Towards empirically more realistic models of opinion dynamics

BEHAVE

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Presentation @ BEHAVE opening workshop

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Social influence

The tendency to alter one's opinions, attitudes, beliefs, or customs, to more closely resemble those of influential others

- Conformity experiments (e.g. Asch)
- Small group research (e.g. Sheriff)
- Persuasion studies (e.g. Myers)
- Innovation diffusion (e.g. Rogers)
- Mass media research (e.g. Katz & Lazarsfeld)
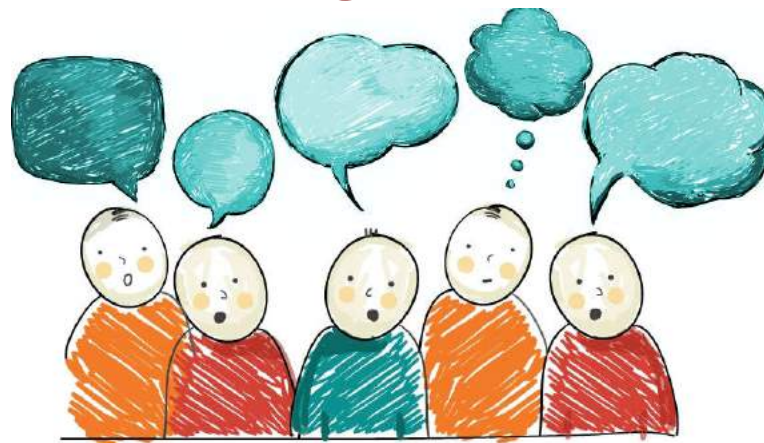
Local convergence and global diversity:
Kissing in France (just one example)

Kissing business acquaintances
X, XXX or XXXXX?

When you greet a friend, how many times do you kiss?

Once
Twice
Three times
Four times
Five times
(18% of Corsica)
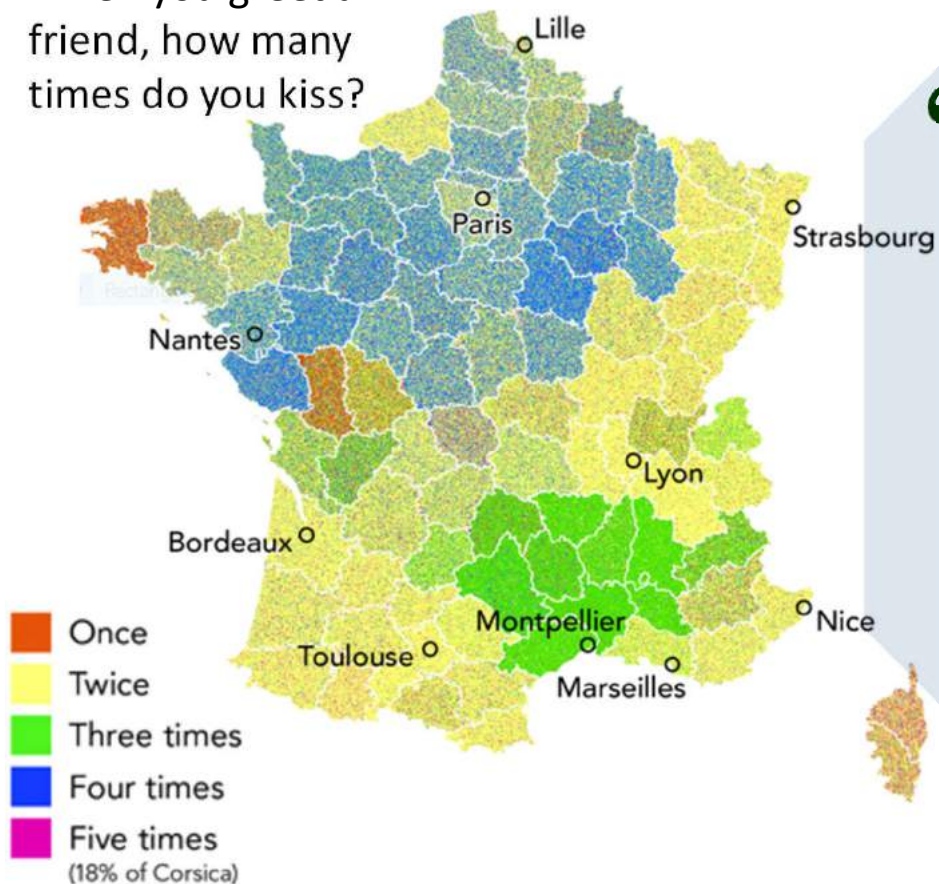
> **"** A colleague tells of a friend who found himself on the border between a three- and a two-kiss stronghold. In his words, the number of times you were expected to touch cheeks literally depended on which way you turned when leaving the house in the morning. **"**

Polarization in political opinions among politically engaged in the U.S.

Data Pew Research Center (2014)
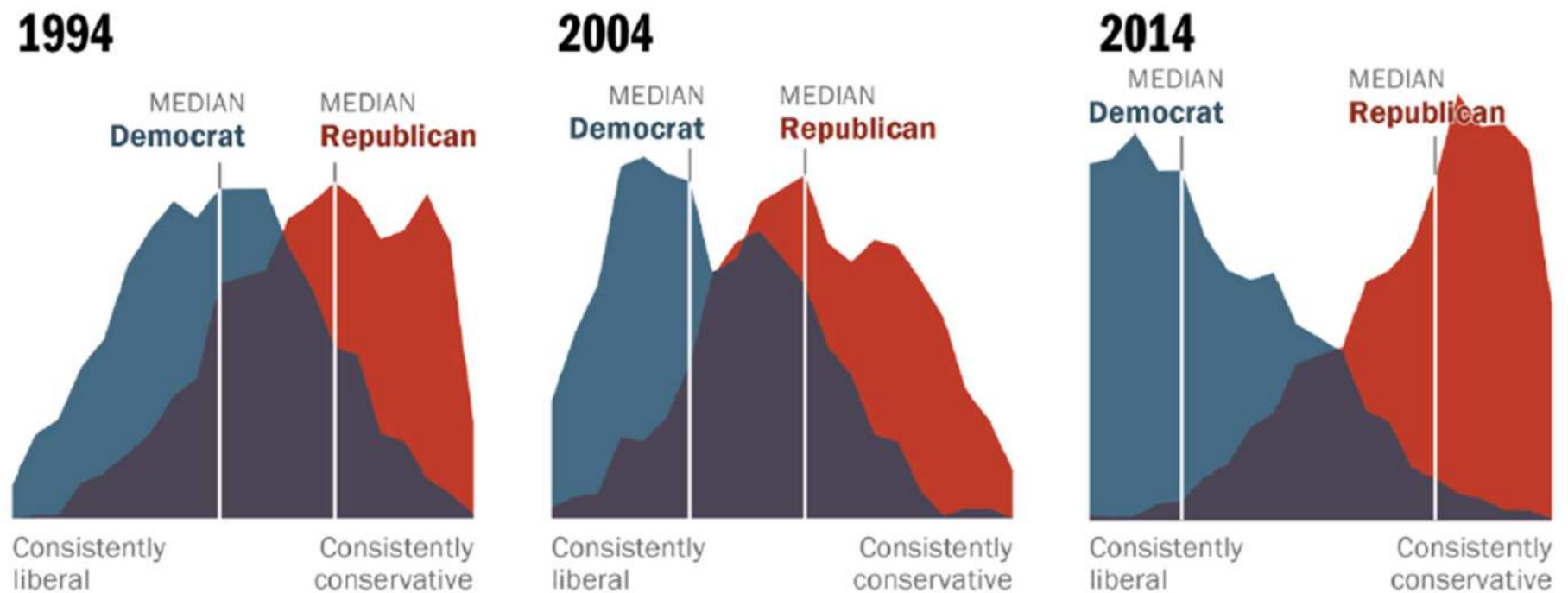
Source: Gentzkow (2016). Polarization in 2016. Stanford University
See also: DiMaggio et al. 1996, Evans 2003, Fischer et al (2009)

How reconcile social influence at micro-level with diversity at macro-level?

