21 - Privacy and security for mobile and ubicomp devices

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March 31, 2015

05-436 / 05-836 / 08-534 / 08-734
Usable Privacy and Security

Carnegie Mellon University
CyLab

institute for SOFTWARE RESEARCH

Engineering & Public Policy

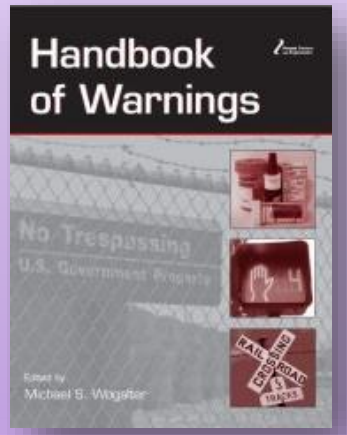
Today!

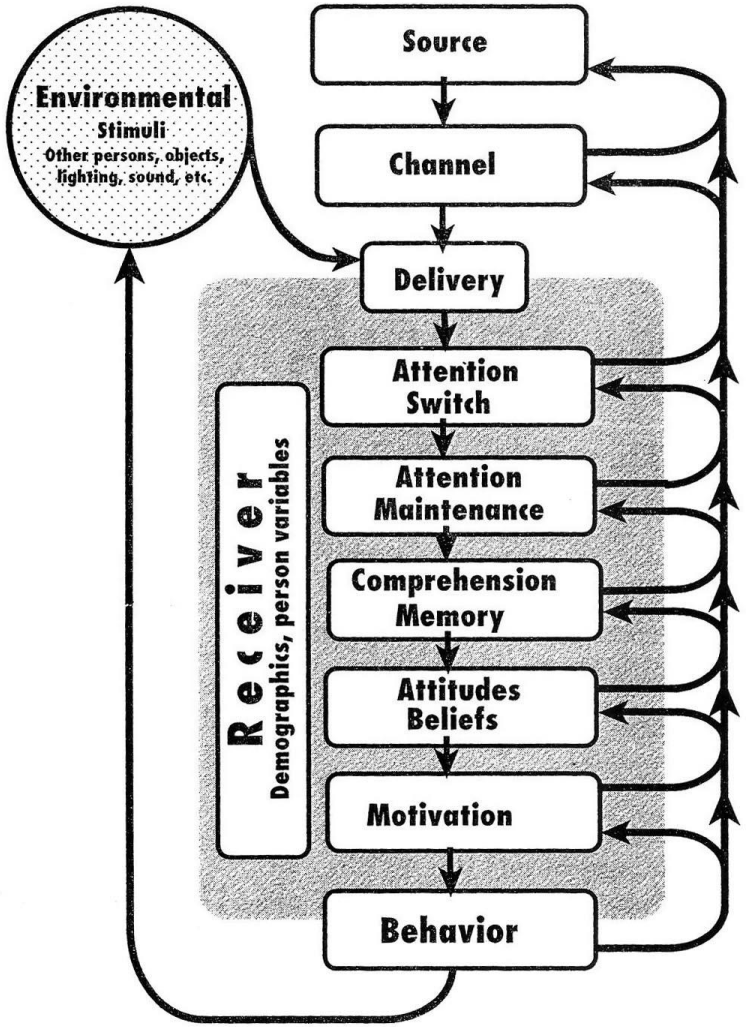
- C-HIP/HITL
- Smartphone app notice and choice
- Privacy notice design space
- Activity: Notices for Google Glass

