The 70th Annual International Communication Association Conference

USC University of Southern California

I'll Play on My Smurf Account: Sybils and Network Measures

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We thank Wargaming for providing data access, and Jeremy Ballenger and Eugene Kislyi for their helpful feedback.

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World of Tanks

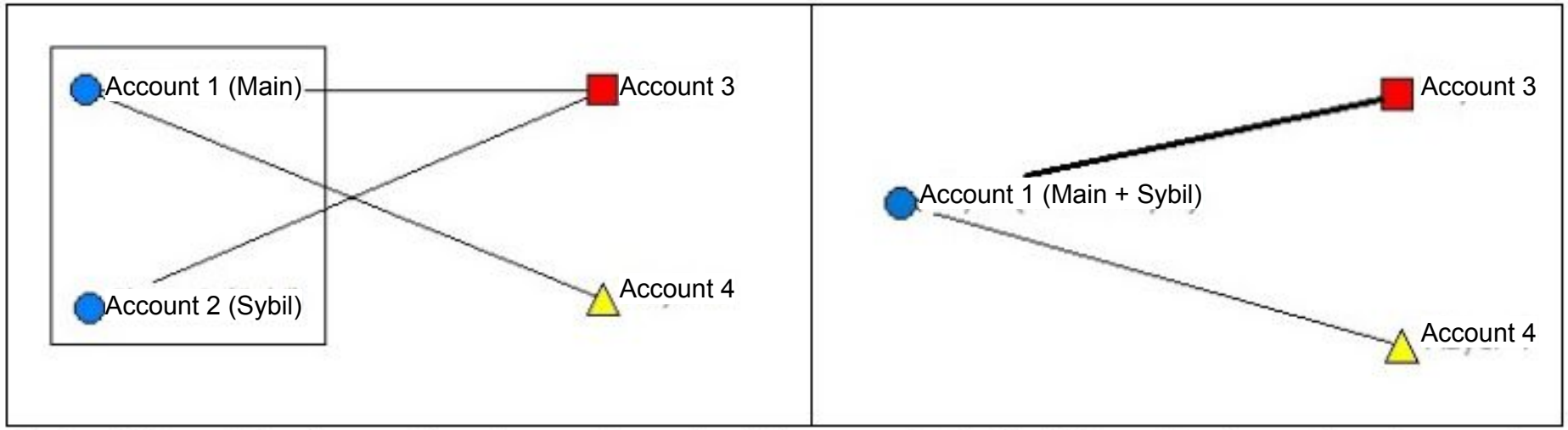
- Massively multiplayer online (MMO) team-based vehicle battle simulator developed by Wargaming.net
- More than 160,000,000 players (worldoftanks.com)
- Various battle modes/ways to connect

