Are your a social keeper or a social explorer? The dynamics of human social behavior in communication networks

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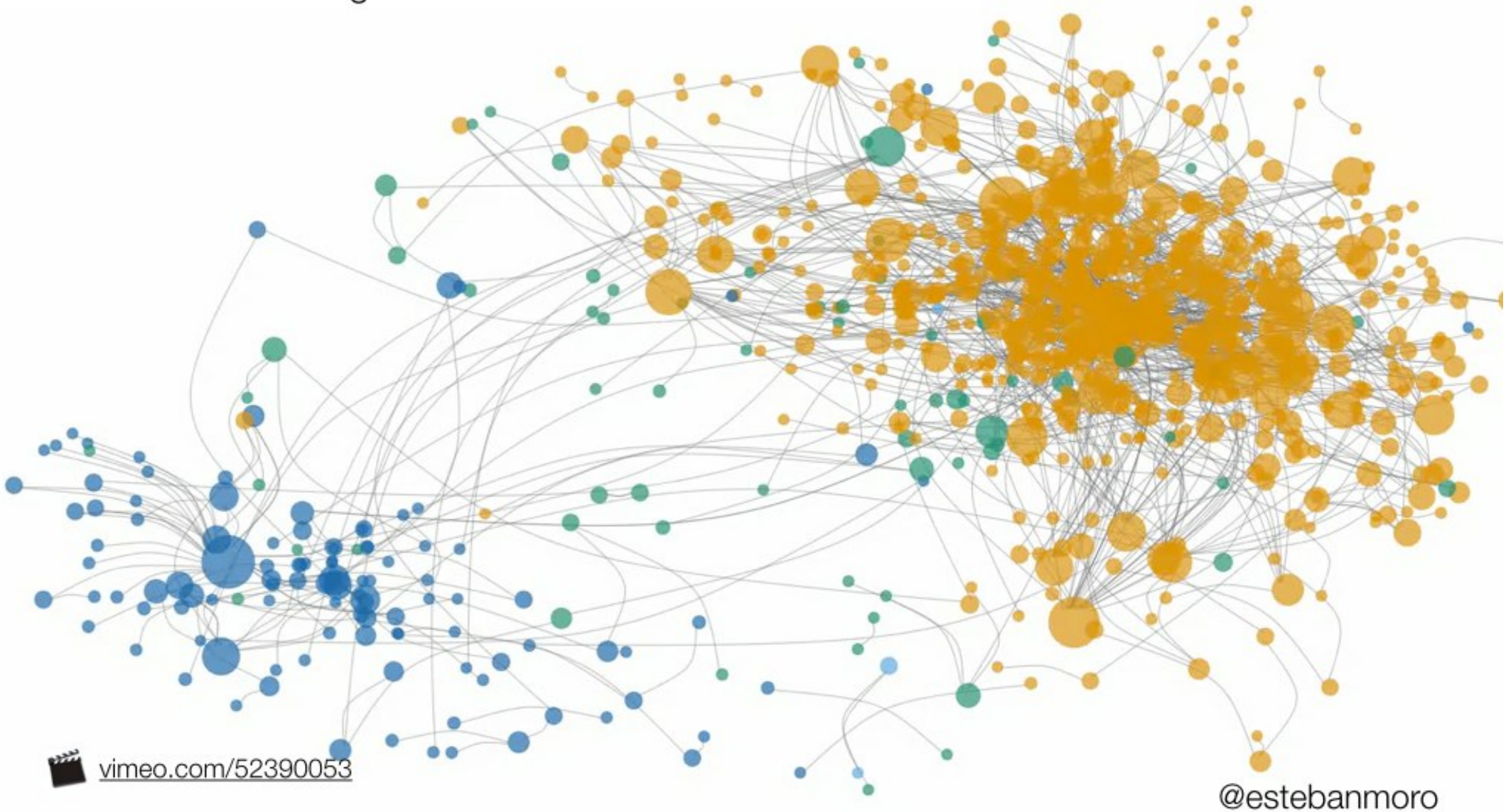
SOCL13

Motivation

How do we manage our social connections in time?



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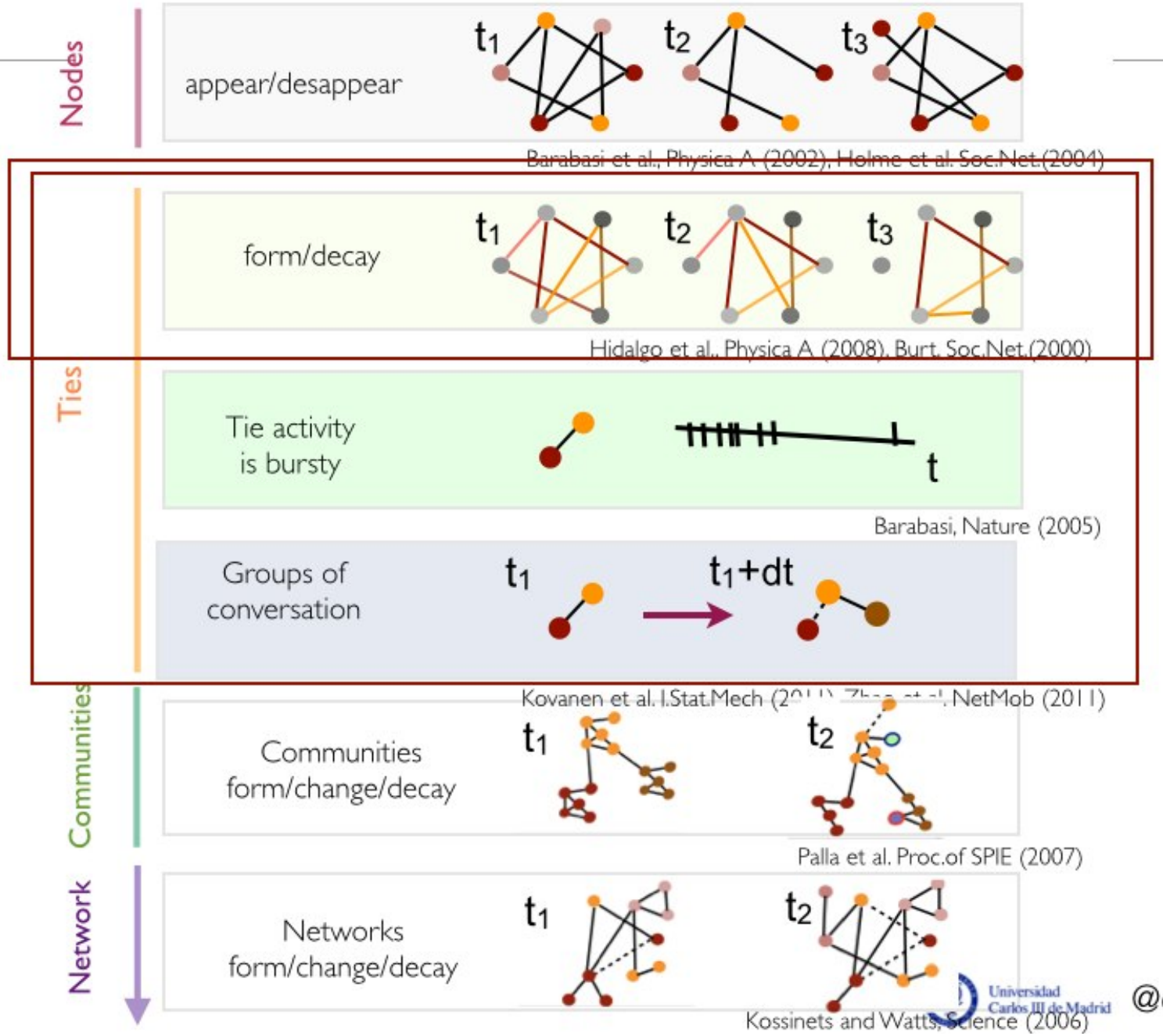
Dynamical processes on real networks



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Motivation

Which is the strategy behind tie formation/decay?

- **Node creation/decay**, growth of networks: Preferential attachment (coupled to node appearance)
  (Leskovec, Backstrom, Kumar & Tomkins '08)
- **Tie formation** (Rivera, Soderstrom, Uzzi '10)
  - Homophily
  - Reciprocity
  - Triadic closure
  - Proximity and Social Foci
  - ...
- **Tie decay** (Burt '00, '02)
  - Tie persistence: 40% of ties decay in one month (Hidalgo, Rodríguez-Sickert '08)

Tie formation/decay

- How many people you don't talk to anymore is in your contacts app?

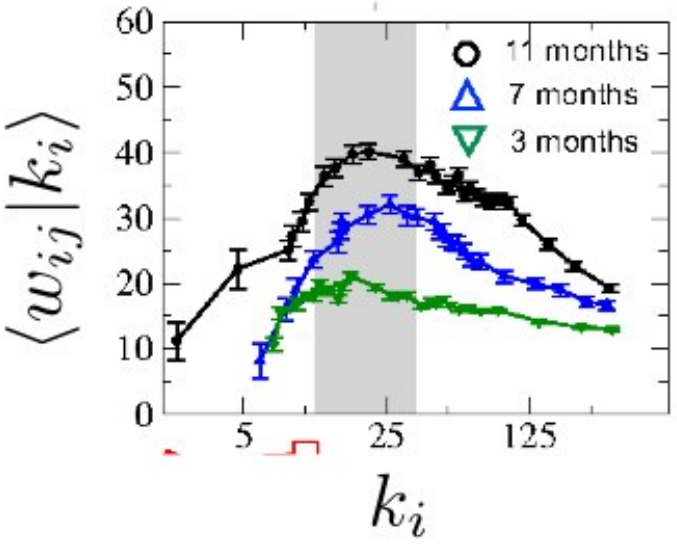
Attention economy

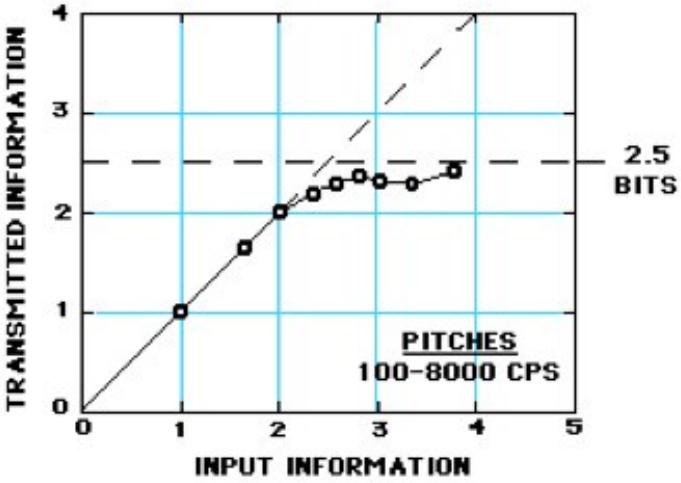
Limits to sociability

- Cognitive
  - Dunbar's number
    - There is a cognitive limit to the number of people with whom one can maintain stable social relationships. (Dunbar 1992)

      Miritello, G, Moro E, Lara R, Dunbar R.
      Social Networks (2013)

  - The magical number Seven Plus Minus Two
    - The number of objects an average human can hold in working memory is 7 ± 2 (Miller '56)





Limits to sociability

- Monetary and time costs

Questions

How do we **manage** our sociability dynamically?