C-HIP Model

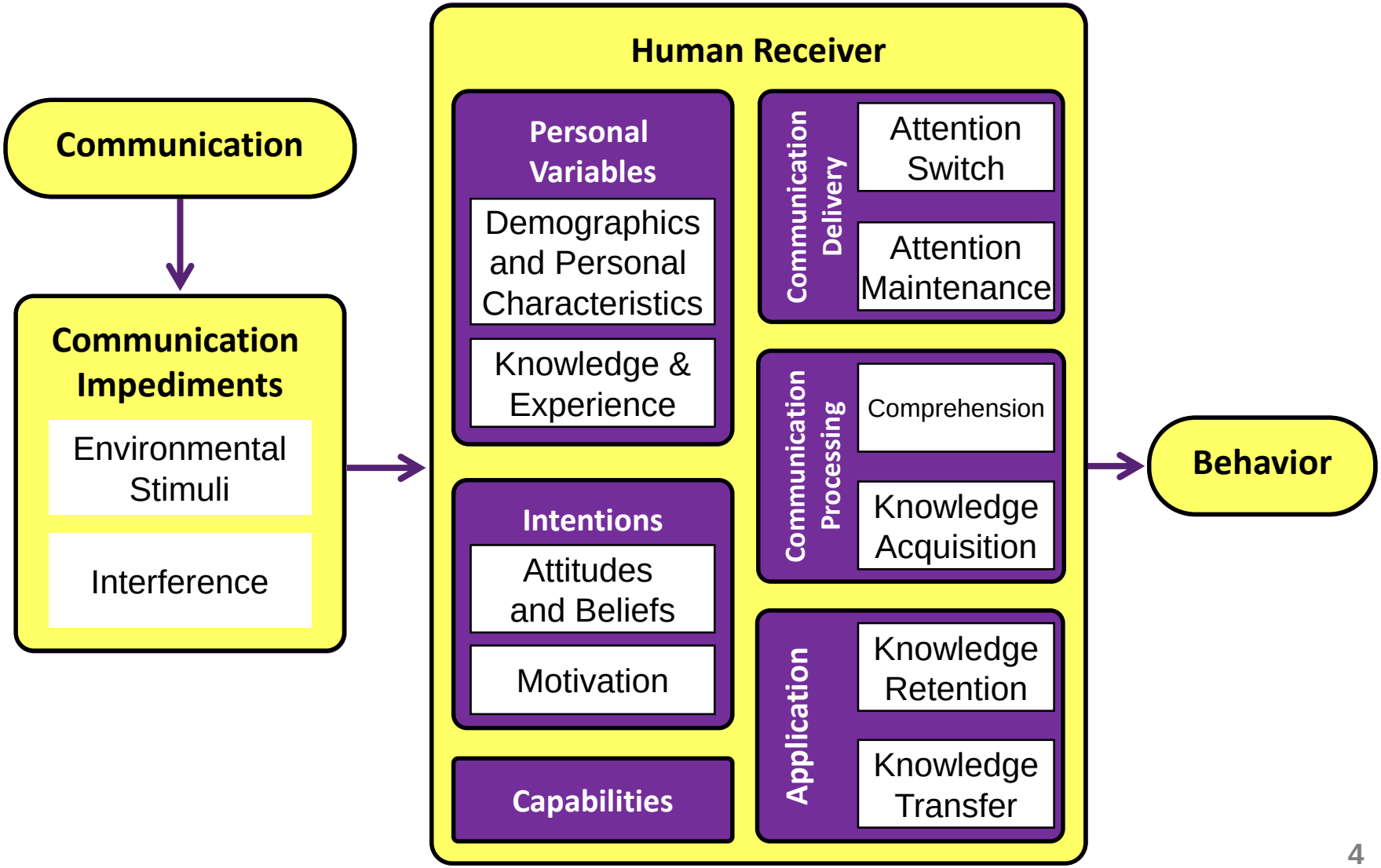
Communication-Human Information Processing Model

Wogalter, M. 2006. Communication-Human Information Processing (C-HIP) Model. In Wogalter, M., ed., *Handbook of Warnings.* Lawrence Erlbaum Associates, 51-61.

