



university of
groningen

faculty of behavioural and
social sciences

sociology

ICS
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Opinion polarization, networks and complex micro-macro interactions

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Presentation @

Networks Match Making Event

Social Sciences meets Mathematics, 20-22 January 2020

Kaap Doorn

Perceptions on polarization in the Netherlands

Data Netherlands Institute for Social Research (2018)

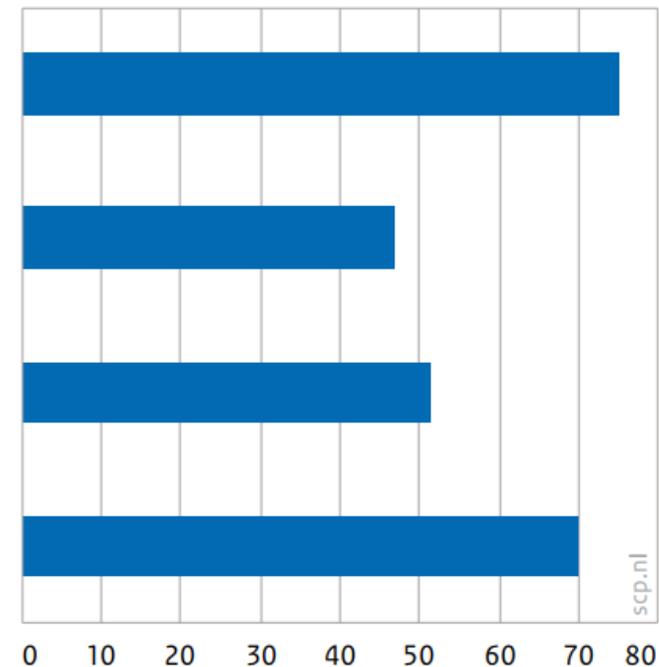
% agree with statement

Disagreement about societal issues is increasing in our country

There is strong pressure to take sides on the topic of refugees

Traditional media amplify disagreement between people

Internet and social media amplify disagreement between people



N=1301, representative random sample

Assimilative social influence

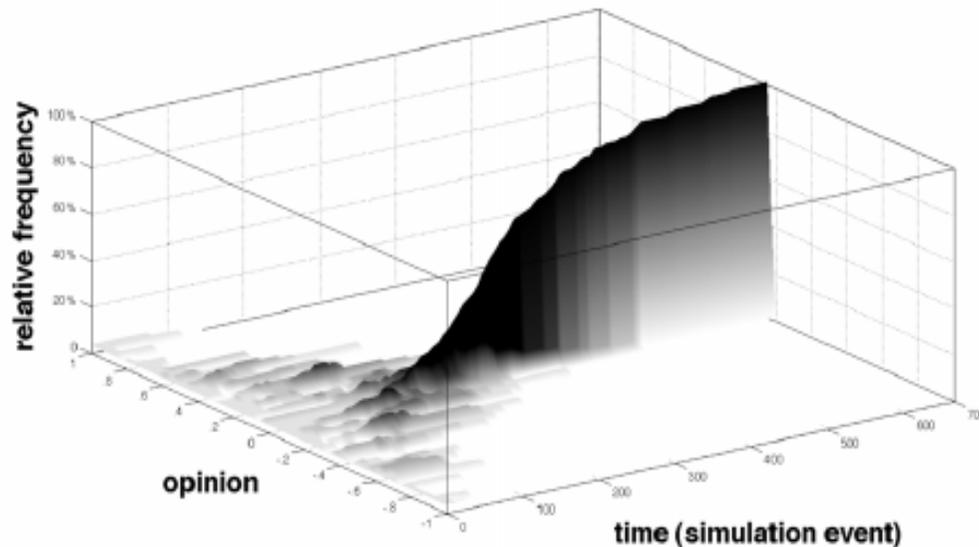
The tendency to alter one's opinions, attitudes, beliefs, or customs, to more closely resemble those of influential others (Axelrod, 1997)

- 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)



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

Social Influence: move towards weighted average opinion of others to whom one is connected, weighted by strength of connection



**Consensus inevitable
in
connected network**

Why polarization? One intuition

Grouping like-minded people

“Today, most Americans live in communities that are becoming more politically homogeneous and, in effect, diminish dissenting views. And that **grouping of like-minded people** is feeding the nation’s increasingly rancorous and partisan politics.”

- Bishop, Bill. 2004. “The Schism in U.S. Politics Begins at Home” .
- 2008. *The Big Sort: Why the Clustering of Like-Minded America is Tearing Us Apart.*

Retreating in our own bubbles

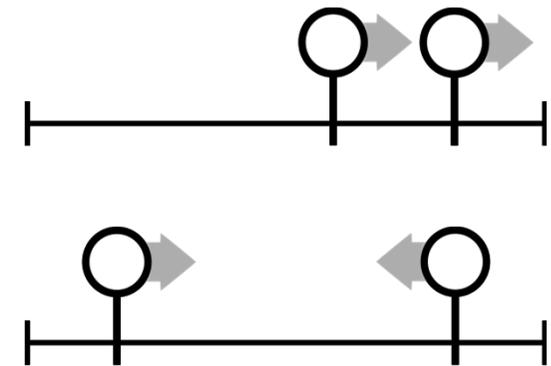
“For ... too many of us it’s become safer to **retreat into our own bubbles**, whether in our neighborhoods, ... or especially our social media feeds, surrounded by people who look like us and share the same political outlook and never challenge our assumptions.”

Farewell address Barack Obama, Chicago, January 10, 2017.

From intuition to model: reinforcing influence

A model based on persuasive argument **theory**

- Opinion is constituted by **arguments**
 $arg_vector \quad ++---- \Rightarrow \quad opinion = -0.33$
- **Influence:** if i interacts with j , then i adopts argument from j .
- **Homophily:** the more similar i and j , the more likely they interact
 - Similarity in opinions, ethnicity, gender, ...

