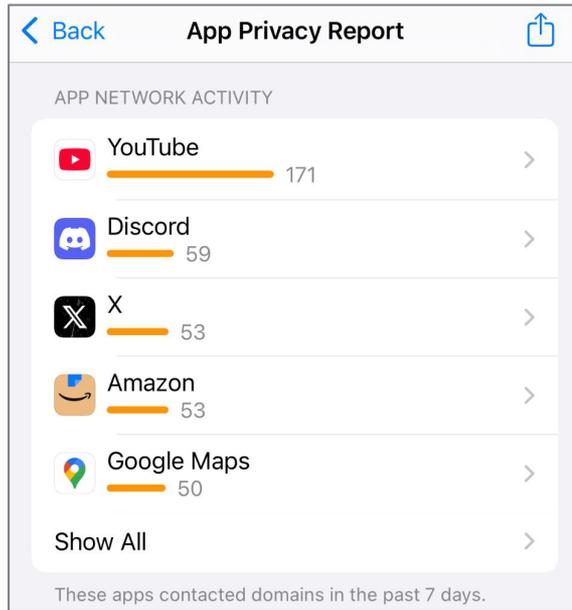
**Impossible** to turn off Contacts  
access for Health or Podcasts

| Contacts  |                 |        |
|---|-----------------|--------|
| Contact info may include phone numbers, email, home addresses, and more.            |                 |        |
|  | BoFA            | None > |
|  | ButterflyMX     | None > |
|  | Google Calendar | None > |
|  | Google Maps     | None > |
|  | Instagram       | None > |
|  | PayPal          | None > |
|  | WhatsApp        | None > |