Axelrod's puzzle (1997)

" If people tend to become more alike in their beliefs, attitudes, and behavior when they interact, why do not all such differences eventually disappear? "

Abelson's puzzle (1964)

" What on earth one must assume in order to generate the bimodal outcome of community cleavage studies? "

- Axelrod, R. (1997). The dissemination of culture a model with local convergence and global polarization. *Journal of Conflict Resolution*, 41(2), 203–226.
- Abelson, R. P. (1964). Mathematical models of the distribution of attitudes under controversy. In N. Frederiksen & H. Gulliksen (Eds.), *Contributions to mathematical psychology* (pp. 142–160). New York: Holt, Rinehart & Winston.

Classical models of social influence in networks
(e.g. French, Abelson, Harary, Lehrer & Wagner,…)

Assimilative Influence:
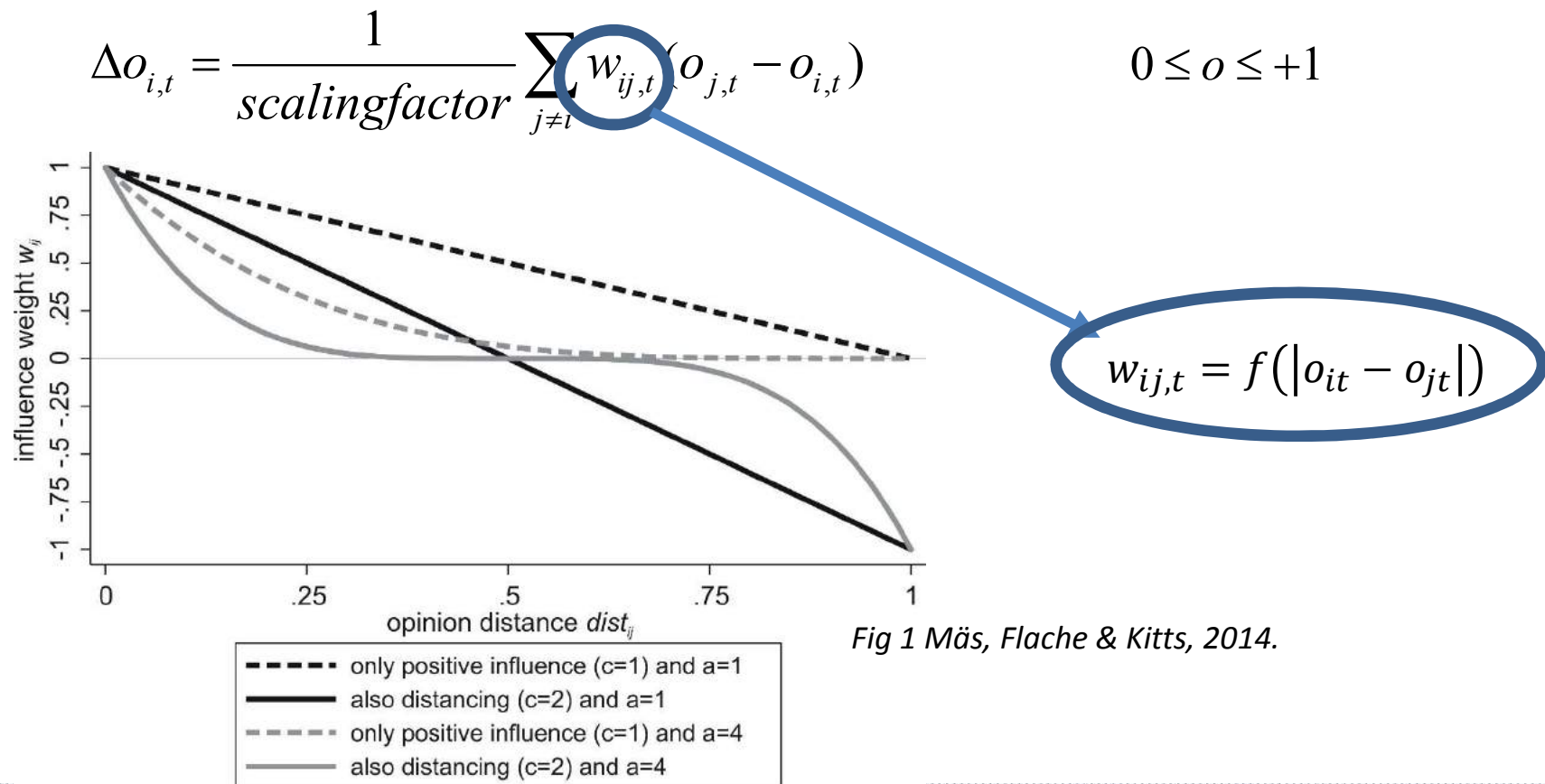move towards opinion of network neighbors
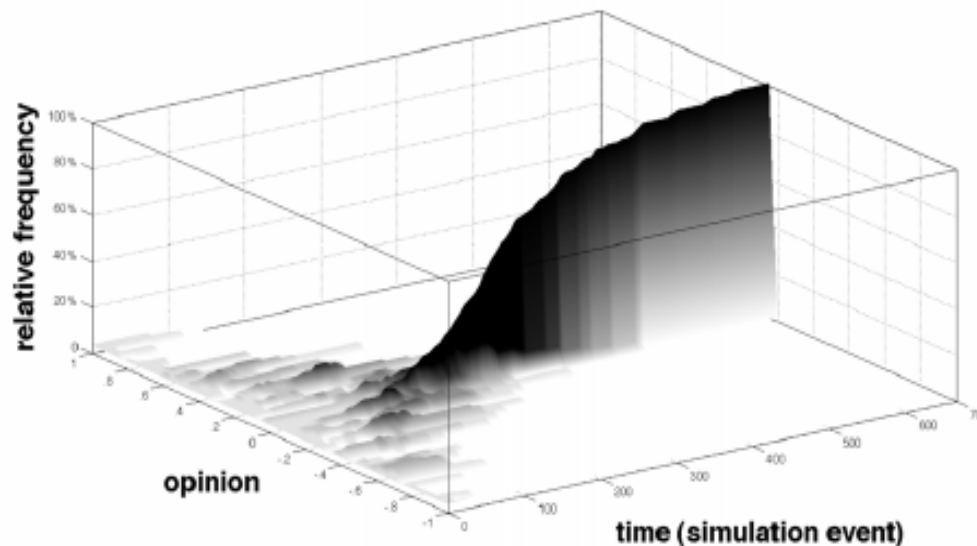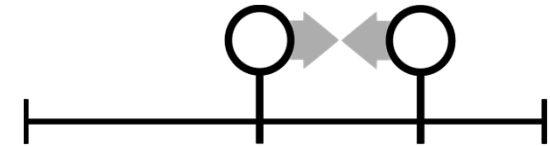
In connected networks, opinions will always converge to perfect consensus

Graph taken from:

Mäs M, Flache A (2013).