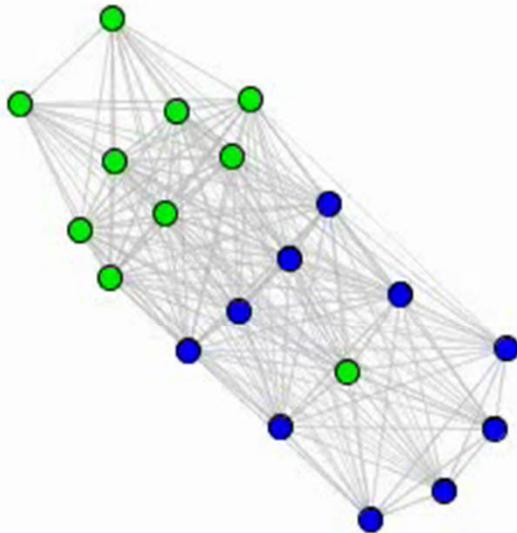


⇒ interaction with similar others

- strengthens “extreme” views, *and*
- is more likely than interaction with dissimilar others

• Mäs, M., Flache, A., Takács, K., & Jehn, K. (2013). *Organization Science* 24. 3: 716–736.
• Mäs, M., & Flache, A. (2013). *PLoS ONE* 8(11): e74516.

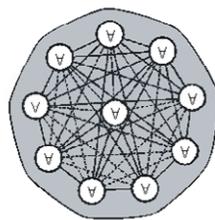
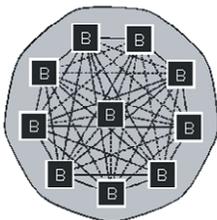
Persuasive argument theory: Opinion polarization through reinforcing influence



Dynamics of opinion and interaction network

Some key assumptions:

- strong demographic faultline
- strong homophily
- demographically biased opinions



Source: Mäs, Flache, Takács & Jehn (2013)

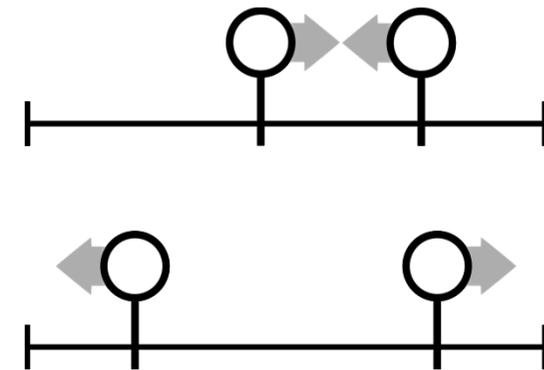
Another micro-theory xenophobia and repulsive influence

- **Xenophobia**

differences too large \Rightarrow relations become negative

- **Repulsive influence**

relations negative \Rightarrow people want to become more dissimilar from each other



Reinforcing
influence model:



Theories

social balance, cognitive dissonance, social judgement

Experiments

group categorization, group polarization, negative referents

Several computational models \rightarrow

- Macy, Kitts, Flache, Benard (2003)
- Jager & Amblard (2005)
- Baldassari & Bearman (2007)
- Flache & Mäs (2008)
- Flache & Macy (2011, JMS) ...

Modelling xenophobia and repulsive influence

Extending earlier social influence models (French etc)

influence network neighbours “assimilative” or “repulsive” or “rejected”