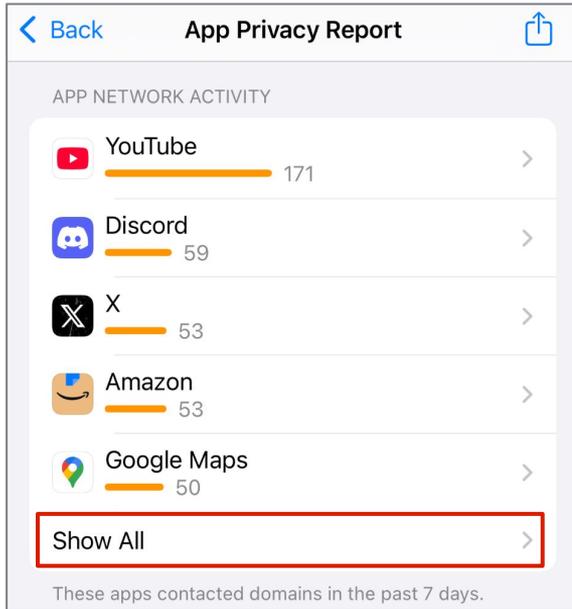


# Network Activity – App Privacy Report Interface

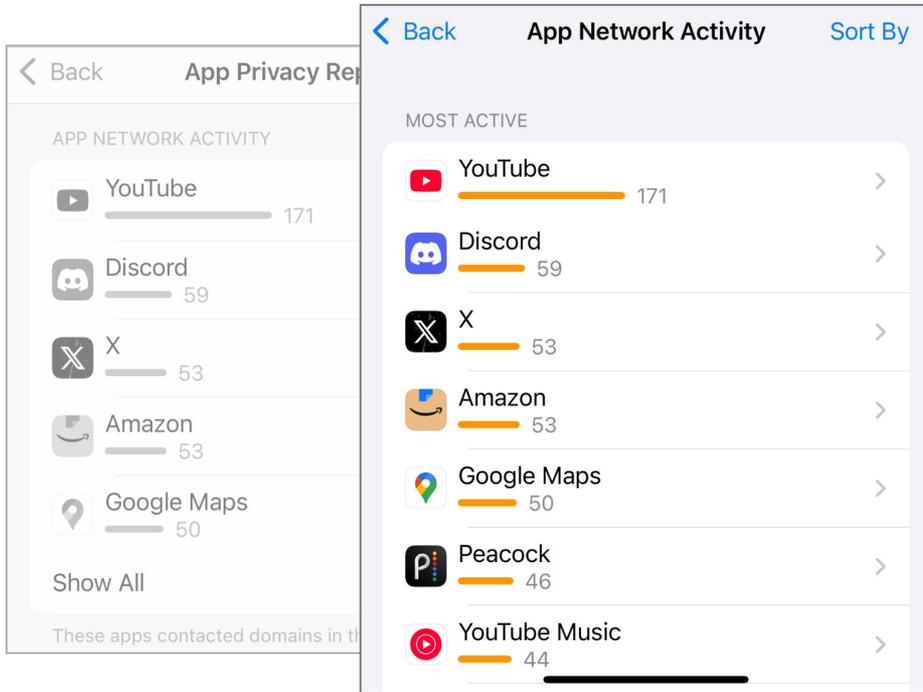
# Network Activity: Interface



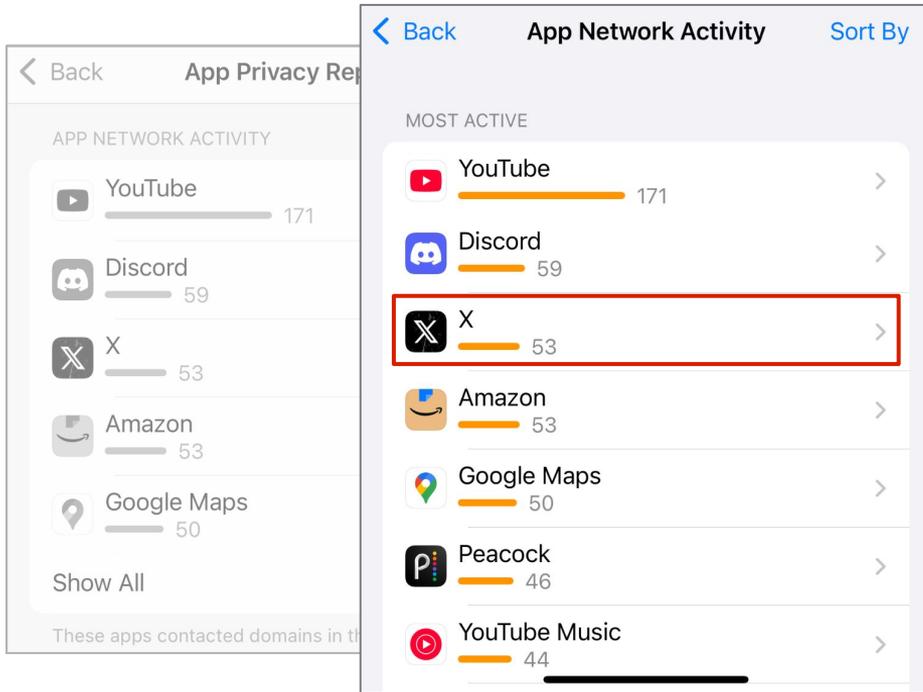
# Network Activity: Interface



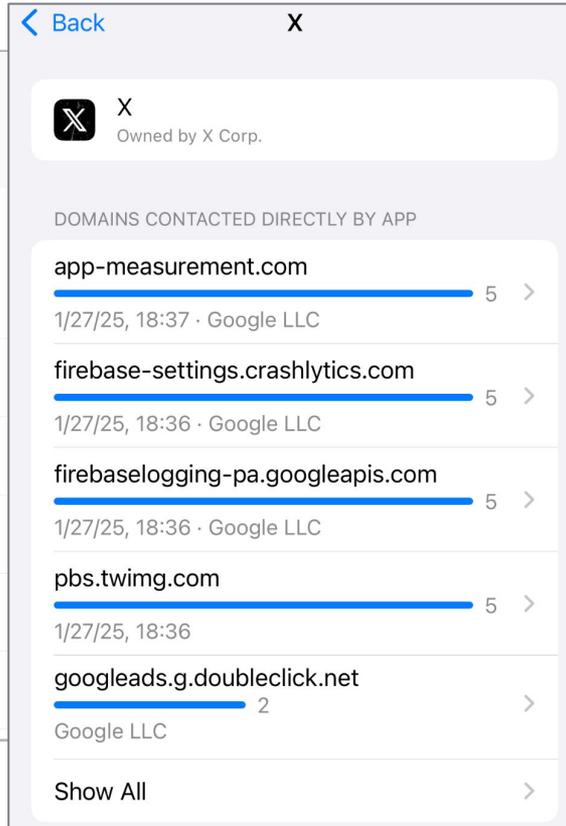
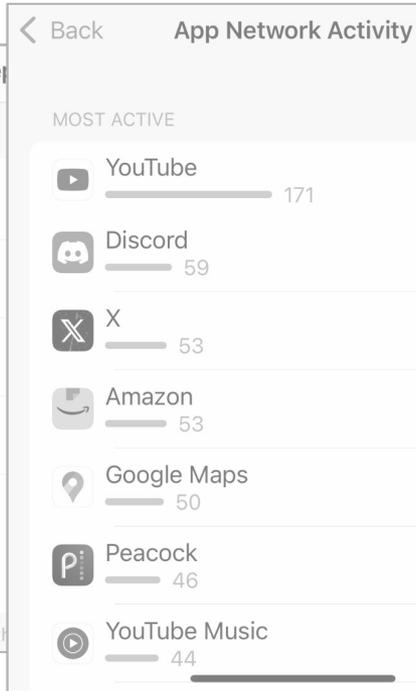
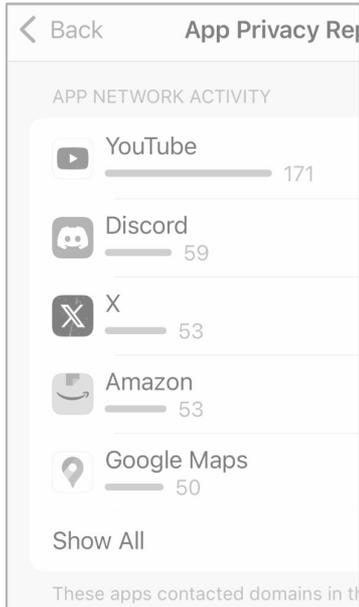
# Network Activity: Interface



