ECE750: Usable Security and Privacy

Privacy - Advertising

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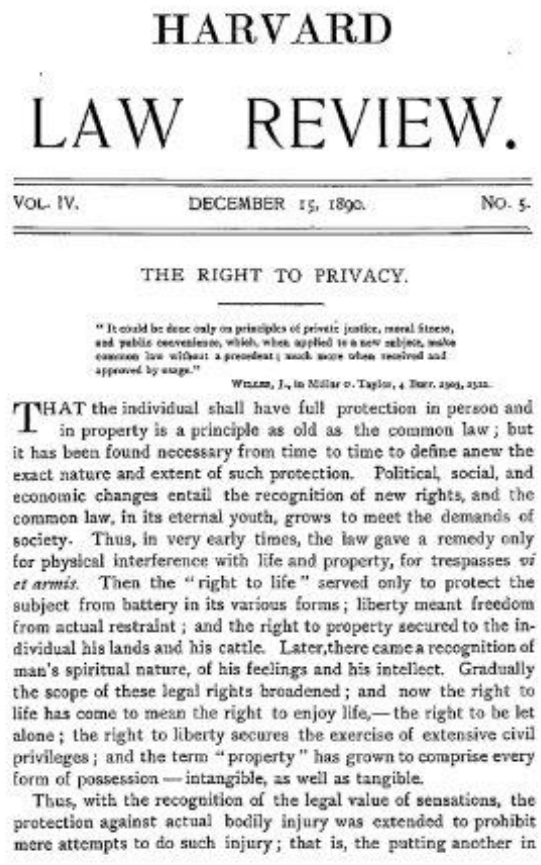
TULiPS
Technology Usability Lab in Privacy and Security

First, the news...

- First 5 minutes we talk about something interesting and recent
- You will not be tested on the news part of lecture
- You may use news as an example on tests
- Why do this?
    1. Some students show up late for various good reasons
    2. Reward students who show up on time
    3. Important to see real world examples

READINGS

Today's readings: Two papers by lawyers



HARVARD

LAW REVIEW.

VOL. IV. DECEMBER 15, 1890. NO. 5.

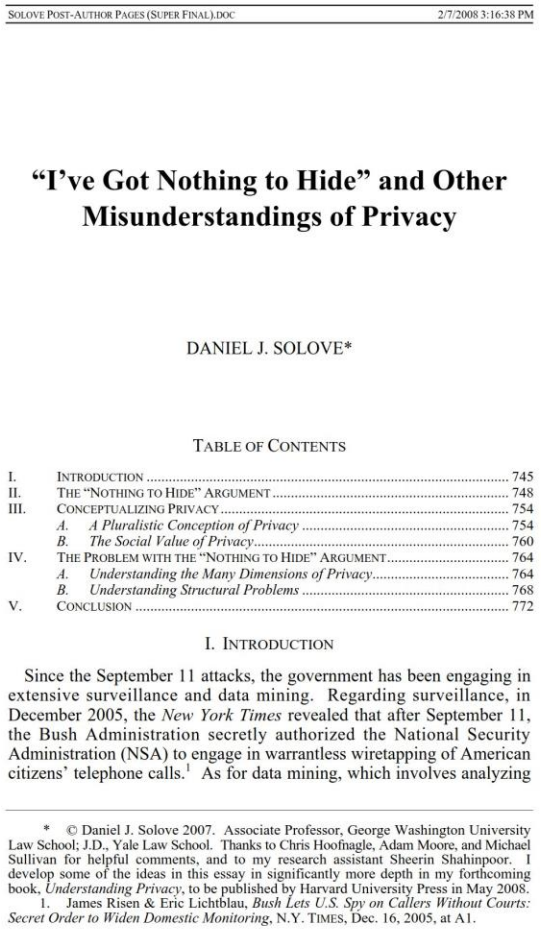
THE RIGHT TO PRIVACY.

"It could be done only on principles of private justice, moral fitness, and public convenience, which, when applied to a new subject, make common law without a precedent; much more when received and approved by usage."

WILLES, J., in Millar v. Taylor, 4 Burr. 2303, 2312.

THAT the individual shall have full protection in person and in property is a principle as old as the common law; but it has been found necessary from time to time to define anew the exact nature and extent of such protection. Political, social, and economic changes entail the recognition of new rights, and the common law, in its eternal youth, grows to meet the demands of society. Thus, in very early times, the law gave a remedy only for physical interference with life and property, for trespasses *vi et armis*. Then the "right to life" served only to protect the subject from battery in its various forms; liberty meant freedom from actual restraint; and the right to property secured to the individual his lands and his cattle. Later, there came a recognition of man's spiritual nature, of his feelings and his intellect. Gradually the scope of these legal rights broadened; and now the right to life has come to mean the right to enjoy life,—the right to be let alone; the right to liberty secures the exercise of extensive civil privileges; and the term "property" has grown to comprise every form of possession—intangible, as well as tangible.

Thus, with the recognition of the legal value of sensations, the protection against actual bodily injury was extended to prohibit mere attempts to do such injury; that is, the putting another in



SOLOVE POST-AUTHOR PAGES (SUPER FINAL).DOC 2/7/2008 3:16:38 PM

"I've Got Nothing to Hide" and Other Misunderstandings of Privacy

DANIEL J. SOLOVE*

TABLE OF CONTENTS

I. INTRODUCTION

Since the September 11 attacks, the government has been engaging in extensive surveillance and data mining. Regarding surveillance, in December 2005, the *New York Times* revealed that after September 11, the Bush Administration secretly authorized the National Security Administration (NSA) to engage in warrantless wiretapping of American citizens' telephone calls.[1] As for data mining, which involves analyzing

 Associate Professor, George Washington University Law School; J.D., Yale Law School. Thanks to Chris Hoofnagle, Adam Moore, and Michael Sullivan for helpful comments, and to my research assistant Sheerin Shahinpoor. I develop some of the ideas in this essay in significantly more depth in my forthcoming book, *Understanding Privacy*, to be published by Harvard University Press in May 2008.

1. James Risen & Eric Lichtblau, *Bush Lets U.S. Spy on Callers Without Courts: Secret Order to Widen Domestic Monitoring*, N.Y. TIMES, Dec. 16, 2005, at A1.

Two papers by lawyers

US Government surveillance and how people are responding

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"the right to enjoy life"

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"the right to be let alone"

"'property' has grown to comprise ... tangible as well as intangible"

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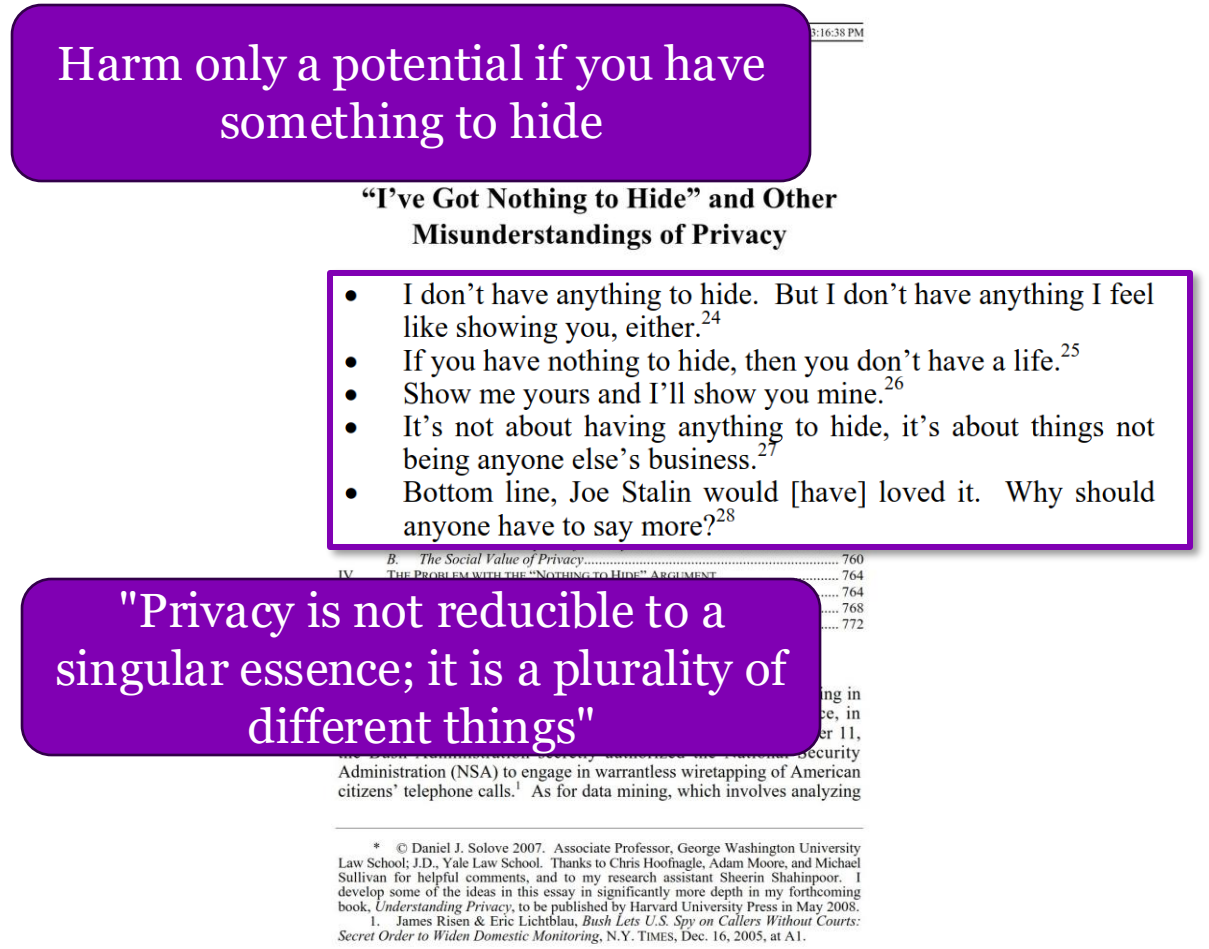
Harm only a potential if you have something to hide



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"I've Got Nothing to Hide" and Other Misunderstandings of Privacy

- I don't have anything to hide. But I don't have anything I feel like showing you, either.[24]
- If you have nothing to hide, then you don't have a life.[25]
- Show me yours and I'll show you mine.[26]
- It's not about having anything to hide, it's about things not being anyone else's business.[27]
- Bottom line, Joe Stalin would [have] loved it. Why should anyone have to say more?[28]

B. *The Social Value of Privacy* 760
IV. THE PROBLEM WITH THE "NOTHING TO HIDE" ARGUMENT 764
..... 764
..... 768
..... 772

"Privacy is not reducible to a singular essence; it is a plurality of different things"

...ng in ...ce, in ...er 11, ...ecurity Administration (NSA) to engage in warrantless wiretapping of American citizens' telephone calls.[1] As for data mining, which involves analyzing

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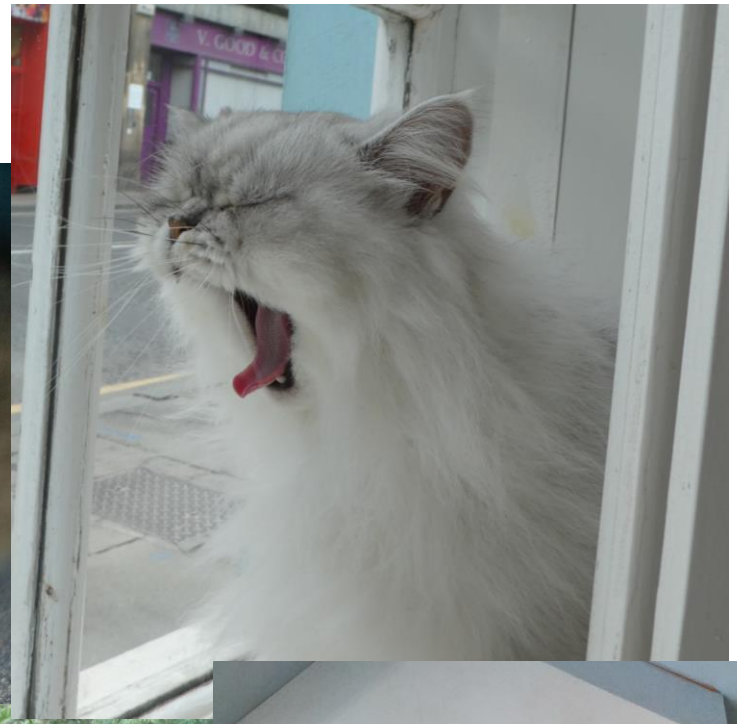
Cat: try and define....