Is there a **universal behavior** in human social strategies?

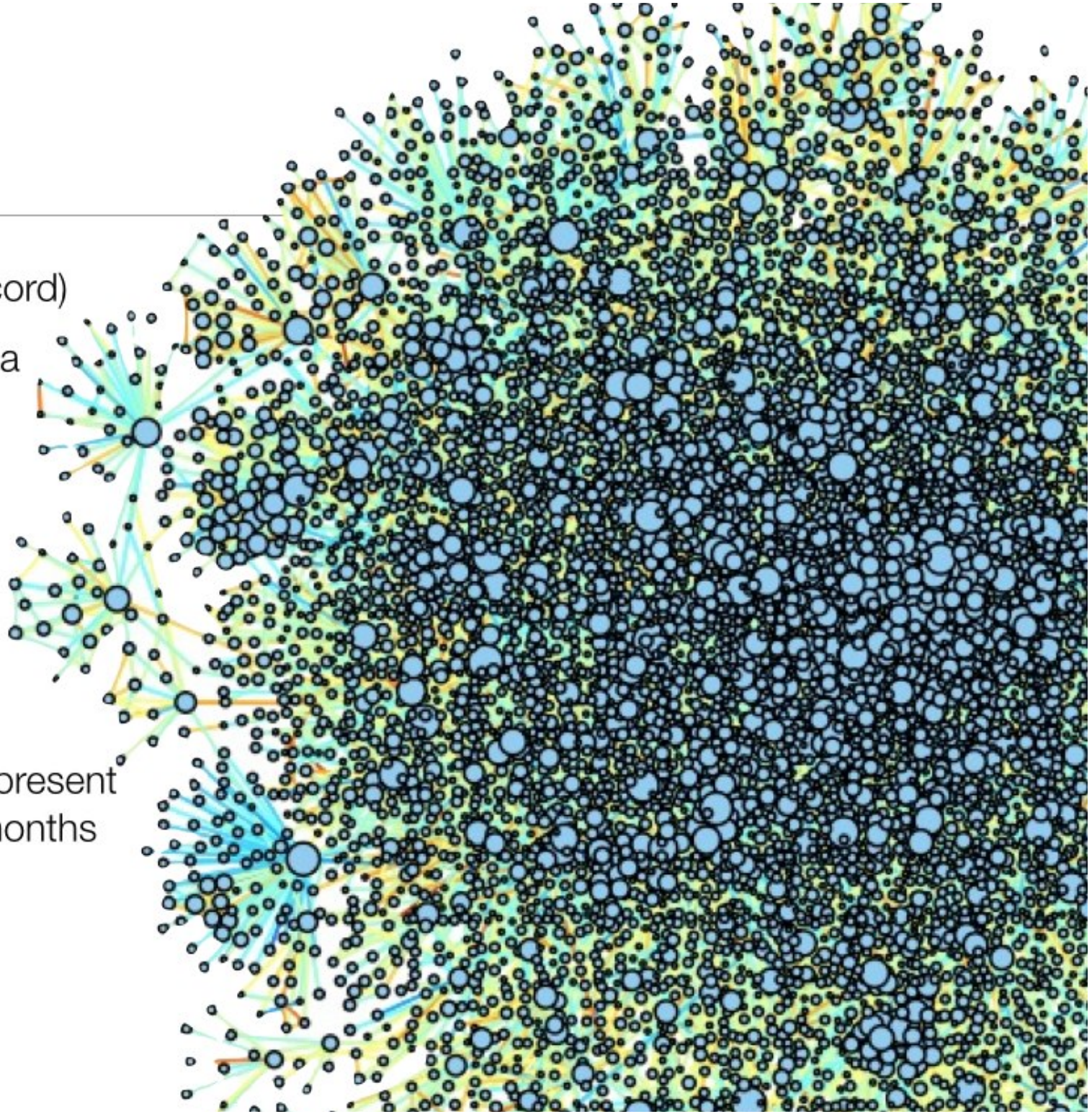
Do different strategies give any social **advantage**?

What are our dynamical social strategies?

1

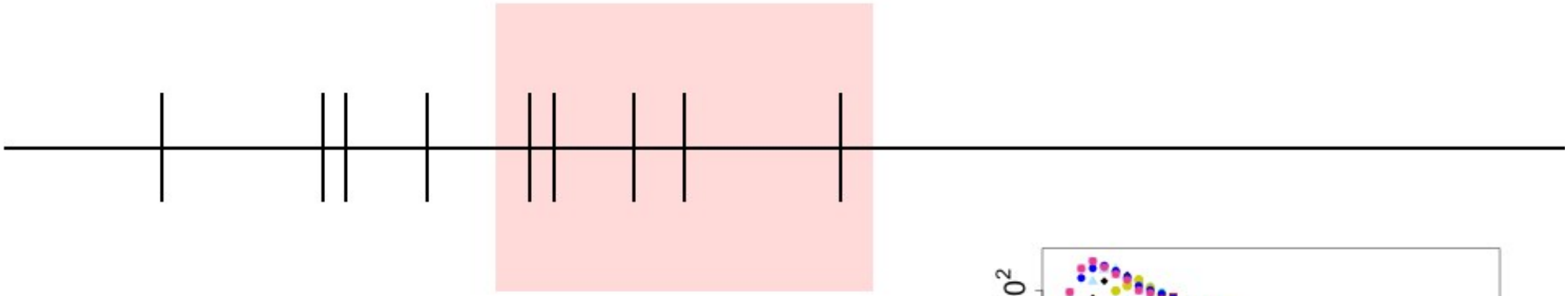
Data

- CDR (Call Detail Record)
  - 19 months of data
  - 23M people
  - 9000M calls
  - 700M ties
- Only reciprocal ties
- Only users who are present throughout the 19 months