Sybils

Sybils

Figure 1

Example of a Sybil Account in a Network

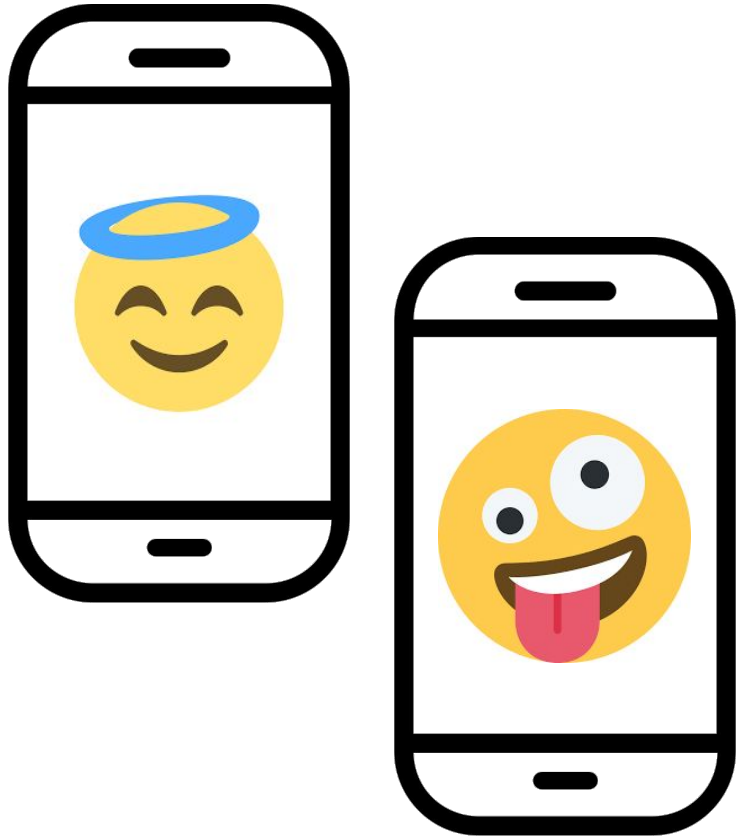


Notes. Network before collapsing main and sybil accounts (left); Network after collapsing main and sybil accounts (right).

Why play with sybil accounts?

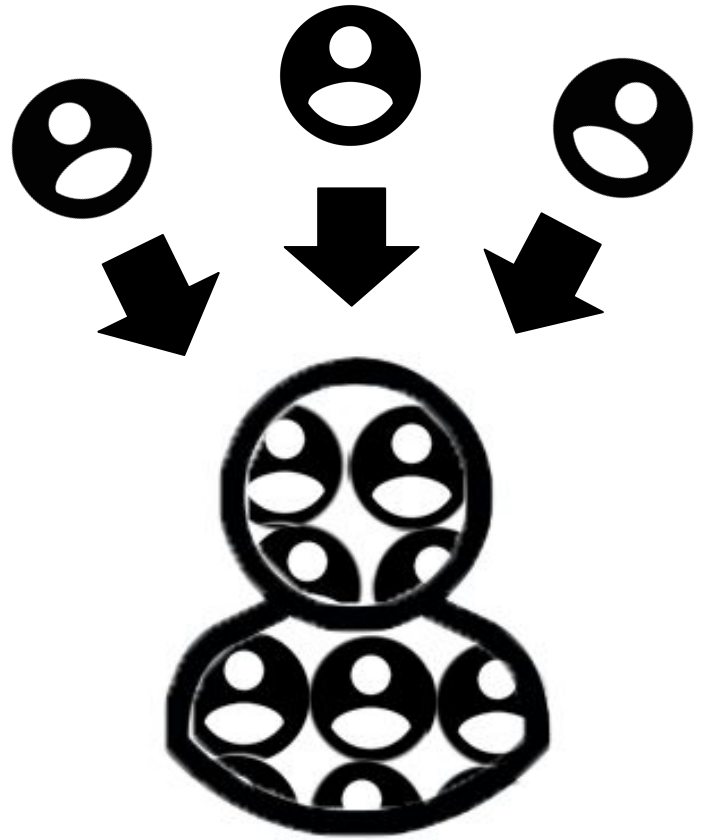
- Impression management
- Privacy
- Accessing different groups
- Gain system benefits

(Aghasian et al, 2017; Bullingham & Vasconcelos, 2013; Goffman, 1978; Kang & Wei, 2019; Marwick & boyd, 2011; Patsakis et al, 2014; Raynes-Goldie, 2010)



Sybils: Extant Approaches

- CS: sybil detection, e.g. friendship networks and clickstreams (Douceur, 2002; Gong et al., 2014; Patsakis et al., 2014; Wang et al., 2013; Yang et al., 2014; Yang et al., 2018)
- Limited exploration on effects and implications when sybils are collapsed
    - Networks based on **each account** → Networks based on **each *individual***



Research Questions

- **RQ1:** What effect does merging sybil accounts have on:
  (a) global player network;
  (b) players' ego networks?

- **RQ2:** What player behaviors predict whether an account is likely to be a sybil account?