Security properties to ensure

Confidentiality	No improper information gathering
Integrity	Data has not been (maliciously) altered
Availability	Data/services can be accessed as desired
Accountability	Actions are traceable to those responsible
Authentication	User or data origin accurately identifiable

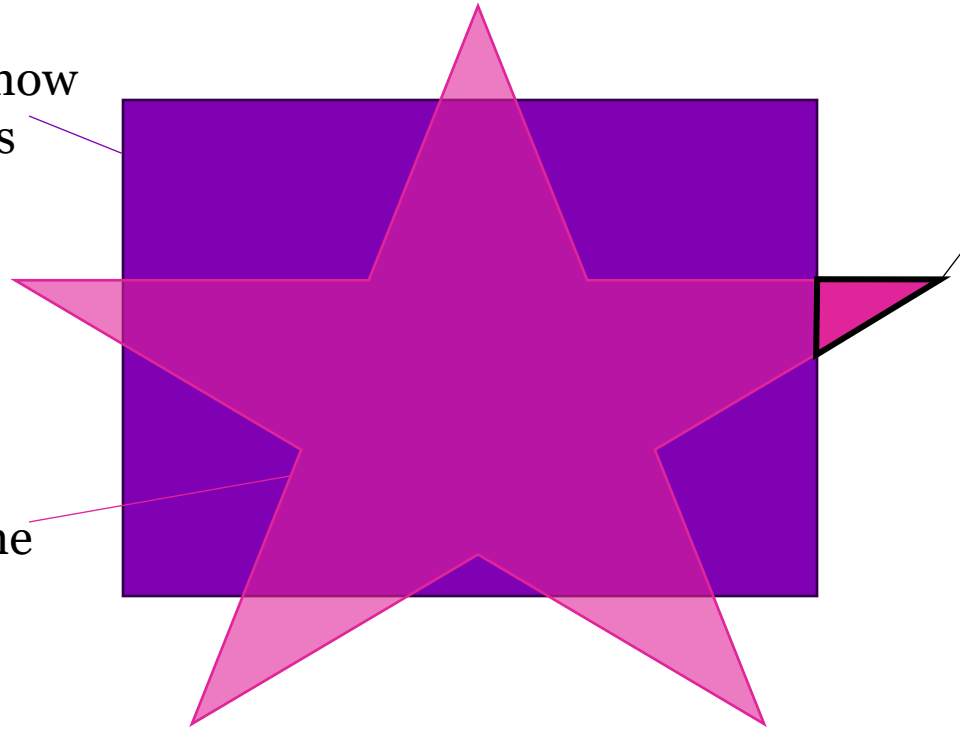
Security expects specifications

- There is no such thing as a fully secure system that is protected from everything.
- Systems can be protected against specified threats, allow specified actions, and accept specified risks.

- Security expects someone to specify who is authorized and how to verify them.
- Issue of who should have access can be complex – Privacy.

- **Confidential**: only authorized entities can read data or infer information
- **Integral**: only authorized entities can alter data.
- **Available**: authorized entities can access the data
- **Accountable**: all actions are recorded and traceable to who/what did it
- **Authenticated**: all entities have had their identities or credentials verified

Theoretically how the system works



Actually how the system works

Hack potential: Get the system to do what the user wants but system designer did not intend.

PRIVACY

Security and usability together

Where did privacy go?

Security	Usability/HCI	Usable Security and Privacy
Humans are a secondary constraint to security constraints	Humans are the primary constraint, security rarely considered	Human factors and security are both primary constraints
Humans considered primarily in their role as adversaries/attackers	Concerned about human error but not human attackers	Concerned about both normal users and adversaries
Involves threat models	Involves task models, mental models, cognitive models	Involves threat models AND task models, mental models, etc.
Focus on security metrics	Focus on usability metrics	Considers usability and security metrics together
User studies rarely done	User studies common	User studies common, often involve deception + active adversary

Based on slides by Lorrie Cranor

Defining privacy

- The Cambridge Dictionary

- Someone's right to keep their personal matters and relationships secret
  - Controlling personal information
  - *The new law is designed to protect people's privacy*

- The state of being alone
  - Controlling access to self
  - *I hate sharing a bedroom – I never get any privacy*

BOUNDARY MANAGEMENT

Humans are constantly managing their image based on context

Boundary Management

- Humans constantly adjust how they present themselves, their "boundaries" based on context
- Because
  - Show of respect to others
  - Managing information flow
  - Demonstrate being part of a group
- Difference between "hiding" something and not actively providing it

Signaling: providing information using non-verbal cues

- Humans sign information all the time that helps others interprete situations
  - Physical body position
  - Clothing choices
  - Tone of voice
  - Facial expression

Study inspiration

Normally my students view phones vertically.

Suddenly all of them are looking at phones horizontally.

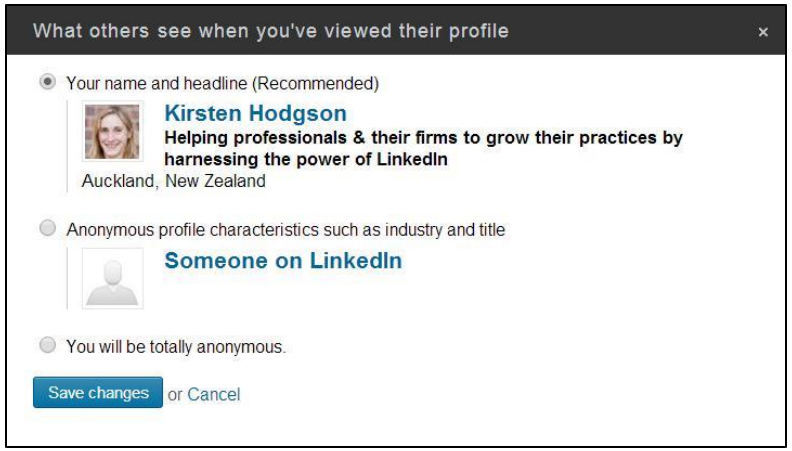
Study inspiration

What happened?

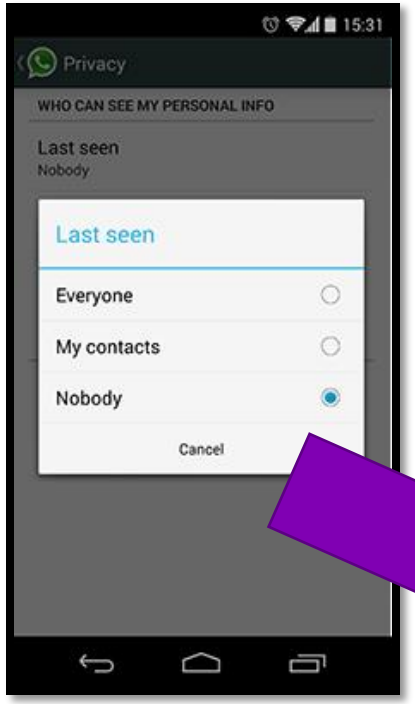
Facebook Messenger introduced a "seen by" feature.

“Seen” visibility in social networks

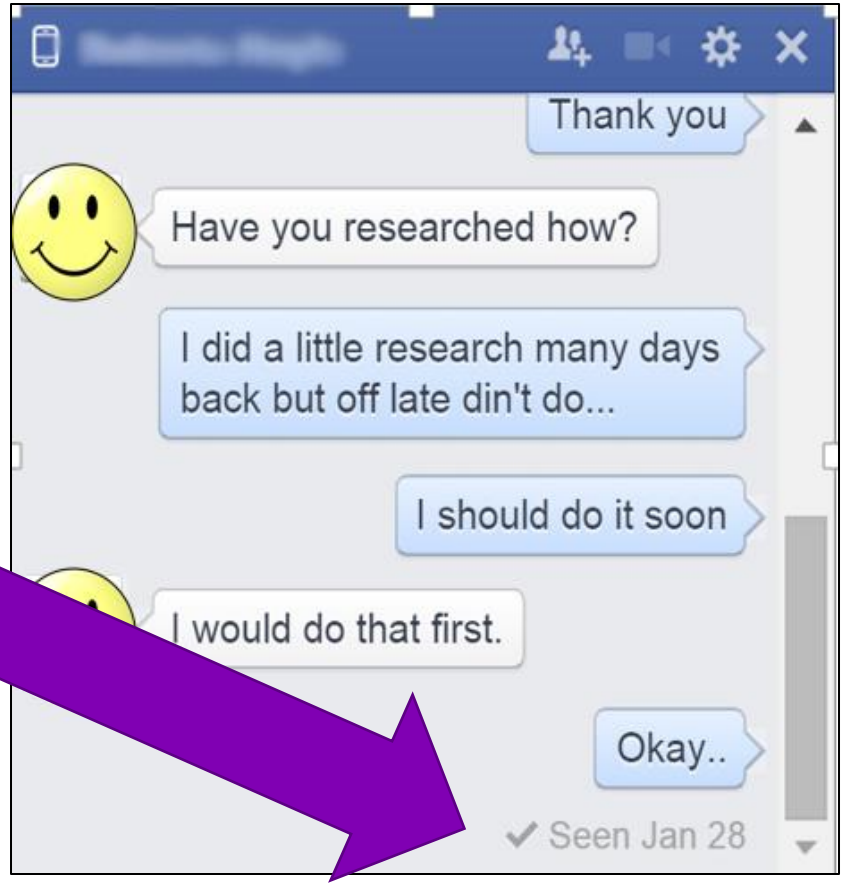
LinkedIn



WhatsApp



Facebook Messenger



R. Hoyle, S. Das, A. Kapadia, A.J. Lee, K. Vaniea. Was my message read? Privacy and signaling on Facebook messenger. In CHI 2017.

Signaling

- Situational information solves technical problems
  - Has the message gotten to the phone ok?
- Also "should I wait for response, or go do something else" problem
  - Are they actively responding?
- People use these small indicators to signal other information
- Binary signal expanded into a wide range of meanings

R. Hoyle, S. Das, A. Kapadia, A.J. Lee, K. Vaniea. Was my message read? Privacy and signaling on Facebook messenger. In CHI 2017.

Method

- Research Question:

How are people using the Facebook Messenger “seen” feature for signaling?

- Two surveys
  - Message senders (n=402)
  - Message recipients (n=316)
- Amazon Mechanical Turk sample - advertisement did not mention privacy or security
- Survey consisted of:
  - Demographics
  - Setting choices
  - Past behaviors
  - Free text prior experiences

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92% knew that another person could see when a message was read

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41% incorrectly thought that visibility could be controlled

R. Hoyle, S. Das, A. Kapadia, A.J. Lee, K. Vaniea. Was my message read? Privacy and signaling on Facebook messenger. In CHI 2017.

68.4% avoided viewing a message because of "seen" feature

Reason	Frequency
I wanted to pretend I never saw the message	68.2%
I was too busy with other work and had no time to view the message	45.8%
I hadn't responded to a correspondence from this person and didn't want to let them know I had logged into Facebook	41.3%
I didn't want people to know I am checking Facebook messages at that time of day or day of week	17.9%
I wanted the other person to know I am ignoring them	8.0%
Other	4.0%

R. Hoyle, S. Das, A. Kapadia, A.J. Lee, K. Vaniea. Was my message read? Privacy and signaling on Facebook messenger. In CHI 2017.

Asked to relate two past situations

one where a message was not read

one where a message was read but not responded to

R. Hoyle, S. Das, A. Kapadia, A.J. Lee, K. Vaniea. Was my message read? Privacy and signaling on Facebook messenger. In CHI 2017.

Qualitatively coded

Guessed reason for not read/reply	Did not **read**	Did not **reply**
Busy	24.1%	11.7%
Pointedly ignoring me	15.4%	27.9%
May be in trouble	5.7%	1.2%
Having technical issues	3.2%	0.5%
May have misinterpreted message	1.0%	10.0%
Is formulating a response	0.0%	2.0%

R. Hoyle, S. Das, A. Kapadia, A.J. Lee, K. Vaniea. Was my message read? Privacy and signaling on Facebook messenger. In CHI 2017.

Implications for design

- Settings
  - Some social media applications allow control and some do not.
  - Assumptions around setting existance impact signal interpretation.
- Access to self
  - Want to control interruptions.
  - Once message is read there is pressure to respond.
- Controlling expectations
  - Letting others assume you are busy.

R. Hoyle, S. Das, A. Kapadia, A.J. Lee, K. Vaniea. Was my message read? Privacy and signaling on Facebook messenger. In CHI 2017.