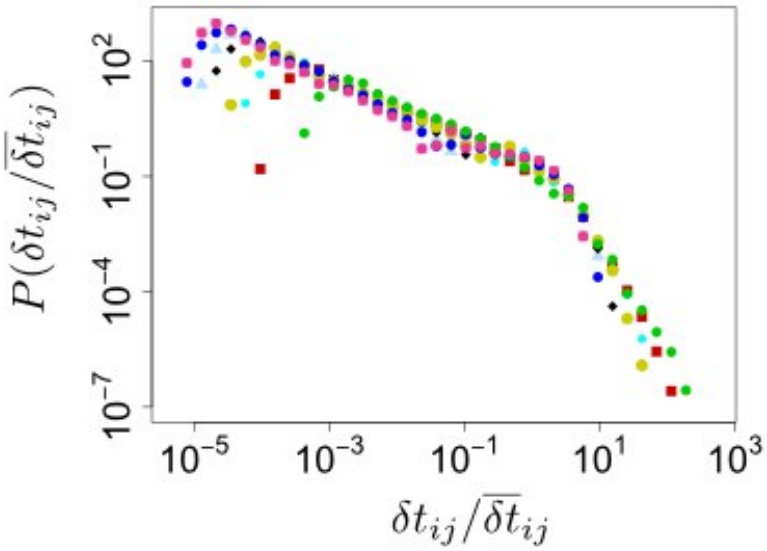


Detecting tie presence - formation/decay

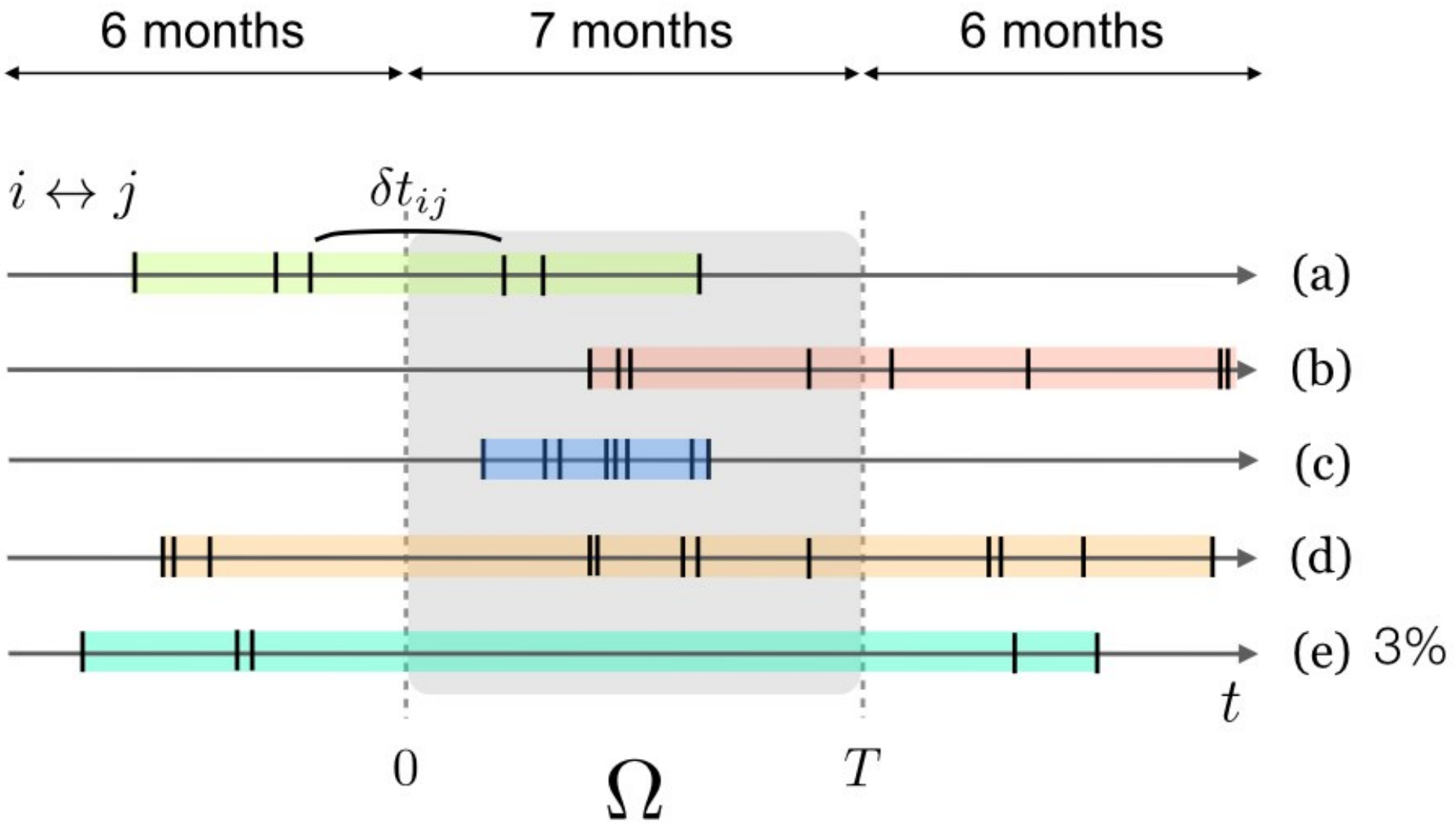
- The problem of detecting formation/decay of ties **is coupled** to the burstiness of interactions



Average interevent time: 14 days
20% of interevent times larger than 2 months



Disentangling bursty interaction from tie dynamics



(Egocentric) dynamical sociability

- Aggregated (revealed) connectivity

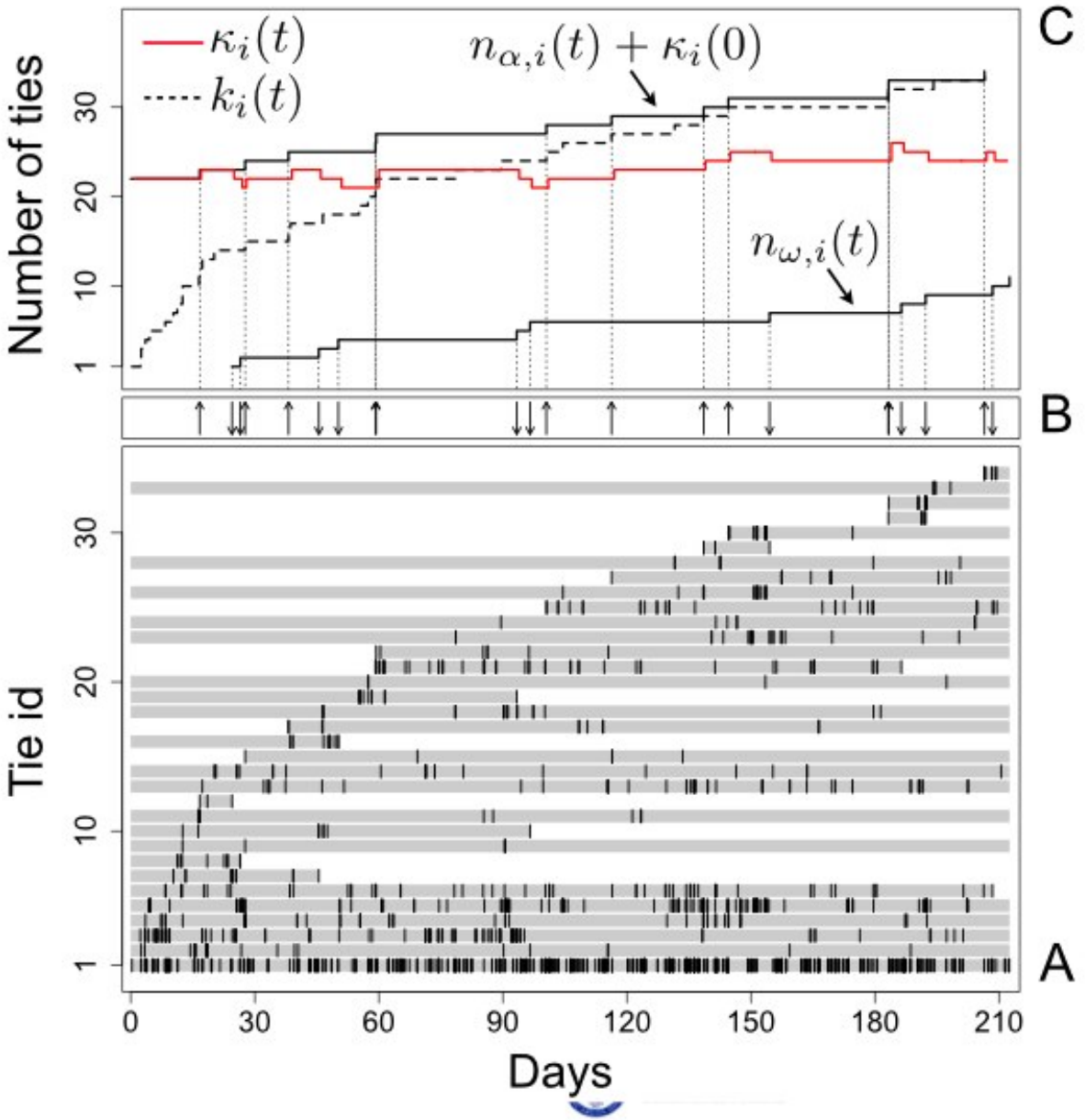
$$k_i(t)$$

- Social capacity

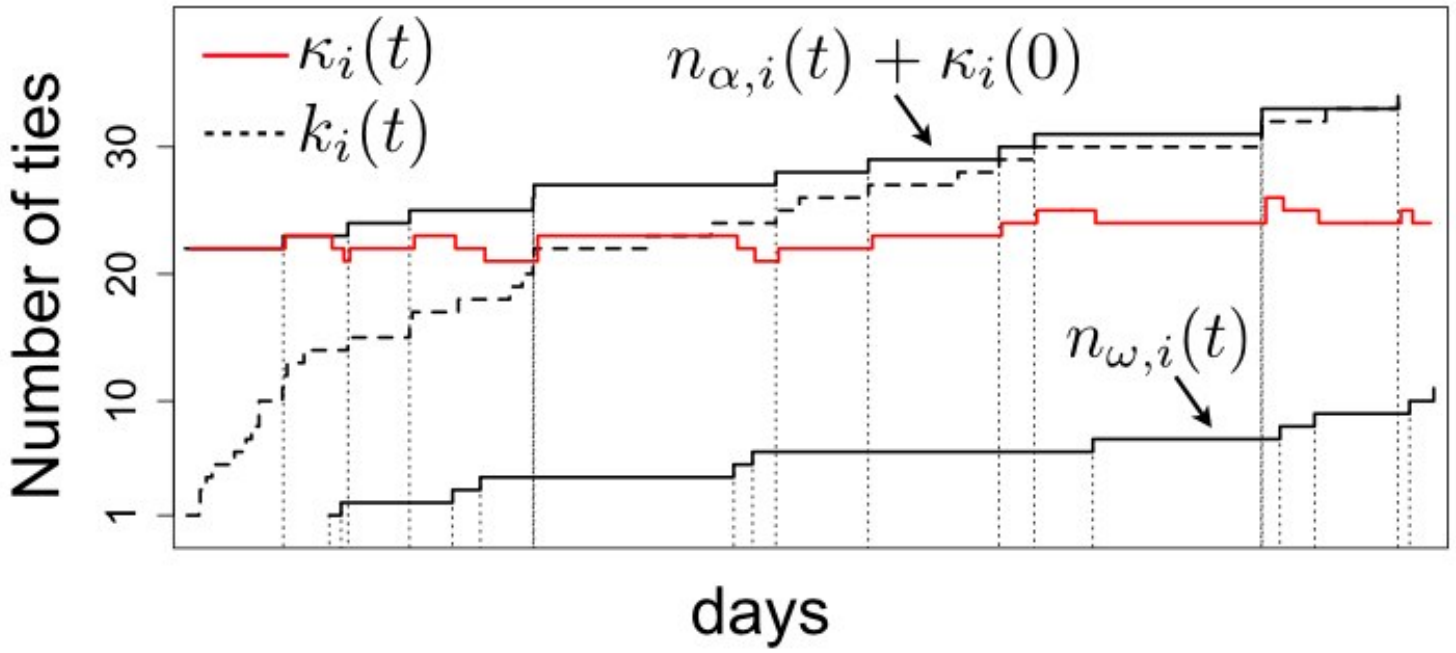
$$\kappa_i(t)$$

- Cumulative number of added/removed ties

$$n_{\alpha,i}(t) \quad \uparrow\uparrow\uparrow\uparrow$$
$$n_{\omega,i}(t) \quad \downarrow\downarrow\downarrow$$