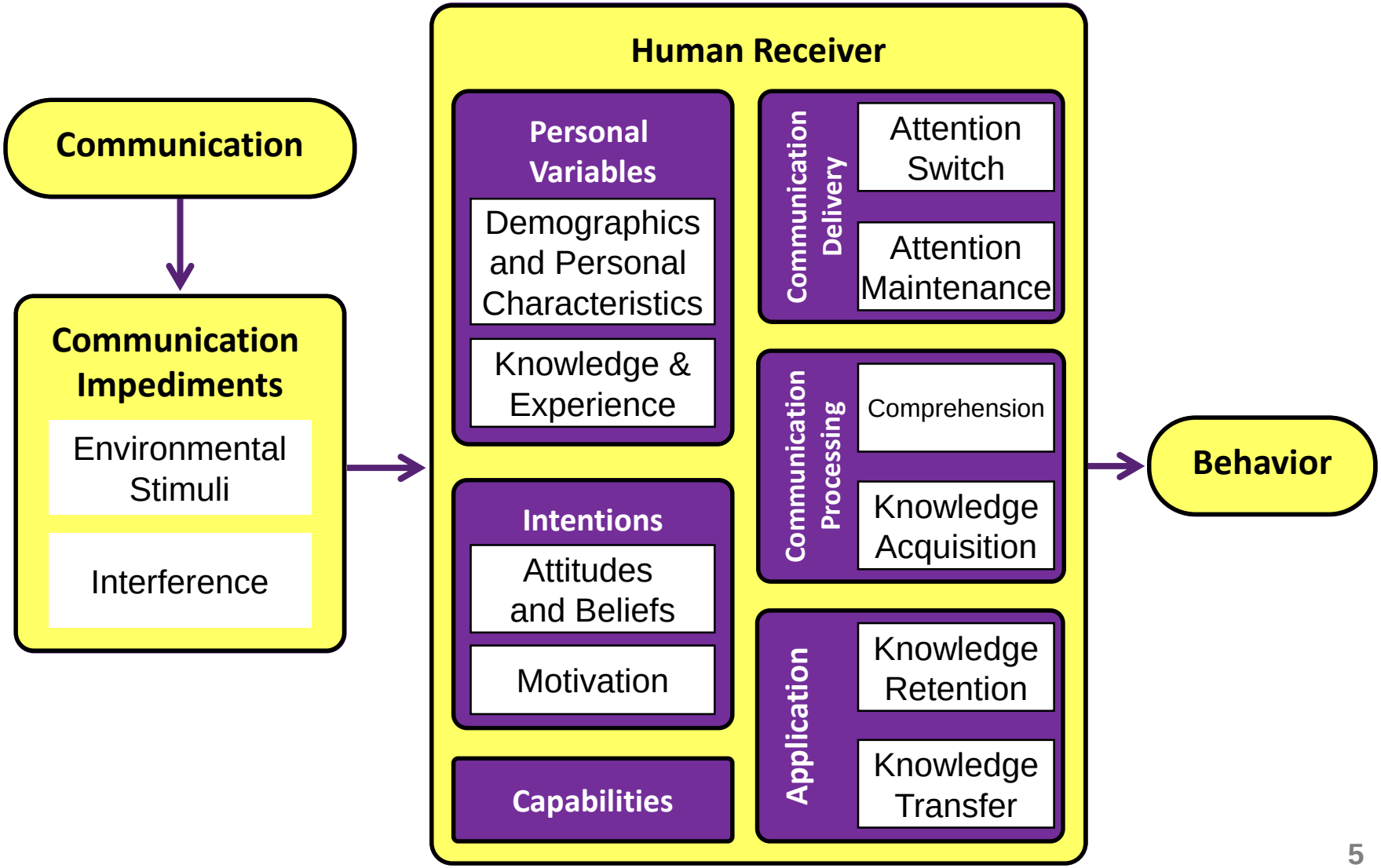




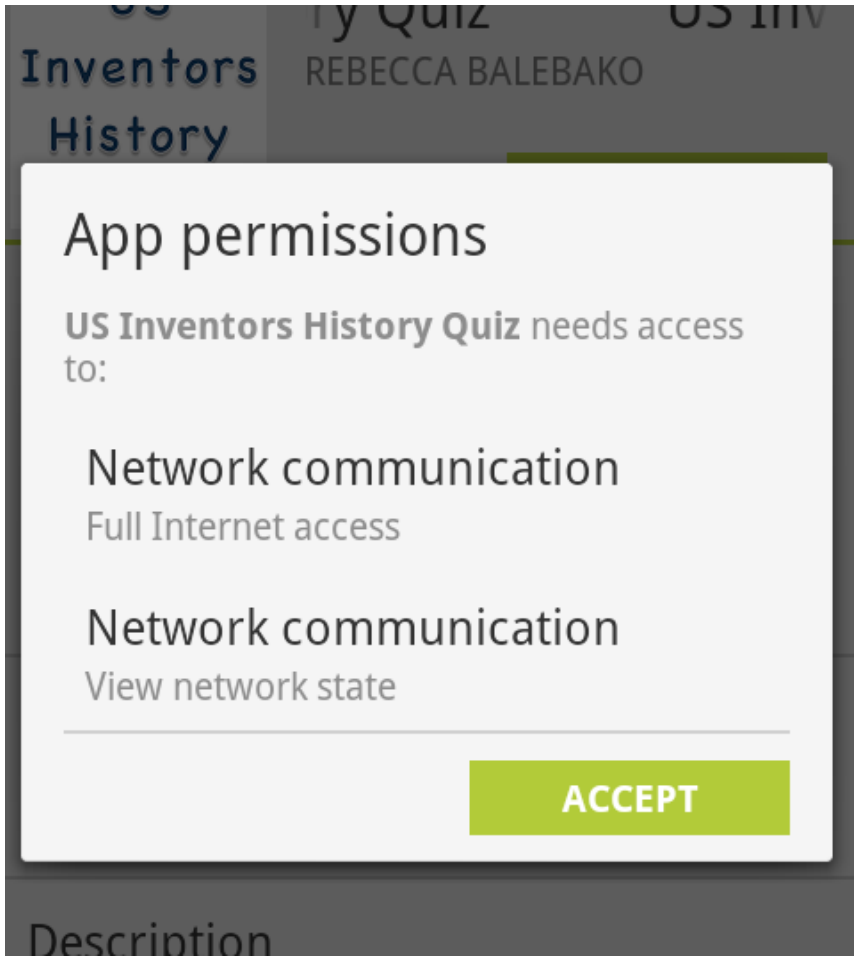
Human-in-the-loop framework



Apply HITL to Android Permissions



Current notices are not sufficient



- Users don’t understand what permissions mean
- Users don’t understand why permissions are being requested
- Users often click through without reading

Expert interviews

- We interviewed 20 experts from industry, academia, and government
- Asked them to describe smartphone security and privacy risks and mitigations
- Many harms could be addressed by better security practices
- Better privacy notices can address only a subset of these harms

Balebako, R., C. Bravo-Lillo, Cranor, L. Is Notice Enough? Mitigating the Risks of Smartphone Data Sharing. I/S: A Journal of Law and Policy for the Information Society. Forthcoming

App developers can protect users

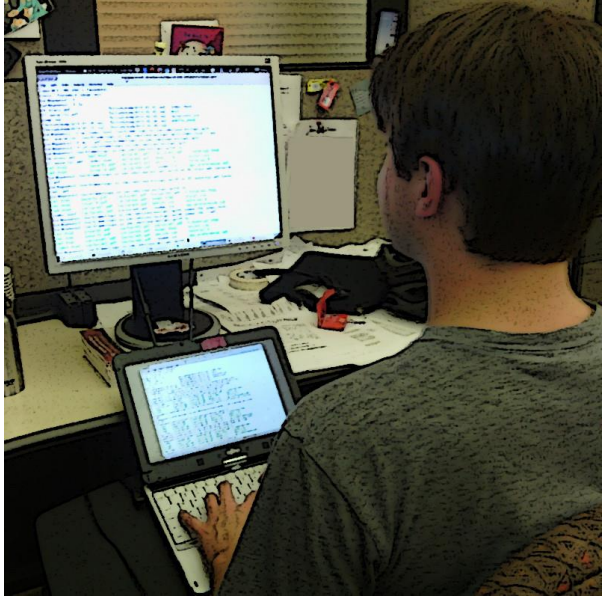
- Best security practices
- Data minimization
- Understand privacy and security of third-party tools they use
- Transparency (privacy policies)

App developer study

- Interviewed 13 and surveyed 228 app developers
- Privacy and security not a high priority
- Small companies tend not to do much to protect security and privacy, rely on web searches and social networks for advice
- Developers use third-party tools without knowing privacy policies
- Many developers unfamiliar with privacy policy or don't have privacy policy

Balebako, R., Marsh, A., Lin, J., Hong, J., Cranor, L. The Privacy and Security

App developer views on privacy policies



- “I haven’t even read [our privacy policy]. I mean, it’s just legal stuff that’s required, so I just put in there.”
- “I don’t see the time it would take to implement that over cutting and pasting someone else’s privacy policies.... I don’t see the value being such that that’s worth it.”