KATZ TEST

Katz vs US (1967)

Katz vs. United States (aka FBI)

- Katz was a gambler
- Used a payphone to place bets
- FBI placed a recording device in the payphone he used and recorded his calls
- Katz claimed he had the right to privacy in the payphone booth, FBI claimed it was a public space

Unreasonable search and seizure

"For the Fourth Amendment protects people, not places. What a person knowingly exposes to the public, even in his own home or office, is not a subject of Fourth Amendment protection. But what he seeks to preserve as private, even in an area accessible to the public, may be constitutionally protected."

-- Katz vs. United States, 1967

US Fourth Amendment:

"The **right of the people to be secure** in their persons, houses, papers, and effects, against **unreasonable searches and seizures**, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized."

Katz test

Two part test

1. "A person have exhibited an actual (subjective) expectation of privacy"
    - They did something to attempt to protect their privacy. Such as shut a door.
2. "The expectation be one that society is prepared to recognize as "reasonable."
    - Other people would agree that shutting a door is a privacy statement.

"Thus a man's home is, for most purposes, a place where he expects privacy, but objects, activities, or statements that he exposes to the "plain view" of outsiders are not "protected" because no intention to keep them to himself has been exhibited. On the other hand, conversations in the open would not be protected against being overheard, for the expectation of privacy under the circumstances would be unreasonable."

—Katz, 389 U.S. at 361 (Harlan, J., concurring)

CONTEXT COLLAPSE

Context Collapse: two previously separate contexts collide

Example: your grandmother decides to visit you at work.

Context Collapse

You join great new social media app everyone is using

Then your mom joins and wants to be your friend…

Context Collapse

- Physically
  - Boundary management is done with people physically near us
  - Know who is present and can adjust to them
  - Privacy can be managed in relation to the context and people present

- Unexpected person
  - Teacher turns out to be in church group
- Context intrusion into a space
  - Radio is an early example, anything could be broadcast into the home
- Data copied between contexts
  - Photographs are an early example. Photo taken in one context can easily move to another.
- Data visible to many contexts at once
  - Social media

Teacher denied degree

- Student posted a photo on MySpace entitled “drunken pirate” showing her drinking from a yellow cup.
- School refused to give her a degree citing “unprofessional behavior”.

Teachers' Virtual Lives Conflict With Classroom

Teacher-to-be says she was denied credential because of online photos.

By ABC News
May 5, 2008, 4:48 PM

May 6, 2008— -- Stacy Snyder was weeks away from getting her teaching degree when she said her career was derailed by an activity common among many young teachers: posting personal photos on a MySpace page.

Snyder, then 27, claimed in a federal lawsuit scheduled to go to trial Tuesday that Millersville University refused to give her a teaching credential after school administrators learned of a photo on her MySpace page labeled "drunken pirate." She said school officials accused her of promoting underage drinking after seeing the photo, which showed Snyder wearing a pirate hat and drinking out of a yellow cup.

"I don't think it's fair," Snyder's father said. "She could have been a great teacher."

Snyder's lawyer, Mark Voigt, said he and Snyder would not comment until after the trial.

Millersville University claimed it would have refused to give Snyder a teaching degree even without the Web page, alleging unsatisfactory performance and unprofessional behavior.

Smart speakers

- Personal assistants that have microphones, speakers, and a connection to the internet
- Interact with users via voice controls
- Can be programmed with a range of functions to perform various tasks
  - Access internet data like the weather
  - Interact with IoT devices, like light switches
  - Initiate third party services like Spotify
  - Be a speaker or microphone for other devices

TULiPS

Dallas News, My dream come true: Alexa turn on the

Research question

- "We aim to compare emerging themes of in-house users of [Smart Speakers] (account and resident owners) and visitors in terms of:
  1) their understanding of how these devices function,
  2) their concerns about data usage
  3) protection behaviours they use
  4) social norms around non-owners using [Smart Speakers].

Methodology

- Interviews with drawing and free listing components
- 19 participants
  - 9 Female, 8 Male, 2 non-binary
  - Students and young professionals
  - Average 26 years old
- Ownership
  - 4 Device owners
  - 6 Resident owners
  - 9 Visitors

<u>Survey structure</u>

- Prior interactions with smart speakers
- Recent interaction with a smart speaker
- Three scenarios
  - Built in: Get tomorrow's weather forecast
  - Third party: Play a specific song from Spotify
  - In-home: Turn on a light in the living room
- Comfort and acceptance of smart speakers in shared spaces

Visitors and residential owners were sometimes surprised by the discovery of a smart speaker.

“Owner” has different meanings technologically and socially.

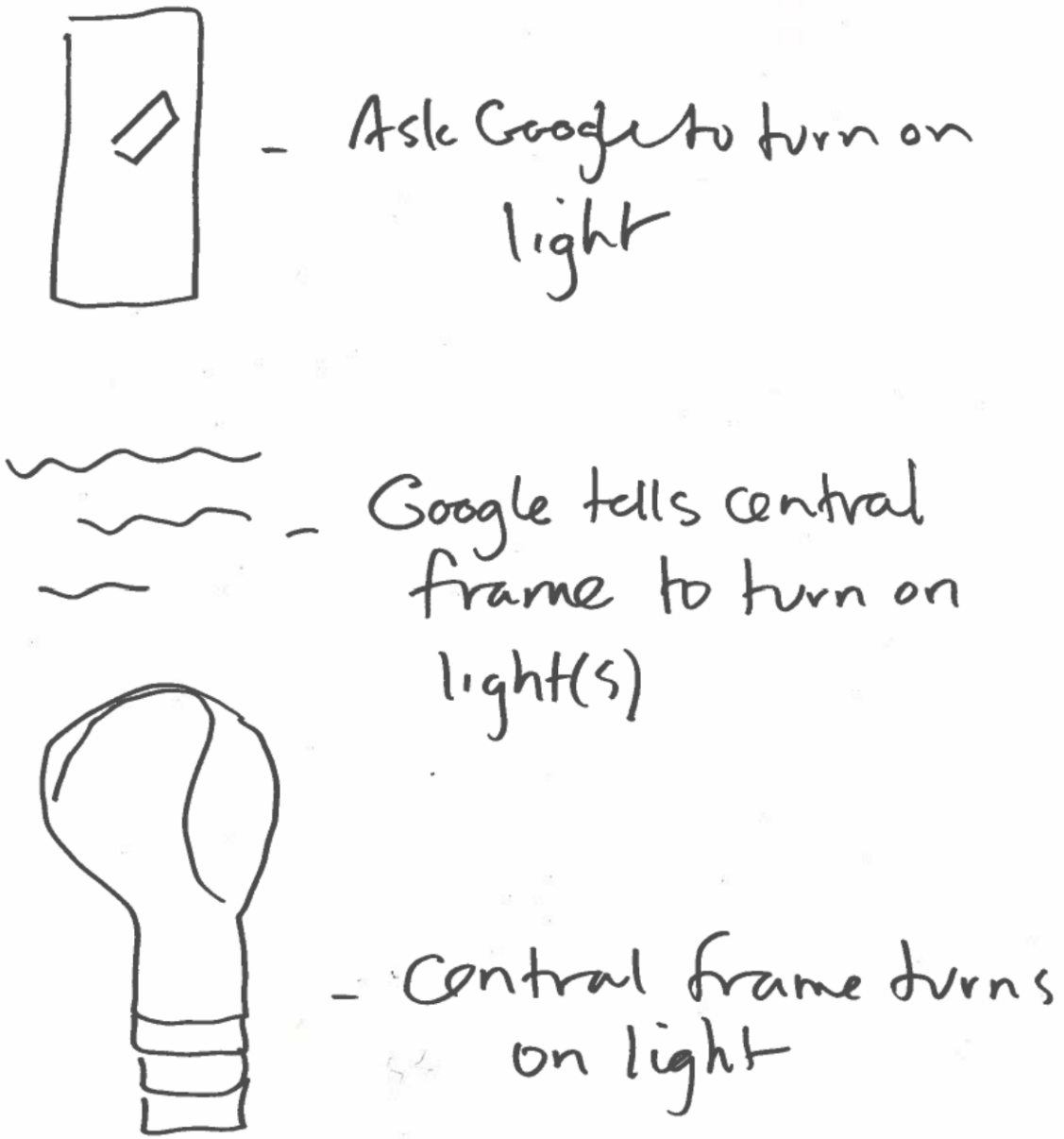
No authentication, yet interactions are linked to a single account.

Unintended connection to device because of no authentication.

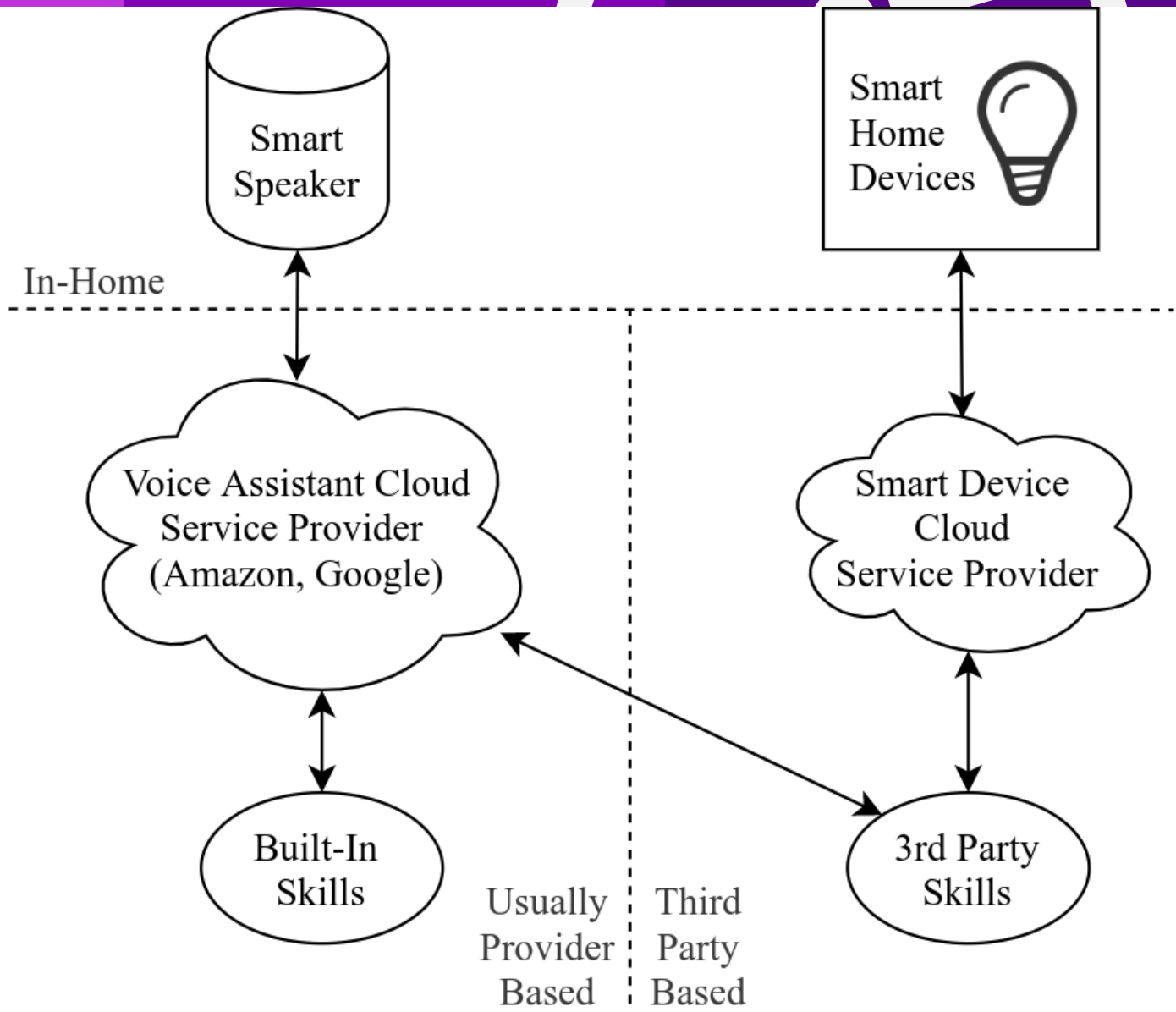
Visitors and owners had similar understanding of connections to cloud services.

Spotify connection obvious.

Lightbulb manufacture connection unclear.



All smart speaker interactions involve an external server. So they require a call-out to the internet.