Methods

- Wargaming.net server data:
  - a list of **sybil accounts** (using a robust proprietary methodology based on behaviors and real-world data)
  - a list of anonymized IDs for players and other players they had *battles alongside*, including *how many times* they had *actively chosen* to play alongside each other player

  ➔ transformed into **“co-play” data**

Datasets Used

Co-play Data

	SPA1	SPA2
0	00001DD103717A29AE6EAF27BC0E5DD8E03F0CAD177F2A...	0048E013B0F7958ACC52E538699ED1DE84D18E2B9620E9...
1	00001DD103717A29AE6EAF27BC0E5DD8E03F0CAD177F2A...	00DF9BA062D72A54D3C5688ED684078920922BC2583BA8...

Sybil Data

	PARENT_SPA_KEY	CHILD_SPA_KEY
0	658CDFD65103B78226828BA1EF405150A3615CF13DE410...	55250F[illegible]219DDB757D7FBD9AFB6FBB249EFAF69E9DE4A...
1	75CEA7828759FE157E838A4E8EE64190876AC50257825B...	35FE10DE6F56666254FC45D7B86D3793780723F68F53B6...

Global Network Analysis

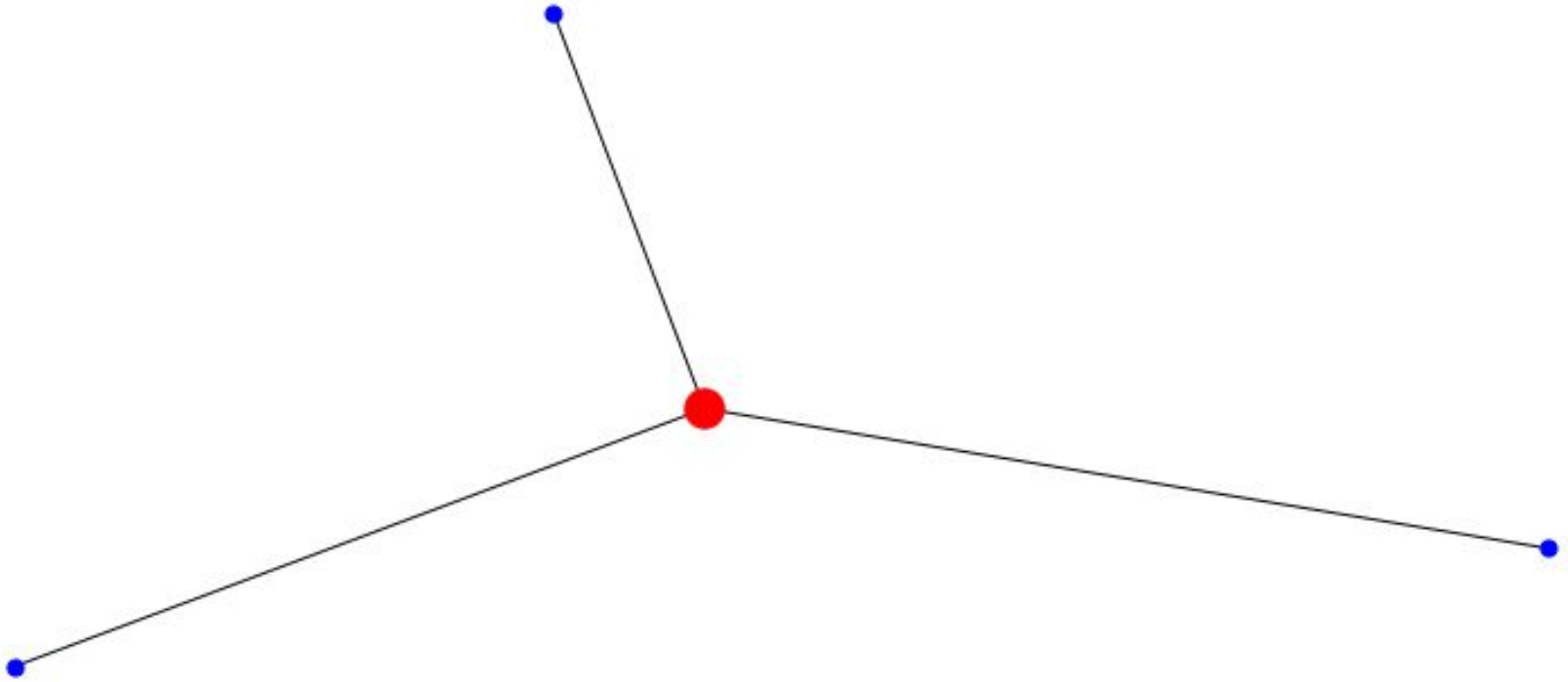
➔ Collapsed co-play network by merging sybil nodes.

