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Erasing Labor with Labor: Dark Patterns and Lockstep Behaviors on Google Play

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Introduction

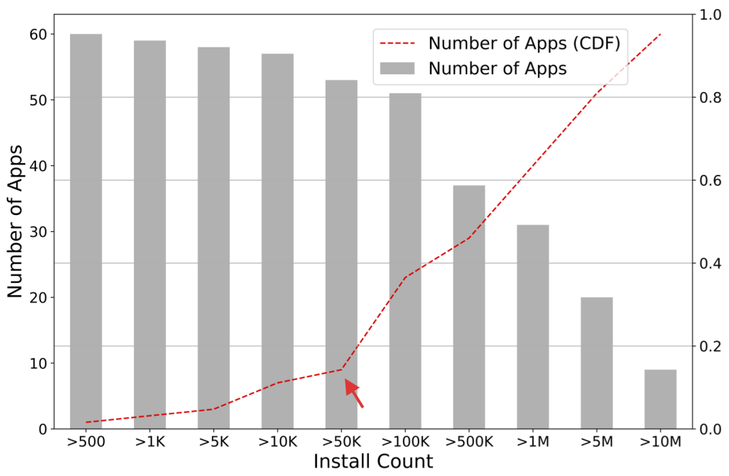
Install-Incentivizing Apps provide users monetary incentive such as money, coupons, gift cards and other rewards for installing other apps on Google Play.

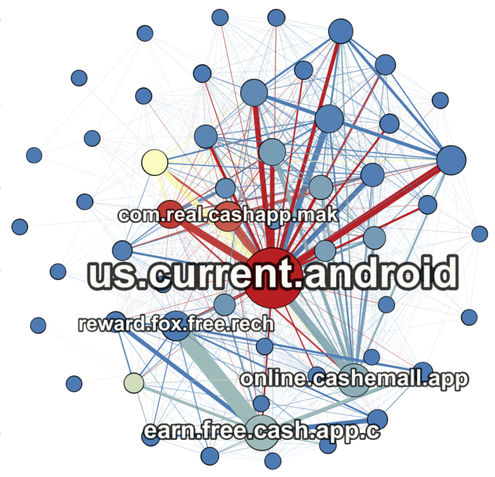
Google Play's Policy forbids developers from manipulating the placement, rating, reviews, install counts of apps by fraudulent or incentivized means.

Apps promoted on **Install Incentivizing Apps** are **6x** more likely to increase installs and **2x** more likely to appear in top charts. (Farooqi et. al, IMC 2020)

How do **Install-Incentivizing Apps** affect **Users**?

Dataset





Install-Incentivizing Apps

N = **60** Apps, **85%** Apps have > **100K** installs, collectively > **160.5M** installs.