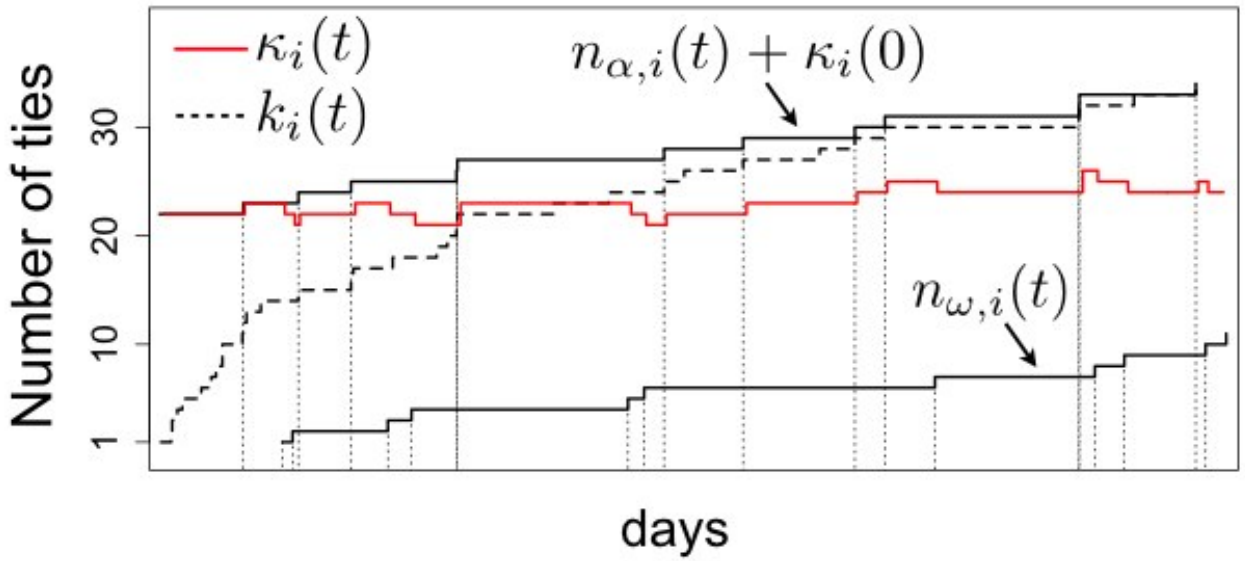
Dynamical social strategy

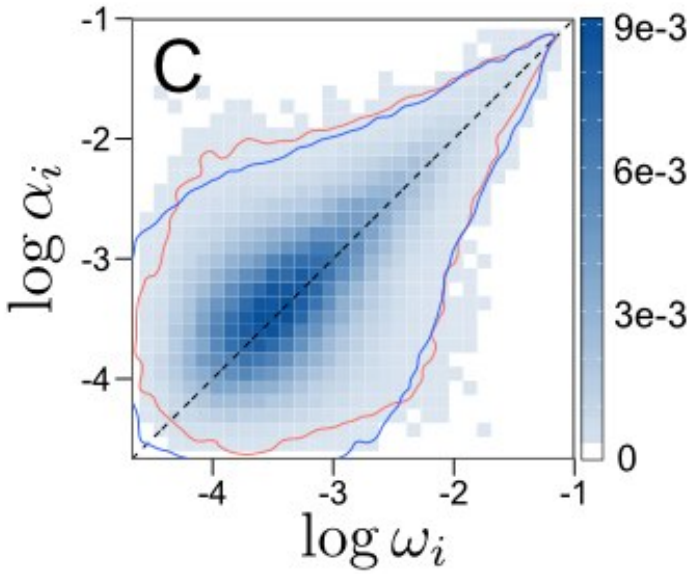


- Very heterogeneous tie evolution
  - Mean $\langle n_{\alpha,i} \rangle \simeq \langle n_{\omega,i} \rangle \simeq 8 \quad \langle k_i \rangle \simeq 16$
  - But $n_{\alpha,i} > 15$ for 20% of nodes
  - Aggregated connectivity typically overestimates sociability by 100%

Dynamical social strategy

- Linear tie formation/decay evolution





- For 80% of users we find

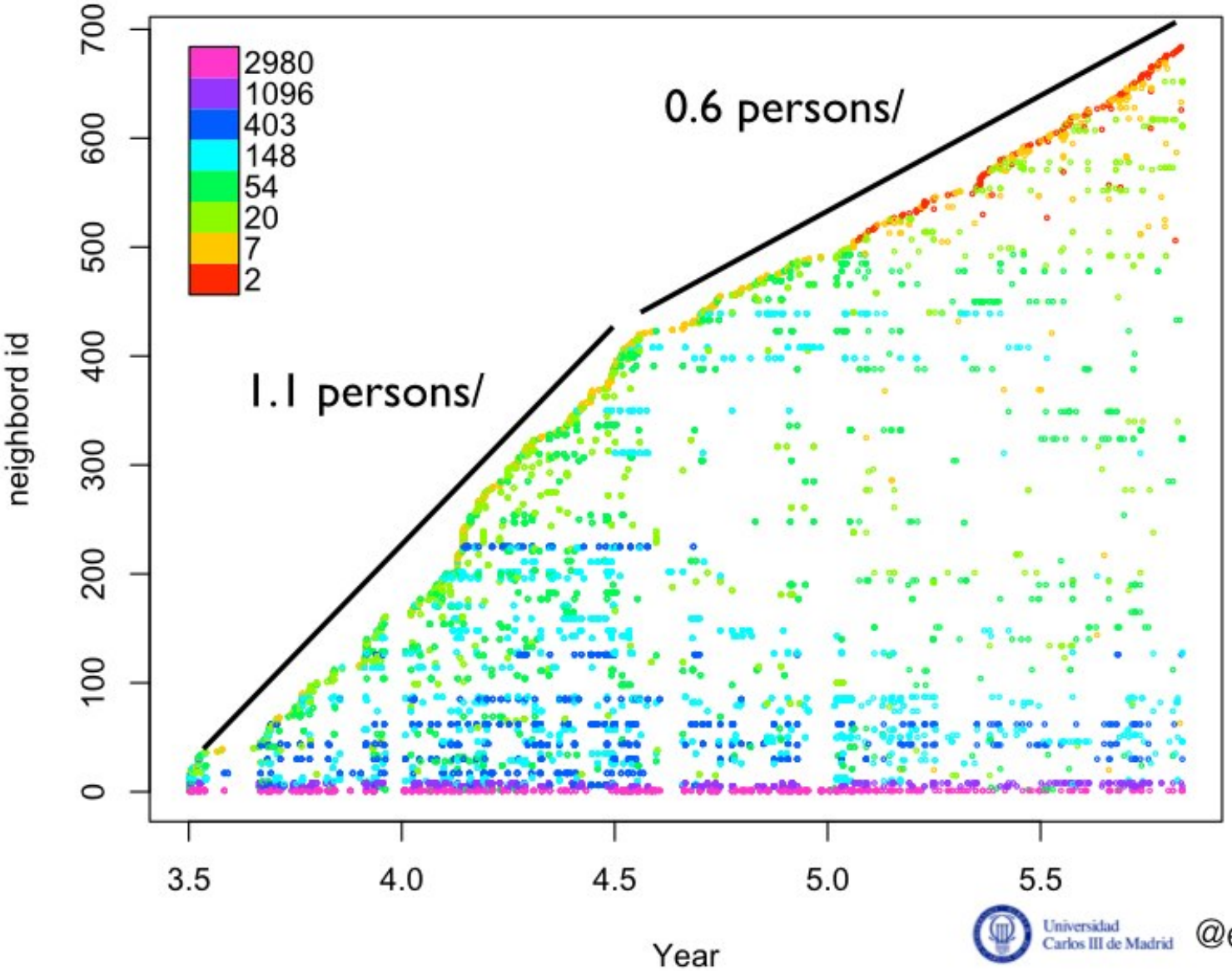
$$n_{\alpha,i}(t) \simeq \alpha_i t \qquad n_{\omega,i}(t) \simeq \omega_i t \qquad \alpha_i \simeq \omega_i$$

- Thus $\kappa_i(t) \simeq \kappa_i(0)$

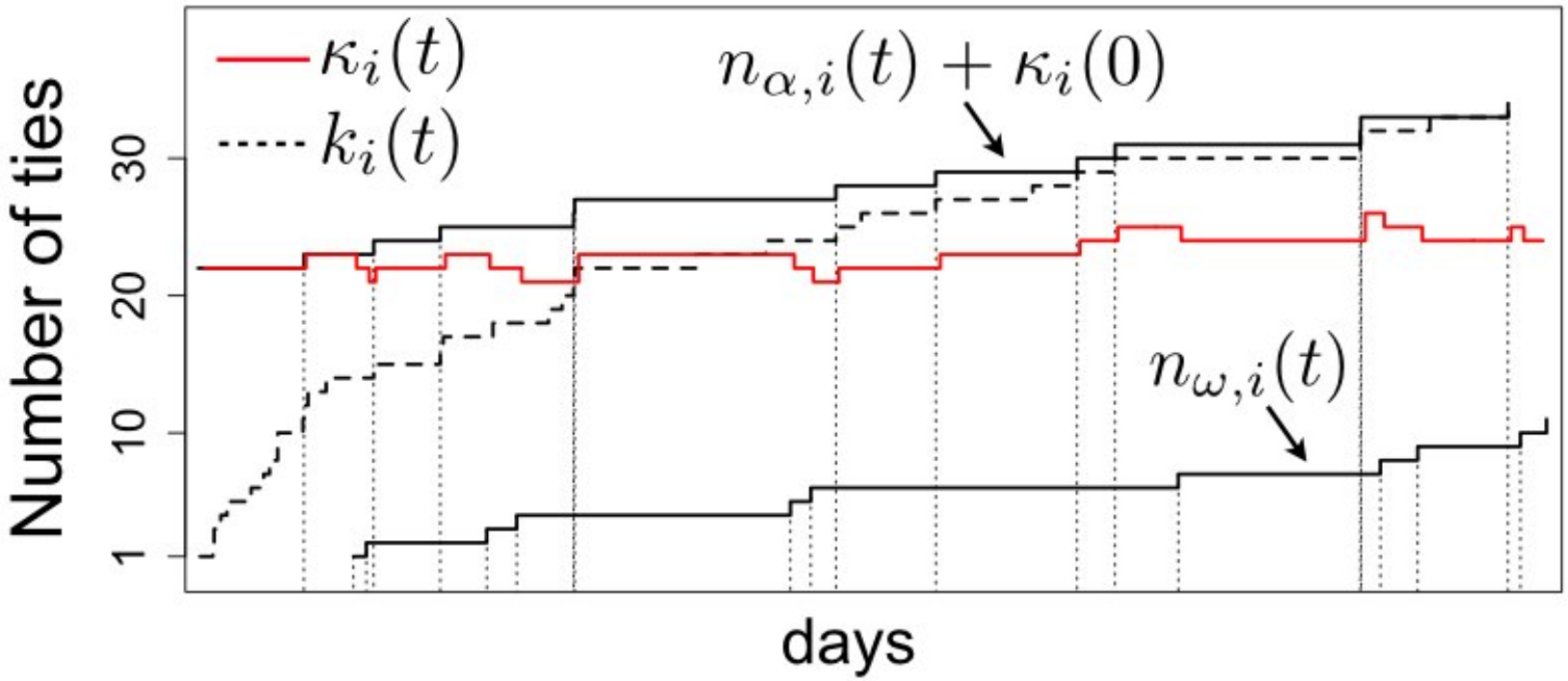
Social capacity is conserved (!)