Statistic	Pre-Merge	Post-Merge	Percent Change
Vertices	169,149	159,787	-5%
Edges	4,233,190	4,202,663	-0.7%
Global Clustering Coefficient	0.06893263	0.06811161	-1.2%
Density	0.0002959112	0.000329211	9.2%

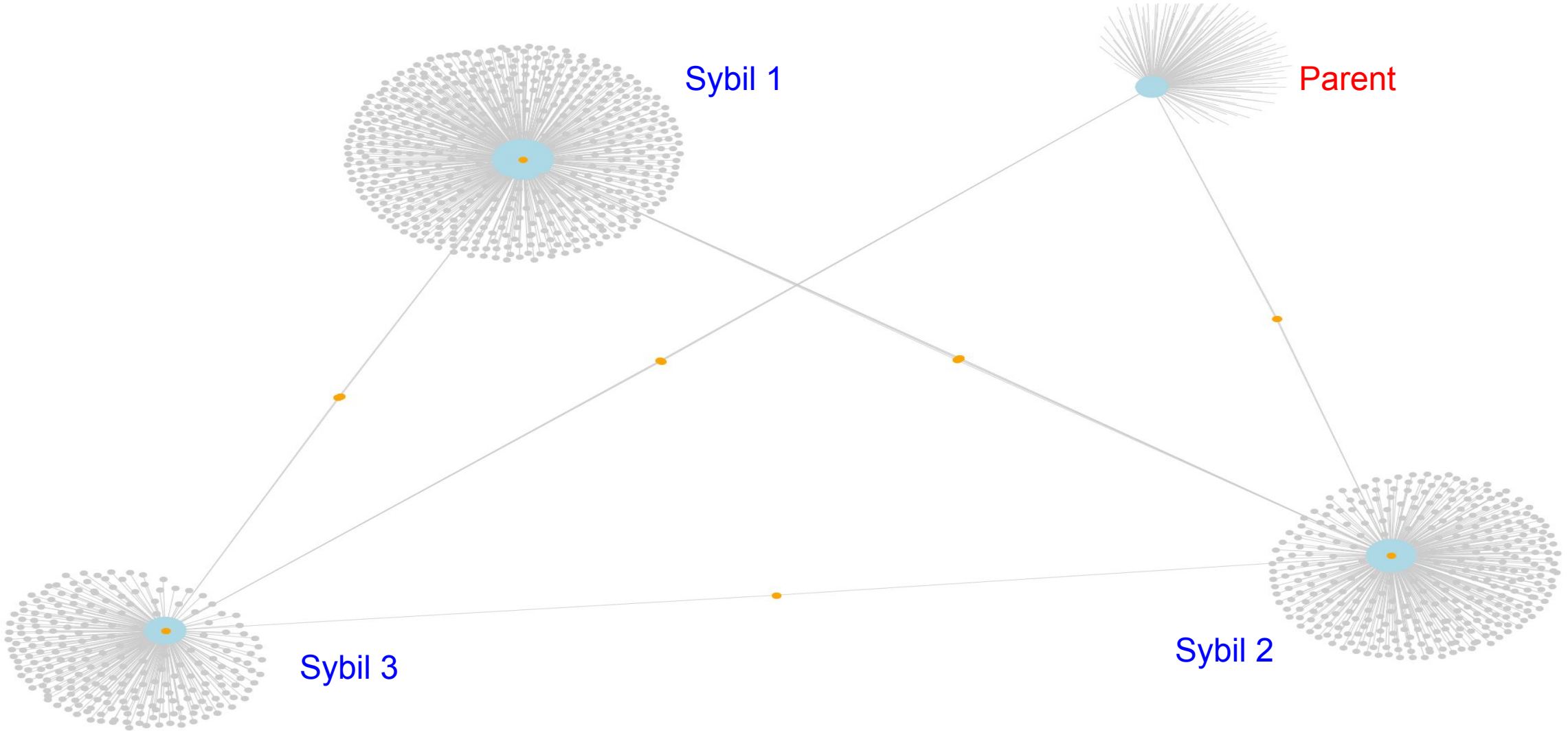
➔ Disproportionate increase in density - low overlap between the ego networks of sybil accounts shared by one person.