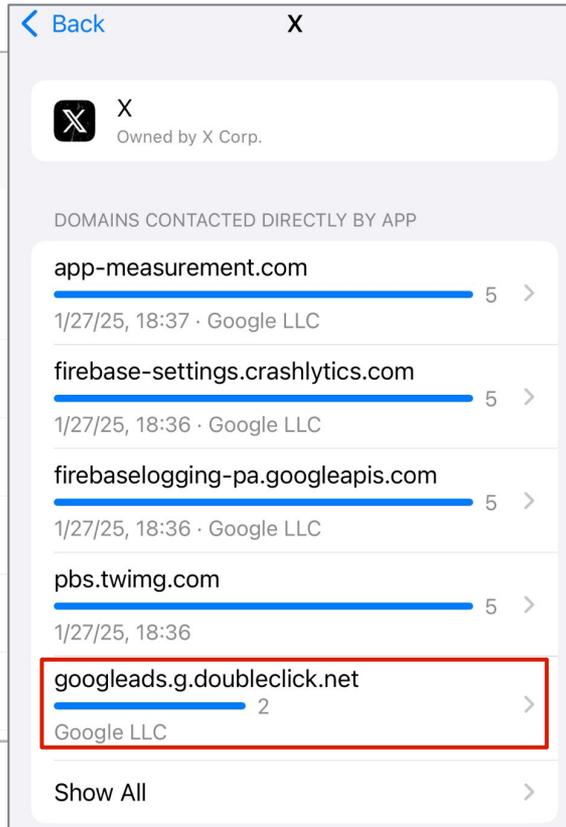
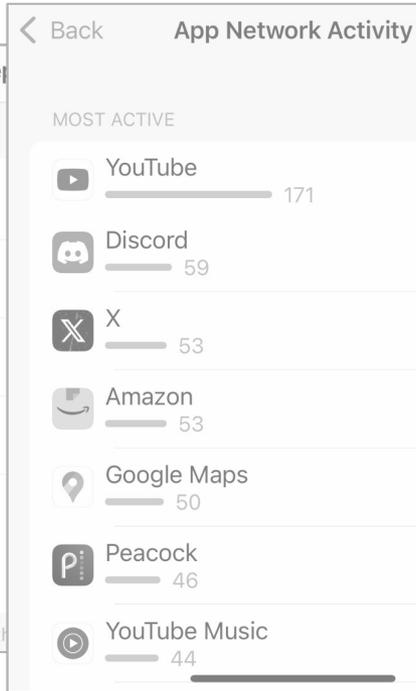
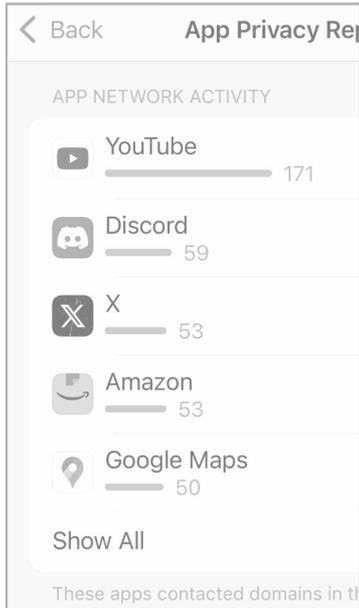
# Network Activity: Interface



# Network Activity: Interface



# Network Activity: Interface



# Network Activity: Interface

← Back App Privacy Report

APP NETWORK ACTIVITY

- YouTube 171
- Discord 59
- X 53
- Amazon 53
- Google Maps 50

Show All

These apps contacted domains in the...

← Back App Network Activity

MOST ACTIVE

- YouTube 171
- Discord 59
- X 53
- Amazon 53
- Google Maps 50
- Peacock 46
- YouTube Music 44

← Back X

X  
Owned by X Corp.

DOMAINS CONTACTED DIRECTLY BY APP

- app-measurement.com  
1/27/25, 18:37 · Google LLC
- firebase-settings.crashlytics.com  
1/27/25, 18:36 · Google LLC
- firebase logging-pa.googleapis.com  
1/27/25, 18:36 · Google LLC
- pbs.twimg.com  
1/27/25, 18:36
- googleads.g.doubleclick.net 2  
Google LLC

Show All

← Back googleads.g.doubleclick.net

Domain googleads.g.doubleclick.net  
Owned by Google LLC

This domain may be following you across multiple apps and websites to combine your activity into a profile.  
[Learn more...](#)

APPS THAT CONTACTED THIS DOMAIN

- YouTube 1/27/25, 09:53
- Uber 1/25/25, 22:51
- X 1/25/25, 10:32
- Instagram 1/23/25, 21:54

WEBSITES THAT CONTACTED THIS DOMAIN

- google.com 1/26/25, 23:11
- latimes.com 1/23/25, 20:56
- burton.com 1/23/25, 12:52
- samcurry.net 1/23/25, 11:10



# Network Activity – Results

Participants identified...

# Third-Party Data Collection and Cross-App Tracking

The screenshot shows a mobile application interface with a back arrow and the text "Back googleads.g.doubleclick.net". Below this, there is a section for the domain "googleads.g.doubleclick.net" with the note "Owned by Google LLC". A warning message states: "This domain may be following you across multiple apps and websites to combine your activity into a profile. Learn more...".

Below the warning, there is a section titled "APPS THAT CONTACTED THIS DOMAIN" containing a list of applications and their contact times:

| App       | Contacted Time |
|-----------|----------------|
| YouTube   | 1/27/25, 09:53 |
| Uber      | 1/25/25, 22:51 |
| X         | 1/25/25, 10:32 |
| Instagram | 1/23/25, 21:54 |

Below this, there is a section titled "WEBSITES THAT CONTACTED THIS DOMAIN" containing a list of websites and their contact times:

| Website     | Contacted Time |
|-------------|----------------|
| google.com  | 1/26/25, 23:11 |
| latimes.com | 1/23/25, 20:56 |
| burton.com  | 1/23/25, 12:52 |

Participants identified...

# Third-Party Data Collection and Cross-App Tracking

Back googleads.g.doubleclick.net

Domain googleads.g.doubleclick.net  
Owned by Google LLC

This domain may be following you across multiple apps and websites to combine your activity into a profile.  
[Learn more...](#)

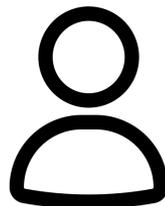
APPS THAT CONTACTED THIS DOMAIN

|   |                |
|---|----------------|
|  YouTube   | 1/27/25, 09:53 |
|  Uber      | 1/25/25, 22:51 |
|  X         | 1/25/25, 10:32 |
|  Instagram | 1/23/25, 21:54 |