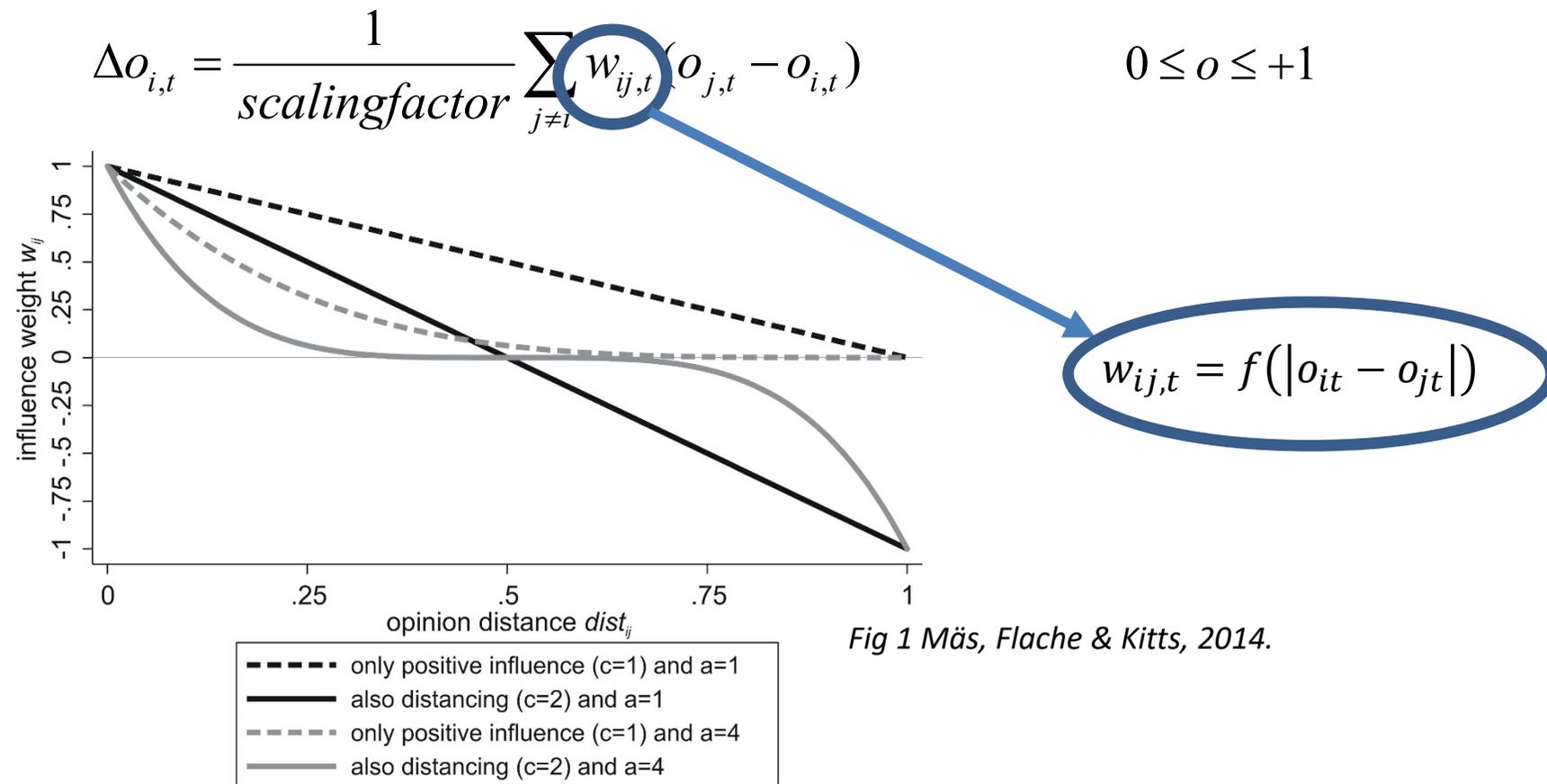
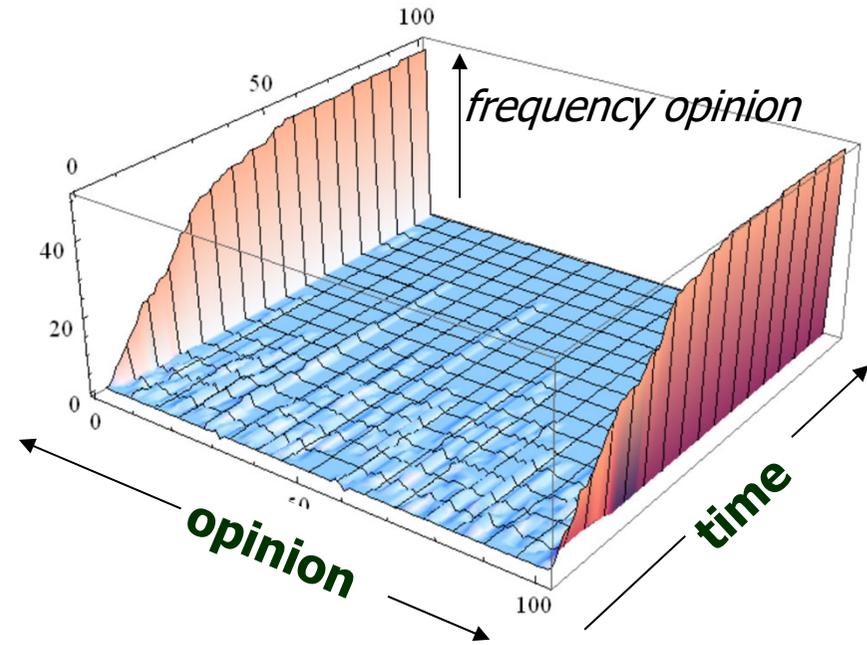
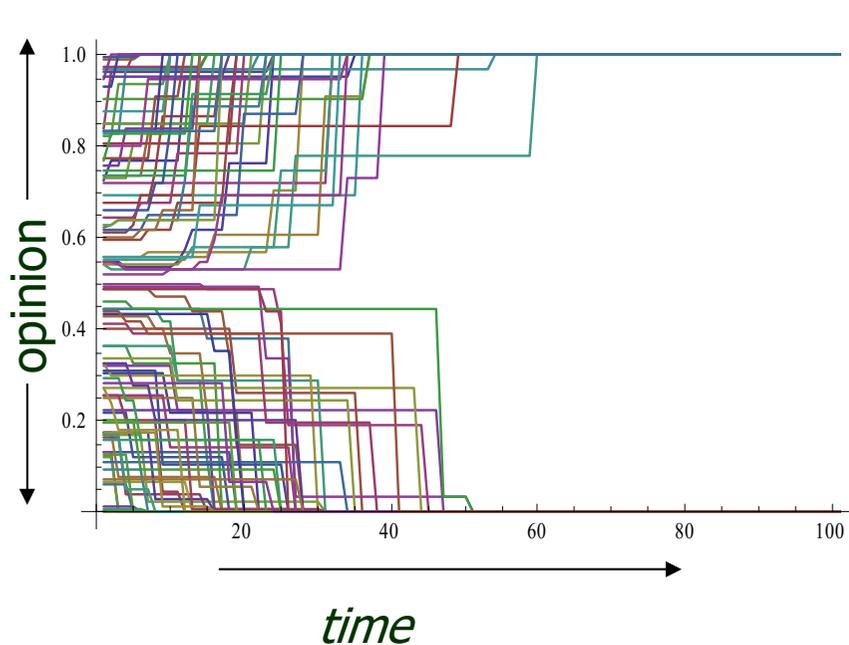


Fig 1 Mäs, Flache & Kitts, 2014.

