

Contextual Permission Models for Better Privacy Protection

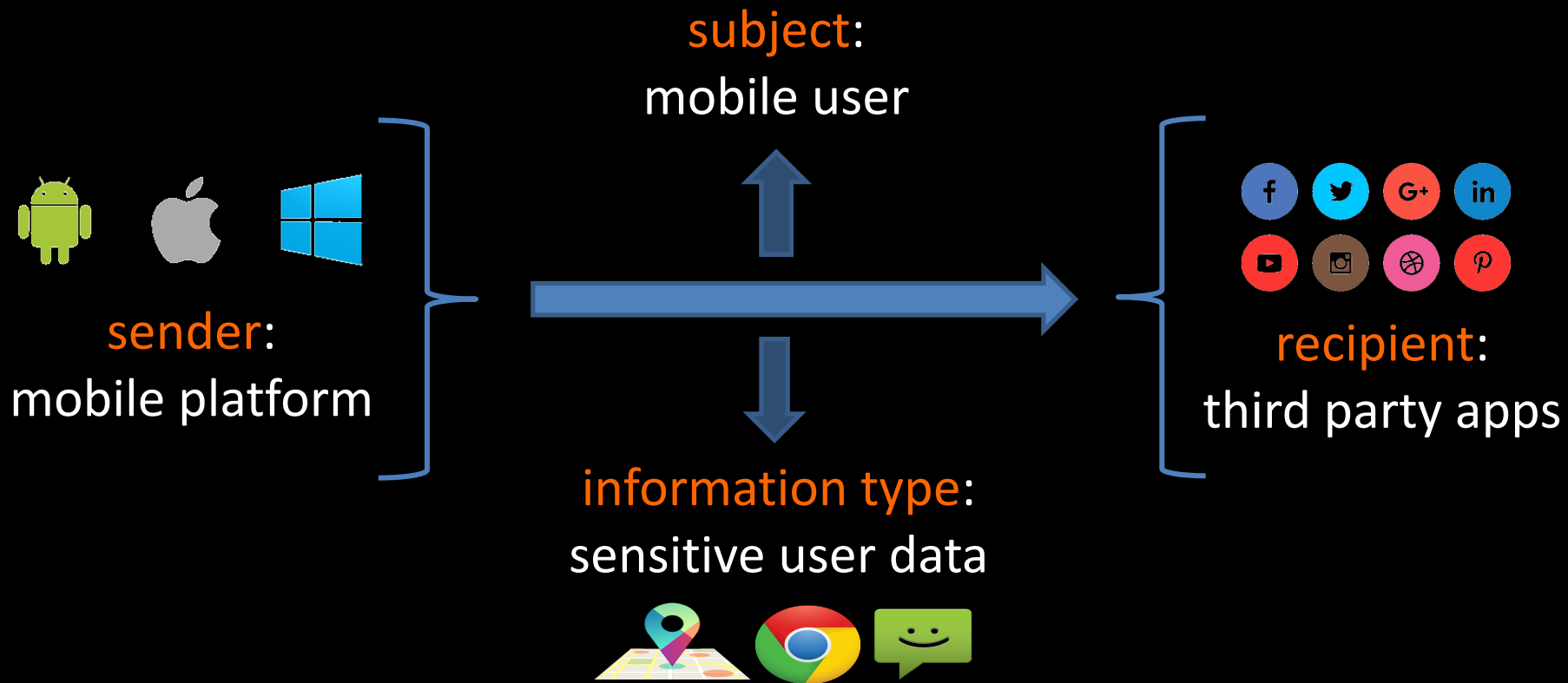


Primal Wijesekera (UC Berkeley | ICSI),
Joel Reardon (U. of Calgary), Irwin Reyes (ICSI),
Lynn Tsai (UC Berkeley),
Jung-Wei Chen, Nathan Good (Good Research),
David Wagner (UC Berkeley),
Konstantin Beznosov (UBC),
Serge Egelman (UC Berkeley | ICSI)

A permission model that only **allows**
applications to access data when it is **expected**
by the user.

Privacy violations occur when sensitive information is used in ways **defying users' expectations.**

transmission principle



retrospective experience sampling



Name	Log Data
Type	API_FUNC
Permission	ACCESS_WIFI_STATE
Function	getScanResults()
App_Name	com.spotify.music
Timestamp	1412888326273
Visibility	FALSE
Screen	ON
Connectivity	NOT_CONNECTED
Location	Lat 37.xxxx Long -122.xxxx 1412538686641
View	com.mobilityware.solitaire/.Solitaire
History	com.android.phone/.InCallScreen com.android.launcher com.android.mms/ConversationList