WEBSITES THAT CONTACTED THIS DOMAIN

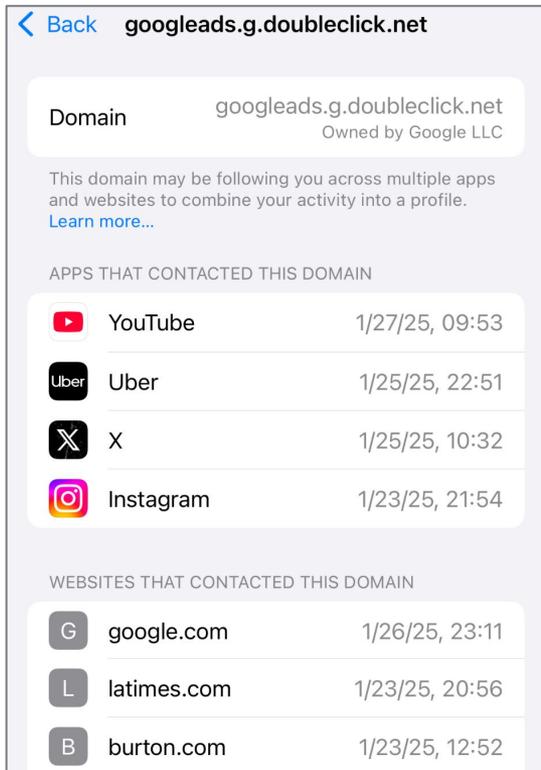
|   |                |
|---|----------------|
|  google.com  | 1/26/25, 23:11 |
|  latimes.com | 1/23/25, 20:56 |
|  burton.com  | 1/23/25, 12:52 |

Google tracking [...] maybe how much I'm using Spotify.



Participants identified...

# Third-Party Data Collection and Cross-App Tracking



Back googleads.g.doubleclick.net

Domain googleads.g.doubleclick.net  
Owned by Google LLC

This domain may be following you across multiple apps and websites to combine your activity into a profile.  
[Learn more...](#)

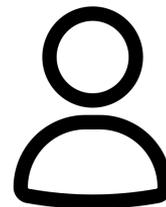
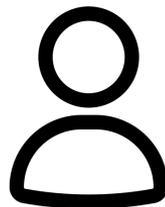
APPS THAT CONTACTED THIS DOMAIN

|   |                |
|---|----------------|
|  YouTube   | 1/27/25, 09:53 |
|  Uber      | 1/25/25, 22:51 |
|  X         | 1/25/25, 10:32 |
|  Instagram | 1/23/25, 21:54 |

WEBSITES THAT CONTACTED THIS DOMAIN

|   |                |
|---|----------------|
|  google.com  | 1/26/25, 23:11 |
|  latimes.com | 1/23/25, 20:56 |
|  burton.com  | 1/23/25, 12:52 |

Google tracking [...] maybe how much I'm using Spotify.



I guess Google is collecting all this information through these other apps as well through this domain.

Participants could not interpret...

## Domain Names

I don't recognize any of these.



|                                   |   |   |
|-----------------------------------|---|---|
| <a href="#">a.ad.gt</a>           | 3 | > |
| <a href="#">cdn.hadronid.net</a>  | 3 | > |
| <a href="#">cdn.shopify.com</a>   | 3 | > |
| <a href="#">cs.admanmedia.com</a> | 3 | > |
| <a href="#">ct.pinterest.com</a>  | 3 | > |
| <a href="#">eexsync.com</a>       | 3 | > |
| <a href="#">hb.yellowblue.io</a>  | 3 | > |
| <a href="#">id.hadron.ad.gt</a>   | 3 | > |
| <a href="#">ids.ad.gt</a>         | 3 | > |

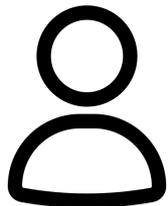
Participants could not interpret...

## Domain Names

I don't recognize any of these.



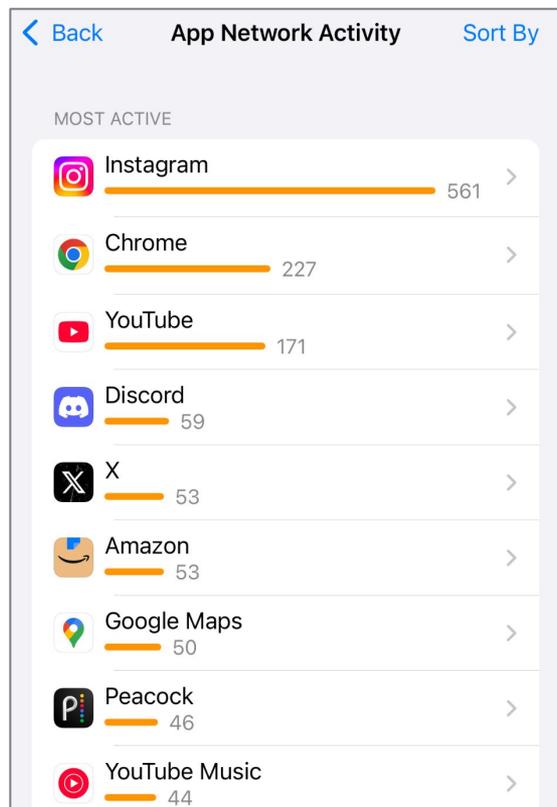
My impression is wow!...I can't really identify a lot of these.



|                   |   |   |
|-------------------|---|---|
| a.ad.gt           | 3 | > |
| cdn.hadronid.net  | 3 | > |
| cdn.shopify.com   | 3 | > |
| cs.admanmedia.com | 3 | > |
| ct.pinterest.com  | 3 | > |
| eexsync.com       | 3 | > |
| hb.yellowblue.io  | 3 | > |
| id.hadron.ad.gt   | 3 | > |
| ids.ad.gt         | 3 | > |