PLoS ONE 8(11): e74516.

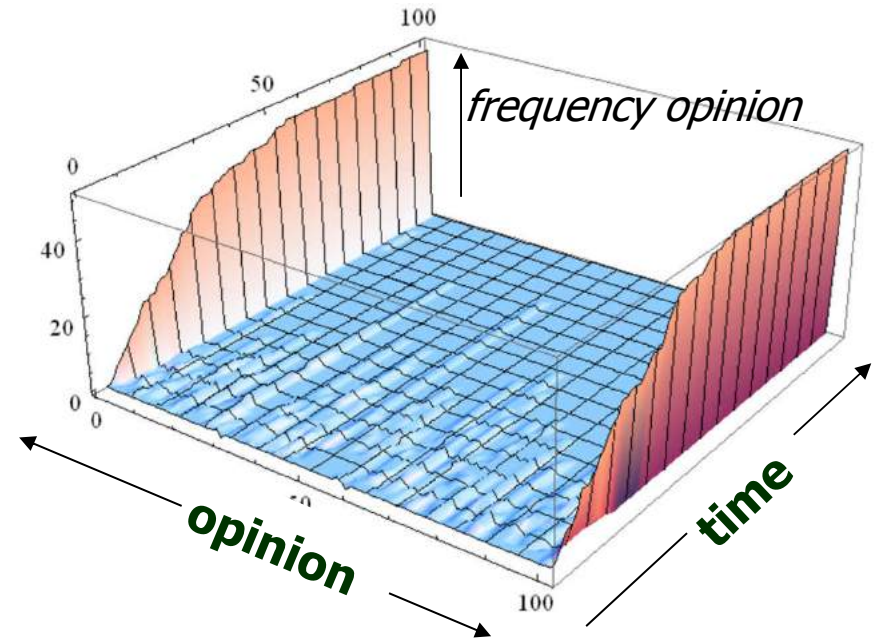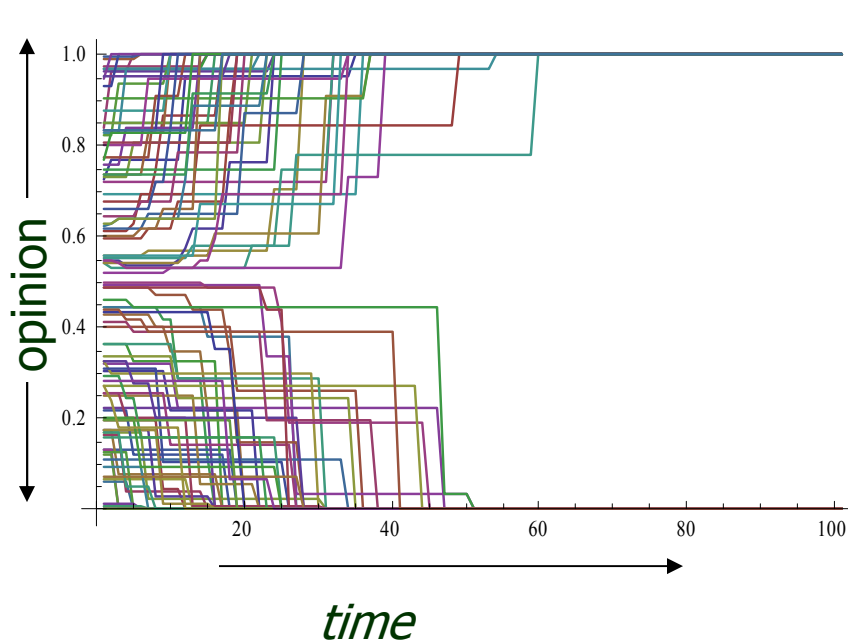# Modelling alternative micro-level influence processes

Extending earlier social influence models (French etc)
influence network neighbours "assimilative" or "repulsive" or "rejected"

$$\Delta o_{i,t} = \frac{1}{scalingfactor} \sum_{j \neq i} w_{ij,t} \left(o_{j,t} - o_{i,t} \right) \qquad 0 \leq o \leq +1$$

$$w_{ij,t} = f\left(\left| o_{it} - o_{jt} \right| \right)$$

Fig 1 Mäs, Flache & Kitts, 2014.

Legend:
- - - - only positive influence (c=1) and a=1
──── also distancing (c=2) and a=1
- - - - only positive influence (c=1) and a=4
──── also distancing (c=2) and a=4

y-axis: influence weight w_{ij}
x-axis: opinion distance $dist_{ij}$

Interplay of assimilative and repulsive influence
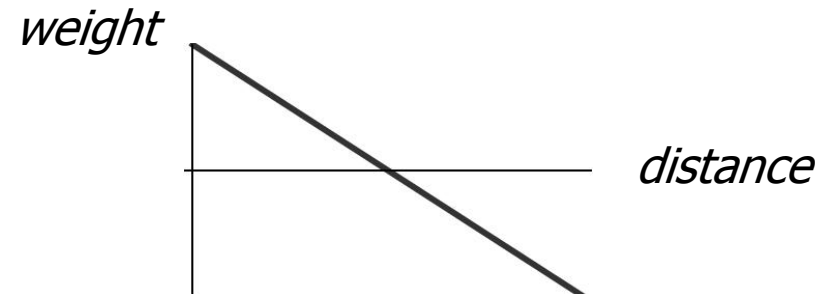# A typical result: bi-polarization

- Initially random uniform
- N=100, 1000 iterations
- Asynchronous updating

e.g.
Macy et al 2003
Jager & Amblard 2005 CMOT
Flache & Macy 2011 JMS

Micro-level "minimize cognitive dissonance"