Ego-Level Network Investigation

➔ Graph of Parent (red) connected to 3 Sybil accounts(blue).



➔ Co-play Ego Network between Parent and Sybil.



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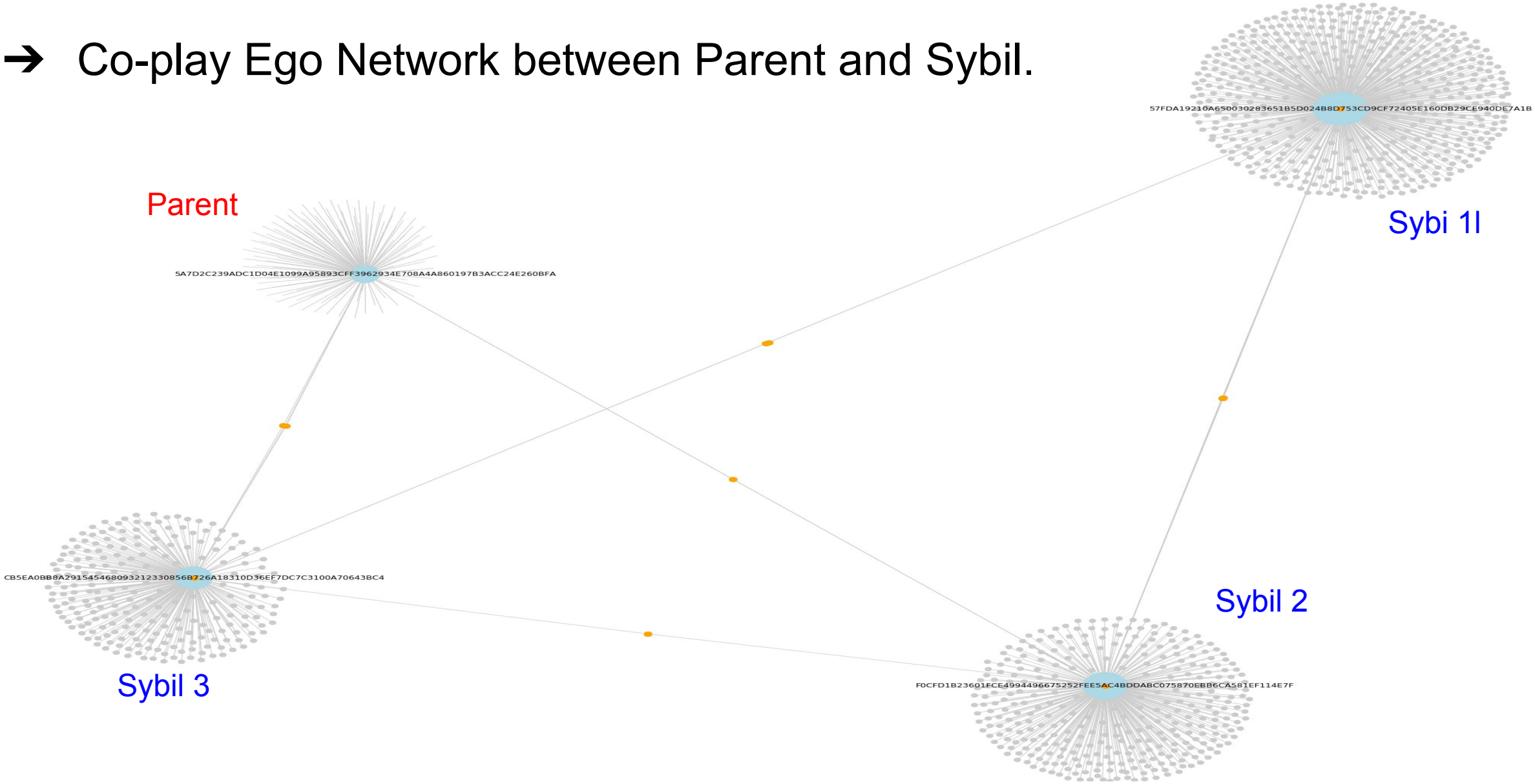


