Dynamics of personal social relationships in Online Social Networks: a study on Twitter

Valerio Arnaboldi, Marco Conti, Andrea Passarella, Robin Dunbar

valerio.arnaboldi@iit.cnr.it
Social Lives vs. Social Networks

- 39 percent of Americans spend more time socializing online than face-to-face

Sources:
Benefits of OSNs

- Facilitate new friendships
- Bolster people’s confidence
- People can “control” their online persona
- Enhance offline friendships
OSNs effects on our society

• Are OSNs changing the properties of our personal social relationships?
• Are the benefits of OSNs enough to justify a shift towards a completely online social life?

We need to fully understand the properties of social relationships in OSNs and the differences from face-to-face relationships
Dynamics of social relationships in OSNs

Goal: study how social relationships and personal social networks are maintained over time in OSNs

• Essential to understand – from an evolutionary perspective – the extent to which OSNs are changing the way we interact socially
• OSNs data contain the entire history of communication between users – unique opportunity to study the evolution of social relationships over time
Methods

- Study the dynamic properties of user’s behaviour in OSNs
- Compare the properties of OSNs with background findings in sociology and psychology about face-to-face

Ego Networks

- Dunbar’s Number – limit of 150 active friendships (on average)
- Structure of concentric circles with typical size (5-15-50-150)
- Active friends are contacted at least once a year
Experimental Data

• Twitter data set containing the whole communication history of more than 2 million users (for up to 7 years of activity)
• The data have been filtered with a SVM to select profiles related to “humans”
• Number of direct messages sent between users (mentions and replies) to capture the maintenance of social relationships
• Active users – people who actively maintain their social relationships in Twitter
• Filtered data contains about 600,000 user profiles
Why Twitter?

• Different from other OSNs
• Widely adopted and growing rapidly
• Easy to collect communication data between users in Twitter (direct messages are 39% of the total communications between “humans”)
• Users are heterogeneous – humans (68%) are mixed with other kinds of profiles (companies, public figures, etc.)
From Tweets to Ego Networks

• A social relationship between two users exists if they exchanged at least one direct message

• An Ego is a Twitter user (human) and alters are all the people with whom she has a social relationship

• Ego network circles are built considering typical frequencies of contact taken from the literature
Ego Network Evolution Over Time

• The communication history of each ego is divided into temporal windows of one year each
• The windows are slid with steps of 1 day and the size and composition of the circles in the ego networks are studied for each window
• To capture the differences between the users, we divide them into three categories based on users’ active lifespan: occasional users (63%), regular users (35%) and aficionados (2%)
We say that a user abandons Twitter if her activity is followed by at least 6 months of inactivity.

- We do not consider accounts created less than 12 months before the download.
- 159,000 accounts (25%) of the data set abandoned Twitter.
- Mostly occasional users (88%), 11.5% regular users and 0.5% aficionados.
Number of contacts added over time

- The communication history of each user is shifted to start from the same point in time (origin)

- People add new contacts in their social networks at a nearly constant rate
The number of contacts actively maintained is limited – effect of cognitive constraints
Different behaviour: Initial boost followed by decay or slow start followed by more stable activity
Different from face-to-face ego networks
Structured ego networks

- Networks maintaining a support clique during all their temporal windows
- More similar to face-to-face ego networks
- Only 5.5% of the analysed ego networks
Ego Network Turnover

- Jaccard coefficient over consecutive (but not overlapped) 1-year windows
- Ego networks with at least 2 years of communications

<table>
<thead>
<tr>
<th>Circle</th>
<th>Occasional users</th>
<th>Regular users</th>
<th>Aficionados</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All ego networks</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active network</td>
<td>0.124</td>
<td>0.098</td>
<td>0.103</td>
</tr>
<tr>
<td>Sympathy group</td>
<td>0.122</td>
<td>0.075</td>
<td>0.072</td>
</tr>
<tr>
<td>Support clique</td>
<td>0.057</td>
<td>0.024</td>
<td>0.012</td>
</tr>
<tr>
<td><strong>Structured ego networks</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active network</td>
<td>0.191</td>
<td>0.190</td>
<td>0.193</td>
</tr>
<tr>
<td>Sympathy group</td>
<td>0.287</td>
<td>0.309</td>
<td>0.362</td>
</tr>
<tr>
<td>Support clique</td>
<td>0.346</td>
<td>0.395</td>
<td>0.488</td>
</tr>
</tbody>
</table>

- Very high turnover (low Jaccard)
- Structured networks show turnover similar to face-to-face networks
- Turnover also affects support cliques
Conclusions

• Compared to “traditional” social networks, Twitter has smaller ego networks with a high percentage of weak ties and really high turnover
• Many users show an initial phase of very high activity followed by decay or abandonment
• A small but noticeable set of users prefer a “slow” start with a gradual increase of activity and more stable networks
• Users’ behaviour in Twitter seems to be adapting to the dynamism of our “liquid” society
Thanks for your attention!

*Velocity of movement and access to faster means of mobility are the principal tool of power and domination.*

Zygmunt Bauman