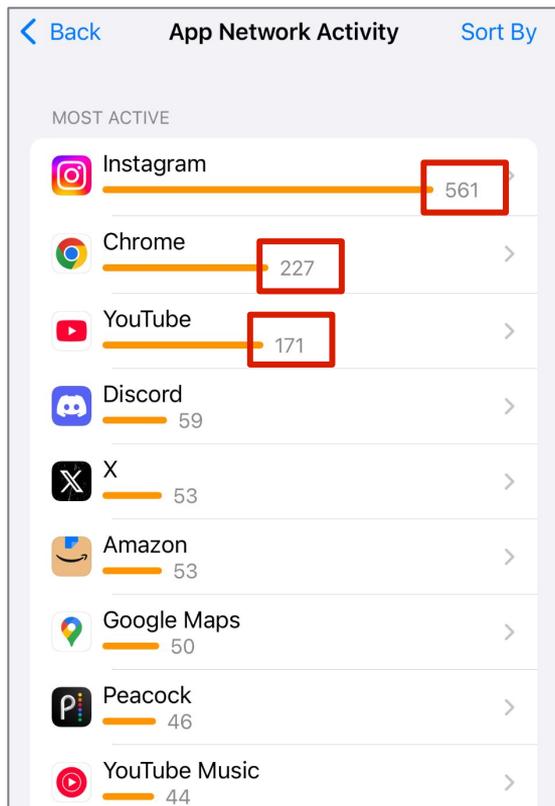
Participants were surprised by...

## How Many Domains Were Contacted

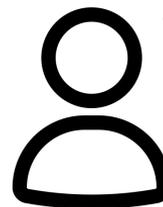


Participants were surprised by...

## How Many Domains Were Contacted

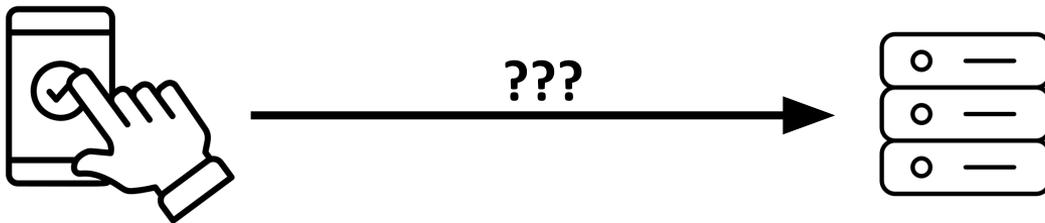


Most surprising thing is that I didn't realize each app would be connecting so many different domains.

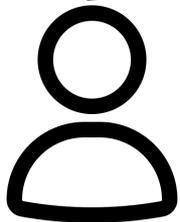


Participants were concerned about...

## Why Domains Are Contacted

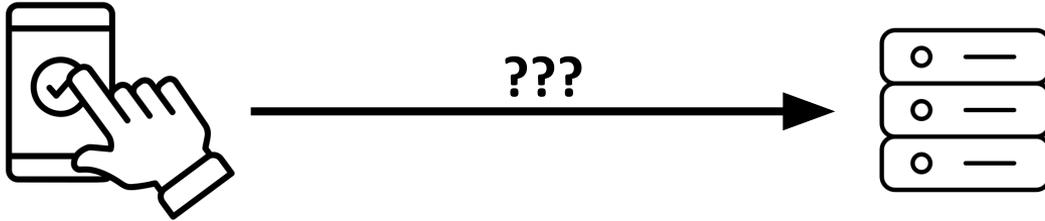


I am not aware of who they are, what they are, what their purpose is ... concerning.

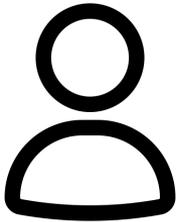


Participants were concerned about...

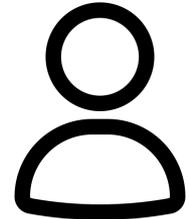
## Why Domains Are Contacted



I am not aware of who they are, what they are, what their purpose is ... concerning.

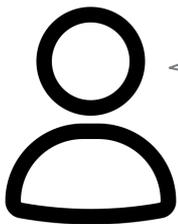


Gosund [app to control smart devices].  
What the heck is it doing?



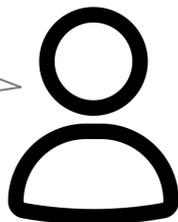
Participants wanted to...

## Look for Information Elsewhere



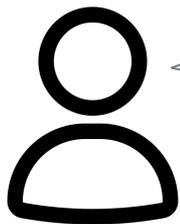
I'm gonna be searching  
[the domains] quite a bit.

I would go and Google [the  
domain]...to make sure it's  
not nefarious.



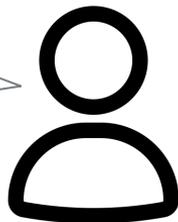
Participants wanted to...

## Look for Information Elsewhere



I'm gonna be searching  
[the domains] quite a bit.

I would go and Google [the  
domain]...to make sure it's  
not nefarious.