Dynamical social strategy

- Linear tie formation/decay evolution



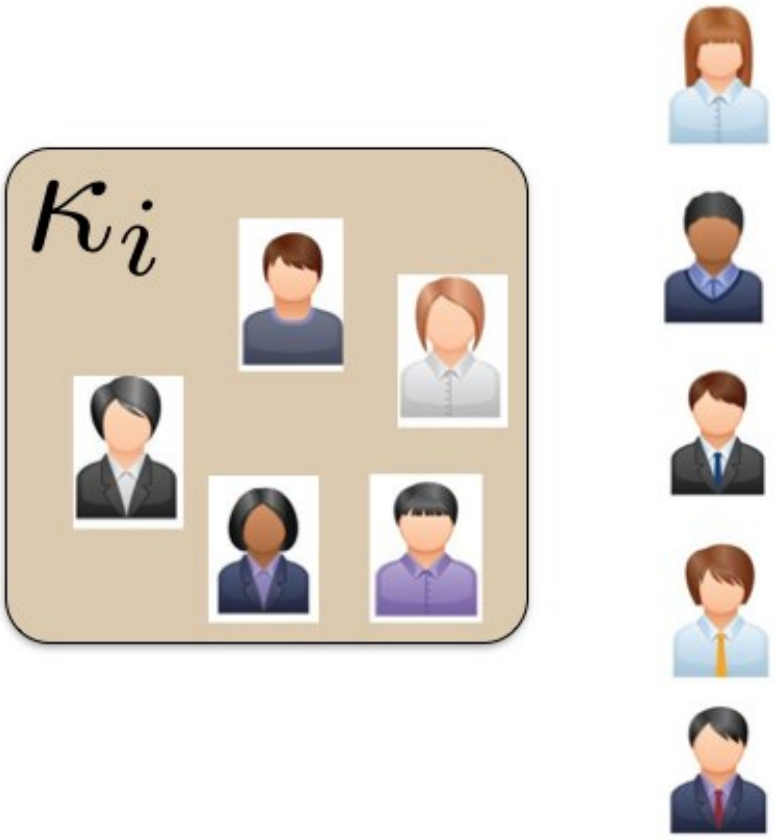
Dynamical social strategy



$$k_i \simeq \overline{\kappa}_i + n_{\alpha,i}$$

Connectivity = Capacity + Activity

Dynamical social strategy

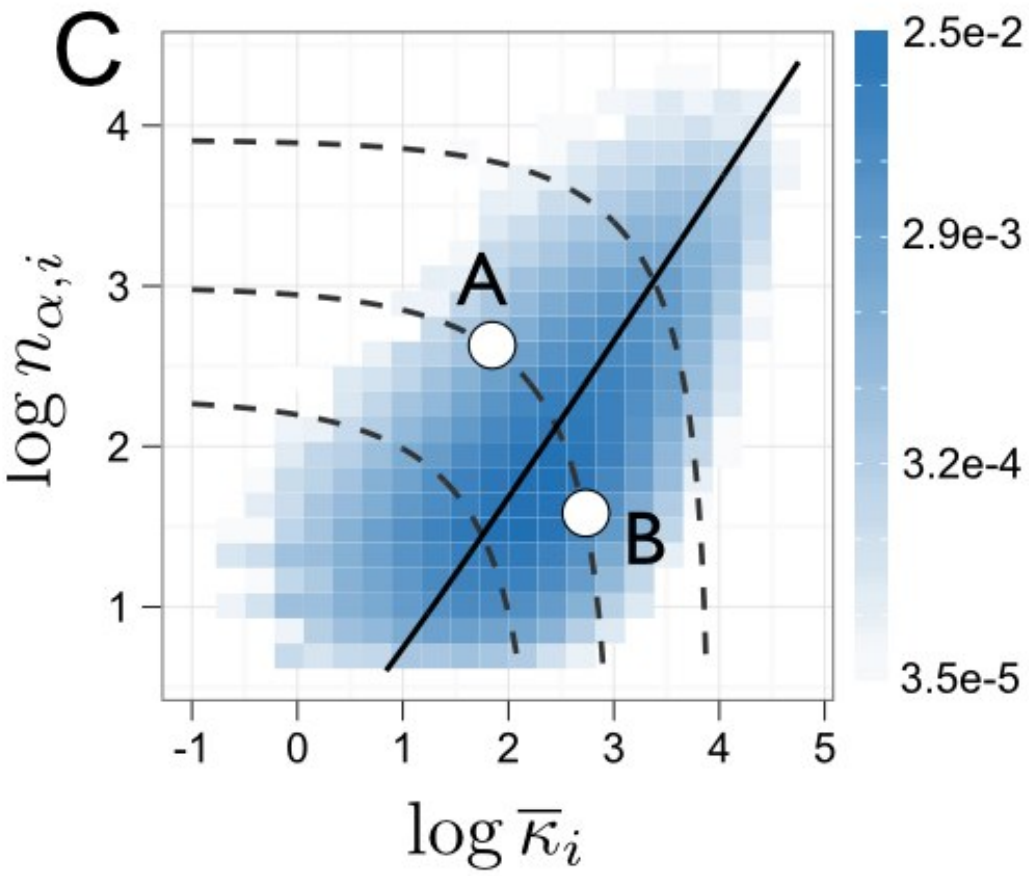


Characterizing dynamical social strategies

- Social capacity and activity are not independent

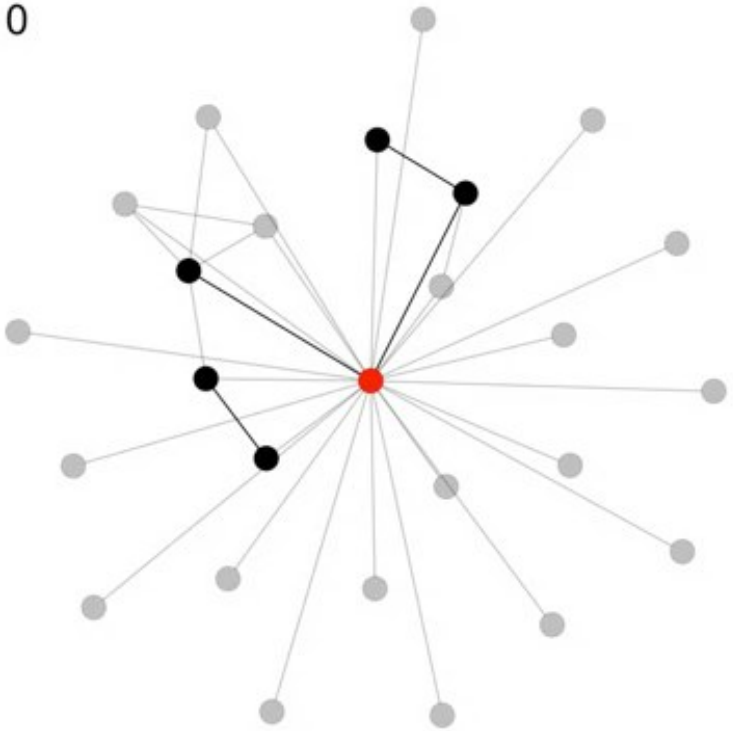
$$n_{\alpha,i} \propto \overline{\kappa}_i$$

- For a given k_i we have
  - Social explorers **(A)** $n_{\alpha,i} \gg \overline{\kappa}_i$
  - Balanced **(-)** $n_{\alpha,i} \simeq \overline{\kappa}_i$
  - Social keepers **(B)** $n_{\alpha,i} \ll \overline{\kappa}_i$