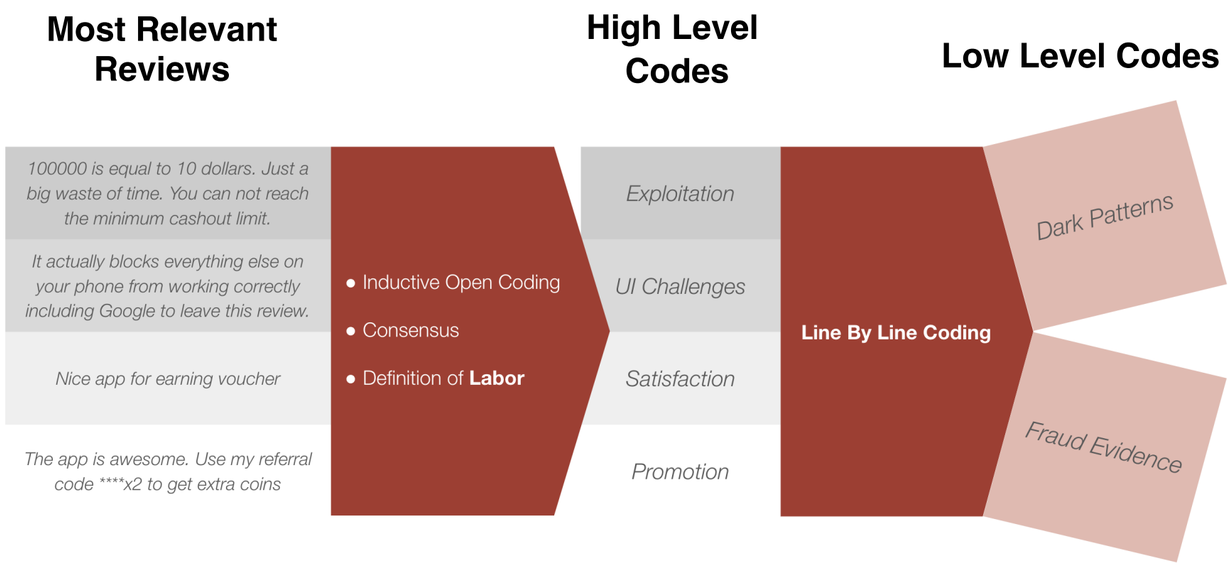
Qualitative Analysis

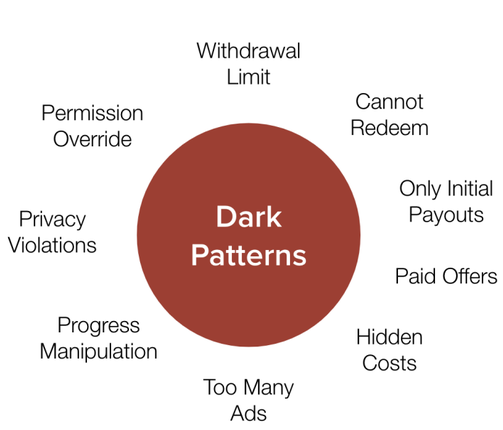
1825 Most Relevant Reviews by **1824** Reviewers over T = **1 Month.**