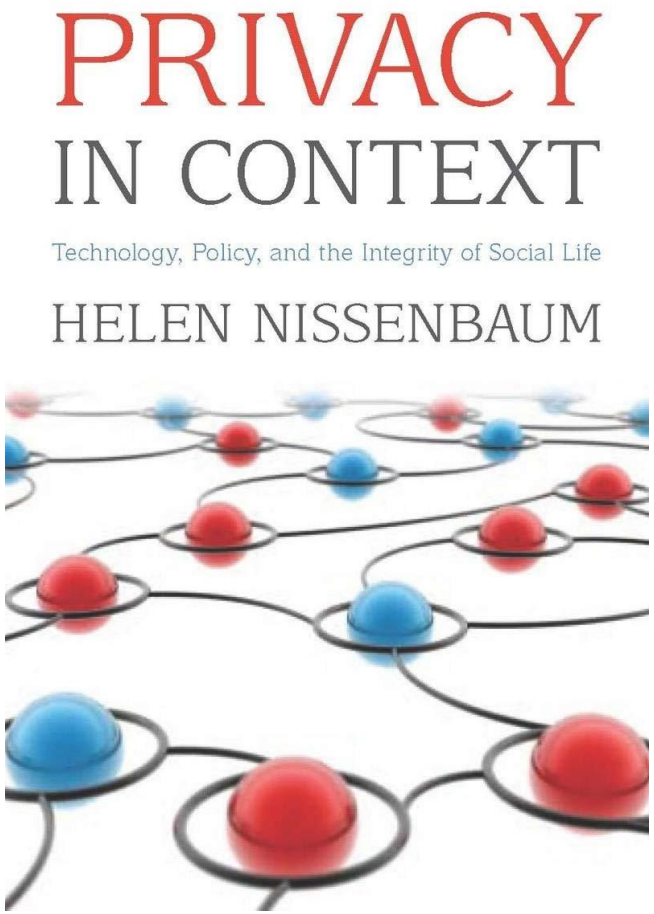
Conclusions

- Existence of smart speakers can be surprising, even for residential owners.
- Smart speakers have only one account, but many users.
- “Ownership” has several meanings in shared spaces, which are not supported by devices.
- Owners and visitors have similar understanding and attitudes around smart speakers.

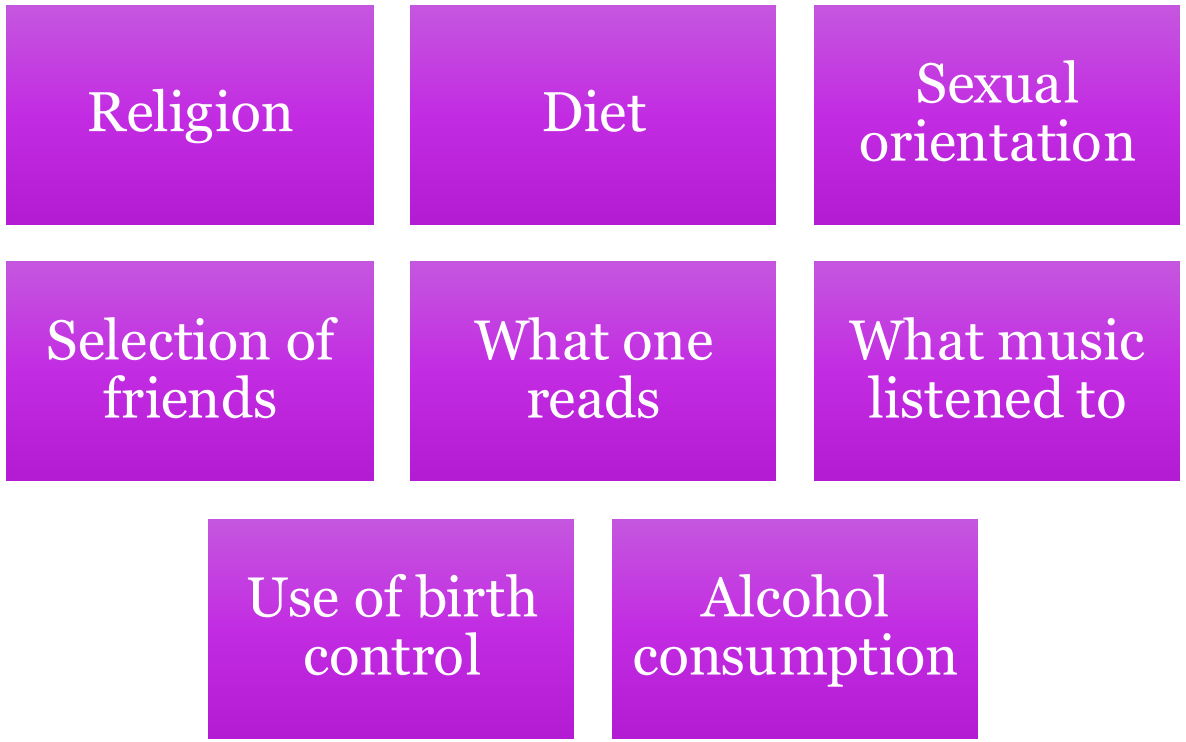
CONTEXTUAL INTEGRITY

Contextual Integrity

"A right to privacy is neither a right to secrecy nor a right to control but a right to appropriate flow of personal information."



Areas of life are protected from public regulation



- Western democracies tend to treat several areas of life as free from public regulation.
- People (theoretically) can engage in these as they wish as long as they do not directly harm others.
- Laws even protect some of these freedoms. For example, it is illegal to ask about some of these in relation to hiring.

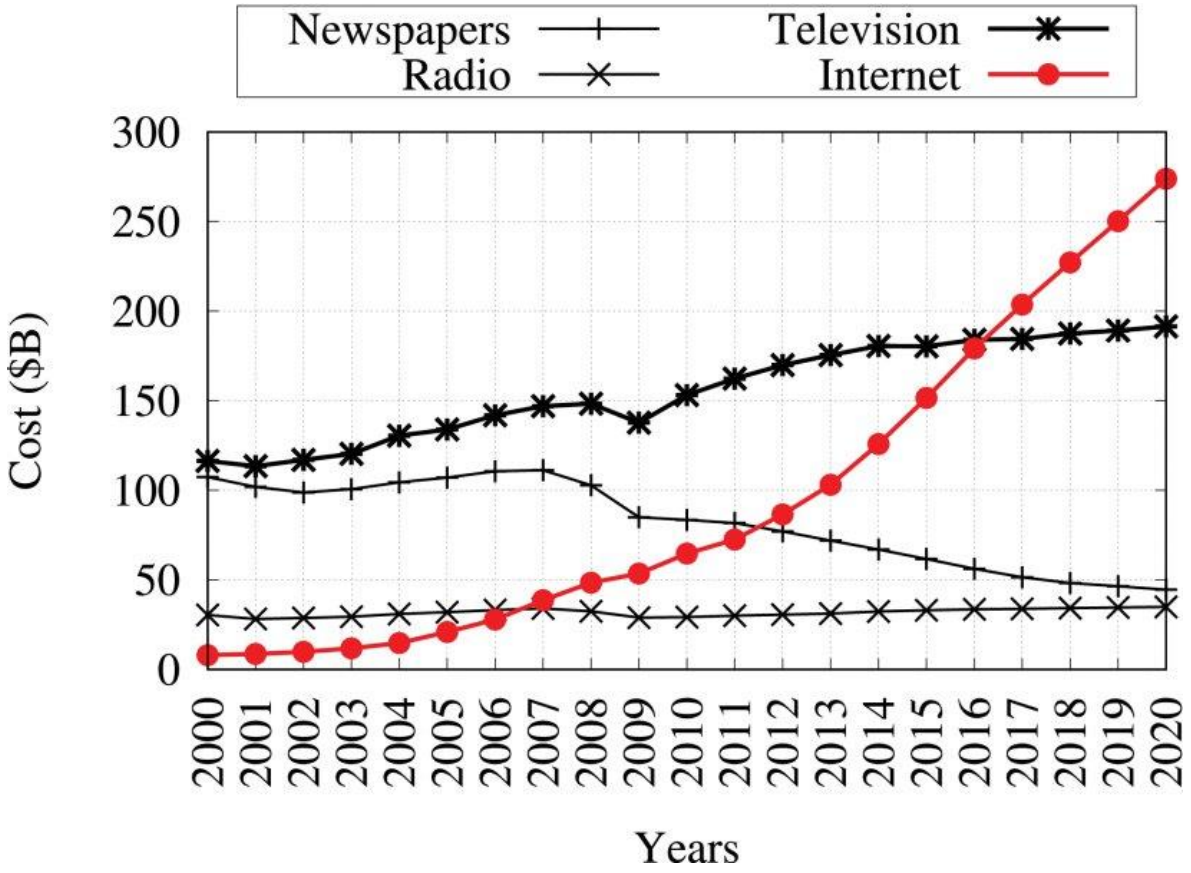
Contextual Integrity

- Contexts
  - Roles
  - Activities
  - Norms
  - Values

ONLINE ADVERTISING

Online advertising is growing

- Cost per impression
- Cost per click
  - Preferred by Microsoft and Google
- Cost per action



Global ad spending by medium.

Z. Pooranian, M. Conti, H. Haddadi and R. Tafazolli, "Online Advertising Security: Issues, Taxonomy, and Future Directions," in *IEEE Communications Surveys & Tutorials*, doi: 10.1109/COMST.2021.3118271.

Many steps

- User opens page (or app)
- Ad publisher asks ad exchange
- Ad exchange facilitates live bidding
- Winning bidder provides an ad
- User's browser download's and displays the ad

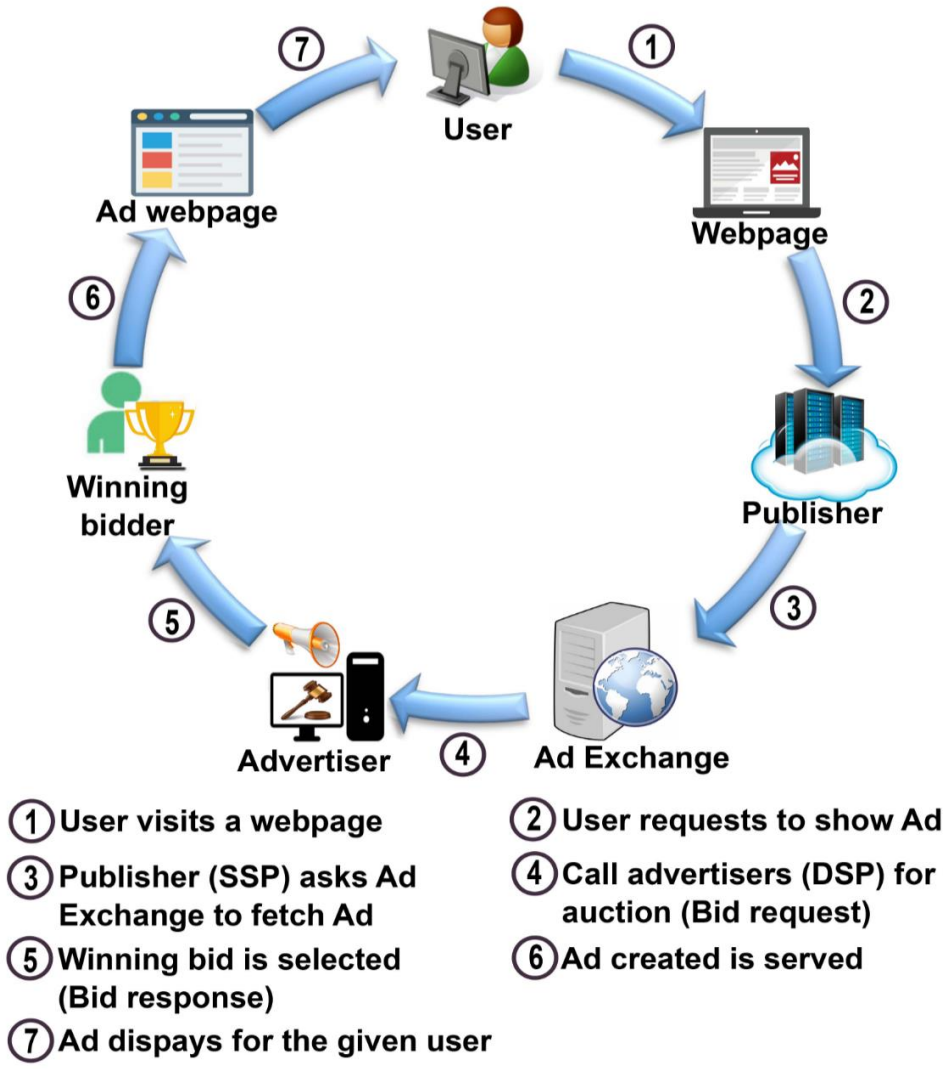
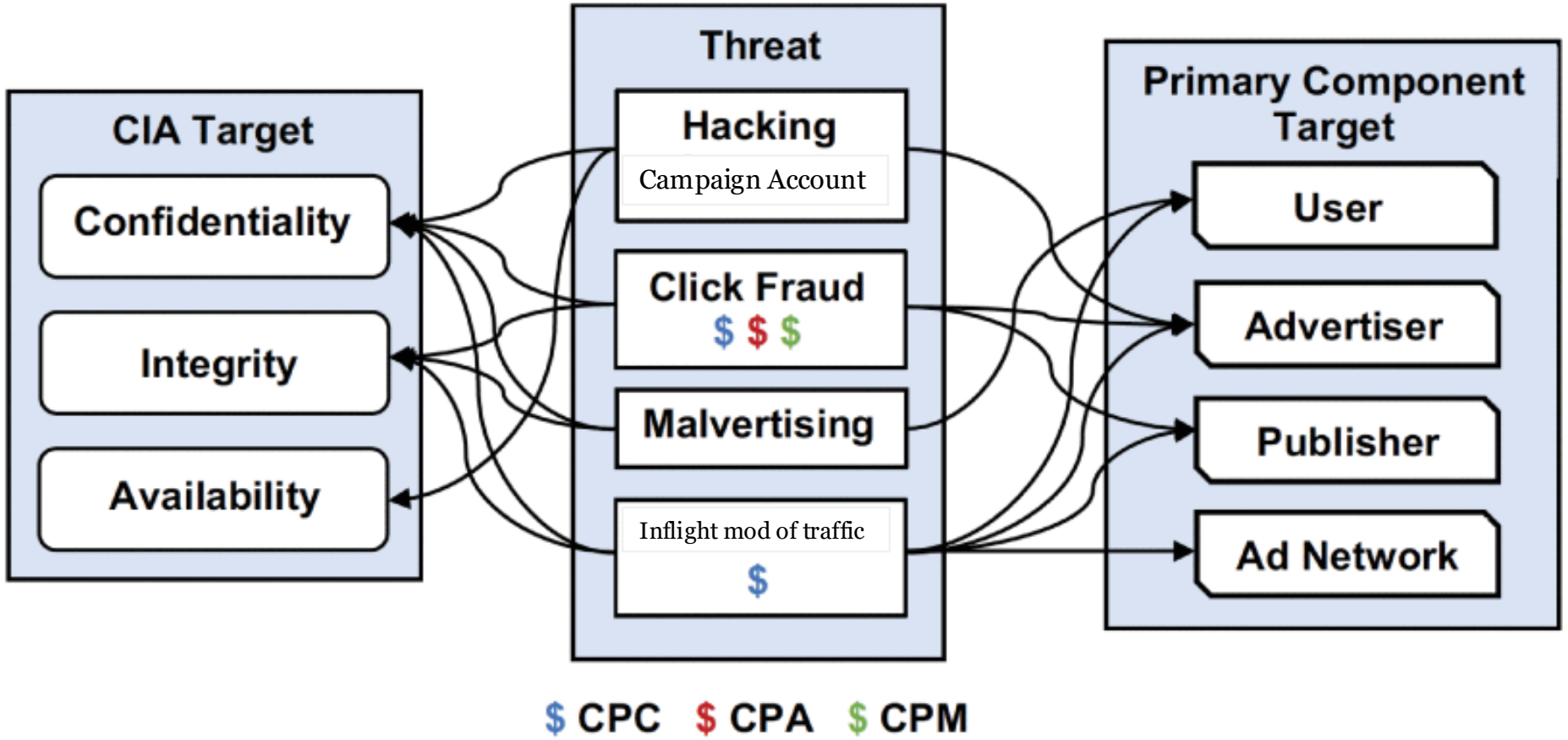