Multistakeholder Processes to Develop Enforceable Codes of Conduct

NTIA Code of conduct

- Developed through 1-year process
- Goal: Short-form privacy notice for apps
  - Inform app users about data collection
  - Improve transparency
  - Standardized notice
- Notice includes
  - 7 data types
  - 8 third-Party Entities

Data Types

- **Biometrics** (information about your body, including fingerprints, facial recognition, signatures and/or voice print.)
- **Browser History and Phone or Text Log** (A list of websites visited, or the calls or texts made or received.)
- **Contacts** (including list of contacts, social networking connections or their phone numbers, postal, email and text addresses.)
- **Financial Information** (Includes credit, bank and consumer-specific financial information such as transaction data.)
- **Health, Medical or Therapy Information** (including health claims and information used to measure health or wellness.)
- **Location** (precise past or current location and history of where a user has gone.)
- **User Files** (files stored on the device that contain your content, such as calendar, photos, text, or video.)

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Third-Party Entities

- **Ad Networks** (Companies that display ads to you through apps.)
- **Carriers** (Companies that provide mobile connections.)
- **Consumer Data Resellers** (Companies that sell consumer information to other companies for multiple purposes including offering products and services that may interest you.)
- **Data Analytics Providers** (Companies that collect and analyze your data.)
- **Government Entities** (Any sharing with the government except where required or expressly permitted by law.)
- **Operating Systems and Platforms** (Software companies that power your device, app stores, and companies that provide common tools and information for apps about app consumers.)
- **Other Apps** (Other apps of companies that the consumer may not have a relationship with)
- **Social Networks** (Companies that connect individuals around common interests and facilitate sharing.)

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BELL
4:21 PM
100%
AWESOME APP
PRIVACY DASHBOARD
seal of trust
DATA COLLECTED
BROWSER HISTORY
YES
PHONE & TEXT LOGS
YES
BIOMETRICS
YES
FINANCIAL
NO
CONTACTS
NO
USER FILES
NO
FULL PRIVACY POLICY

Usability test subgroup

- Never reached a consensus on what or how to test
- No usability testing ever occurred

Carnegie Mellon study

- Quick study to inform NTIA MSHP
- 791 participants recruited online (cost $913.35)
- 4 experts from NTIA MSHP
- 10 app scenarios
- Users read each scenario and tried to determine which data types and entities were described
- 2 conditions – with and without parentheticals

Rebecca Balebako, Rich Shay, and Lorrie Faith Cranor. Is Your Inseam a Biometric? A Case Study on the Role of Usability Studies in Developing Public Policy. USEC 2014.

Scenario example

The SuperTax app lets you fill out and submit your tax forms quickly and easily.

SuperTax will take a picture of your W-2. It will answer questions about your financial information, including salary and interest income.

It will then submit your return to state and federal agencies.

The scenarios describe the data collection and sharing completely, so **you do not need to guess anything outside of what is described.**

16. For each data collected by the app, what type of data is it?

	Biometrics	Browser History and Phone or Text Log	Contacts	Financial Information	Health, Medical or Therapy Information	Location	User Files	None of the Above	Not Sure
Photo of W-2	○	○	○	○	○	○	○	○	○
Salary	○	○	○	○	○	○	○	○	○
Interest Income	○	○	○	○	○	○	○	○	○

Parenthetical condition

The different types of entities with which data can be shared are defined as follows:

- Ad Networks (Companies that display ads to you through apps.)
- Carriers (Companies that provide mobile connections.)
- Consumer Data Resellers (Companies that buy and/or sell consumer information to other companies for multiple purposes including offering products and services that may interest you.)
- Data Analytics Providers (Companies that collect and analyze your data.)
- Government Entities (Any sharing with the government except where required or expressly permitted by law.)
- Operating Systems and Platforms (Software companies that power your device, app stores, and companies that provide common tools and information for apps about app consumers.)
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27. Apps can share data with different categories of entities. For each of the entities with which this app shares data, what category would best describe the entity?

