Diffusion Dynamics of Games on Online Social Networks

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LOLapps -> MySpace
Motivation

• How can games be designed to propagate efficiently along a social network?
  – What are the best invitation strategies at the individual level?
  – Are there network effects?
Related work

• Online viral marketing (Leskovec et al., EC’06)

• Social influence & diffusion
  – Backstrom et al. 2006: joining LJ groups or CS conferences
  – Aral et al. 2009: distinguishing homophily and influence
  – Liben-Nowell & Kleinberg 2008: email chain letters
  – many studies of diffusion in blogs and microblogs (Twitter)
  – Bakshy et al. 2009: social networks and content diffusion

• Facebook
  – Sun et al. (ICWSM 2009): diffusion of pages on FB
  – Gjoka WOSN 2008: more apps, decreased average usage
Outline

• games we studied

• invitation efficiency
  – inviter
    • profile
    • invitation patterns
  – invitee
    • how many and how different are the inviters?

• network effects for games that favor large within-game groups
• 50 million active users/month (June 2010)
• founded in 2008
• 300,000 user generated applications
• 11 games
a tale of 2 games

- Grow your family (Yakuza Lords) or entourage (Diva Life) and win battles/gigs
Game activities

Yakuza Lords

Diva Life

Number of Actions

Action Portion of Each Type

1.0

0.8

0.6

0.4

0.2

0.0

1 5 20 100

battles

battle_view

invites

banks

properties

healing

characters

locations

item

mission
# Game demographics

<table>
<thead>
<tr>
<th>Yakuza Lords</th>
<th>Diva Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 million users (July 2009 – Feb 2010)</td>
<td>2 million users (Sept 2009 – Feb 2010)</td>
</tr>
<tr>
<td>85% male</td>
<td>96% female</td>
</tr>
<tr>
<td>most players 18-38 years old</td>
<td>“”</td>
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</tbody>
</table>

## Age distribution

![Age distribution graph](image)

- **Yakuza Lords**
  - Population Probability Density
  - Age of Gamers

- **Diva Life**
  - Population Probability Density
  - Age of Gamers
inviting friends
Your friends don’t all want to play

Name: I'm sick of Farmville notifications, I don't care about your lost cow.
Type: Products
13,329 people like this.

Name: I don't care about your fishes, farm, pets or mafia... :P
Type: Local Business
1,023 people like this.

Name: Stop sending me Farmville requests
I DON'T PLAY!
Type: Products
1,012 people like this.
In defense of social invites

- I don't care about your farm, or your fish, or your park, or your mafia!!
  Club
  1,468 people like this.

- I don't care that YOU don't care about my farm, fish and mob!
  Local Business
  1,814 people like this.

- I DON'T CARE if YOU DON'T CARE about my farm, cafe, fish, island, etc. LOL
  Local Business
  176 people like this.

- I don't care that you don't care about my farm, or my fish...
  Local Business
  245 people like this.

- I care about your farm, fish, park, & your mafia! Those who don't R Haters!
  Website
  633 people like this.
Are social invites worth it?

- only 37/25% (YL/DL) users received invites before installing game...

- However...
  - 20% of non-invited players stayed past the first day
  - 50% of invited players stuck around more than a day, and 20% were still there 80 days later.
How broadly are users inviting?

- Invite a few friends who are close and/or might be interested? Or invite everybody?

![Graphs showing Cumulative Probability and Average Number of Invitees](image-url)
Inviter efficiency: strategy

• Some users are more active inviters:
  – 10% of users account for 50% of successful invites.

• But inviting fewer friends gives higher yield per invite
  – $\rho(\text{success rate, } \# \text{ invites sent}) = -0.77$
why is less more when it comes to invites? 

pacing, repetition, selectivity

• to control for # of invites sent, consider separately users who have invited 6, 12, or 20 friends
• inviters who pace their invites are more likely to succeed:
  – $\rho$ (median interval between sending an invite, success rate) 
    = 0.09~0.19***
• sending repeat invites pays off
  – $\rho$ (av. # invites per friend, success rate) = 0.23~0.27***
• inviting fewer users at once gives higher yield
  – $\rho$ (av. # invites per click, success rate) = - 0.35~0.49***
Inviter efficiency: profile

- Can one identify successful inviters based on their profile?
  - no correlation with gender, education, hometown, relationship status
  - weak correlation ~0.1 with age
the inviter’s network & sharing

- almost no correlation ($\rho \sim -0.04$) between the size of an inviter’s network and success rate

- almost no correlation with # of walls posts (game and other) $\rho \sim 0.04$

- or privacy level of profile ($\rho \sim -0.06$) (what gets shared publicly).
inviters engagement with the game and success

• higher engagement <-> higher invite success

 correlation between Life Time an success rate

• the top 10% of inviters by success rate have an average lifespan of 70 days
Putting it together: Invitation cascades

successful invitation

user who joined game
Cascades are wide and shallow

• small-world: everyone runs into everyone else in the game in a small number of steps
invitations
spread
and
collide
who is inviting you?

• more invites from different people -> higher probability of joining

• but inviters don’t have to be different form each other... entropy of profiles does not matter

• helps if inviters belong to the same clique
  – \( \rho \) (clustering coefficient) = 0.21 (YL), \( \rho = 0.14 \) (DL)
Are cliques being absorbed into the game?

- families grow rapidly at first, then more and more slowly

- when friends join forces their success rate grows (they share credit for new recruits)
How far does influence carry?

- correlation between one’s success rate and descendants’ av. success rate
Using networks to propagate games or using games to grow networks?

- Users add each other as friends in order to grow families...
conclusion

• games are spreading successfully and virally over social networks, as users invite friends
• it’s not so much who the inviter is, but how selective and persistent they are
• engagement correlates with success
• family-structured games experience boost from network effects
• persuasive users are proximate in the network
• games can modify the social networks they are spreading on
future work

• tracing user created games
  – what are the properties of viral games?
• characterizing large-scale cascades

more info

• http://netsi.org