Characterizing Harms of Incentivized Advertising on Google Play

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Third-party Apps

Platform

Online Social Networks

Smartphones

Third-party App

User

Developer
Third-party Apps

User

Platform

Online Social Networks

Smartphones

Third-party App

Developer

Millions of third-party apps

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Candy Crush Saga
@candycrushsaga · Games/Toys
Abuse of Third-party Apps

Platform

Online Social Networks

Smartphones

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User

Developer

4
Abuse of Third-party Apps

- Reputation fraud
- Privacy/Data breaches

**Twitter** cuts off API access to follow/unfollow spam dealers

**Instagram** will soon start cracking down on accounts that use third-party apps to dole out fake likes and followers

[The Cambridge Analytica Files]

Revealed: 50 million Facebook profiles harvested for Cambridge Analytica in major data breach

The data was collected through an app called thisisyourdigitallife, built by academic Aleksandr Kogan, separately from his work at Cambridge University. Through his company Global Science
Today’s Talk

Platform

Online Social Networks
Smartphones

Third-party App

User
Developer
Understanding Incentivized Mobile App Installs on Google Play Store

Shehroze Farooqi Álvaro Feal Tobias Lauinger Damon McCoy Narseo Vallina-Rodriguez

ACM Internet Measurement Conference (IMC 2020)
Mobile App Ecosystem

Developers create a variety of engaging mobile apps

Popular app stores

App store metrics

User engagement metrics

Monetization/Revenue

Install counts  Visibility in top charts
Registrations  Session lengths
In-app ads  In-app purchases
Investor funding  Stock trading
## Mobile App Ecosystem

Developers create a variety of engaging mobile apps.

<table>
<thead>
<tr>
<th>Popular app stores</th>
<th>Google Play</th>
<th>App Store</th>
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</thead>
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### App store metrics

- Increasing competition
- Visibility in top charts

### User engagement metrics

- Registrations
- Session lengths

### Monetization/Revenue

- In-app ads
- In-app purchases
- Investor funding
- Public stocks

Increasing competition and visibility in top charts highlight the need for mobile app install advertising campaigns.
Mobile App Install Campaigns

Traditional (non-incentivized) mobile app install campaigns
Find interested users

Cost of install is high

Incentivized mobile app install campaigns
Pay users to install the app
Users may not be really interested in the app

Considerably cheaper than non-incentivized
Incentivized Mobile App Install Campaigns

<table>
<thead>
<tr>
<th>Install Counts</th>
<th>“Install App &amp; Open only.”</th>
<th>Manipulate app store’s metrics (e.g., Install counts, visibility in top charts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Registrations</td>
<td>“Install App &amp; Register an Account.”</td>
<td>Deceive investors to raise funding</td>
</tr>
<tr>
<td>Usage metrics</td>
<td>“Install App &amp; Reach Level 13.”</td>
<td>Monetize artificial user engagement through ads</td>
</tr>
<tr>
<td>Revenue metrics</td>
<td>“Install App &amp; make any purchase of $1.”</td>
<td></td>
</tr>
</tbody>
</table>
Incentivized Installs have a bad reputation

Potentially fake engagement from uninterested users

Violation of app store policies
  Manipulation of app store metrics

Apple App Store banned them

Google Play Store does not completely ban them

“We've observed instances where incentivized installs are utilized solely to manipulate the placement of apps [...] we also recognize that incentivized installs can be a legitimate user acquisition channel for some developers”
Buy App Installs
Stand Out from the crowd & Rank Higher!

Get your app promoted with high quality installs from real people and real devices!
Because it’s a unique chance to get noticed by thousands of new users at unbeatable prices! Buy app installs from the #1 provider on market!

Meet Our Exclusive Solutions:
Built for Superior Monetization & Brand Engagement

Offer Wall
Users choose to earn rewards from their favorite apps, games, and websites by completing quick actions, like downloading apps or watching videos.

Market Research
To earn more rewards, users complete a short profile and receive targeted surveys based on their lifestyle and demographic makeup.