Fig. 3. The process of serving ads in an online advertising system.

Z. Pooranian, M. Conti, H. Haddadi and R. Tafazolli, "Online Advertising Security: Issues, Taxonomy, and Future Directions," in *IEEE Communications Surveys & Tutorials*, doi: 10.1109/COMST.2021.3118271.

Security from the advertisers' perspective

- Cost per impression
- Cost per click
- Cost per action



The linkage between threats, CIA target, and primary component target.

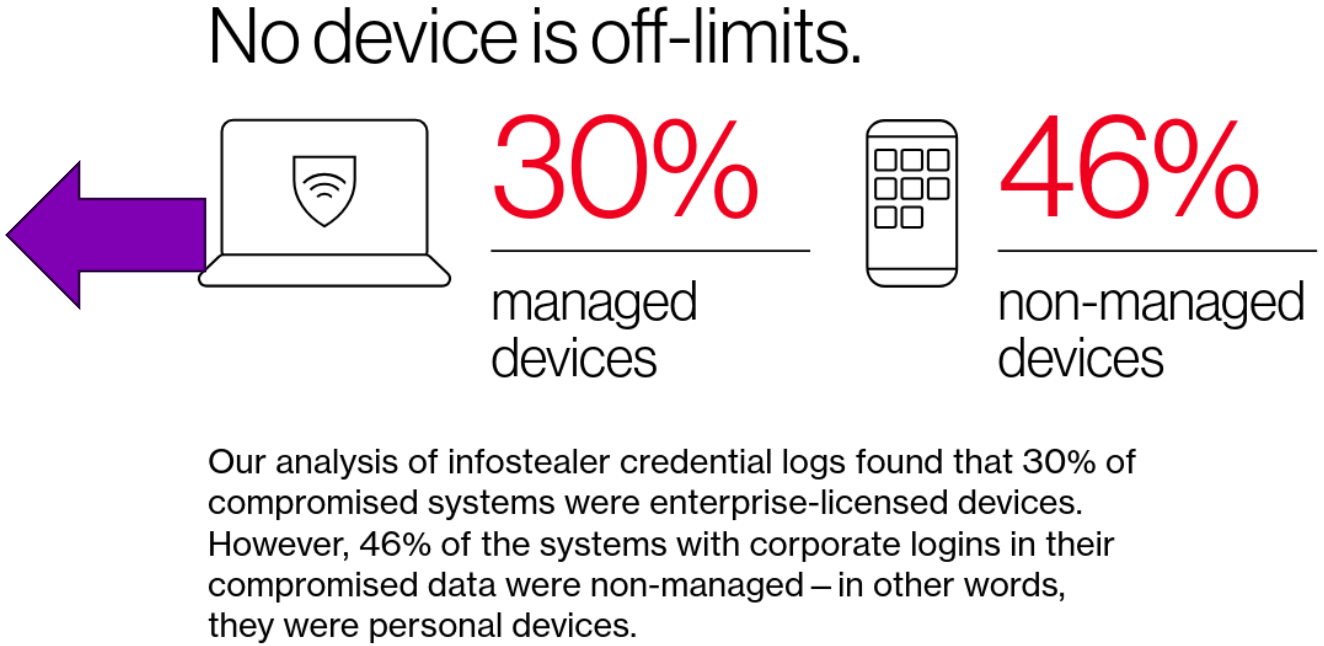
Z. Pooranian, M. Conti, H. Haddadi and R. Tafazolli, "Online Advertising Security: Issues, Taxonomy, and Future Directions," in *IEEE Communications Surveys & Tutorials*, doi: 10.1109/COMST.2021.3118271.

Security from the end-user perspective

- Malvertising
- Fake or fraud advertising
- Data collection by advertiser
- Peer-privacy – someone seeing an ad over their shoulder

Humans are an important part of a secure system

- Phishing – scam emails causing people to give away login credentials
- Giving away important data
- Giving access to important resources
- Putting company information into AI
- Logging in from unmanaged computers



Verizon Data Breach Report Infographic 2025

Giving access to important resources

he downloaded free software from popular code-sharing site GitHub while trying out some new artificial intelligence technology on his home computer. The software helped create AI images from text prompts.

It worked, but the AI assistant was actually malware that gave the hacker behind it access to his computer, and his entire digital life.
The hacker gained access to 1Password, a password-manager that Van Andel used to store passwords and other sensitive information, as well as "session cookies," digital files stored on his computer that allowed him to access online resources including Disney's Slack channel.

WSJ The Wall Street Journal + Follow 796.1K Followers

A Disney Worker Downloaded an AI Tool. It Led to a Hack That Ruined His Life.

Story by Robert McMillan, Sarah Krouse • 2mo • 5 min read

The stranger messaging Matthew Van Andel online last July knew a lot about him—including details about his lunch with co-workers at Disney from a few days earlier.

His mind raced; he knew no one outside Disney would have access to that information. How did the person messaging him on chat forum Discord know what he had said in a private workplace Slack channel?

"I have gained access to certain sensitive information related to your personal and professional life," another Discord message said. Van Andel realized he had been hacked.

The next morning, the lunchtime Slack exchange became one of more than 44 million Disney messages from the workplace collaboration tool published online by a cryptic hacking group with murky motivations. The hacker had used Van Andel's login credentials to steal from his employer.

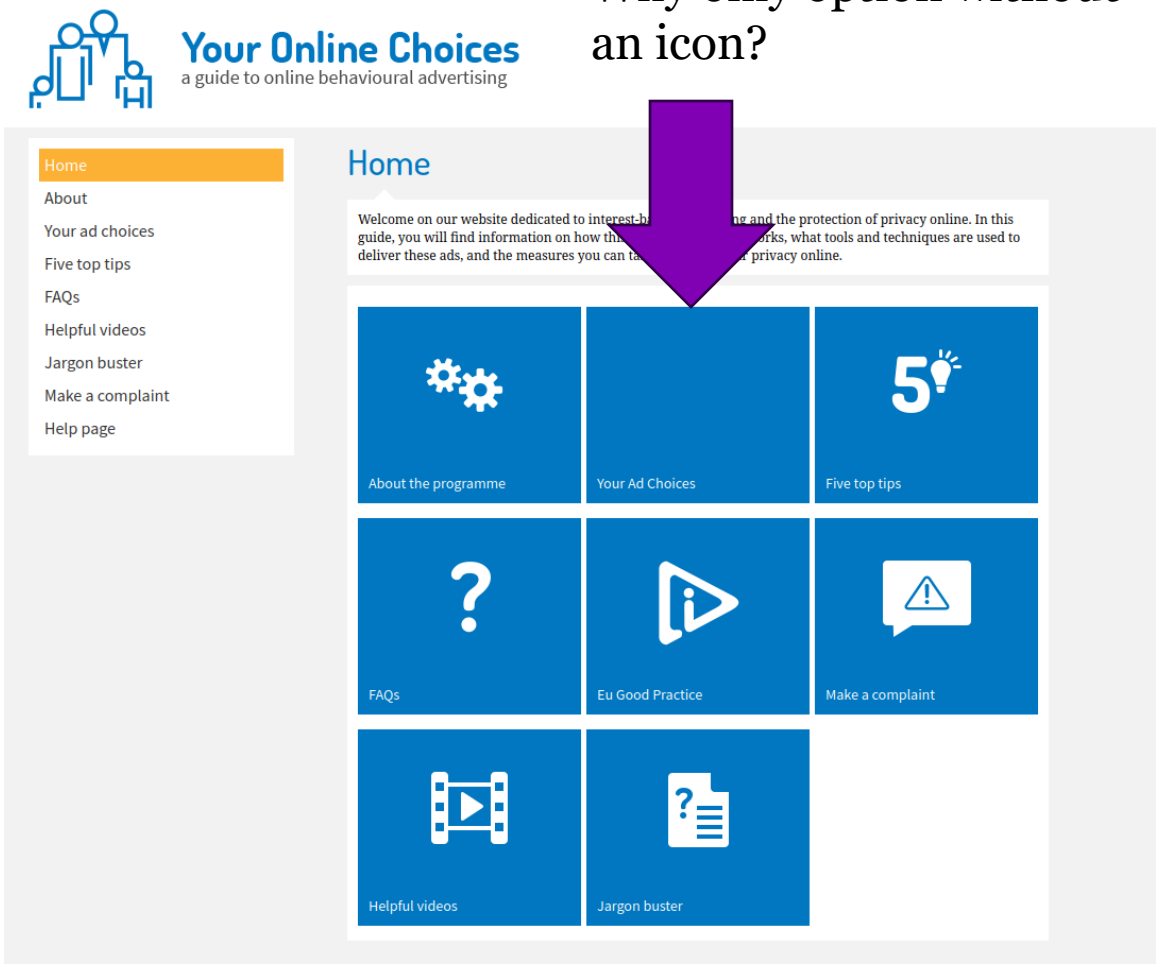
The hack sent Disney's cybersecurity team in motion to assess the damage. Private customer information, employee passport numbers, and theme park and streaming revenue numbers were in the huge data dump.

The breach upended Van Andel's life. The hacker stole his credit card numbers and racked up bills—and leaked his account login details, including those to financial accounts. The attacker published Van Andel's personal information online, ranging from his Social Security number to login credentials that could be used to access Ring cameras within his home.

Your Online Choices

- Run by advertisement alliance
- One of the most user-hostile sites I know of

Option most users want. Why only option without an icon?