Ego-Level Network Investigation

	Degree (before collapse)	Local Clustering Coefficient (before collapse)	Degree (after collapse)	Local Clustering Coefficient (after collapse)
Parent	143	0.014	1216	0.013
Sybil 1	511	0.04		
Sybil 2	339	0.011		
Sybil 3	236	0.012		

Behavioral Dynamics of Sybil Accounts

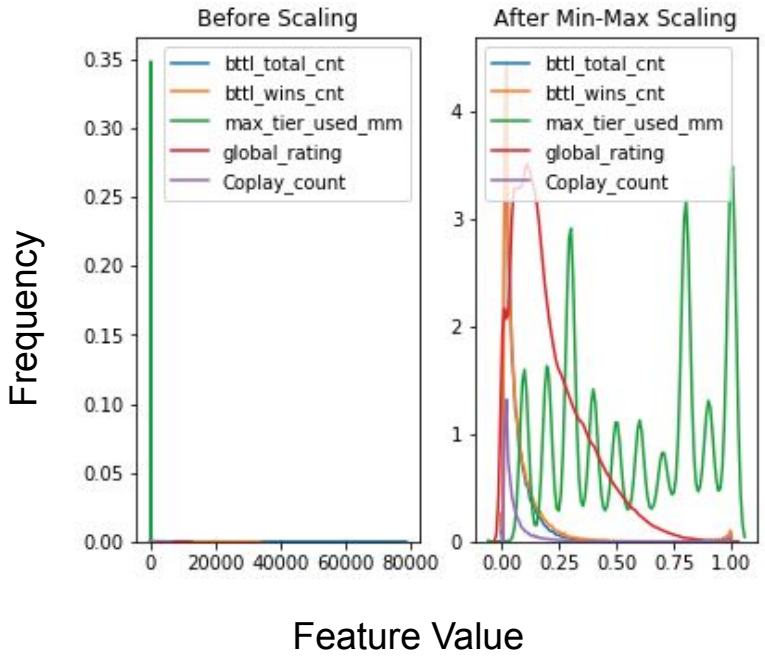
Features -

spa_key_sha256	bttl_total_cnt	bttl_wins_cnt	max_tier_used_	global_rating	Coplay_count	sybil_status
72A02EA50BD7...	18	9	3	74	72.0	0.0
3F0CAD177F2A...	7460	3656	10	4574	66.0	1.0

Behavioral Dynamics of Sybil Accounts

Imbalanced Dataset- SMOTE

- ➔ Number of Regular accounts in training data = 1,051,919
- ➔ Number of Sybil accounts in training data = 187,227
- ➔ After oversampling, number of Regular accounts = 789,006
- ➔ After oversampling, number of Sybil accounts = 789,006