Owned & Operated Property
With high-quality in-stream video and display, MediaTV delivers superior creator engagement, brand engagement, and user monetization via a rewarding model.
Outline

Understanding the ecosystem of Incentivized mobile app Installs

Effectiveness of existing Google Play Store’s defenses
  Purchase incentivized installs

Impact of incentivized installs
  Monitoring infrastructure to identify incentivized install campaigns
  Characterize incentivized install campaigns
  Measuring Impact
Outline

Understanding the ecosystem of Incentivized mobile app Installs

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  Characterize incentivized install campaigns
  Measuring Impact
Incentivized Install Ecosystem

1. Advertise offer for app installs
2. Push app install offer
3. Accept offer to install app
4. User completes the offer
5. Notify offer completion
6. Pay $$$ for offer completion
7. Pay $$ after offer completion
8. Pay $ for completing offer

Developer

IIP

Offers

Affiliate App

Install and run app

User

Third-Party Mediator
Incentivized Install Ecosystem - Developer

1. Advertise offer for app installs
2. Push app install offer
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7. Pay $$ after offer completion
8. Pay $ for completing offer

No Activity → Only install an app
Activity → Perform additional tasks
Incentivized Install Ecosystem - IIP

Developer

Incentivized Install Platform (IIP)
Observe a spectrum of IIPs based on our interactions

IIP

(1) Advertise offer for app installs
(2) Push app install offer
(3) Accept offer to install app
(4) User completes the offer
(5) Notify offer completion
(6) Pay $$$ for offer completion
(7) Pay $$ after offer completion
(8) Pay $ for completing offer

User

Third-Party Mediator

Vetted IIPs
More established developers

Unvetted IIPs
Less established developers
Incentivized Install Ecosystem - IIP

Incentivized Install Platform (IIP)

Aggregate offers from developers

Display list of offers in an offer wall
Incentivized Install Ecosystem

Affiliate App
- Large user base
- Accessed by users of affiliate apps

1. Advertise offer for app installs
2. Push app install offer
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Developer
IIP
Affiliate App
User
Third-Party Mediator

Offer List
- Check-in Task
- Popular Offer
- Fantastic Offer Wall
- Wow Offer Wall
- Awesome Offer Wall

Offers

CoT Description
- Offer structure: Developer (IIP) → Affiliate App → User → Third-Party Mediator
- Value proposition: Incentivized install ecosystem for app installs
- Key steps:
  1. Advertise offer for app installs
  2. Push app install offer
  3. Accept offer to install app
  4. User completes the offer
  5. Notify offer completion
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Affiliate App
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Developer

IIP

Affiliate App

User

Third-Party Mediator

User

Likely crowd workers
Outline

Understanding the ecosystem of Incentivized mobile app Installs

**Effectiveness of existing Google Play Store’s defenses**

*Purchase incentivized installs*

Impact of incentivized installs
- Monitoring infrastructure to identify incentivized install campaigns
- Characterize incentivized install campaigns
- Measuring Impact
Purchase Incentivized Installs

Developed and published a honey mobile app on Google Play Store

Purchased 500 incentivized installs from three IIPs

Increased the public install count of our honey app

Google Play Store’s defenses failed to detect incentivized installs

Users who installed these apps looked like bots or crowd workers
Outline

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## Monitoring Infrastructure

### Affiliate App Automation
- **Automation Script**
- **Android Phone**

### Offer Wall Traffic Interception
- **MITM Proxy Server**
- **IIP Servers**

### Incentivized Install Offers

![Diagram showing the flow from Affiliate App Automation to Offer Wall Traffic Interception to Incentivized Install Offers]
Filter HTTP responses that contain offer walls

Typically JSON format
Monitoring Infrastructure

Affiliate App Automation
- Automation Script
- Android Phone

Offer Wall Traffic Interception
- MITM
- Proxy Server
- IIP Servers

Incentivized Install Offers

Offer's Metadata
- App's name
- Offer description
- Offer payout
## Monitoring Infrastructure

### Affiliate App Automation
- **Automation Script**
- **Android Phone**

### Offer Wall Traffic Interception
- **MITM Proxy Server**
- **IIP Servers**

### Google Play Store Crawler
- **Top charts**
- **Developer info**
- **# Installs**

### Incentivized Install Offers
- **Apps**

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**Table:**

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<th>Android Phone</th>
<th>Offer Wall Traffic Interception</th>
<th>Incentivized Install Offers</th>
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**Diagram:**

- Automation Script
- Android Phone
- MITM Proxy Server
- IIP Servers
- Incentivized Install Offers
- Apps
- Top charts
- Developer info
- # Installs
Monitoring Infrastructure