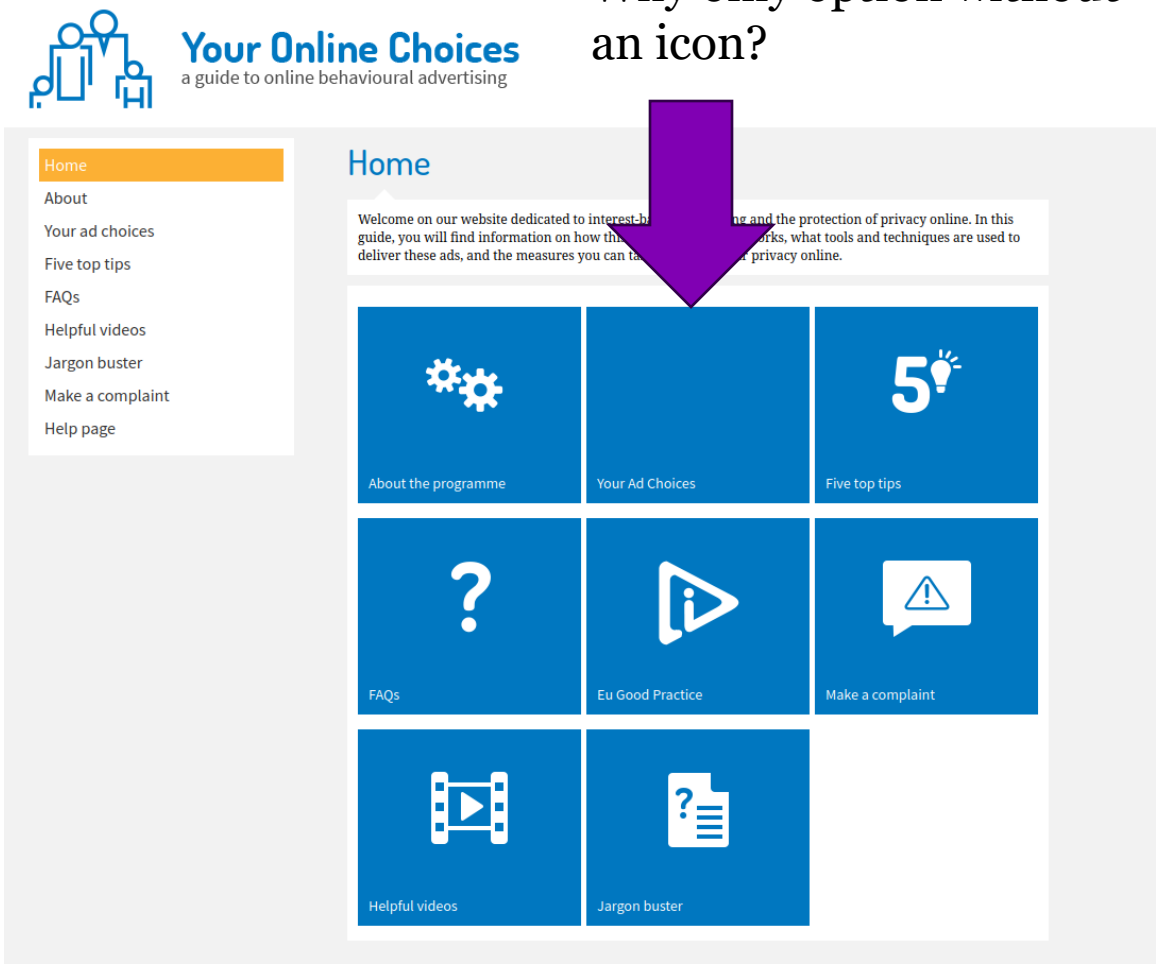


Your Online Choices

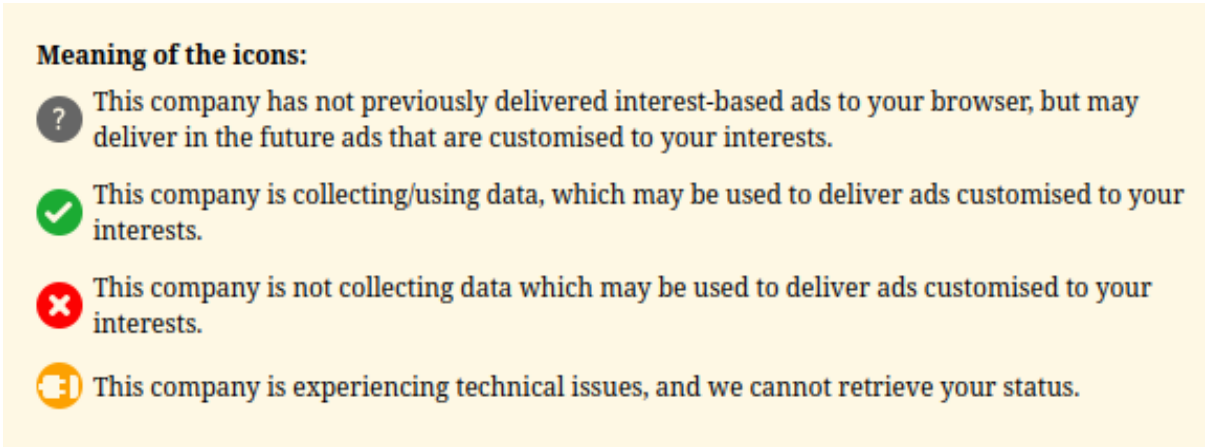
Meaning of the icons:

- This company has not previously delivered interest-based ads to your browser, but may deliver in the future ads that are customised to your interests.
- This company is collecting/using data, which may be used to deliver ads customised to your interests.
- This company is not collecting data which may be used to deliver ads customised to your interests.
- This company is experiencing technical issues, and we cannot retrieve your status.

Option most users want. Why only option without an icon?



Your Online Choices



Defining privacy

- The Cambridge Dictionary

- Someone's right to keep their personal matters and relationships secret
  - Controlling personal information
  - *The new law is designed to protect people's privacy*
- The state of being alone
  - Controlling access to self
  - *I hate sharing a bedroom – I never get any privacy*

```
<uses-permission android:name="android.permission.INTERNET" />
<uses-permission android:name="android.permission.ACCESS_COARSE_LOCATION" />
<uses-permission android:name="android.permission.ACCESS_FINE_LOCATION" />
<uses-permission android:name="android.permission.ACCESS_NETWORK_STATE" />
<uses-permission android:name="android.permission.ACCESS_WIFI_STATE" />
```

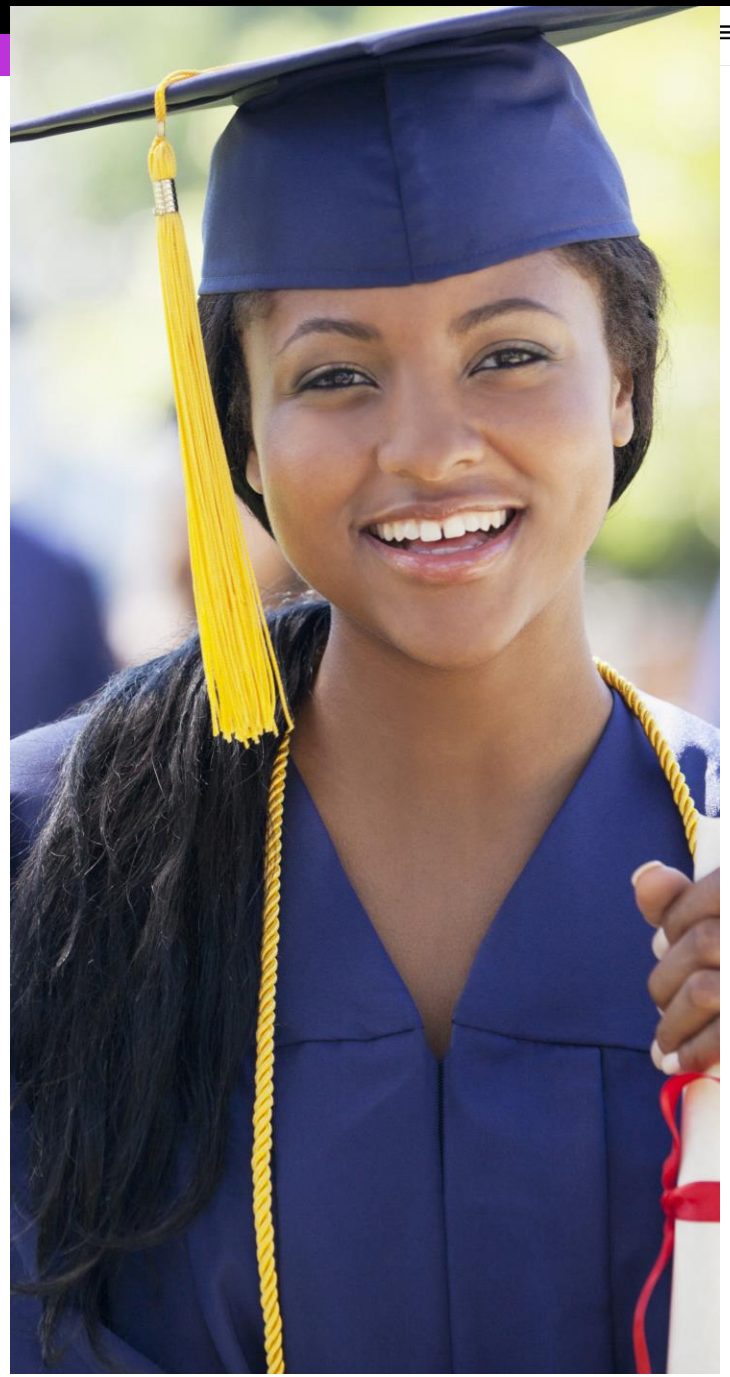
Developers and Privacy

Quick Start Guide page in Amazon Mobile Ad Network

Margaret Hamilton

Computer Scientist
MIT

Computer scientist Margaret Hamilton poses with the Apollo guidance software she and her tear developed at MIT. Credit: Courtesy MIT Museum



Obama Becomes First President to Write a Computer Program

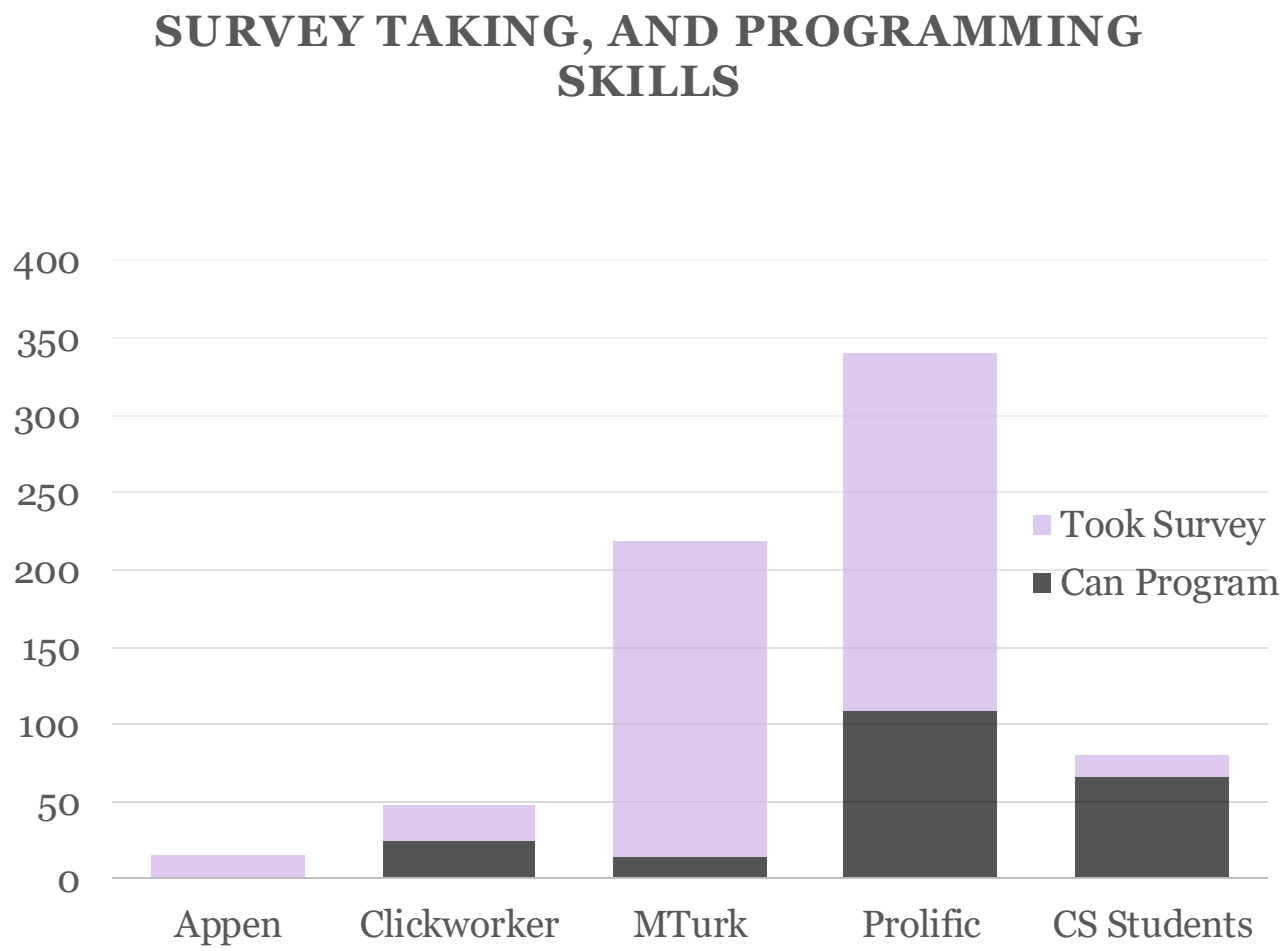
Today President Obama became the first president in history to write a computer progran

Adrianna Mitchell, a middle-school student from Newark, NJ, explains a coding learning program to President Barack Obama during an "Hour of Code" event i Eisenhower Executive Office Building on the White House complex in Washington, DC, on Monday, Dec. 8, 2014. JACQUELYN MARTIN/AP

PRESIDENT BARACK OBAMA told the world that everyone should learn how to code. And now he's putting his money where his mouth is.