Interplay of assimilative and repulsive influence

A typical result: bi-polarization

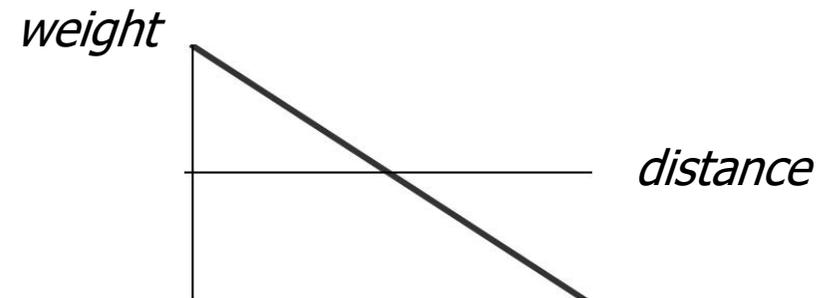


- Initially random uniform
- $N=100$, 1000 iterations
- Asynchronous updating

e.g.
 Macy, Kitts, Flache & Benard 2003
 Jager & Amblard 2005 CMOT
 Flache & Macy 2011 JMS



Initial distribution



Micro-level influence weight function

Conditions for conflicting predictions? Spatial / network segregation + local interaction

Inner City of Chicago, 2010.



2010 Census Block Data

1 Dot = 1 Person



Reinforcing influence

Segregation

- ⇒ more interaction with similar people
- ⇒ more reinforcing influence
- ⇒ more polarization

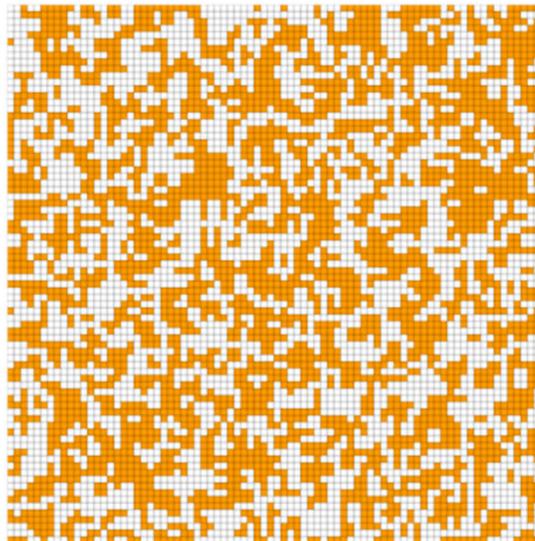
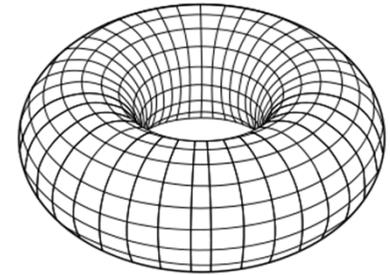
Repulsive influence

Segregation

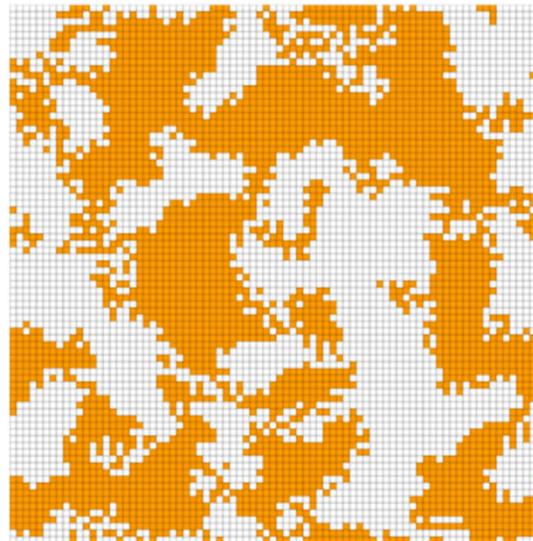
- ⇒ less interaction with dissimilar people
- ⇒ less repulsive influence
- ⇒ less polarization

Varying segregation

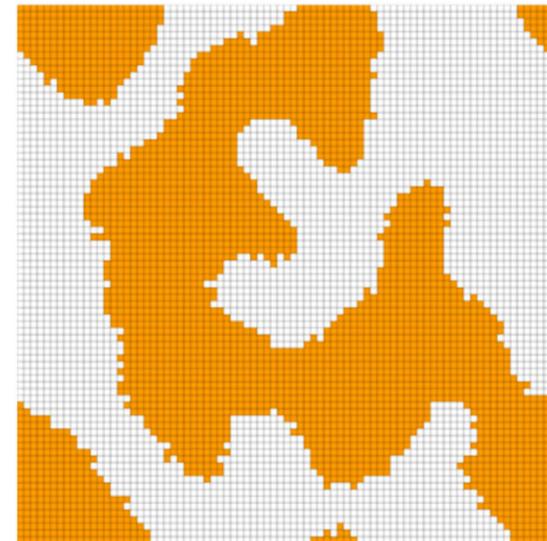
Settings with increasing level of segregation obtained from a Schelling-Sakoda like segregation algorithm



Low segregation



Medium segregation



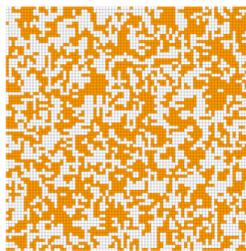
High segregation

Feliciani, Flache & Tolsma 2017 JASSS

Reinforcing influence

Slightly modified persuasive argument model (more efficient):