Feature Scaling -

- ➔ MinMax Scaler - Transform all features into a uniform scale between 0-1

Behavioral Dynamics of Sybil Accounts

Algorithm - Random Forest Model

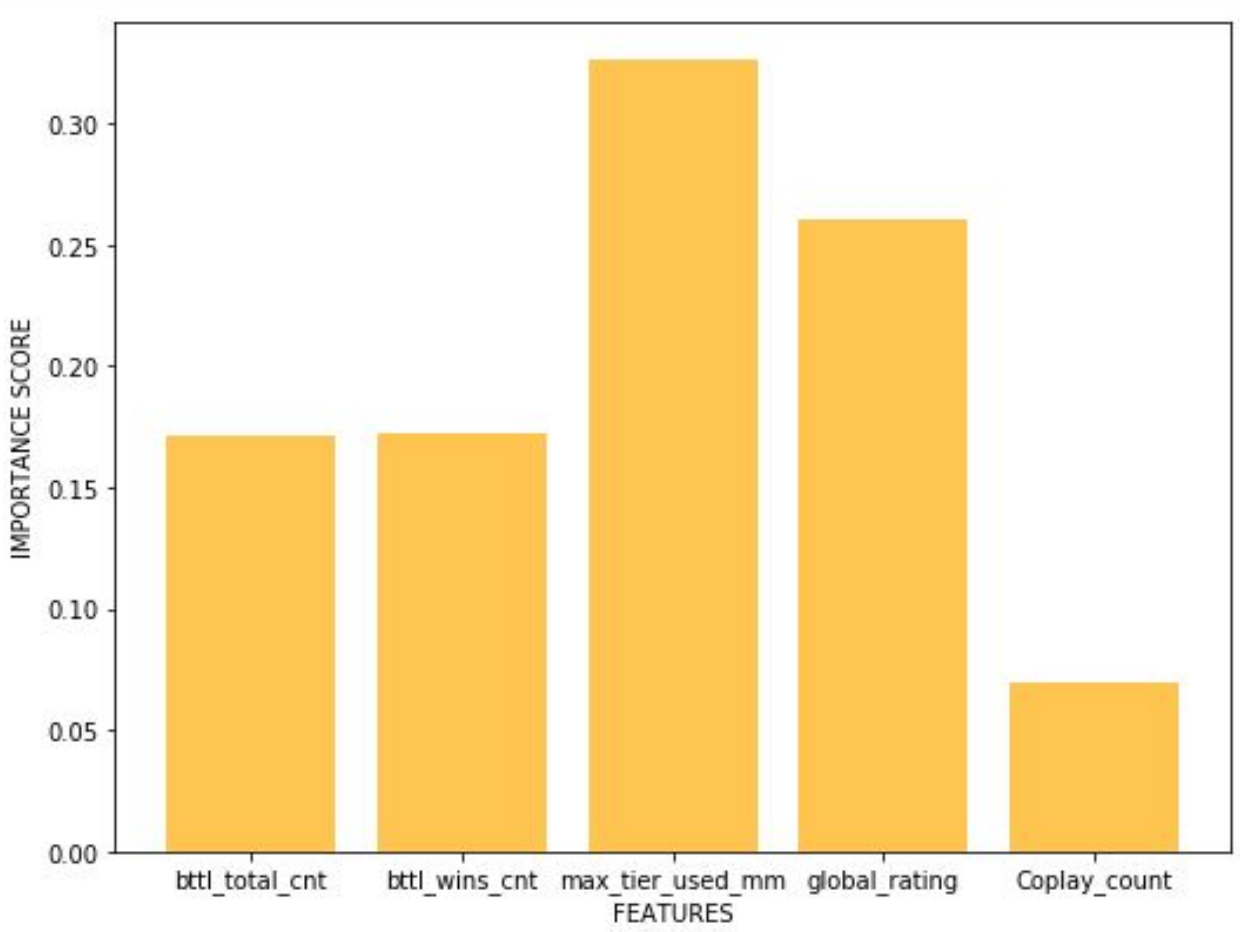
- ➔ Class 0 - Regular Account
- ➔ Class 1 - Sybil Account (Parent/Child)

	precision	recall	f1-score	support
0.0	0.9524	0.9711	0.9617	315712
1.0	0.8168	0.7267	0.7691	56032
accuracy			0.9342	371744