Google

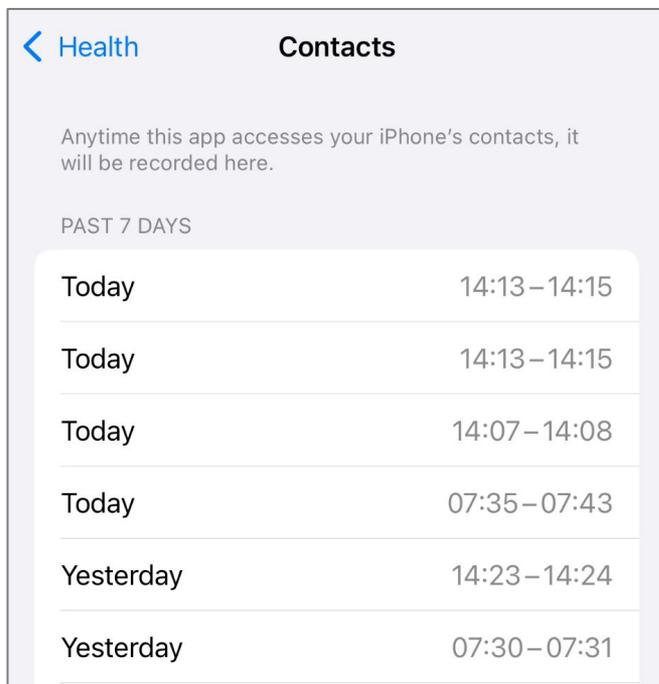




# Recommendations

## Data &amp; Sensor Access:

# Explain Why Apps Are Accessing Data or Sensors



The screenshot shows the 'Health' app interface for a contacts app. It displays a list of access events for the 'PAST 7 DAYS'. Each event is represented by a row with a date and a time range. The events are as follows:

| Date      | Time Range    |
|-----------|---------------|
| Today     | 14:13 – 14:15 |
| Today     | 14:13 – 14:15 |
| Today     | 14:07 – 14:08 |
| Today     | 07:35 – 07:43 |
| Yesterday | 14:23 – 14:24 |
| Yesterday | 07:30 – 07:31 |

Current implementation

## Data &amp; Sensor Access:

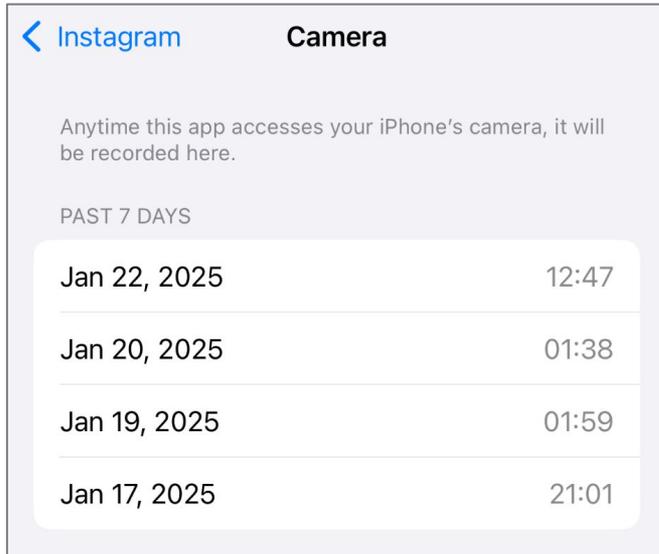
# Explain Why Apps Are Accessing Data or Sensors

| Time      | Duration    |
|-----------|-------------|
| Today     | 14:13–14:15 |
| Today     | 14:13–14:15 |
| Today     | 14:07–14:08 |
| Today     | 07:35–07:43 |
| Yesterday | 14:23–14:24 |
| Yesterday | 07:30–07:31 |

Current implementation

| Time      | Duration    |
|-----------|-------------|
| Today     | 14:13–14:15 |
| Today     | 14:13–14:15 |
| Today     | 14:07–14:08 |
| Today     | 07:35–07:43 |
| Yesterday | 14:23–14:24 |

## Data & Sensor Access: Add Permission Toggles



Instagram Camera

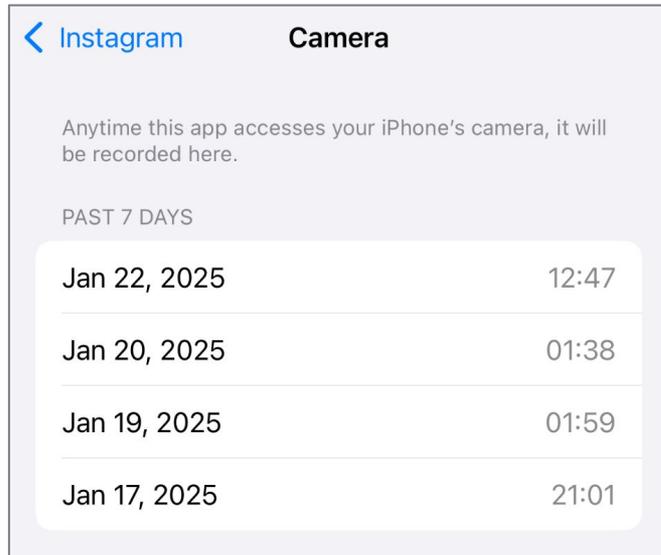
Anytime this app accesses your iPhone's camera, it will be recorded here.

PAST 7 DAYS

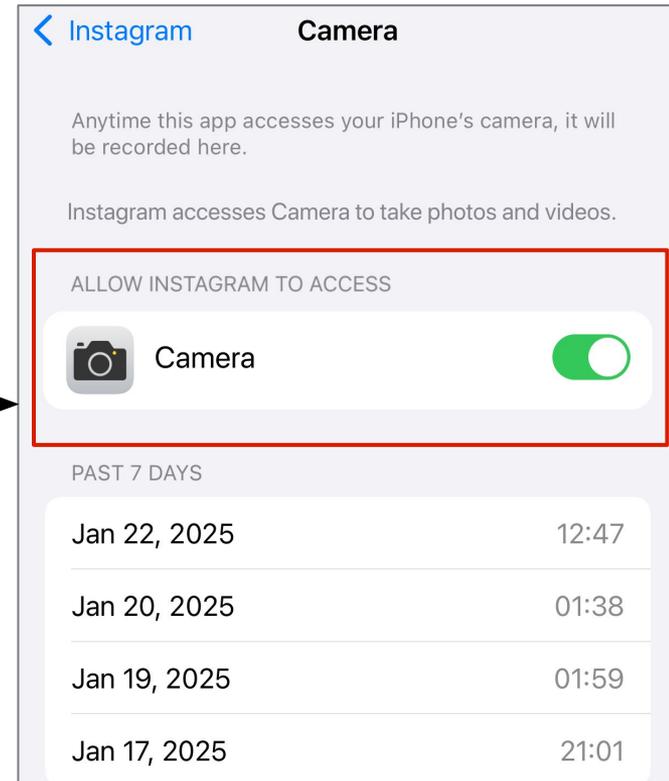
|              |       |
|--------------|-------|
| Jan 22, 2025 | 12:47 |
| Jan 20, 2025 | 01:38 |
| Jan 19, 2025 | 01:59 |
| Jan 17, 2025 | 21:01 |