Earlier today, to help kick-off the annual Computer Science Education Week, Obama became the first president ever to write a computer

Comparing Recruitment Channels For Passing Five Programming Questions



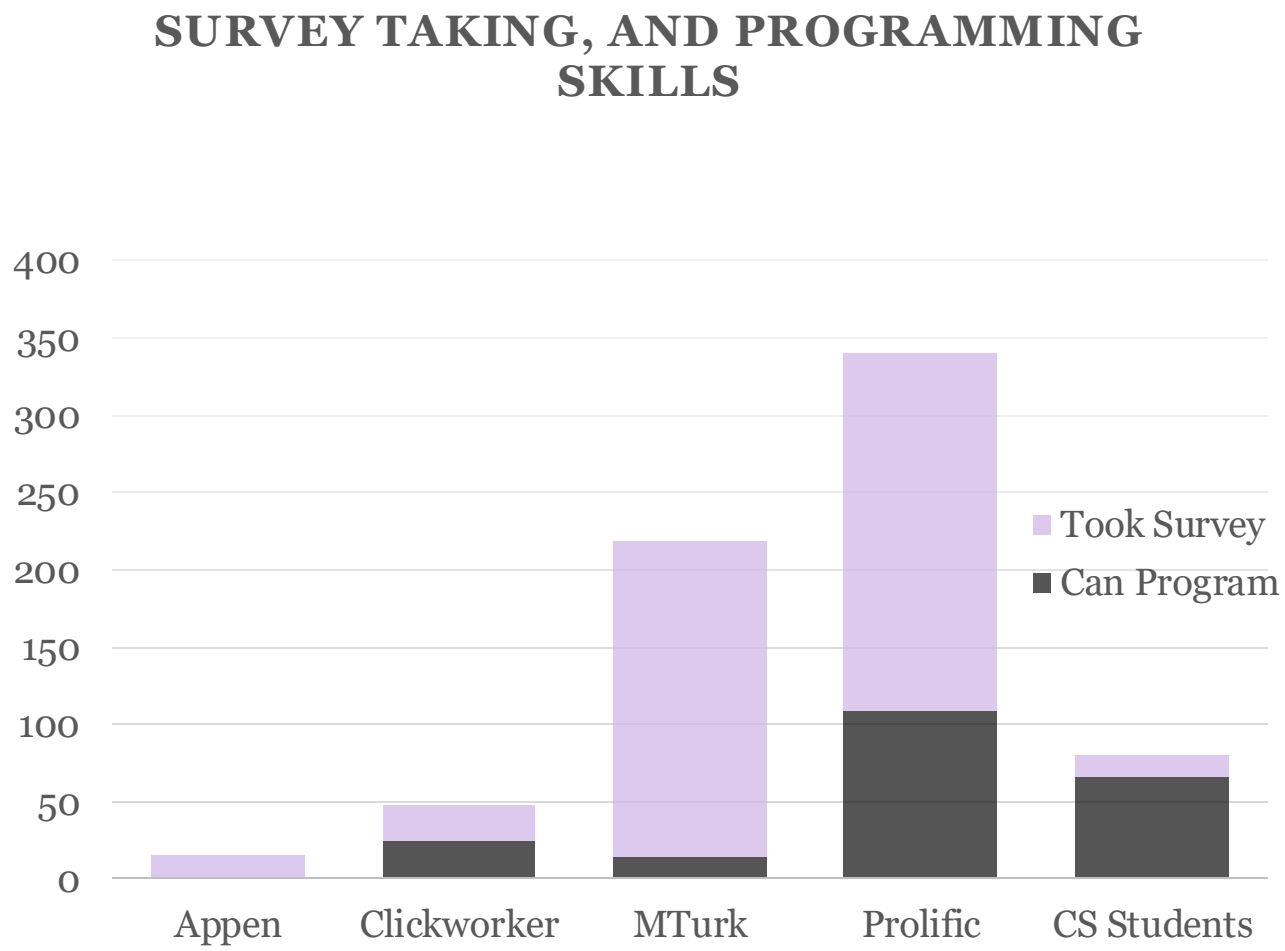
Programming skills question topics:

1. Website frequently used to aid programming
2. Compiler's function
3. Recursive function
4. Boolean value
5. Function parameter

Anastasia Danilova, Alena Naiakshina, Stefan Horstmann, and Matthew Smith. 2021. Do you Really Code? Designing and Evaluating Screening Questions for Online Surveys with Programmers. In Conference on Software Engineering (ICSE).

M. Tahaei, K. Vaniea; "Recruiting Participants With Programming Skills: A Comparison of Four Crowdsourcing Platforms and a CS Student Mailing List"; CHI 2022. Honorable

Comparing Recruitment Channels For Passing Five Programming Questions



Which of these values would be the most fitting for a Boolean?

- ❑ Small
- ❑ Solid
- ❑ Quadratic
- ❑ Red
- ❑ True

M. Tahaei, K. Vaniea; "Recruiting Participants With Programming Skills: A Comparison of Four Crowdsourcing Platforms and a CS Student Mailing List"; CHI 2022. Honorable

CHI 2020 Paper

CHI 2020, April 25–30, 2020, Honolulu, HI, USA

Understanding Privacy-Related Questions on Stack Overflow

Mohammad Tahaei, Kami Vaniea, Naomi Saphra
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sciendo

Proceedings on Privacy Enhancing Technologies ; 2022 (2):1–18

Mohammad Tahaei*, Tianshi Li, and Kami Vaniea

Understanding Privacy-Related Advice on Stack Overflow

What do developers ask about regarding privacy?

How are developers defining “privacy”?

Research questions

What topics do Stack Overflow users associate with the word “privacy”?

What or who is pushing Stack Overflow users to engage with privacy-related topics?

How to disable Google asking permission to regularly check installed apps on my phone?

Asked 5 years

83

13

I'm de
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Can I trust react-devtools not to breach my privacy?

Asked 11 months ago Active 11 months ago Viewed 141 times

1

I am starting to develop webapps in React, and I have found out that the Chrome extension react-devtools is almost a defacto requirement for coding react applications.

The tool (and react) is made by Facebook, a company infamously known for their complete lack of moral when it comes to data gathering and creepy surveilance of us all. And it requires the ability to access everything you are browsing (which is probably needed to work it's magic), in order to be installed.

react-devtools have almost 1,5 million users (and they are probably all developers). Am I supposed to believe that Facebook will not exploit this obvious opportunity to follow every single thing we developers do in Chrome?

Does anybody in here know anything about react-devtools, and have anybody tried to analyse what data react-devtools sends in what directions? Because frankly I don't have this amount of trust for Facebook anymore, but is seems like react-devtools is inevitable, if I want to make React apps? :-(