- ➔ Root Mean Squared Error: 0.25643

Behavioral Dynamics of Sybil Accounts

Feature Importance-



Implications/Future Directions

- Low overlap between parent and child sybil accounts.
  - Active context management: intentional “division of situations” (c.f. Rinsta/Finsta; Meyrowitz, 1985)

Statistic	Pre-Merge	Post-Merge	Percent Change
Vertices	169,149	159,787	-5%
Edges	4,233,190	4,202,663	-0.7%
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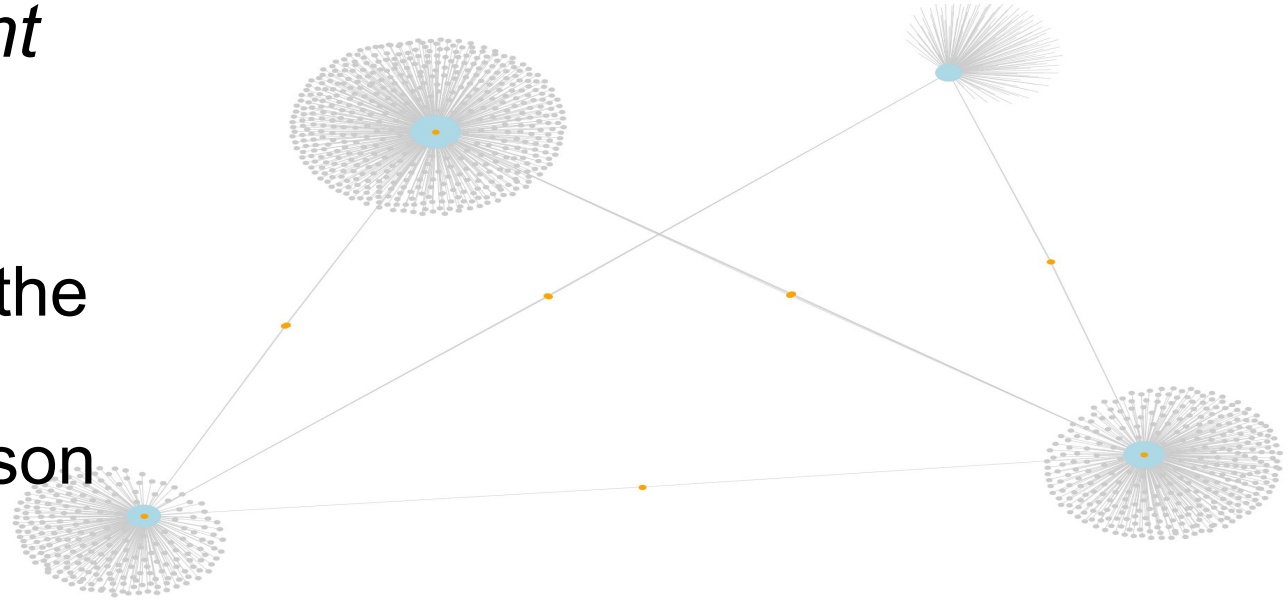
Implications/Future Directions

- Brokers may NOT be brokers per se, but brokers for *different* accounts of the *same* person
  - Brokerage/bridge *between* sybils (already connected to the same individual)
  - May be sybils of another person
  - May be individuals from overlapping contexts



Implications/Future Directions

- Network size management
  - Desire to keep smaller core network (parent account)
  - “Moving on” to reinvent self

	Degree (before collapse)	Local Clustering Coefficient (before collapse)	Degree (after collapse)	Local Clustering Coefficient (after collapse)
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Implications/Future Directions

- Features: mastery over familiarity?
  - Mastery: maximum tier, global rating > battle win
  - Familiarity: battle count, maximum tier
- Features: relative less importance of the # co-plays
  - Managing core networks: social groups are predictive, but quality trumps quantity (c.f. Dunbar's number)
  - Performance-oriented: playing/doing *better* is more important than playing/doing *with*