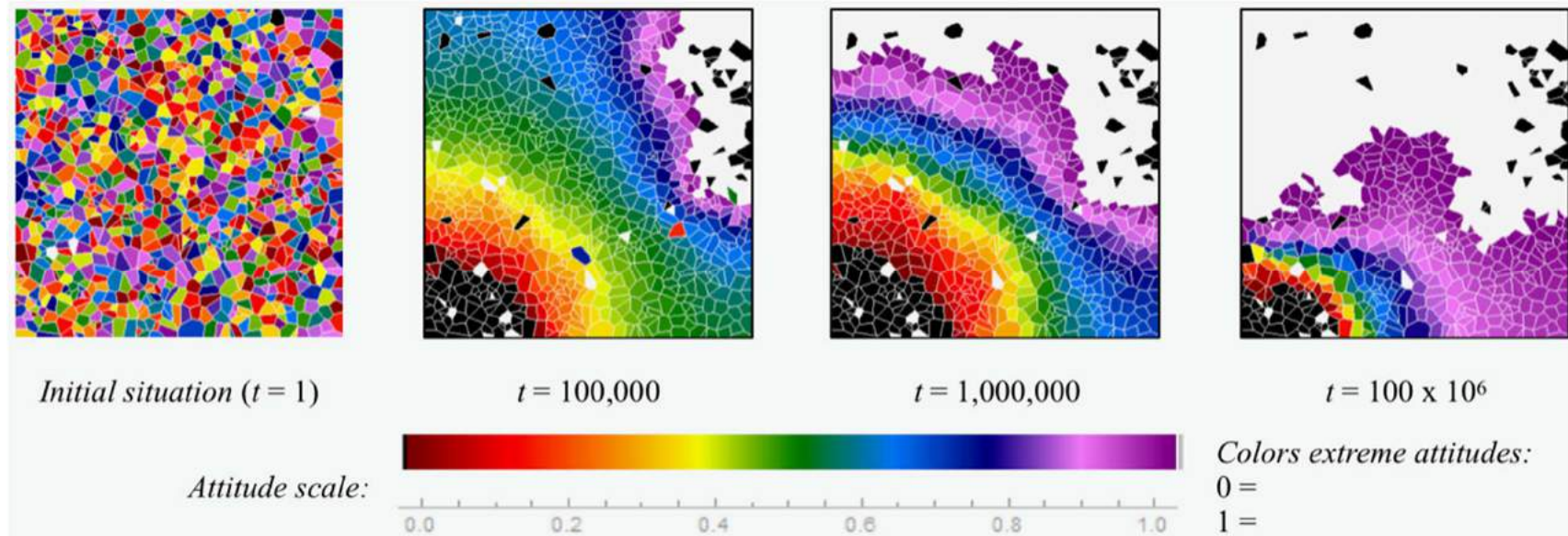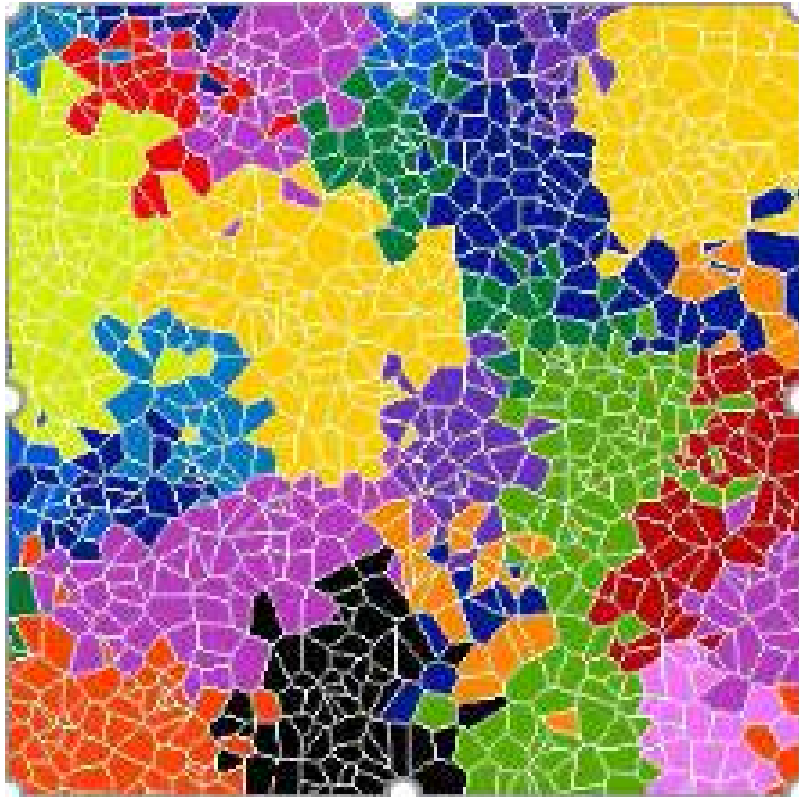# Bi-polarization dynamic in spatial setting

Fig. 7. Flache (2018).
JAMT 25.4:996-1023

› Local disagreement -> "hotspots" for emergent local polarization
› Assimilative influence spreads through network
› Complex pattern of "extreme" and moderate regions emerges

Clustering with "rejected influence"
(adapted bounded confidence)

› Assimilitive if neighbors agree sufficiently

› Otherwise ignore neighbors' influence =>

› Emergent local regions

› No more influence accross boundaries

Micro-level "bounded confidence"

Flache, A. & M.W. Macy 2011. Local Convergence and Global Diversity: From Interpersonal to Social Influence. *Journal of Conflict Resolution.*
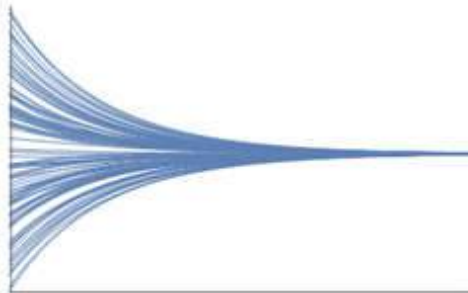
Models of Social Influence: Towards the Next Frontiers

Andreas Flache[a], Michael Mäs[a], Thomas Feliciani[a], Edmund Chattoe-Brown[b], Guillaume Deffuant[c], Sylvie Huet[c] and Jan Lorenz[d]
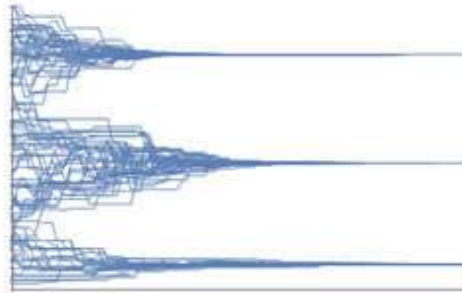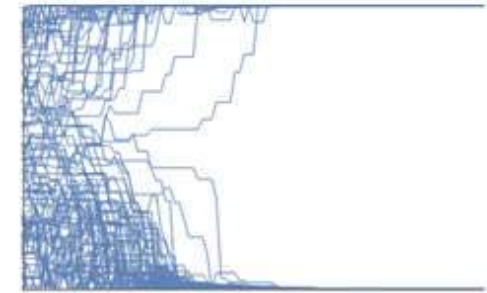
Typical opinion dynamics generated by different agent-based models of social influence

Strategies to bring together computational modeling with data

Strategy 1: test **micro assumptions**
- computational modelling has told us what to look for
- lab experiments (offline and online)

Strategy 2: test **macro predictions** for real settings
- input info from (big) data on opinion distributions in space / time
- simulation of "real setting" with alternative models
- data (voting, opinion surveys, online) to assess predicted opinion patterns

