Social identity shapes consensus formation in opinion dynamics models

Social Simulation Conference 2022

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[Young people's] message is clear: the older generation has failed, and it is the young who will pay in full — with their very futures.

– United Nations

www.un.org/en/climatechange/youth-in-action

We young people need to say that we must hold the older generations accountable for the mess they have created [...]

– Greta Thunberg, Fridays for Future

(2018, CNN Interview)

twitter.com/CNN/status/1077444076176359426

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$\longrightarrow$ Climate change is social

(Fielding and Hornsey, 2016; Pearson, Schuldt, and Romero-Canyas, 2016)

Social identity shapes the formation of individual opinions

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Homophily

People tend to interact predominantly with similar others

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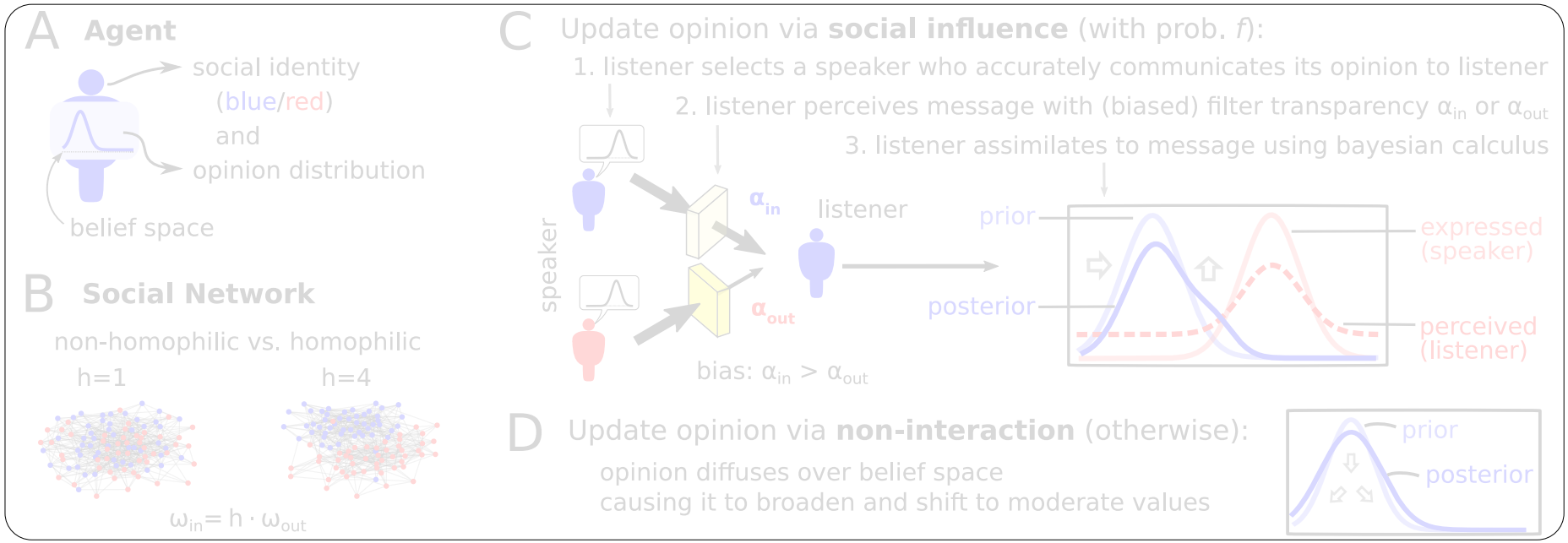
- How do these processes affect consensus formation?
- Enter opinion formation models
- But socio-psychological dimensions often neglected

  (Sobkowicz, 2020; Galesic et al., 2021)

Research agenda

- Develop an opinion formation model including social identity and related socio-psychological individual processes.
- How do homophily and in-group favouritism bias affect
  1. *whether* consensus forms in general?
  2. *how fast* consensus forms?