Monitored from March 2019 to June 2019

Automated 8 affiliate apps

5 vetted IIPs

2 unvetted IIPs

Most popular affiliate app had 10M+ install counts

2,126 unique incentivized installs offers from 922 unique apps
## Characterizing Incentivized Install Campaigns

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Vetted</th>
<th>Unvetted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Install Count</td>
<td>1,000,000+</td>
<td>1,000+</td>
</tr>
<tr>
<td>Median Payout</td>
<td>$0.45</td>
<td>$0.04</td>
</tr>
<tr>
<td>“No activity” offers</td>
<td>29%</td>
<td>91%</td>
</tr>
<tr>
<td>“Activity” offers</td>
<td>71%</td>
<td>9%</td>
</tr>
</tbody>
</table>

**dichotomy between vetted & unvetted IIPs**
Measuring Impact

Impact on app store metrics
- Increase in install counts
- Appearance in top charts
Measuring Impact

Impact on app store metrics
  Increase in install counts
  Appearance in top charts

Impact on investor funding
  Crunchase.com database

Incentivized install campaign from 12th March to 27th March

Password manager Dashlane closes on $30M, adds former Spotify CMO to board

Sarah Perez  @sarahintampa / 11:39 am CDT  April 12, 2019

Incentivized install campaign from 7th May to 14th May

Password manager Dashlane raises $110M in Series D, adds CMO

Zack Whittaker  @zackwhittaker / 11:27 am CDT  May 30, 2019
Measuring Impact

Impact on app store metrics
  Increase in Install Counts
  Appearance in top charts

Impact on investor funding
  Crunchase.com database

Monetization strategies
  Arbitrage
  Advertisement
Experimental Setup

Baseline apps

Lumen Privacy Monitor App [Razaghpanah ‘15 ]
Sampled 300 apps
Apps from all types of popularities

Chi-squared test of independence

Statistical significance level of 0.05
Perform two separate tests i.e., [Vetted vs. Baseline] and [Unvetted vs. Baseline]
## Results

<table>
<thead>
<tr>
<th></th>
<th>Vetted</th>
<th>Unvetted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in install counts</td>
<td>$\chi^2 = 26.0$, $p = 3.378e^{-7}$</td>
<td>$\chi^2 = 39.9$, $p = 0.000$</td>
</tr>
<tr>
<td>Appearance in top charts</td>
<td>$\chi^2 = 5.43$, $p = 0.02$</td>
<td>$\chi^2 = 0.22$, $p = 0.64$</td>
</tr>
<tr>
<td>Investor funding</td>
<td>$\chi^2 = 4.7$, $p = 0.03$</td>
<td>$\chi^2 = 2.8$, $p = 0.10$</td>
</tr>
</tbody>
</table>

* Green box indicates statistically significant correlation exists  
** Red box indicates failure to establish statistically significant correlation
Outline

Understanding the ecosystem of Incentivized mobile app Installs

Effectiveness of existing Google Play Store’s defenses
  - Purchase incentivized installs

Impact of incentivized installs
  - Monitoring infrastructure to identify incentivized install campaigns
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Responsible disclosure
Responsible Disclosure

Developers could be deceived/defrauded

Disclosed our findings to 137 popular apps with 5M+ installs

’’We aren’t aware of an incentivized install campaign for the [...] Incentivized install campaigns contradict our policy [...]’’

’’ Agencies sometimes misuse our company logo and links to our landing pages to create fraudulent ads [...] Most are abusing their roles in the affiliate advertising marketplace to make quick sales [...] Our team is always monitoring these types of practices to be able to block this type of campaign as soon as possible’’
Responsible Disclosure

Disclosed our findings to Google
Summary

Incentivized installs can have negative impacts on app store and beyond

Investor funding

Potential violations of Google Play Store’s policies

Lack of enforcement of existing Google Play Store’s defenses
Concluding Remarks

Our measurements and infrastructure can help:
- Google Play Store to identify policy violations
- App developers to determine if they are being deceived
- Investors to determine if app developers are misleading them
- Consumer protection agencies to audit systemic fraud

Other harms of incentivized advertising
- Privacy of users

Emerging use of incentivized advertising
- In response to ad-blocking
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