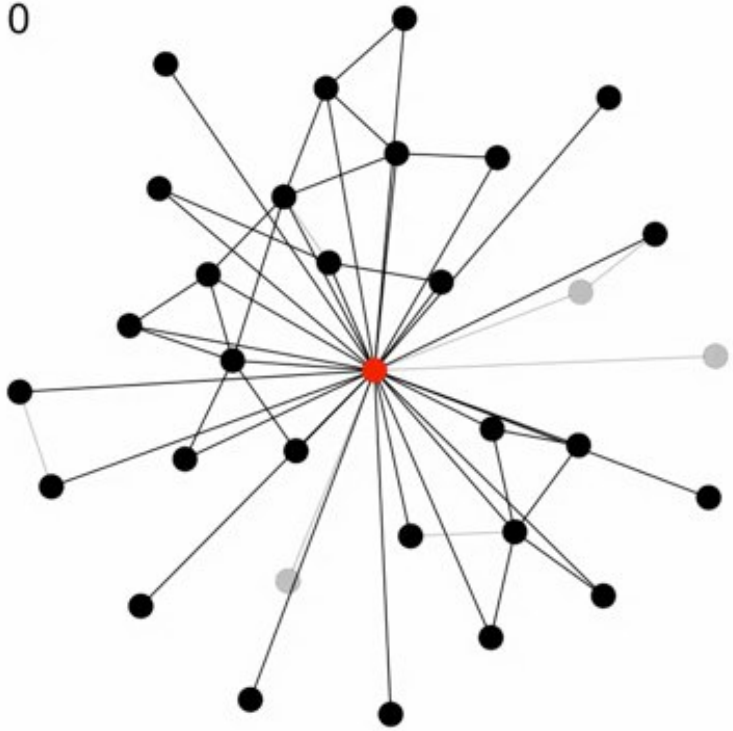
Miritello, Lara, Cebrián and EM
Scientific Reports 3, 1950 (2013)

Characterizing dynamical social strategies



$n_{\alpha,i} = 23, \overline{\kappa}_i = 4$

Social explorer



$n_{\alpha,i} = 3, \overline{\kappa}_i = 24$

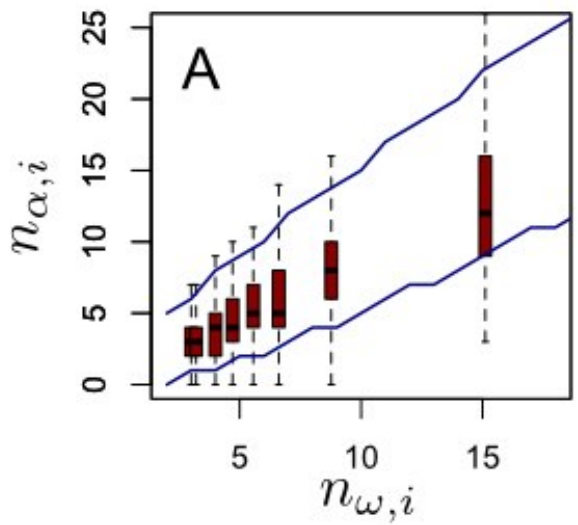
Social keeper

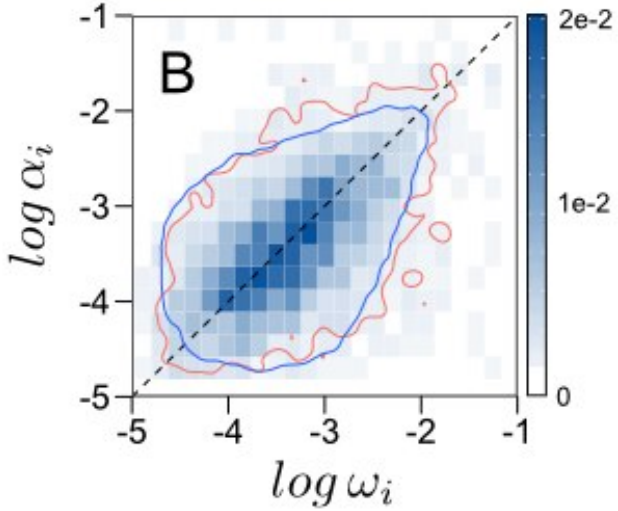
Comparison to other social networks

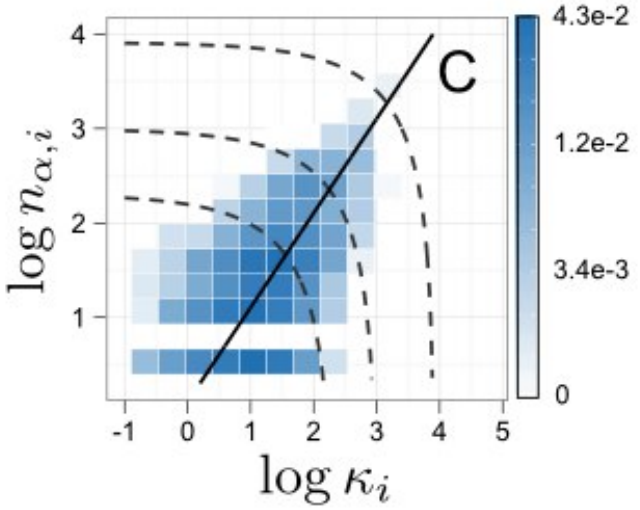
- Characterization of dynamical social strategies for 6 months of time

SocNet	N	$\langle k_i \rangle$	$\langle \overline{\kappa}_i \rangle$	$\langle n_{\alpha,i} \rangle$
Phone calls	20M	16	8	8
Facebook wall [1]	10k	8	3	5