Current implementation

## Data & Sensor Access: Add Permission Toggles

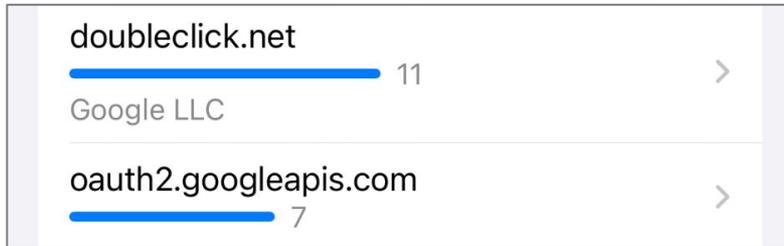


Current implementation



Network Activity:

## Label Domains with Their Purpose



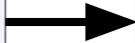
A screenshot of a network activity log showing two entries. Each entry consists of a domain name, a blue horizontal bar representing a count, and a right-pointing chevron. The first entry is 'doubleclick.net' with a count of 11. Below it is 'Google LLC'. The second entry is 'oauth2.googleapis.com' with a count of 7.

|                       |    |   |
|-----------------------|----|---|
| doubleclick.net       | 11 | > |
| Google LLC            |    |   |
| oauth2.googleapis.com | 7  | > |

Current implementation

Network Activity:

## Label Domains with Their Purpose

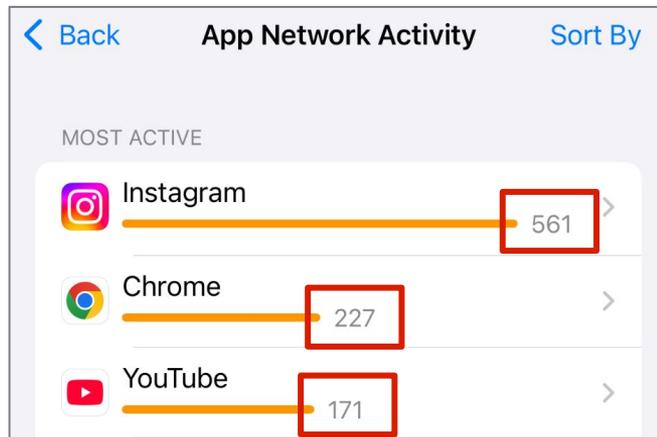


|                       |    |   |
|-----------------------|----|---|
| doubleclick.net       | 11 | > |
| Google LLC            |    |   |
| oauth2.googleapis.com | 7  | > |

Current implementation

|                                   |    |   |
|-----------------------------------|----|---|
| doubleclick.net                   | 11 | > |
| Google LLC                        |    |   |
| Used for Tracking and Advertising |    |   |
| oauth2.googleapis.com             | 7  | > |
| Used for Authentication           |    |   |