ToRealSim

Towards empirically realistic simulation models
of opinion dynamics
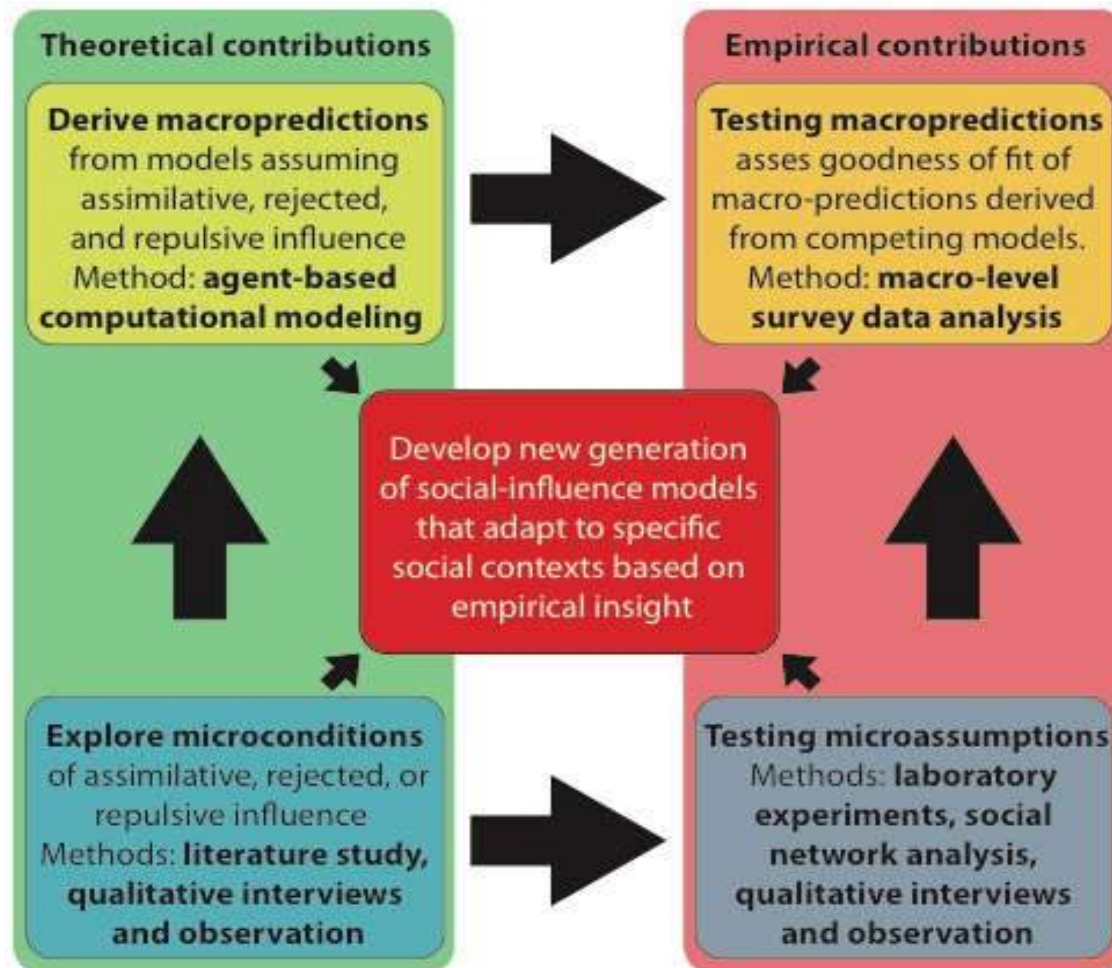
ORA grant project

4 teams, 3 yrs.

(NL, D, UK, F)

Combines computational and empirical social scientists

What goes on at the microlevel?

Controlled lab experiments

RESEARCH ARTICLE

Discrepancy and Disliking Do Not Induce Negative Opinion Shifts

Károly Takács[1]*, Andreas Flache[2], Michael Mäs[2]

Differentiation without Distancing. Explaining Bi-Polarization of Opinions without Negative Influence

Michael Mäs[1]*, Andreas Flache[2]

1 Chair of Sociology, in particular Modeling and Simulation, ETH Zurich, Zurich, Switzerland, **2** Department of Sociology/ICS, University of Groningen, Groningen, The Netherlands

# Experiments testing repulsive influence in lab

We conducted a series of 4 experiments with in total 443 subjects.

Overall design:

› Measure subjects' opinions on pre-selected issues.
  - *E.g. "0..100 percent of immigrants who come to the Netherlands for economic reasons should receive a residence permit."*

› Pair subjects with variation distance on opinions and other characteristics.
› Repeated sequence of
  - exposure to others' opinions,
  - (exchange messages to influence each other)
  - adjust opinions.

› Attractions ("weights") were also measured repeatedly
› In some conditions, we *manipulated initial attraction*
  - E.g. dictator games, football support, different moral positions

Takács, Flache & Mäs 2016. *Plos One* 11(6): e0157948.

What to expect? Theory first.

Hypotheses
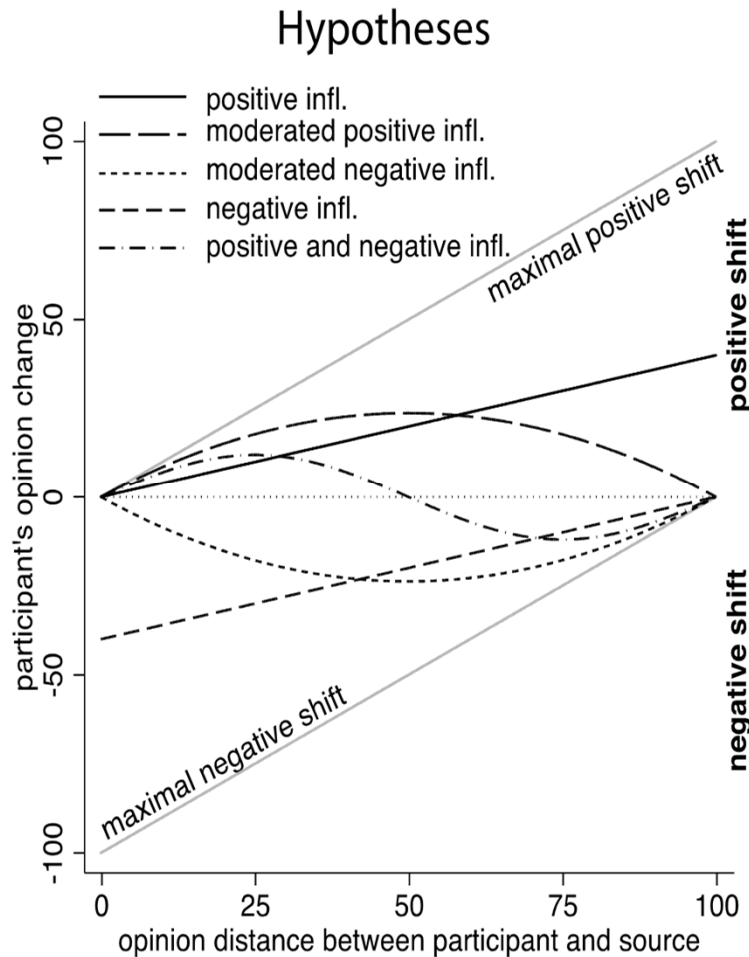
Basic model:

$$\Delta o_{it} = w_{ijt}\left(o_{j,t} - o_{i,t}\right)$$

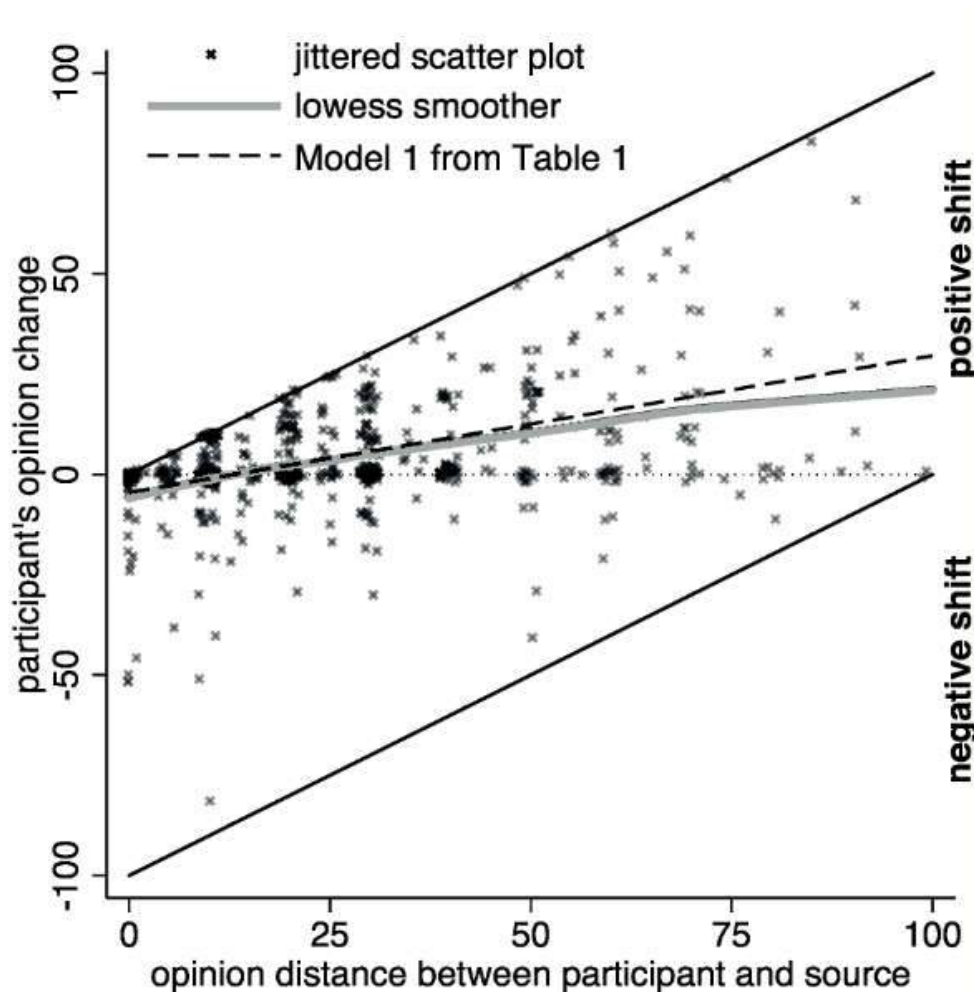Assimilative influence:

$$w_{ijt} = c, \quad c > 0$$

Moderately rejected influence:

$$w_{ijt} = 100 - d\left|o_{j,t} - o_{i,t}\right|, \quad w_{ijt} > 0$$

Assimilative + repulsive influence:

$$w_{ijt} = 50 - e\left|o_{j,t} - o_{i,t}\right|, \quad w_{ijt} \underset{\geq}{\leq} 0$$

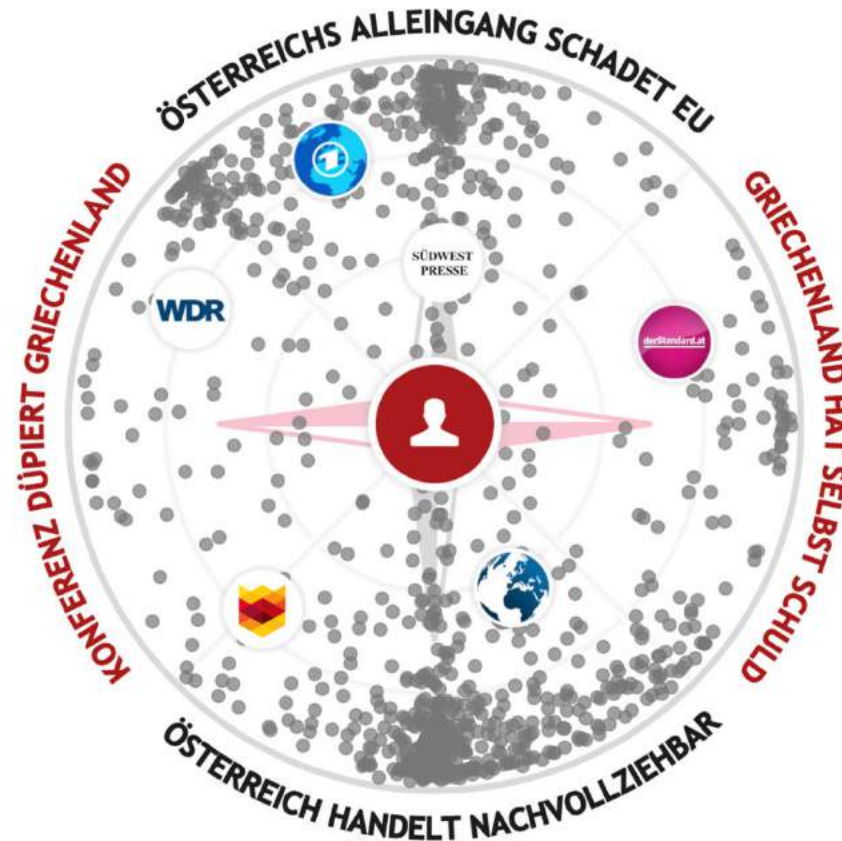# "Discrepancy and Disliking Do Not Induce Negative Opinion Shifts"

Tentative conclusions:

- Influence mainly assimilative

- LESS (!) repulsive influence if large disagreement

Takács, Flache & Mäs 2016. *Plos One* 11(6): e0157948.

Social influence and polarization on online news sites

Michael Mäs
Bernhard Clemm von Hohenberg
Bary Pradelski

Michael Mäs
Bernhard Clemm von Hohenberg
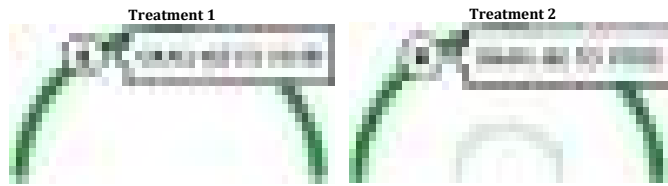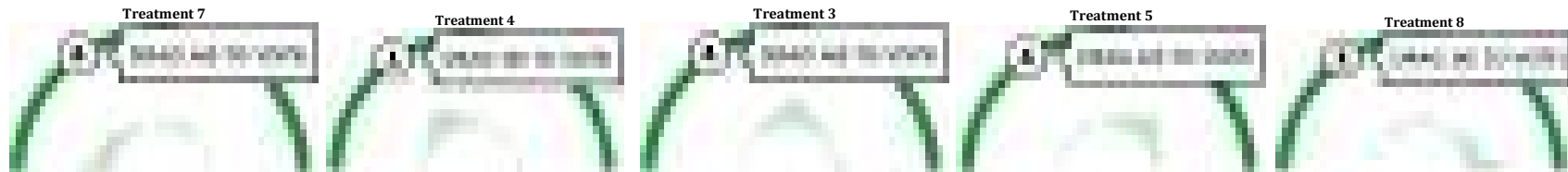Bary Pradelski

Experimental treatments manipulate distributions that participants see before voting