[1] B. Viswanath et al. 2009



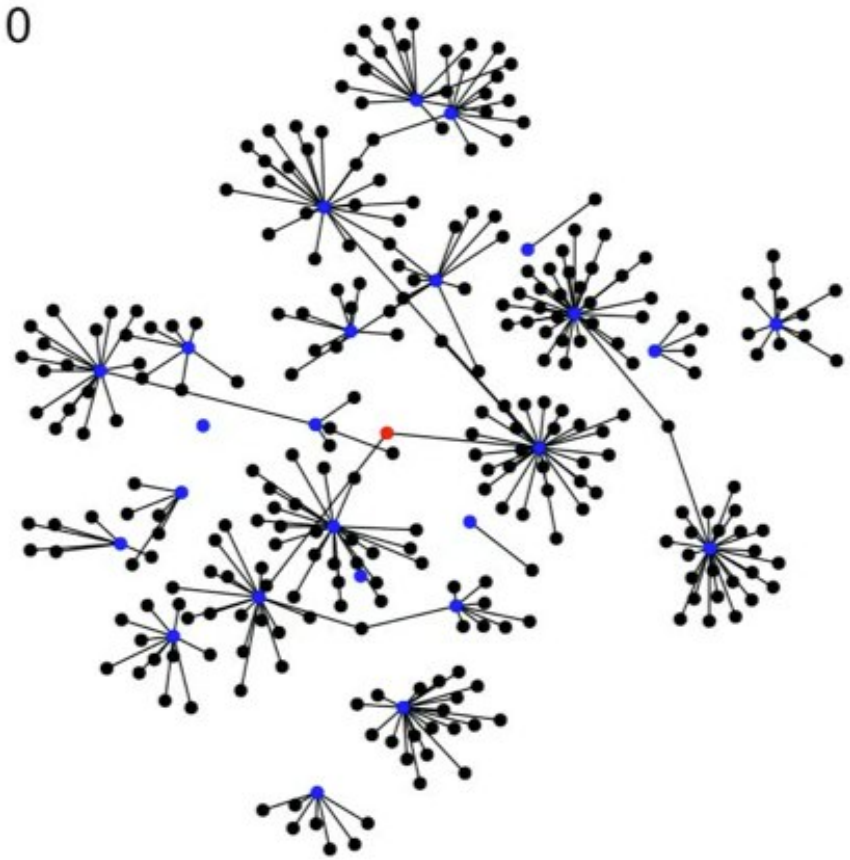




Properties of dynamical social strategies

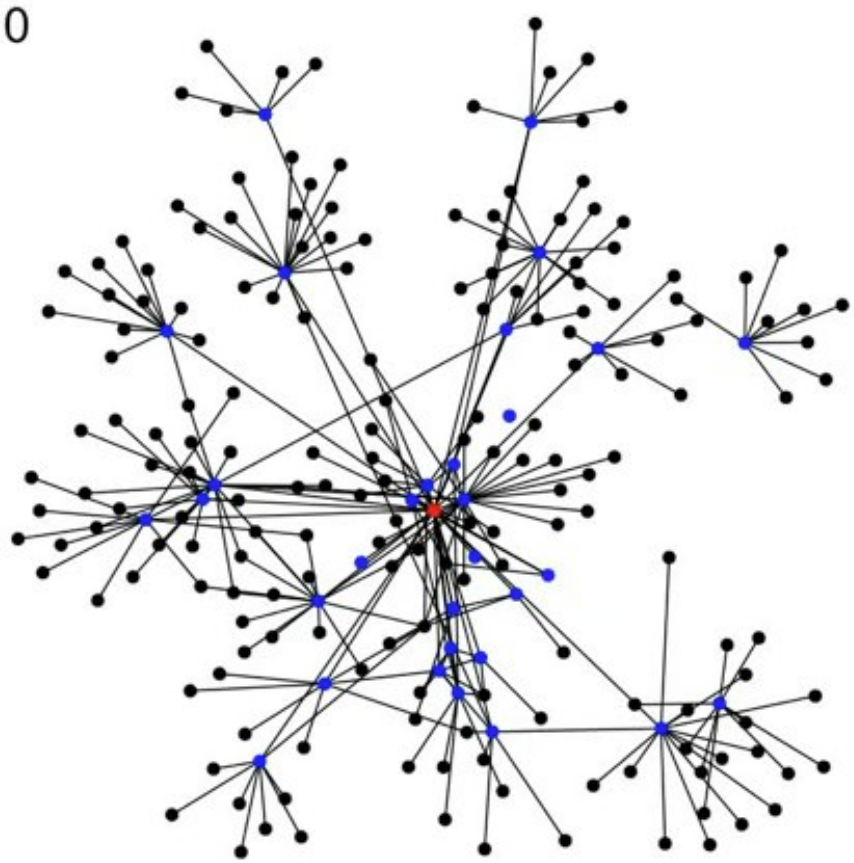
2

Social strategies are assortative



Social explorer

https://vimeo.com/65257905



Social keeper

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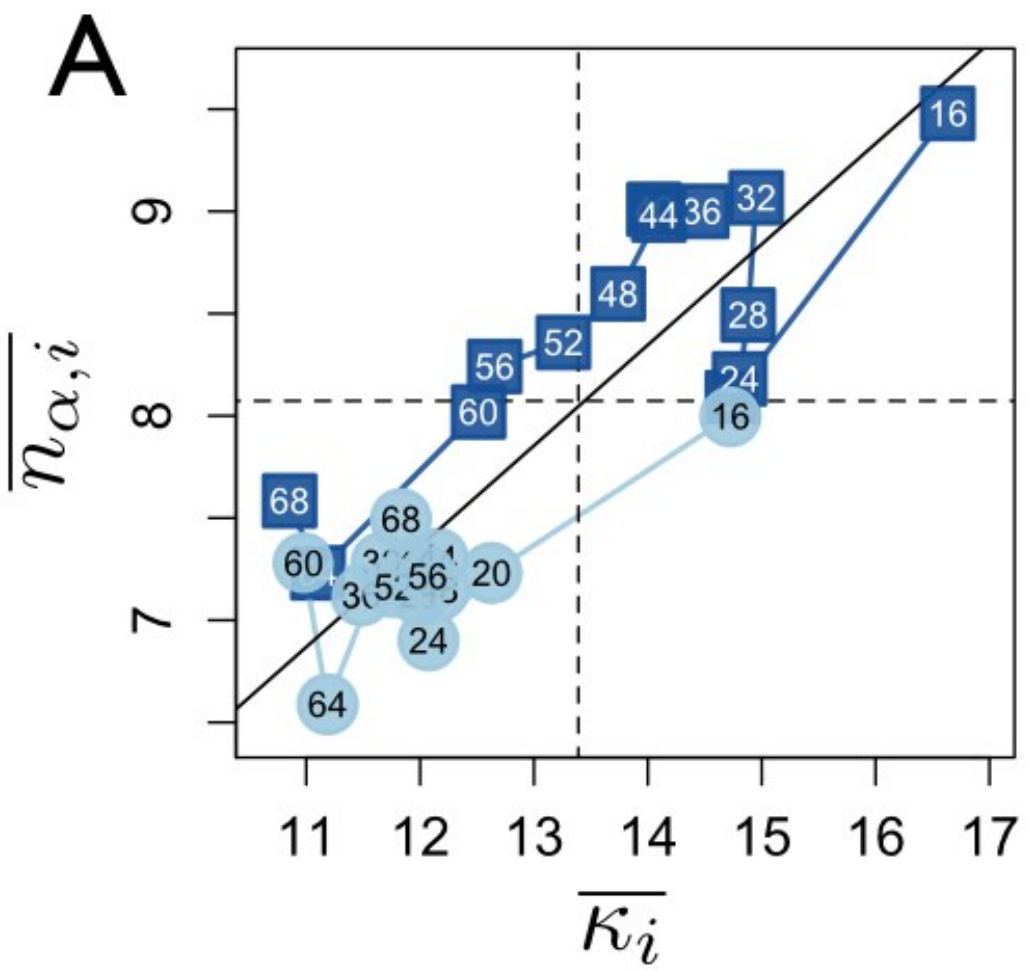
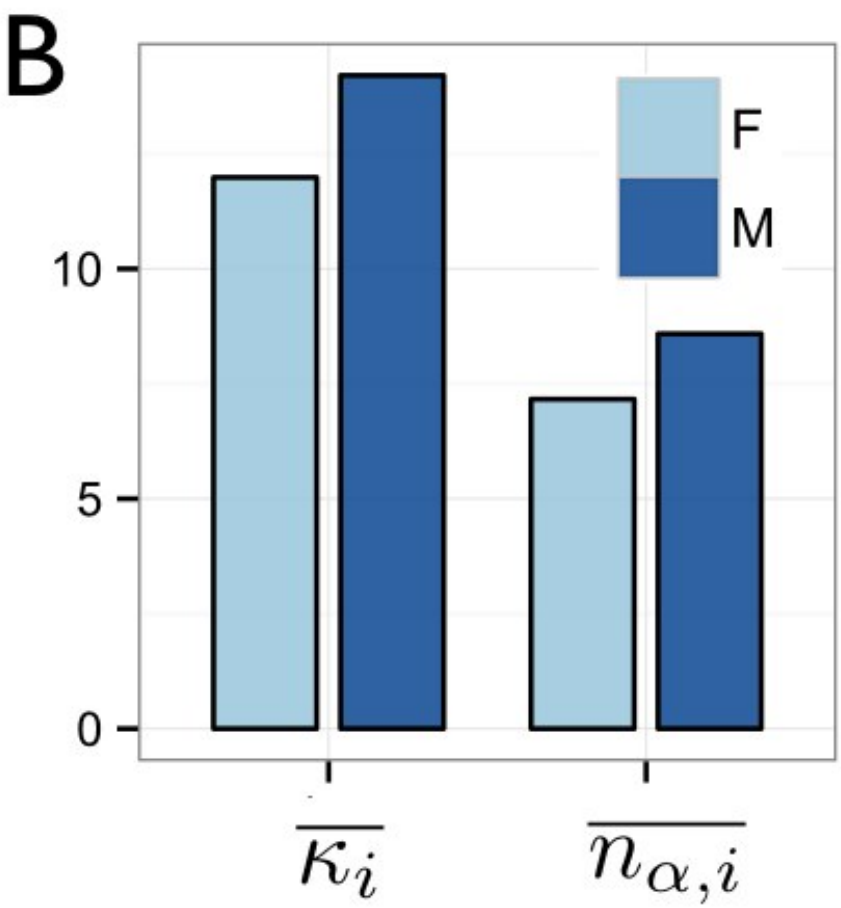
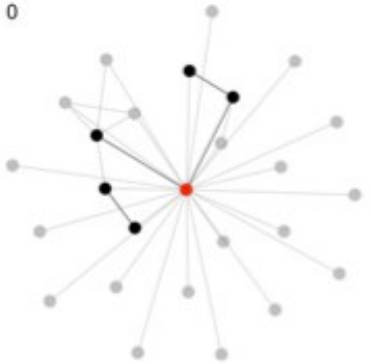
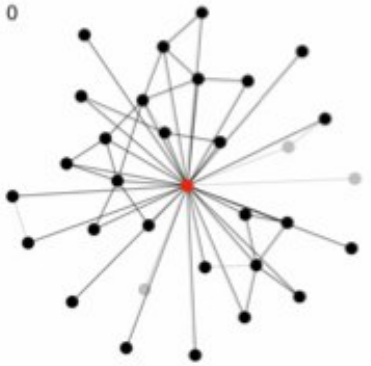
Social strategies demographics





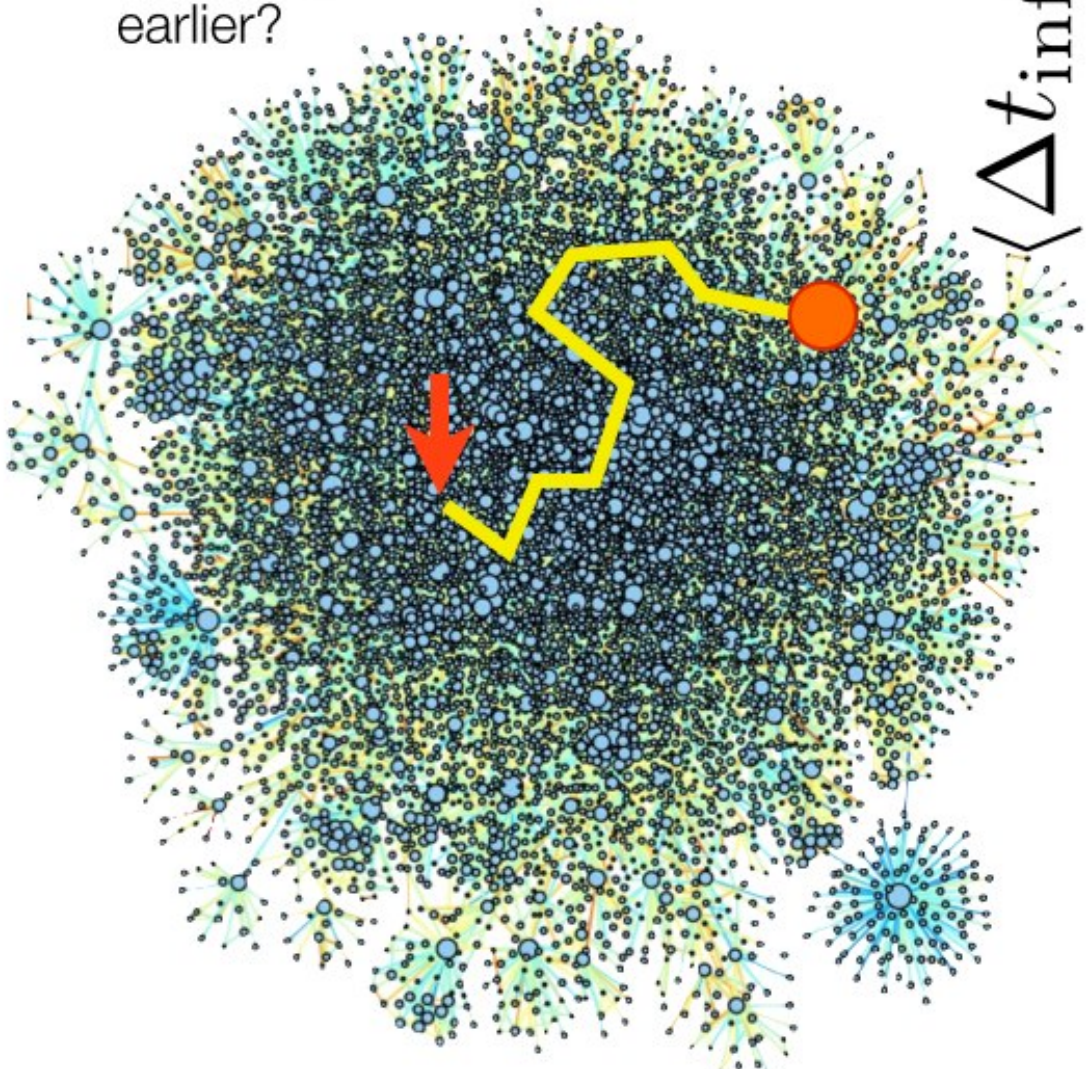
Miritello, Lara, Cebrián and EM
Scientific Reports 3, 1950 (2013)