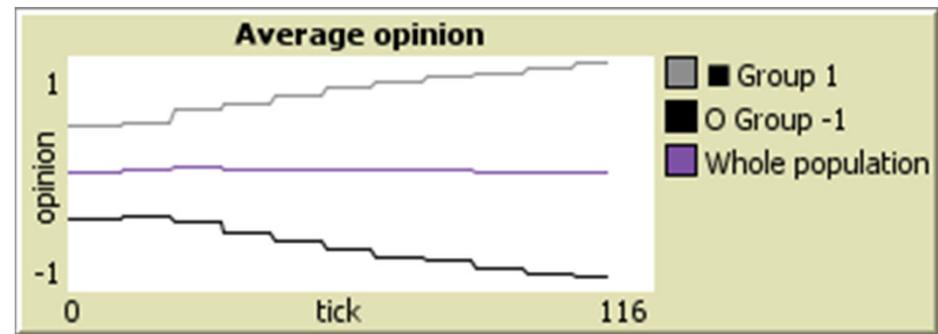
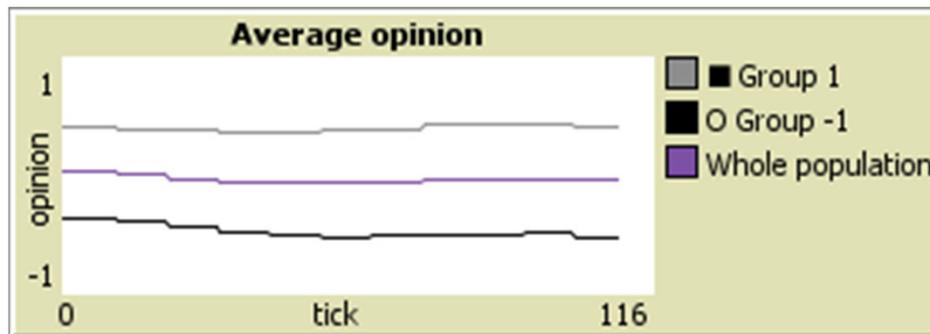
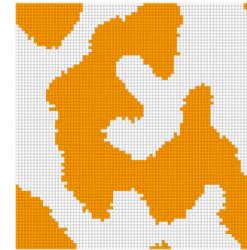
- *Argument vector not explicitly represented*
- *Influence: i adopts + argument j with *prob* proportional to opinion j .*
- *Homophily: the more similar i and j , the more likely they interact*



Low

Segregation

High



Change in opinion disagreement between the two groups. Representative runs.

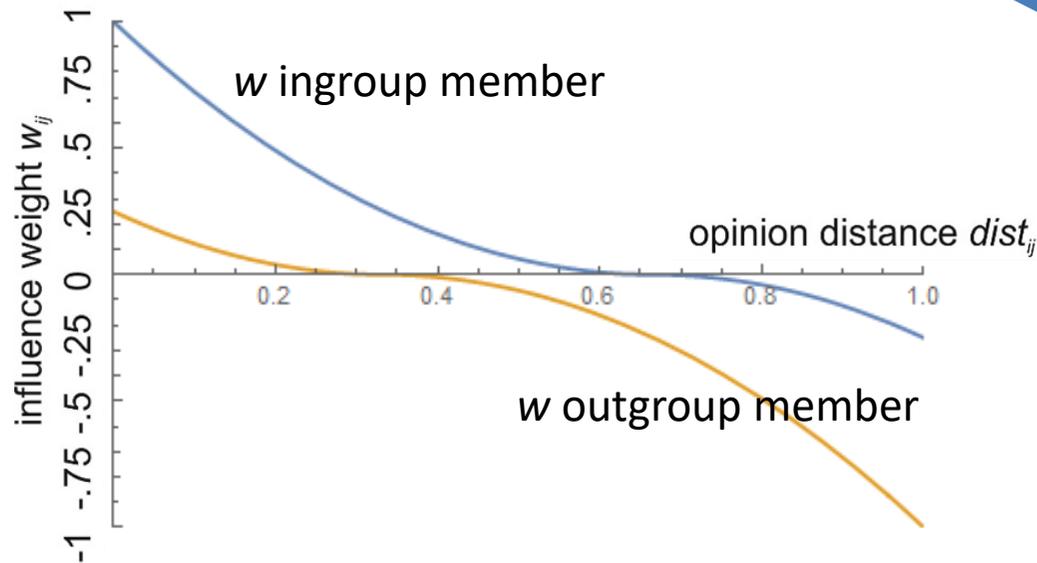
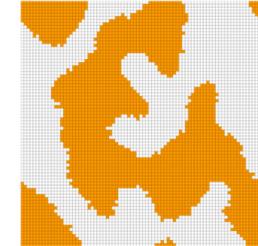
(Feliciani, Flache & Mäs, under review)

Repulsive influence and segregation

Extending model towards intergroup setting

$$\Delta o_{i,t} = \frac{1}{\text{scalingfactor}} \sum_{j \neq i} w_{ij,t} (o_{j,t} - o_{i,t})$$

$$0 \leq o \leq +1$$



Influence weight depends on:

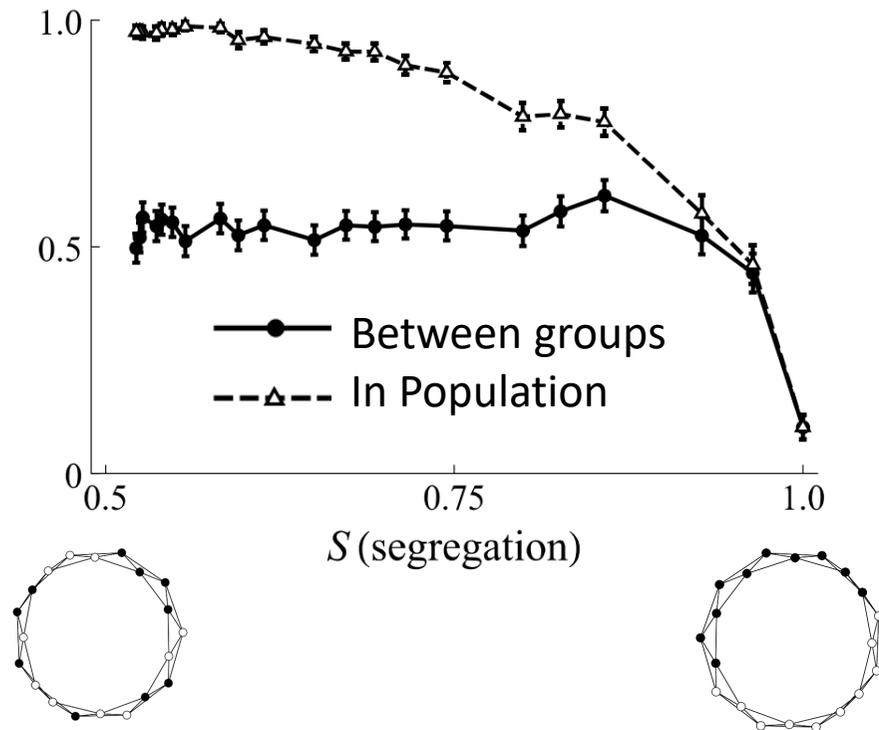
- opinion disagreement
- same group or not