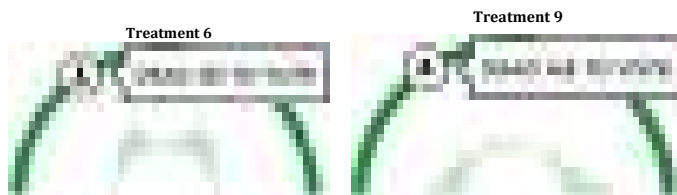## Baseline treatments

Uni-modal distributions

Bi-modal distributions

Michael Mäs
Bernhard Clemm von Hohenberg
Bary Pradelski

average displayed ratings

opinion scale

0   10   20   30   40   50
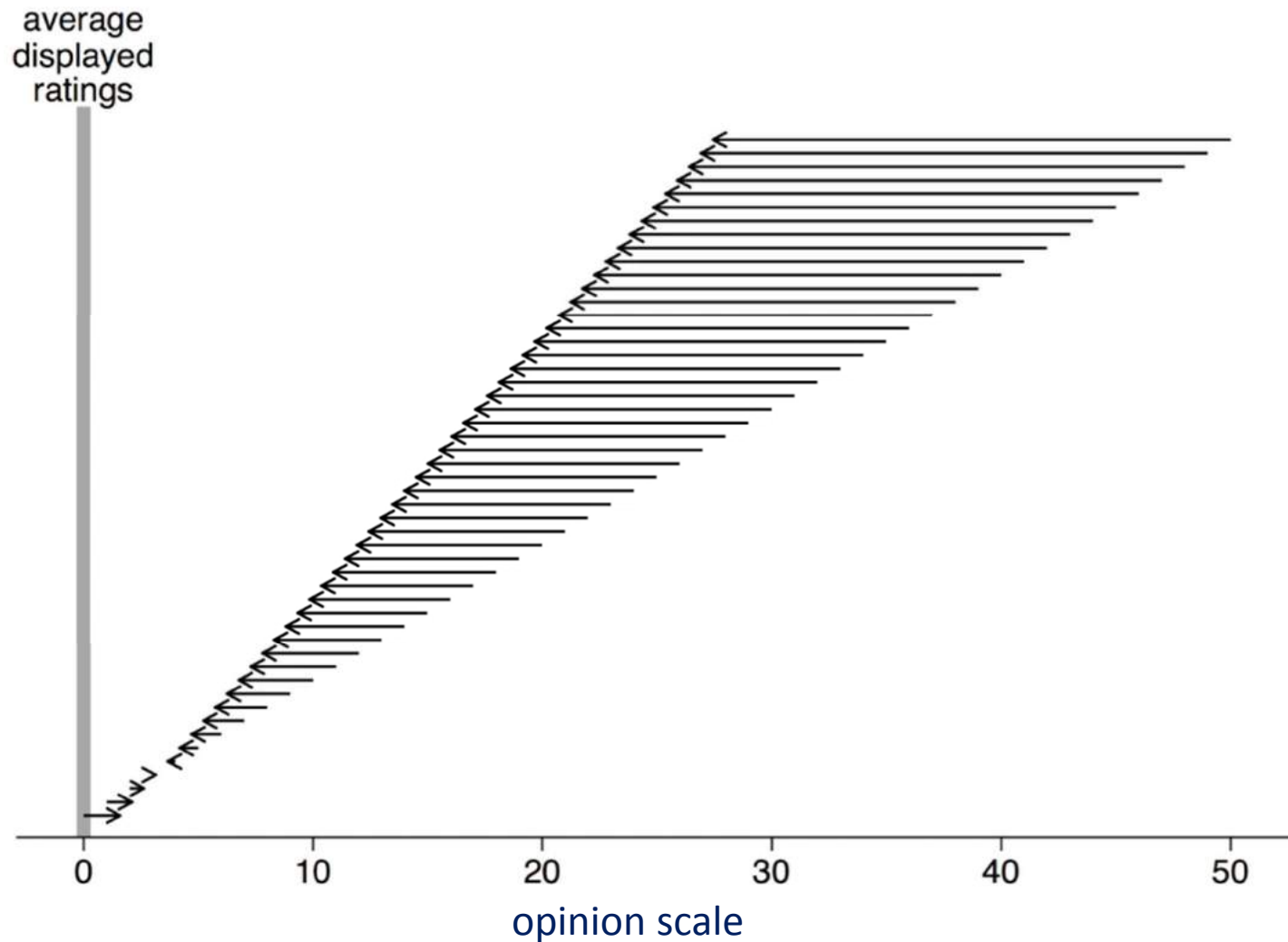
Main result:

Participants move towards average of population
NO evidence for repulsive influence, again

Michael Mäs
Bernhard Clemm von Hohenberg
Bary Pradelski

Tentative conclusions from experiments testing negative influence

Best micro-level model to explain how participants change their opinions after exposure to other's opinion:

Assimilative influence:
> **the larger the distance, the larger the shift**

Should we therefore discard negative influence model?

NO, more empirical work needed:
- Effects of group identities
- Interaction in groups
- More contentious issues at stake
- …

Strategy 2: translating real spatial distributions into initial configurations for cellular automaton (CA)

Spatial distribution ethnic groups
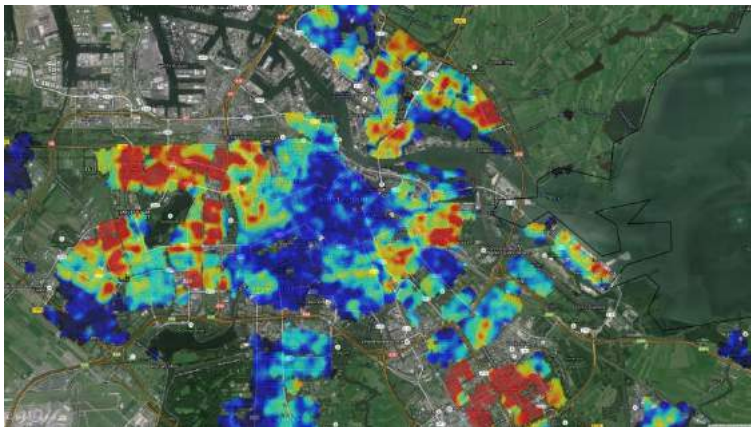
Map geographic positions on positions cell in CA

Assign "type" cell with probability (here based on color code map)

Data from Statistics Netherlands
(here: Amsterdam, 2011)

Linking spatial socio-demographic data to spatial distribution of opinions. The outcome variable
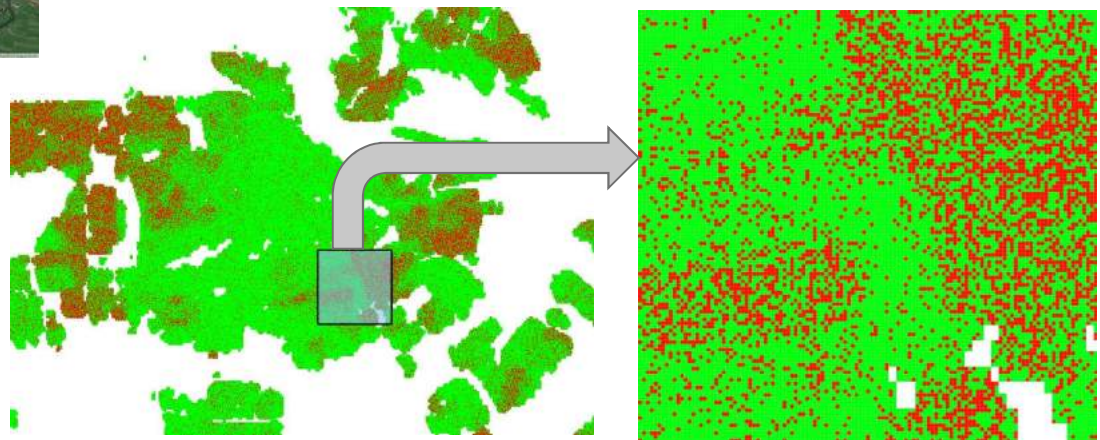
PVV voters per polling station (Dutch general election 2012)