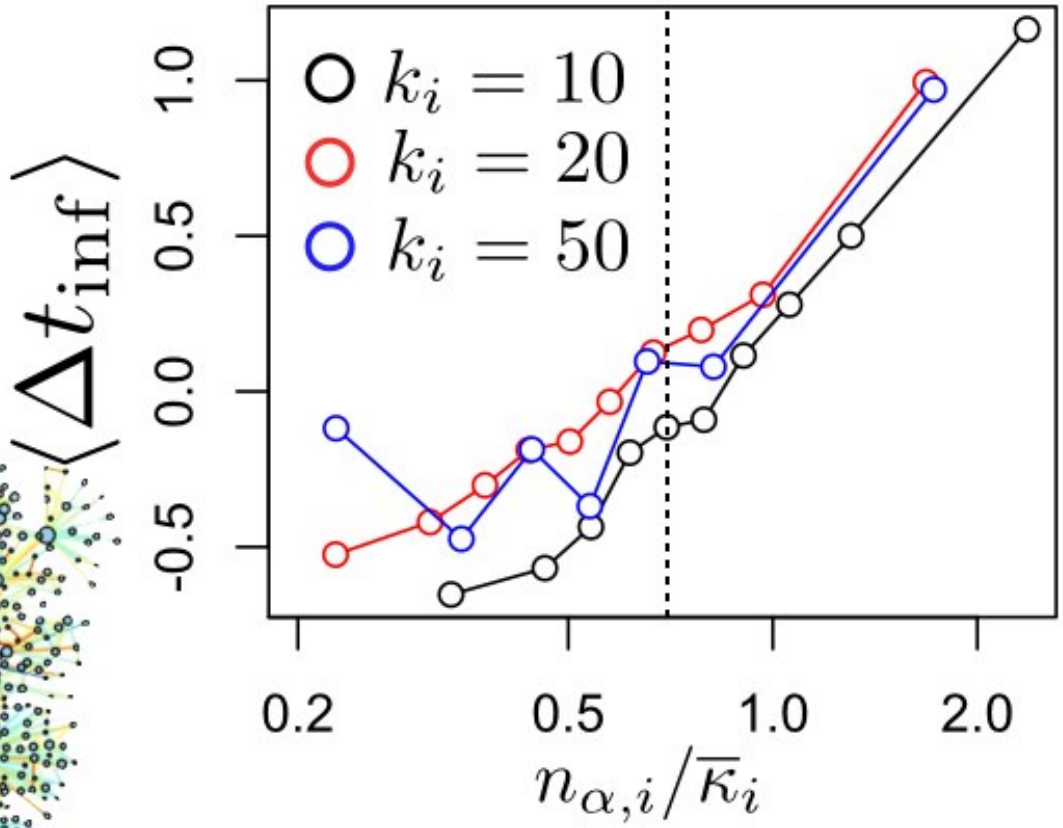
Social strategies and economical status

Urban / Wealthy Areas	More social explorers	
Rural / Poor Areas	More social keepers	

Information awareness

- Does social strategies give any advantage to receive information earlier?





Social keepers received information before

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12
1
2
3
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7
8
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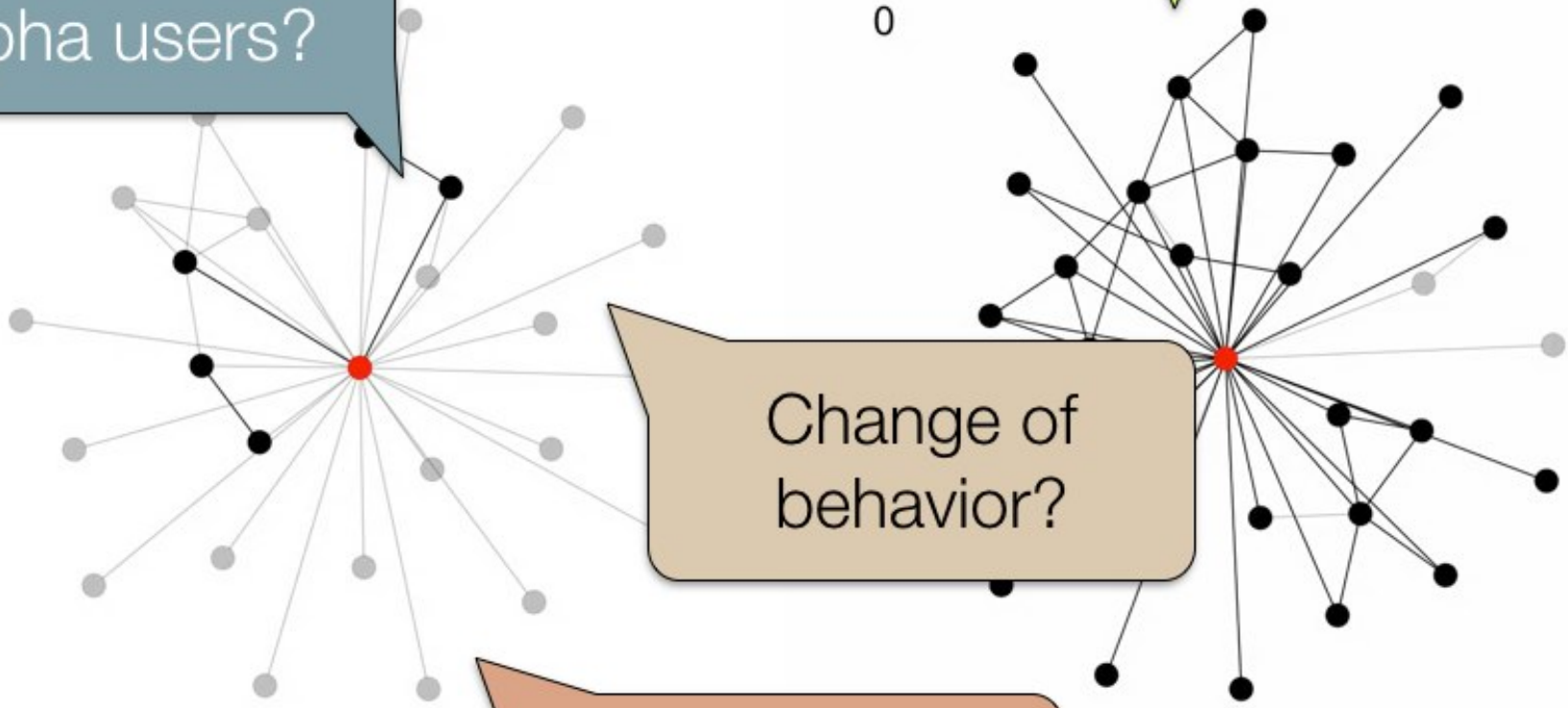
10
11
ASSIGNMENTS
REST/PLAY
LUNCH
LECTURES
READ BOOK
MEDITATION
DEVOTION
BREAKFAST
LECTURES
SOLVE PQs
LECTURES
J23RF

Outlook 3

Outlook

Early adopters / alpha users?

Which one is more influential?



Change of behavior?

What is their social / structural role? Temporal/static bridges

$n_{\alpha,i} = 23, \overline{\kappa}_i =$ $= 3, \overline{\kappa}_i = 24$

Social explorer ocial keeper

Summary

Miritello, Lara, Cebrián and EM
Scientific Reports 3, 1950 (2013)

- **There is no such a thing as static social connectivity**
  Observed connectivity is a result of
  - Social Capacity
  - Social activity
  - An thus depends on: time window, data, definition of links, etc.
- Users have different dynamical social strategies
  - **Social explorers** (activity >> capacity)
  - Social balanced (activity = capacity)
  - **Social keepers** (activity << capacity)

Which one are you?

- Dynamical social strategies are assortative and change with age
- Best strategy to get aware of information is to be a social keeper

check your strategy at...

soctrategy.org

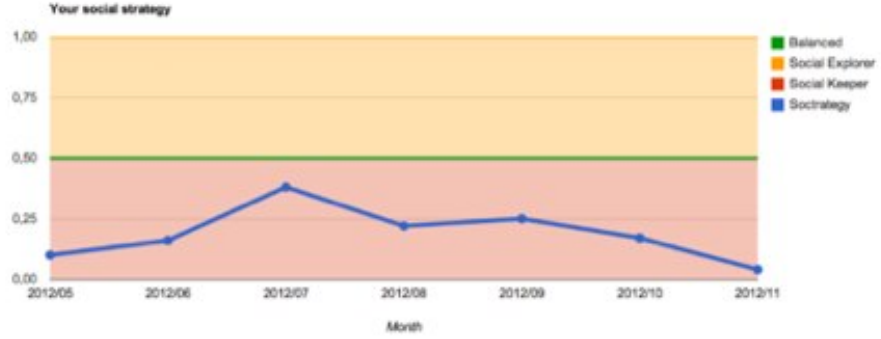
SOCTRATEGY.ORG

Soctrategy

Soctrategy.org is a beta online application to check your social strategy on Facebook.

Are you a **social explorer**? This means you are always looking for new people, new sources of information, new people to talk...

Or are you a **social keeper**? You have a closed circle around you, not only in your real life but also in Facebook.



Your **social strategy** is a mood: sometimes you need to explore the limits of your social network to get new friends, new contacts, new conversations. But our social capacity is limited [1] and we maintain a nearly constant number of conversations. Soctrategy shows the evolution of your strategy and tells you when you are a **keeper** or an **explorer**.

“Attention is the rarest and purest form of generosity.”

Simone Weil

Book

- How two people communicate
  - Detect link decay
- How people allocate their time across their social relationships
  - Find your “best” friends
- How people manage their sociability? Social strategies?
  - Detect social behaviors