$$w_{ij,t} = f(d_{ij,t})$$

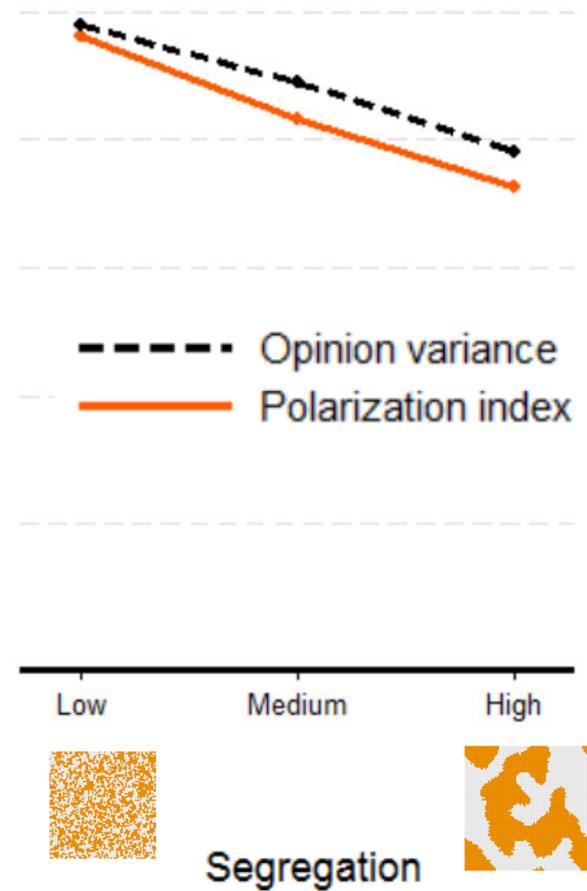
$$d_{ijt} = \beta_O |o_{jt} - o_{it}| + \beta_D |g_j - g_i|$$

Repulsive influence: Segregation can decrease polarization between groups

Polarization indices



Polarization indices



Flache 2019, Pp. 213-228 in: Abergel et al.

Feliciani, Flache & Tolsma 2017, JASSS

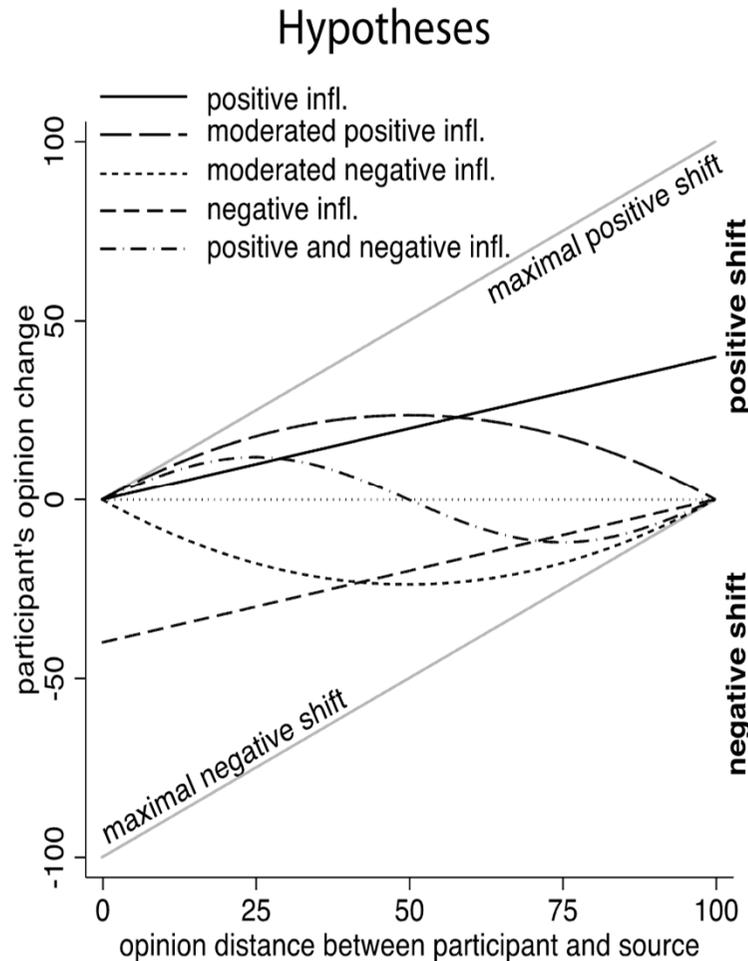
Experiments testing repulsive influence in lab

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

What to expect? Theory first.