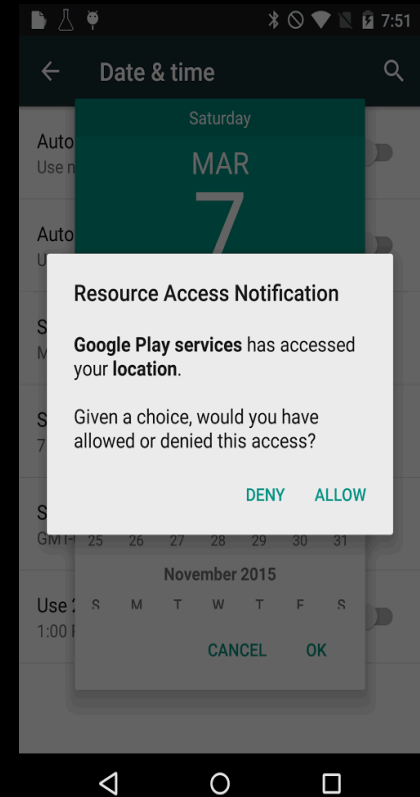
users wanted to *vary their privacy decisions*
based on the requesting app's visibility

how often users should be prompted

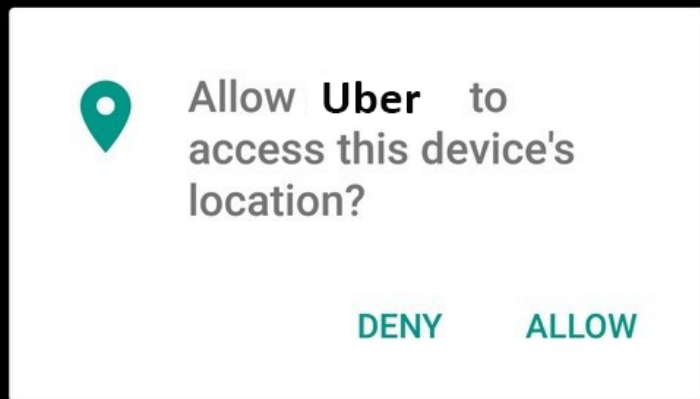
4 exposes per minute/user!

collecting the ground truth

133 Android smartphone users
176 million events recorded
4,224 prompt responses



more contextual factors



{visibility, foreground app}

Android Permissions Remystified: A Field Study on Contextual Integrity. P. Wijesekera, A. Baokar, A. Hosseini, S. Egelman, D. Wagner, and K. Beznosov. Proceedings of the 24th USENIX Security Symposium, 2015.

The Feasibility of Dynamically Granted Permissions: Aligning Mobile Privacy with User Preferences

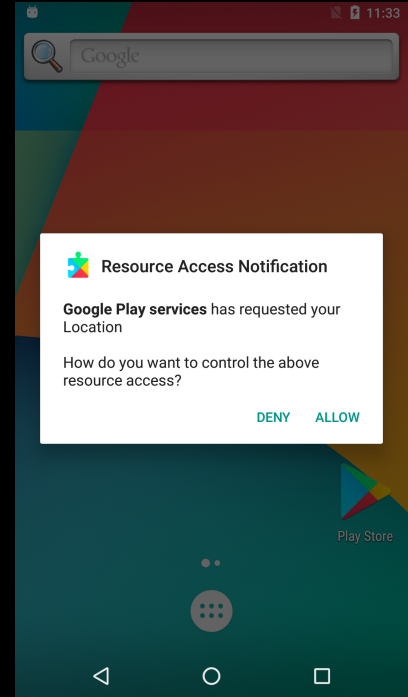
P. Wijesekera, A. Baokar, L. Tsai, J. Reardon, S. Egelman, D. Wagner, K. Beznosov. IEEE S&P 2017 (Oakland).

contextual cues helped

	Error Rate	Average Prompts/User
Ask-on-first-use	15.4%	12
ML Model	03.2%	12
ML Model (lower prompt count)	07.4%	08

implementation in Android

37 Android smartphone users
6,216 hours of real-world use
5.4 million requests intercepted
1,159 privacy decisions



Contextualizing Privacy Decisions for Better Prediction (and Protection)