## Network Activity: Provide a Summary

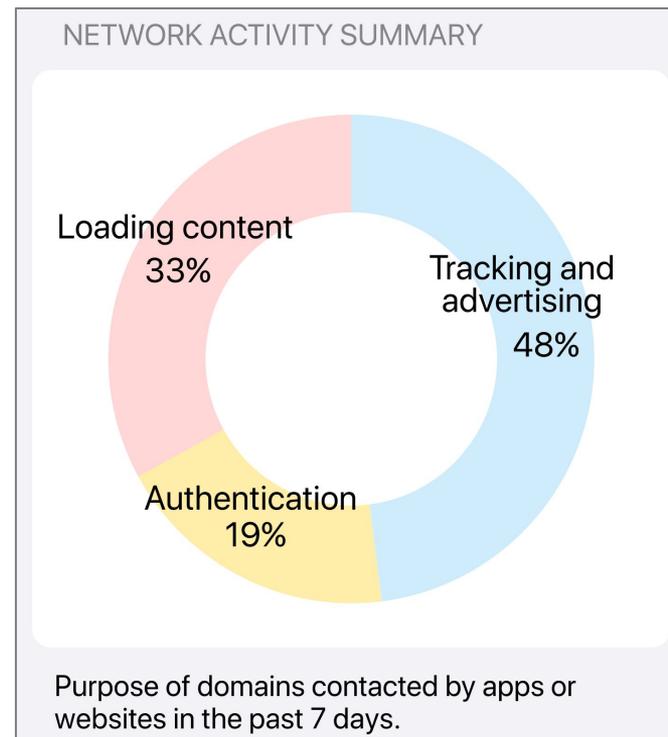


Current implementation

## Network Activity: Provide a Summary

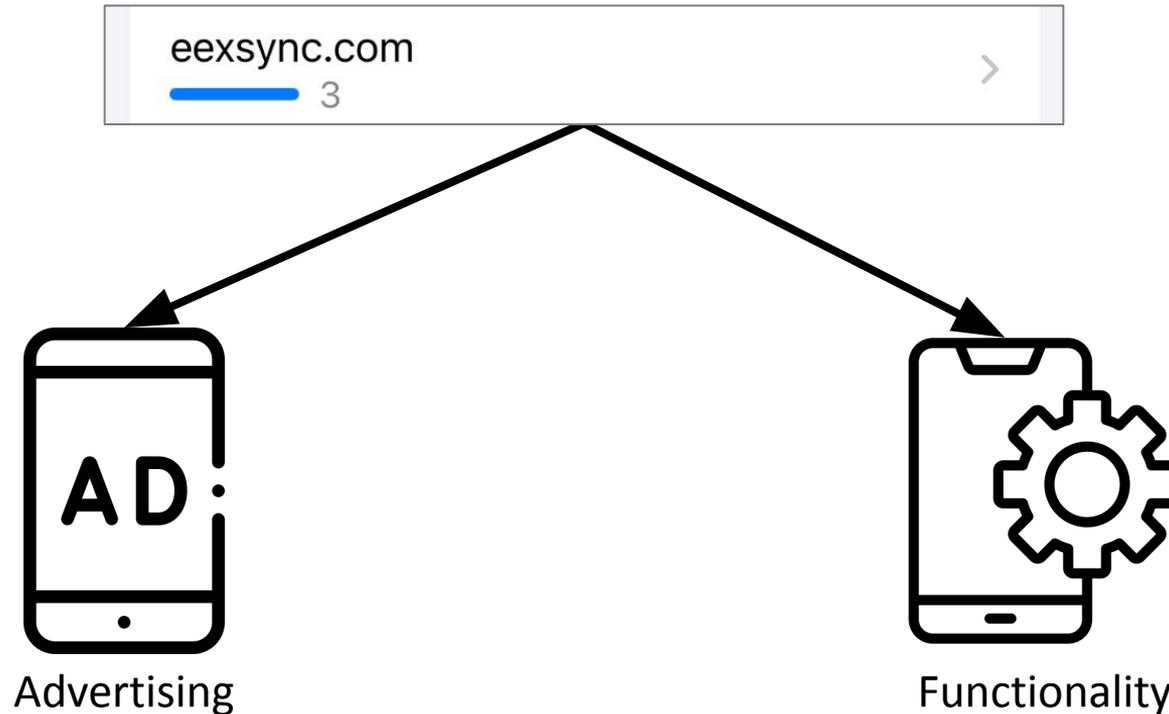


Current implementation



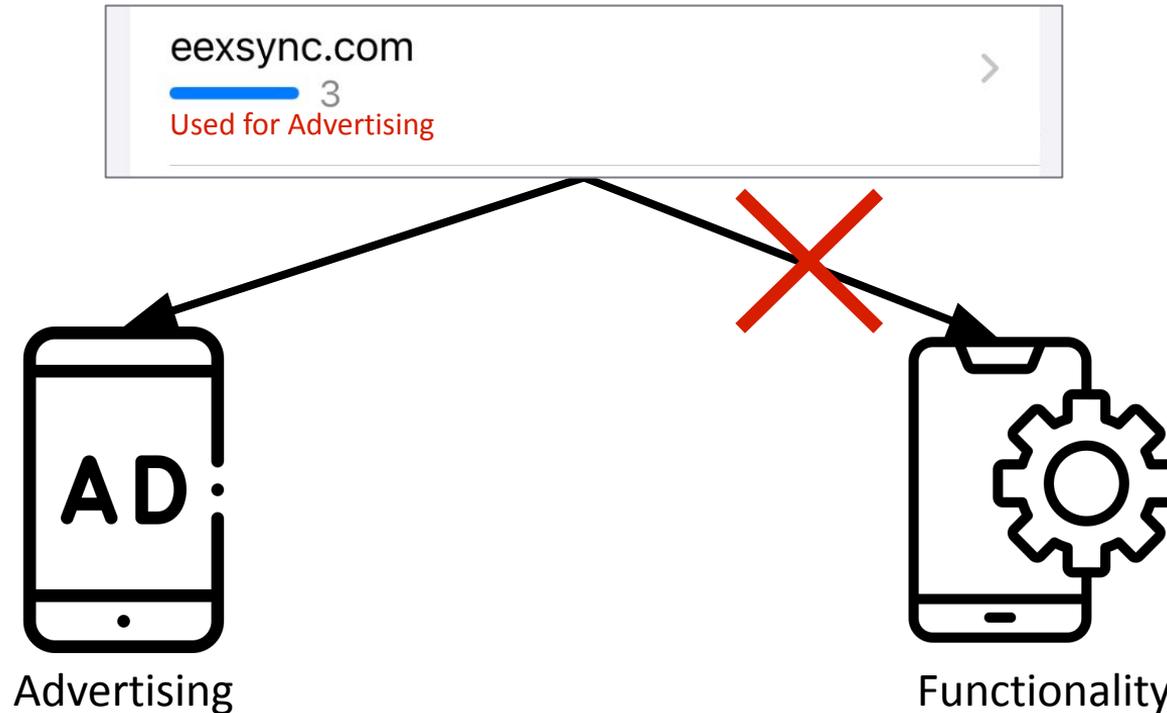
Network Activity:

# Disentangle Domain Functions



Network Activity:

# Disentangle Domain Functions



# Context & Control Make Privacy Dashboards Informative & Actionable

- Do newer privacy dashboards help users comprehend privacy practices?
- App Privacy Report (newer, widely available, shows a new type of info):
  - 😊 Some information was understandable and actionable
  - 😞 Lack of context → frequent confusion and concern
  - 😞 Hard to address concerns
  - 😞 Desired fixes ≠ available settings
- Recommendations:
  1. Label and summarize network activity
  2. Disentangle domain functionalities
  3. Make settings accessible within dashboard



Full Paper  
[wxyowen.github.io](https://wxyowen.github.io)