Basic model:

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

Assimilative influence:

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

Moderately rejected influence:

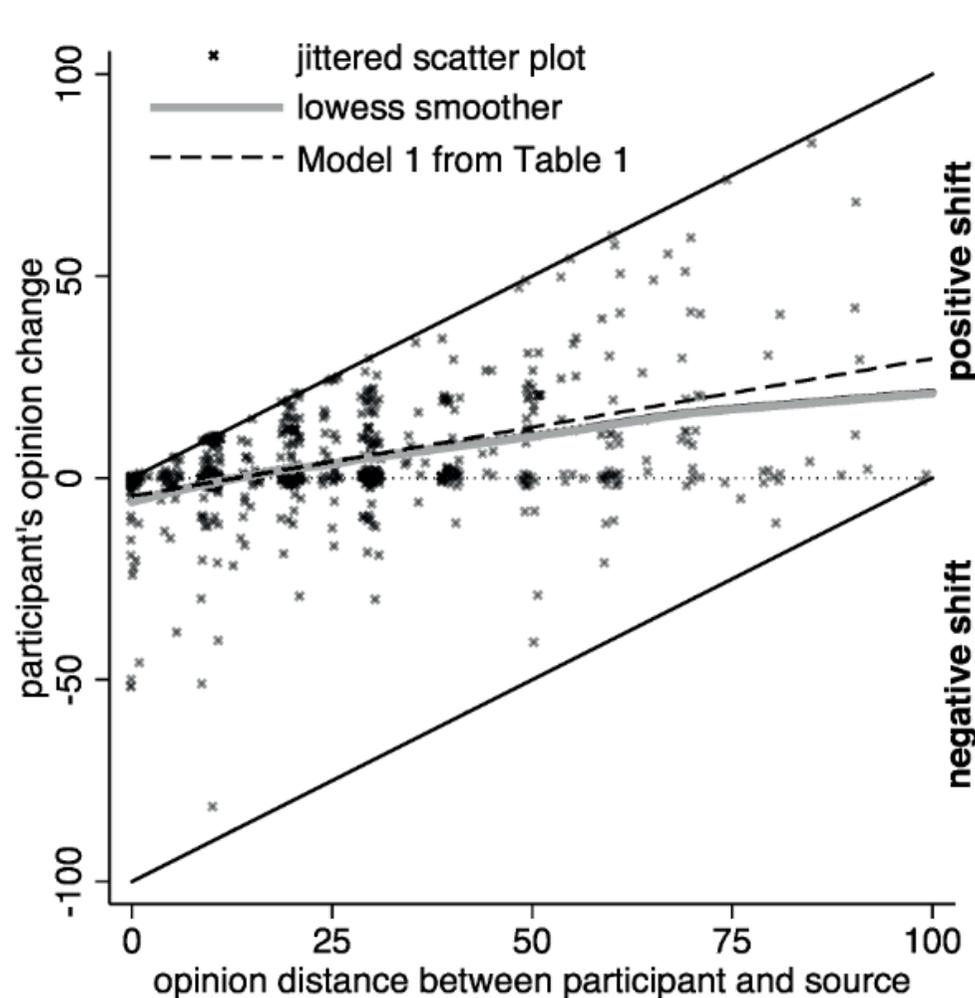
$$w_{ijt} = 100 - d|o_{j,t} - o_{i,t}|, \quad w_{ijt} > 0$$

Assimilative + repulsive influence:

$$w_{ijt} = 50 - e|o_{j,t} - o_{i,t}|, \quad w_{ijt} \begin{matrix} \leq \\ \geq \end{matrix} 0$$

“Discrepancy and Disliking Do Not Induce Negative Opinion Shifts”

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

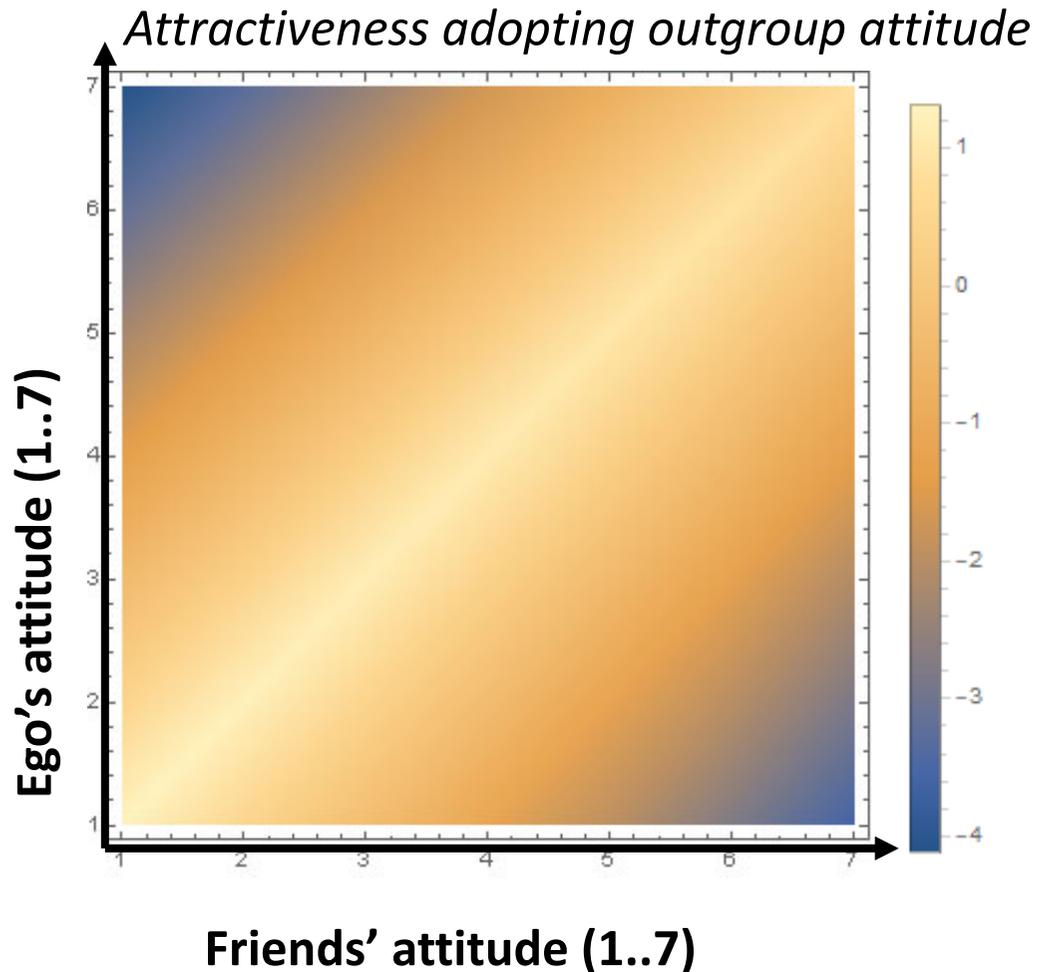


Tentative conclusions:

- Influence mainly assimilative
- LESS (!) repulsive influence if large disagreement

Beyond experiments: field data

Estimating effects of friends' outgroup attitude on own outgroup attitude



Estimated from data on
co-evolution of friendships and
outgroup attitudes
(SAOM)

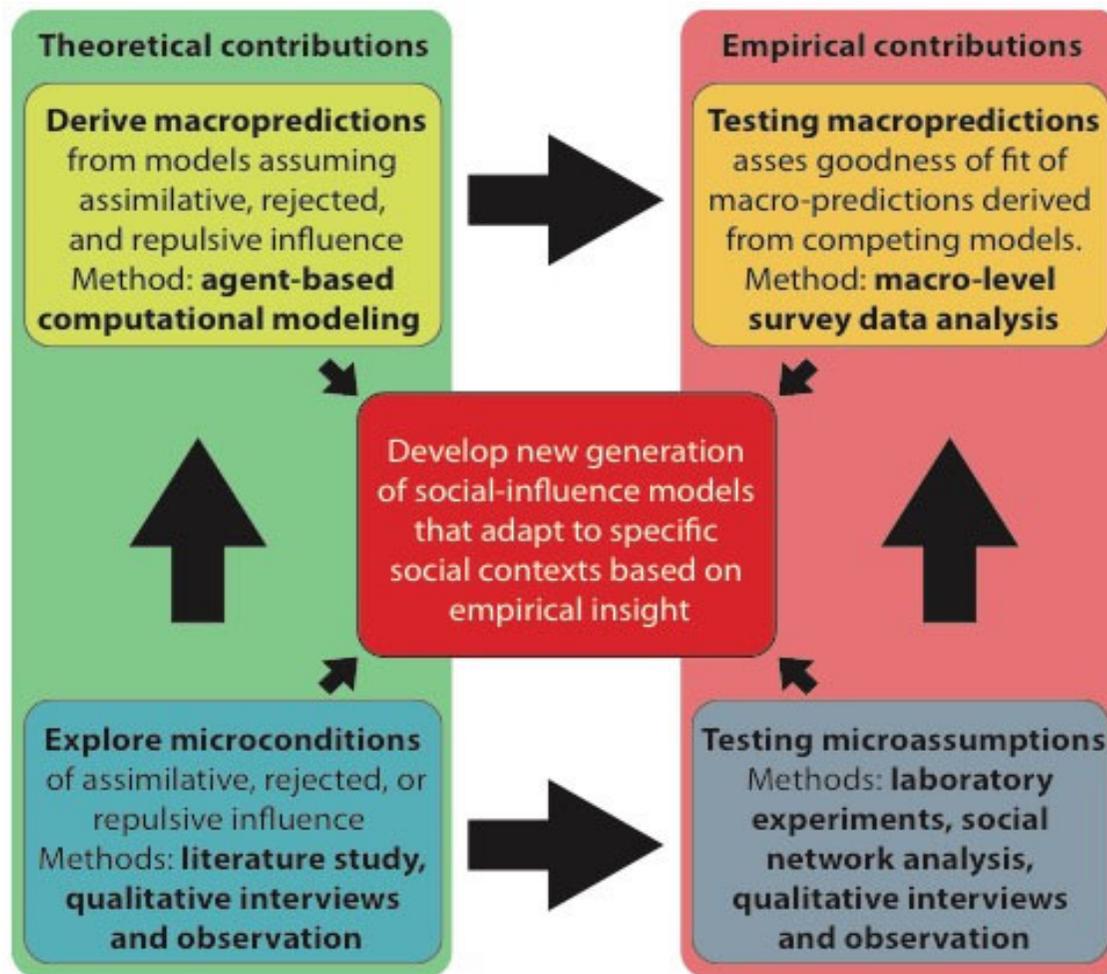
Controlling for:
various friendship selection preferences
(reciprocity, ethnic homophily, triad
closure)
Various other effects on opinion change
(e.g. group specific bias)

Arnhem School Study
N=837, 12-13 year old,
Two waves (2008, 2009)

Zingora, Stark & Flache. 2019. *Group Processes & Intergroup Relations*.

How further? ToRealSim

Towards more realistic simulation models of opinion dynamics



ORA grant project
4 teams, 3 yrs.
(NL, D, UK, F)

Combines
computational and
empirical social
scientists

Many open questions. Some are ...

- Given initial opinion distributions, network structures, demographic characteristics etc. AND model of social influence and network selection dynamics-> (how likely) will the outcome be consensus, opinion fragmentation, polarization or sth else? Will the process converge at all?
- Which (incremental) changes in network structure can help to prevent polarization most effectively (given ...)?
- Given observed changes of opinions and networks in a connected population, (how) can I draw inferences to the underlying social influence and social selection dynamics?

Looking forward to your questions and comments

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

Credits

ICS
RUG / UU / RU



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Michael Mäs

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Norms and Networks Group

Cornell

Michael W. Macy

Linköping University

Karoly Takács

University of Massachusetts

James Kitts

University of Utrecht

Tobias Stark

(Some) related published work

- Flache 2019. Social integration in a diverse society. In: Abergel e.a. doi.org/10.1007/978-3-030-11364-3_15
- 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*.
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- 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.
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- Stark, Flache & Veenstra 2013. Generalization of positive and negative attitudes towards individuals to outgroup attitudes. *PSPB* 39: 608-622.
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- 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. *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.