	Ad Networks	Carriers	Consumer Data Resellers	Data Analytics Providers	Government Entities	Operating Systems and Platforms	Other Apps	Social Networks	None of the Above	Not Sure
State Agency	○	○	○	○	○	○	○	○	○	○
Federal Agency	○	○	○	○	○	○	○	○	○	○

Results

- All 4 experts agreed less than half the time
  - So unclear which answers are correct
- High agreement (>60% agreement) among online participants occurred less than half the time
- Parentheticals helped some, but some definitions were confusing
- Little evidence that these categories and definitions are well understood by users or experts

Impact of timing on recall of privacy notices

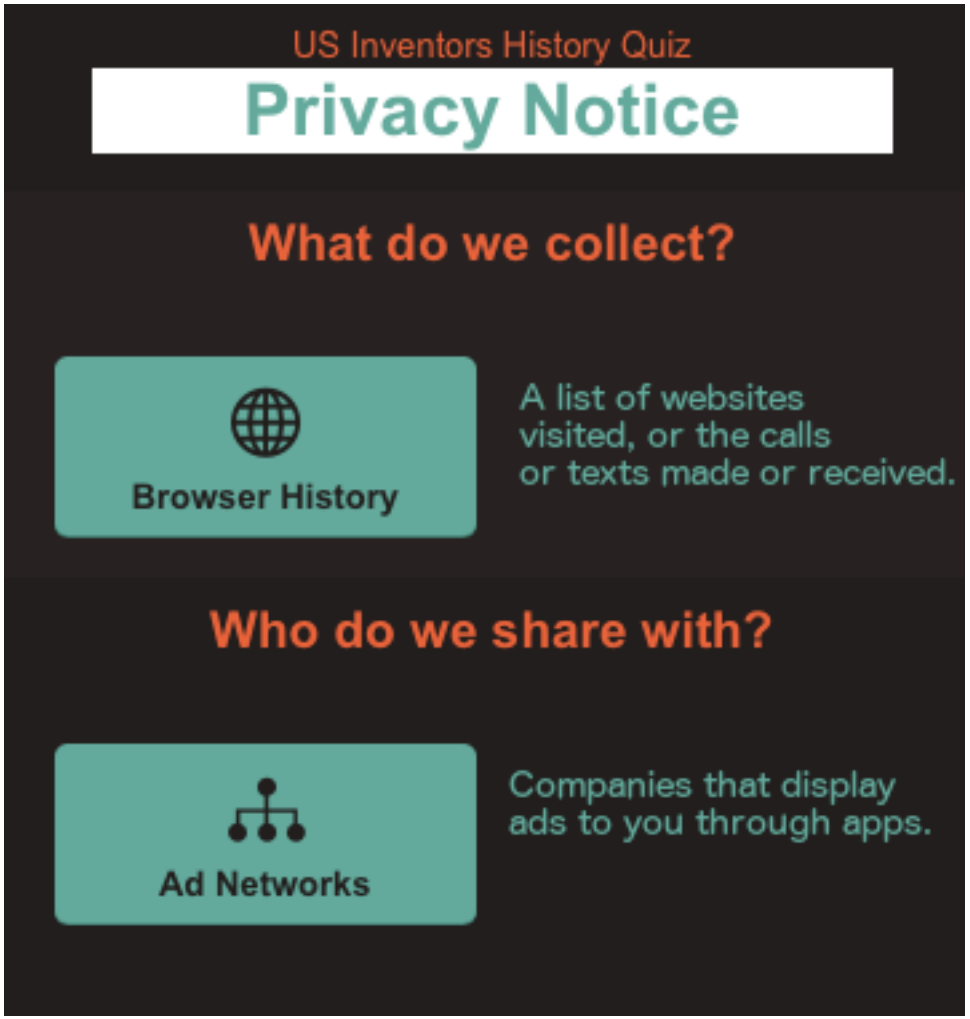
- Where can we put app privacy notices so they will be most effective?
  - In the app store?
  - After users download app?
  - After users start using app?

Conducted web survey and field experiment

- 277 survey participants played virtual app online and asked to recall privacy notice a minutes later
- 126 field experiment participants downloaded and played app, and asked to recall privacy notice the next day