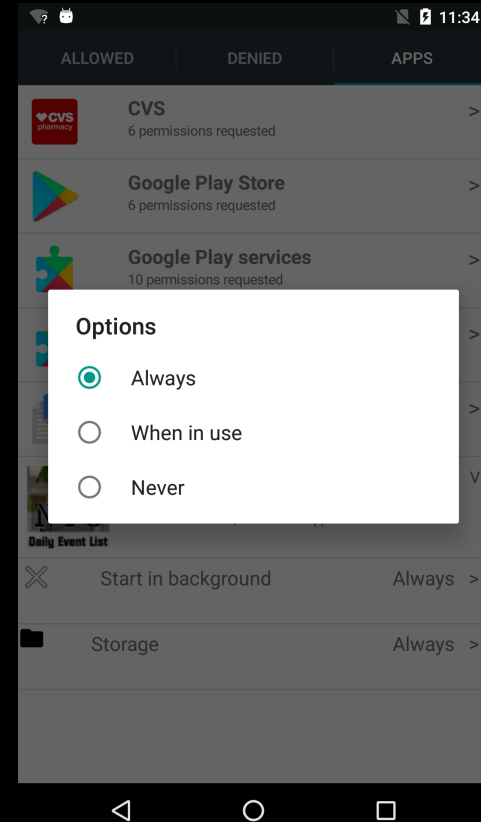
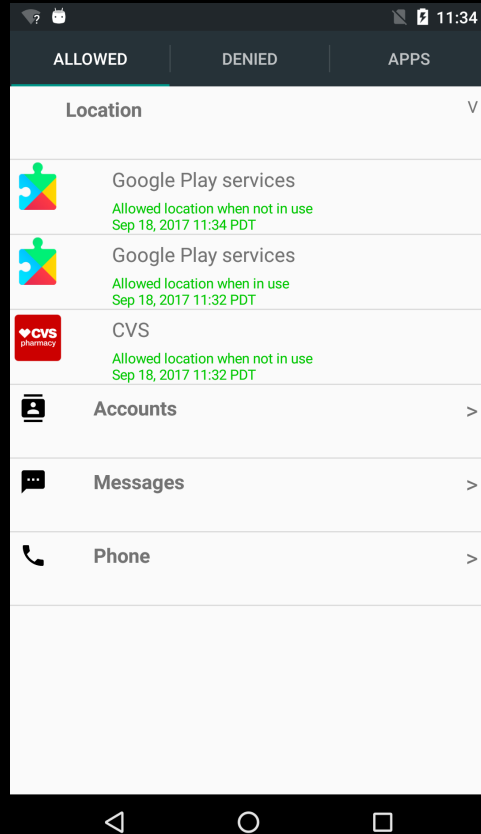
Primal Wijesekera, Joel Reardon, Irwin Reyes, Lynn Tsai, Jung-Wei Chen, Nathan Good, David Wagner, Konstantin Beznosov, and Serge Egelman. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '18), 2018.

**Honorable Mention Award*

contextual model works

	Error Rate	Average Prompts/User
Ask-on-first-use	20.00%	15
Contextual Model	5.26%	12

audit and review



distribution of contextual impact

contextuals

defaulters

unknowns

what's the impact of the **purpose** of a
permission request?

fewer privacy decisions for higher privacy protection

what are other potential factors that influence users' decision?

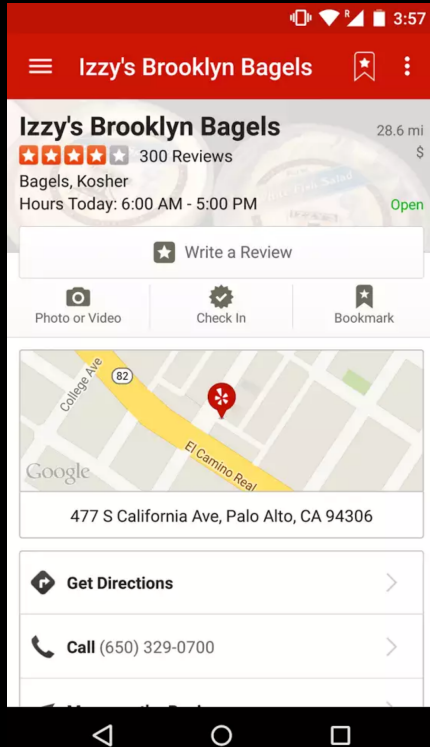
other approaches to model the context of a mobile user?

fewer privacy decisions for higher privacy protection

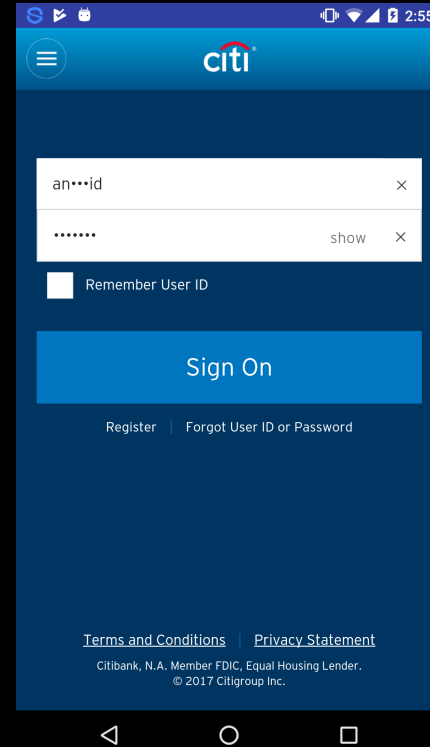
given a choice between usability and privacy participants still make contextual decisions

role of the data recipient is an important transmission principle

contextual influence



expected



not expected

the real world reaction of users and applications

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*what the other **contextual factors** that are likely to affect users decisions?*

*can the platform use past data to **predict** user's **future decisions**?*

features for machine learning

permission information

- permission
- visibility
- time of day

behavioral traits

- browsing habits
- audio preferences
- screen locking habits

contextual preferences

- under different visibility levels
- under different foreground applications

f -score

	Allow Class	Deny Class
Ask-on-first-use	0.73	0.45
Contextual Model	0.83	0.50