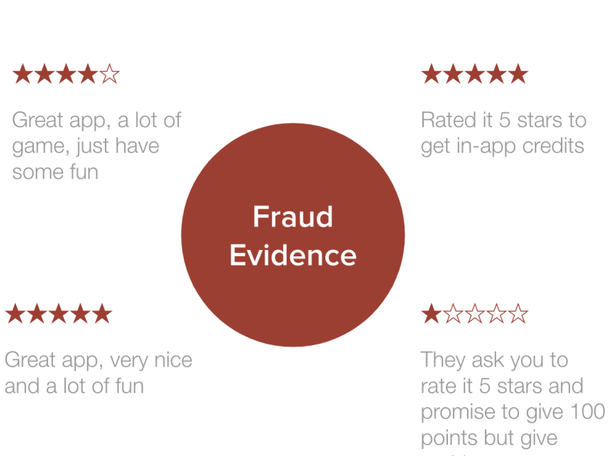
Quantitative Analysis

319K Daily New Reviews by **301K** Reviewers over T = **5 Months.**

Qualitative Analysis



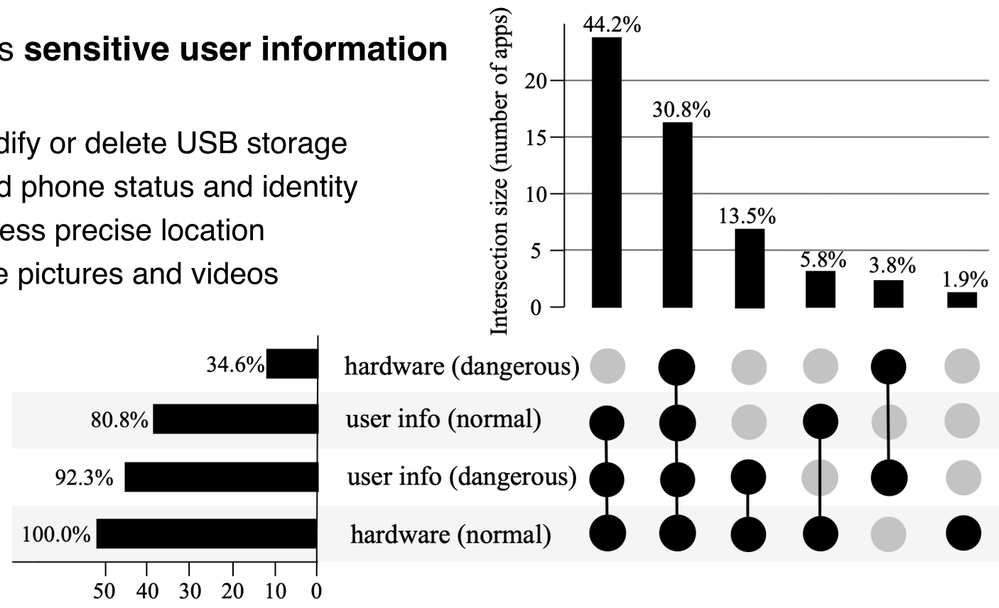




Permissions

92% access **sensitive user information**

41 apps modify or delete USB storage
24 apps read phone status and identity
19 apps access precise location
14 apps take pictures and videos



34% perform restricted hardware actions

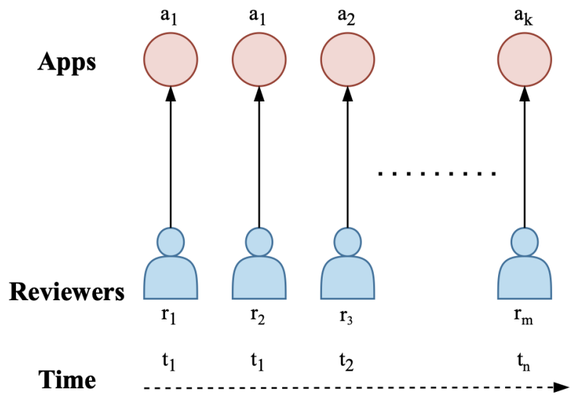
14 apps draw over other apps

Other **extremely dangerous** permissions

5 apps can create accounts and set passwords
3 apps can add/modify calendar events and send emails
2 apps can read contacts

Overall, 95% apps comprise dangerous permissions

Lockstep Behaviors



Goal

To detect burst of reviews on an app within a short time-period.

Experimental Setup

Two edge-streams

- E_{boost}: *rating (review) ≥ rating (app)*
- E_{sink} : *rating (review) < rating (app)*

Algorithm

MIDAS-F: Streaming χ^2 testing approach to determine whether observed and expected mean # of edges for a node are significantly different.

(Bhatia et. al, TKDD 2022)

Evaluation

50 most suspicious clusters of reviews based on **anomaly scores**

Highly Identical Review Pair (r_1, r_2) → **cosine similarity (r_1, r_2)** = 1

E_{boost}

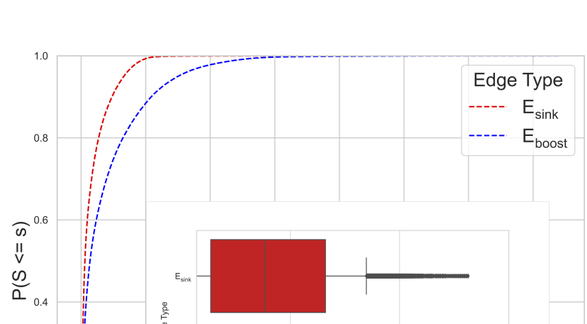
>35% reviews (**1,687 of 4,717**) form highly identical pairs

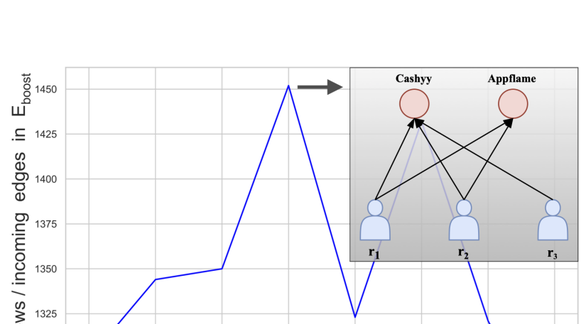
47 (94%) clusters contain highly identical review pairs

E_{sink}

>10% reviews (**45 of 432**) form highly identical pairs

21 (42%) clusters contain highly identical review pairs





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