reactjs facebook security privacy

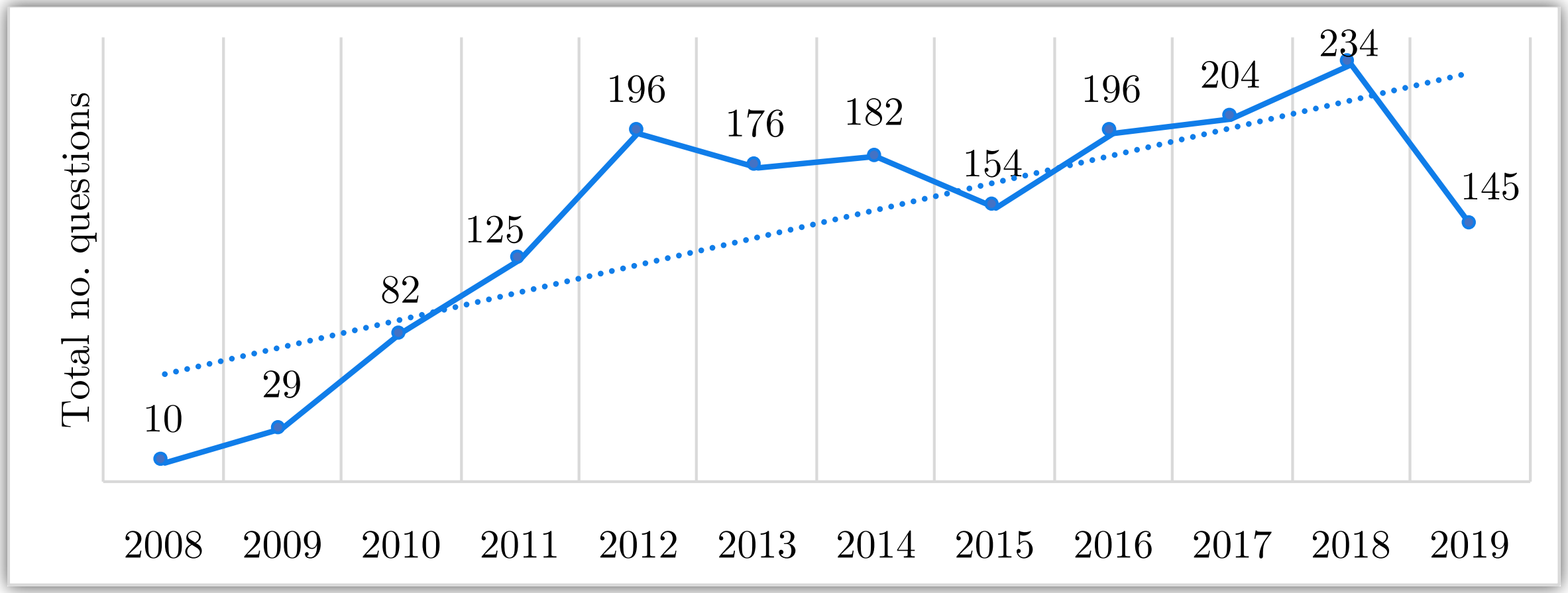
share edit flag

asked Feb 6 '19 at 8:58

hasse

804 ● 1 ● 7 ● 20

Questions mentioning privacy

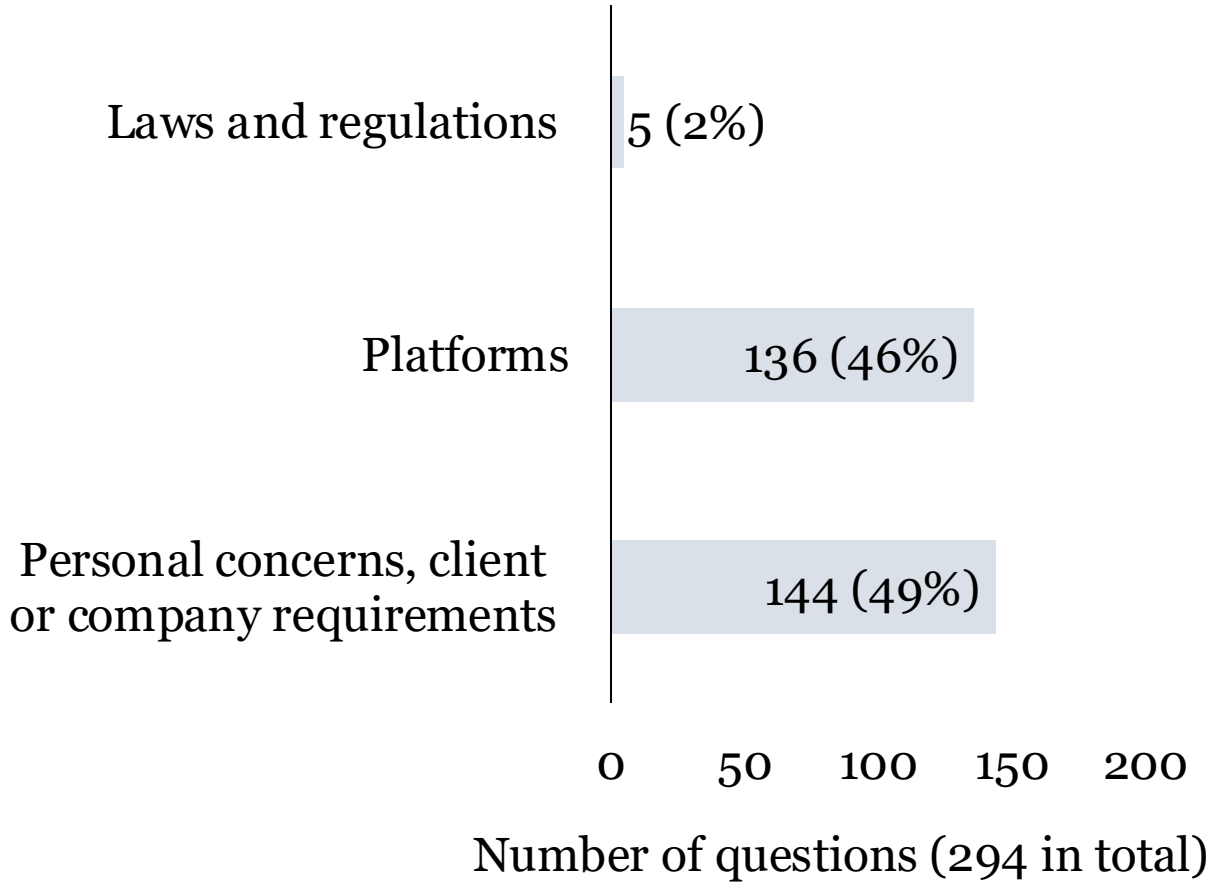


Count of questions mentioning privacy per year (SO-privacy)

Qualitative coding

- 315 randomly selected questions
  - 21 questions excluded for being vague or not about privacy
- 2 coders
- Looked at three aspects:
  - Question type
  - Driver
  - Privacy aspect

Drivers



Platforms

"I am submitting my app on App Store Connect\My App page and when I submit for review, it shows ***error*** *on App Information: "****You must provide a Privacy Policy URL****." even I have pasted the link to the website show the privacy policy there. I have checked the link using https://developers.facebook.com/tools/debug/sharing/ and they show no error. Do you know what could be the reason and how to fix it ?"* [53097654 - 2018].

Open coding & thematic of 294 SO questions

Topic	Questions	Views
Access control	40%	103,654
Developers with privacy concerns	24%	57,136
Privacy policies	13%	127,225
Developers as end-users	7%	89,279
Developers ignoring Privacy by Design principles	6%	9,681
Versions and updates	4%	22,269
Encryption	3%	11,100
Privacy and code issues	2%	2,523

Developers

Developers need help doing security and privacy right.

Unfortunately existing tools and guides are filled with dark patterns.

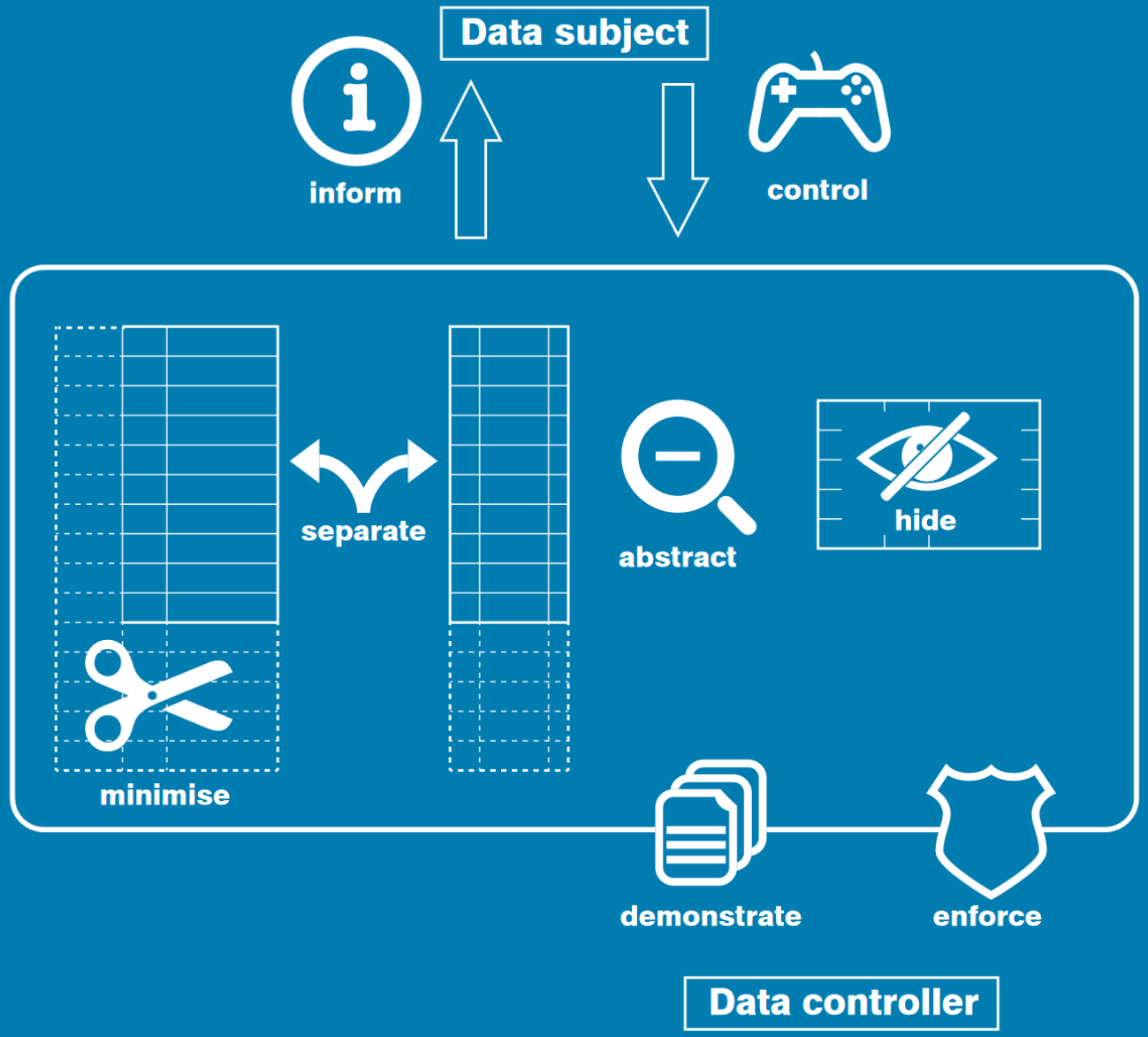
```
public void loadForm(){
    UserMessagingPlatform.loadConsentForm(
        this,
        new UserMessagingPlatform.OnConsentFormLoadSuccessListener() {
            @Override
            public void onConsentFormLoadSuccess(ConsentForm consentForm) {
                MainActivity.this.consentForm = consentForm;
                if(consentInformation.getConsentStatus() == ConsentInformation.ConsentStatus.REQUIRED) {
                    consentForm.show(
                        MainActivity.this,
                            new ConsentForm.OnConsentFormDismissedListener() {
                                @Override
                                public void onConsentFormDismissed(@Nullable FormError formError) {
                                    // Handle dismissal by reloading form.
                                    loadForm();
                                }
                            });

                }

            }
        },
        new UserMessagingPlatform.OnConsentFormLoadFailureListener() {
            @Override
            public void onConsentFormLoadFailure(FormError formError) {
                /// Handle Error.
            }
        }
    );
}
```

Infinite loop till user consents.

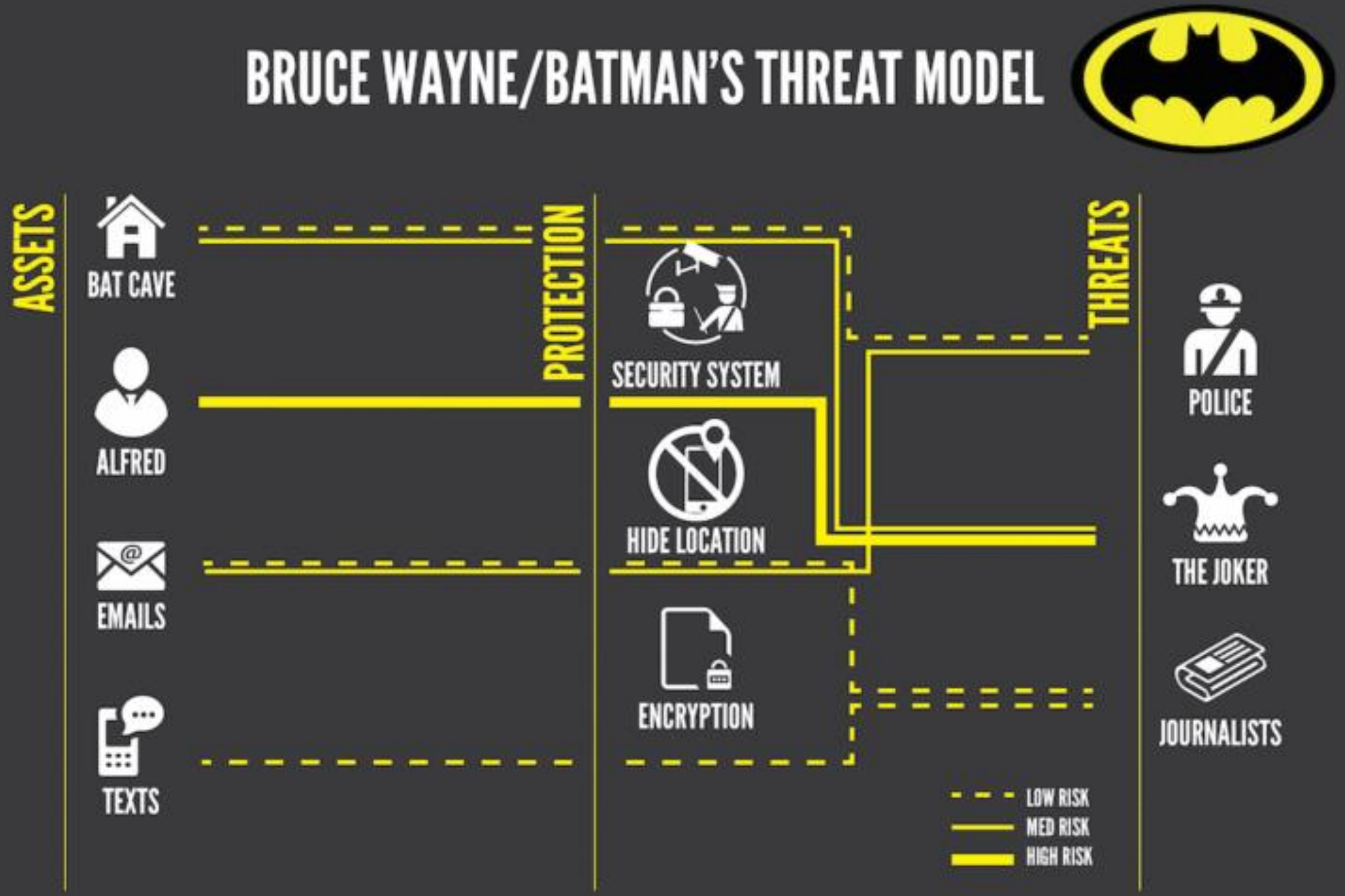
Google Ad Mob getting started guide



Privacy design strategy	Occurrences
Inform	48 (43.2%)
Hide	45 (40.5%)
Control	35 (31.5%)
Minimize	33 (29.7%)
Abstract	5 (4.5%)
Separate	3 (2.7%)
Enforce	2 (1.8%)
Demonstrate	2 (1.8%)

Jaap-Henk Hoepman. Privacy Design Strategies (The Little Blue Book). Radboud University, 2019

THREAT MODELS



https://arstechnica.com/information-technology/2017/07/how-i-learned-to-stop-worrying-mostly-and-love-my-threat-model/