Simple app quiz on American inventors

Notice based on NTIA prototype



Conditions varied only when notice was shown

- Not Shown
- App Store
- Before use
- During use
- After use

Participants remembered notices shown during app use

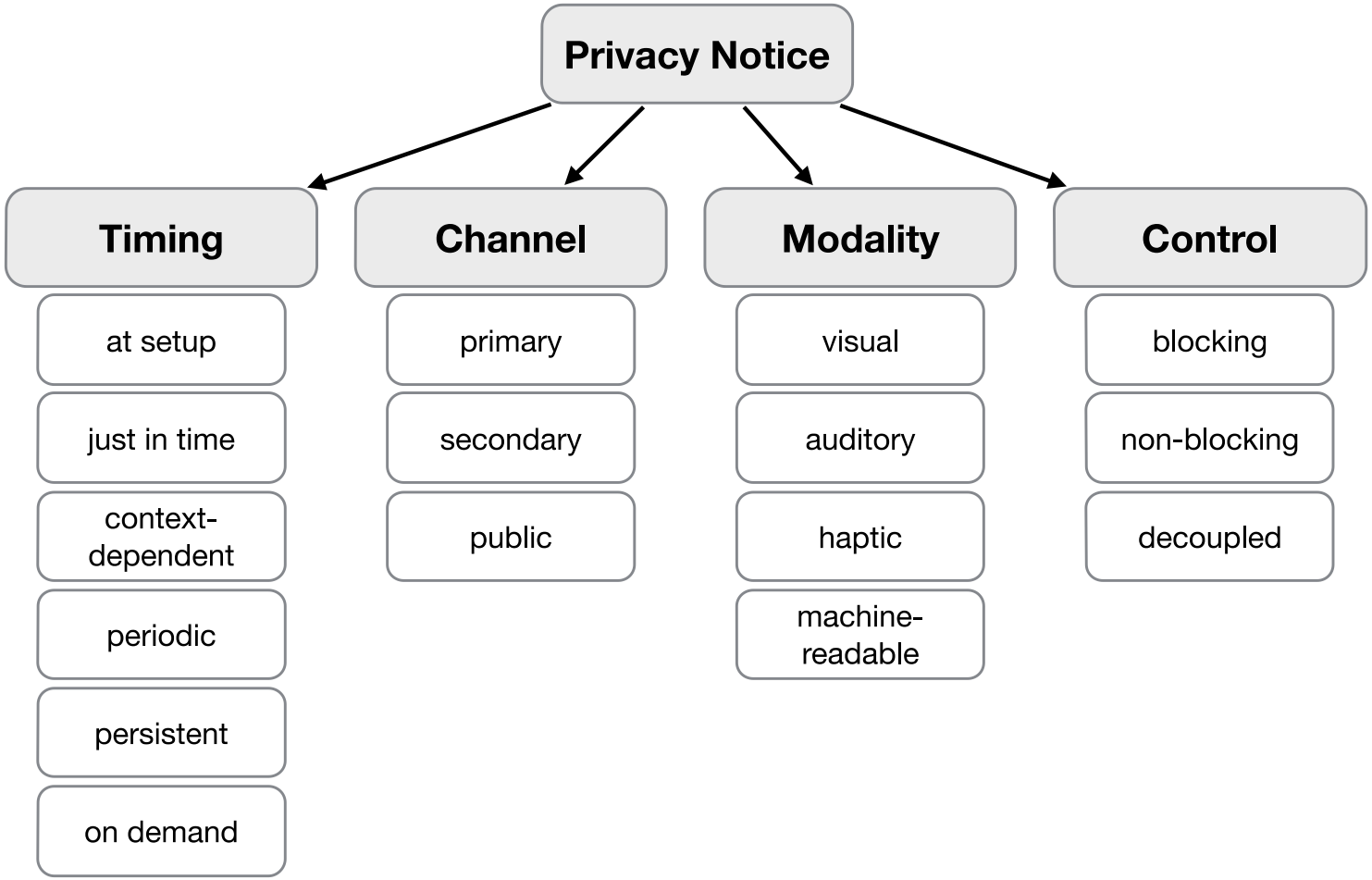
- Notice shown in app use had better recall than shown in app store
- Notice shown in app store was not significantly different than no notice

Condition	Web Survey	Field
Not shown	3%	9%
App store	17%	14%
Before use	37%*	33%*
During use	43%*	20%*
After use	28%*	37%*

Recommendations

- Better app privacy notices, informed by user studies
  - Meaningful terms and definitions
  - Placement where they will be noticed and read
- Security and privacy tools for app developers
- Better support for security and privacy from app platform providers

Privacy notice design space



Activity: Design a notice for people in the vicinity of Google Glass wearers