○ <5%

○ 5-10%

● 10-15%

● 15-20%

● 20-25%

● 25-30%

● >30%
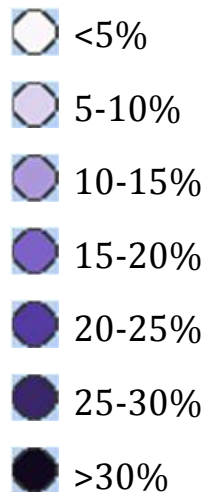
- First steps: Feliciani et al Social Simulation Rome, September 2016.
- Source: *nrc.nl*

Towards more realistic models of opinion dynamics

Challenges
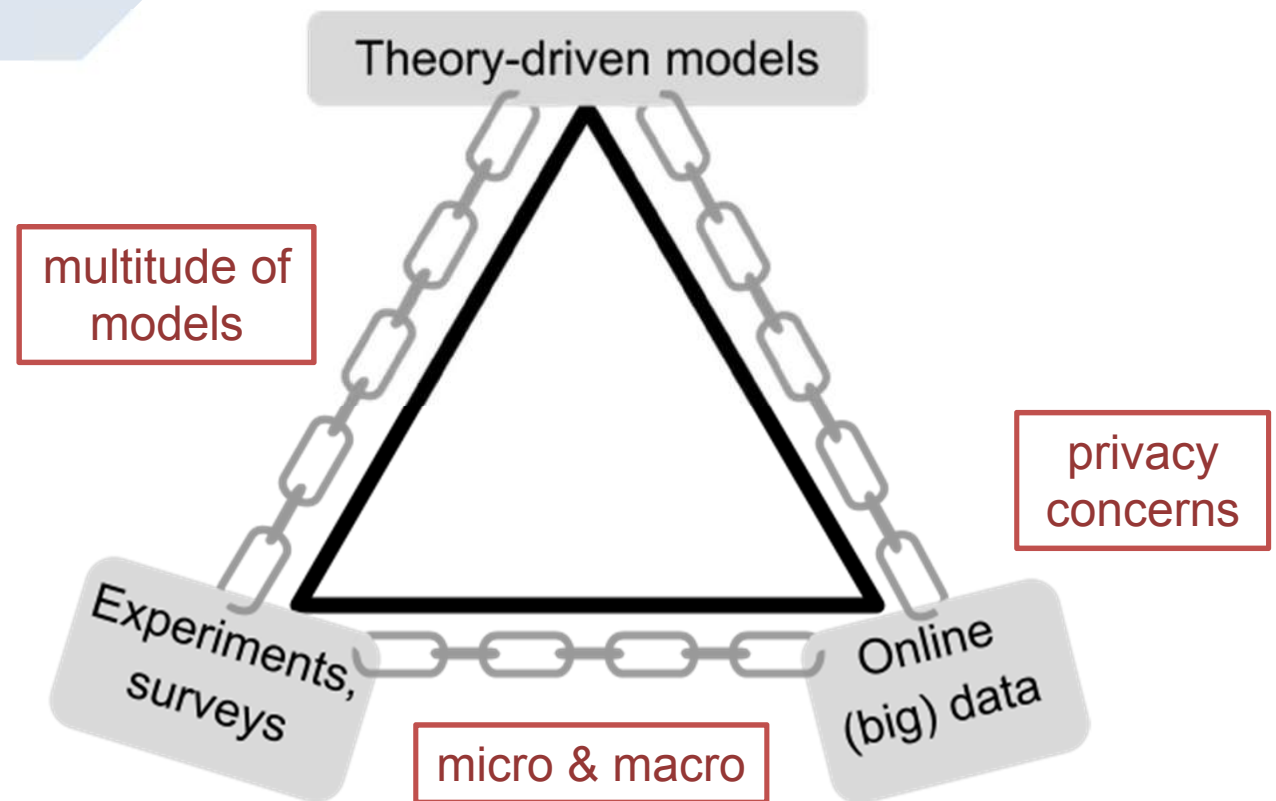
Thank you for your attention

Want to know more? http://www.gmw.rug.nl/~flache/

Credits

ICS
RUG / UU / RU

university of groningen

Michael Mäs
Thomas Feliciani
Marijn Keijzer
Jelmer Draaijer
Norms and Networks Group

Cornell — Michael W. Macy
Hungarian Academy of Sciences — Karoly Takács
University of Massachusetts — James Kitts

(Some) related published work:

- Flache 2018. Between Monoculture and Cultural Polarization. *JAMT*. 25.4: 996–1023.
- Flache 2018. About Renegades and Outgroup Haters. *ACS*. https://doi.org/10.1142/S0219525918500170
- Keijzer, Mäs & Flache. 2018. Communication in online social networks fosters cultural isolation. *Complexity*.
- Flache, Mäs, Feliciani, Chattoe-Brown, Deffuant, Huet, & Lorenz. 2017. Models of social influence. *JASSS* 20.4.
- Feliciani, Flache & Tolsma. 2017. How, When and Where Can Spatial Segregation Induce Opinion Polarization? Two Competing Models. *JASSS*.
- Leszczensky, Flache, Stark, & Munniksma. 2017. The Relation between Ethnic Classroom Composition and Adolescents' Ethnic Pride." *GPIR*. doi: 10.1177/1368430217691363.
- Takács, Flache, & Mäs. 2016. Discrepancy and Disliking Do Not Induce Negative Opinion Shifts. *PLoS ONE*.
- Munniksma, Verkuyten, Flache, Stark & Veenstra, 2015. Friendships and outgroup attitudes among ethnic minority youth. *IJIR*, 44 , 88-99.
- Stark, Mäs & Flache, 2015. Liking and disliking minority-group classmates. *SSR* 50:164-176.
- Mäs & Flache. 2013. Differentiation without Distancing. Explaining Bi-Polarization of Opinions without Negative Influence. PLoS ONE 8(11): e74516.
- Munniksma, Stark, Verkuyten, Flache & Veenstra. 2013. Extended intergroup friendships within social settings. *GPIB*. 16(6) 752–770.
- Stark, Flache & Veenstra 2013. Generalization of positive and negative attitudes towards individuals to outgroup attitudes. *PSPB* 39: 608-622.
- Mäs, Flache, Takács & Jehn 2013. In the short term we divide, in the long term we unite: *Organization Science* 24. 3: 716–736.
- Stark & Flache, 2012. The Double Edge of Common Interest. *SoE* 85.2:179-199.
- Flache & Macy, 2011. Local Convergence and Global Diversity. *JCR* 55.6: 968 - 993.
- Flache & Macy 2011. Small Worlds and Cultural Polarization. *JMS* 35.1: 146-176.
- Mäs, Flache & Helbing, 2010. Individualization as Driving Force of Clustering Phenomena in Humans. *PLoS Computational Biology* 6(10): e1000959.
- Flache & Mäs 2008. How to get the timing right? *CMOT* 14.1:23-51.
- Flache & Mäs 2008. Why do faultlines matter? *SimPat* 16.2: 175-191.