Model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social identity
(blue/red)
and
opinion distribution
belief space
B Social Network
non-homophilic vs. homophilic
h=1
h=4
$\omega_{in} = h \cdot \omega_{out}$
C Update opinion via **social influence** (with prob. *f*):
1. listener selects a speaker who accurately communicates its opinion to listener
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opinion diffuses over belief space
causing it to broaden and shift to moderate values
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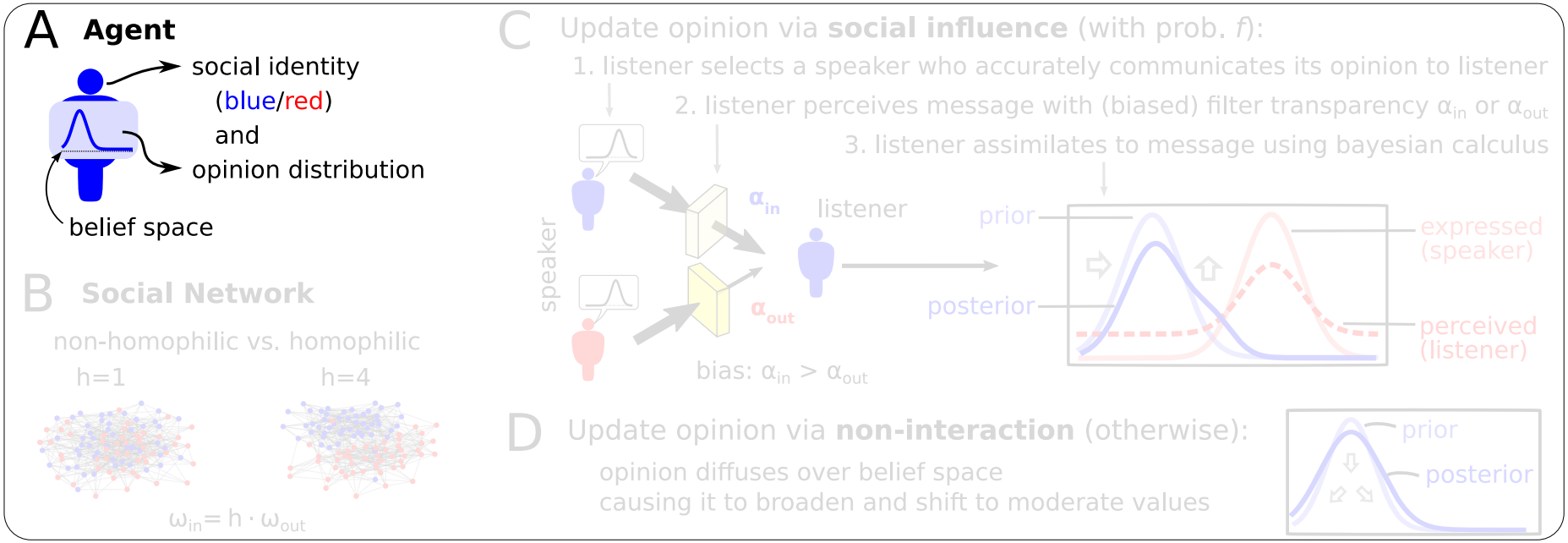
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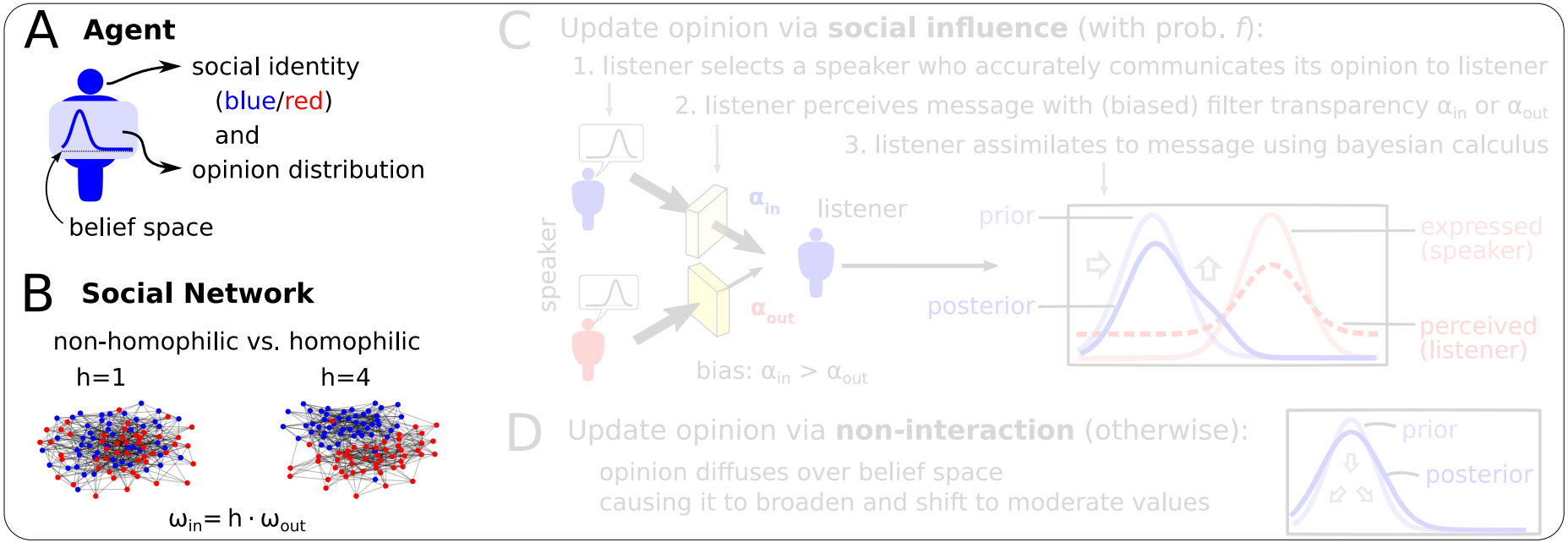
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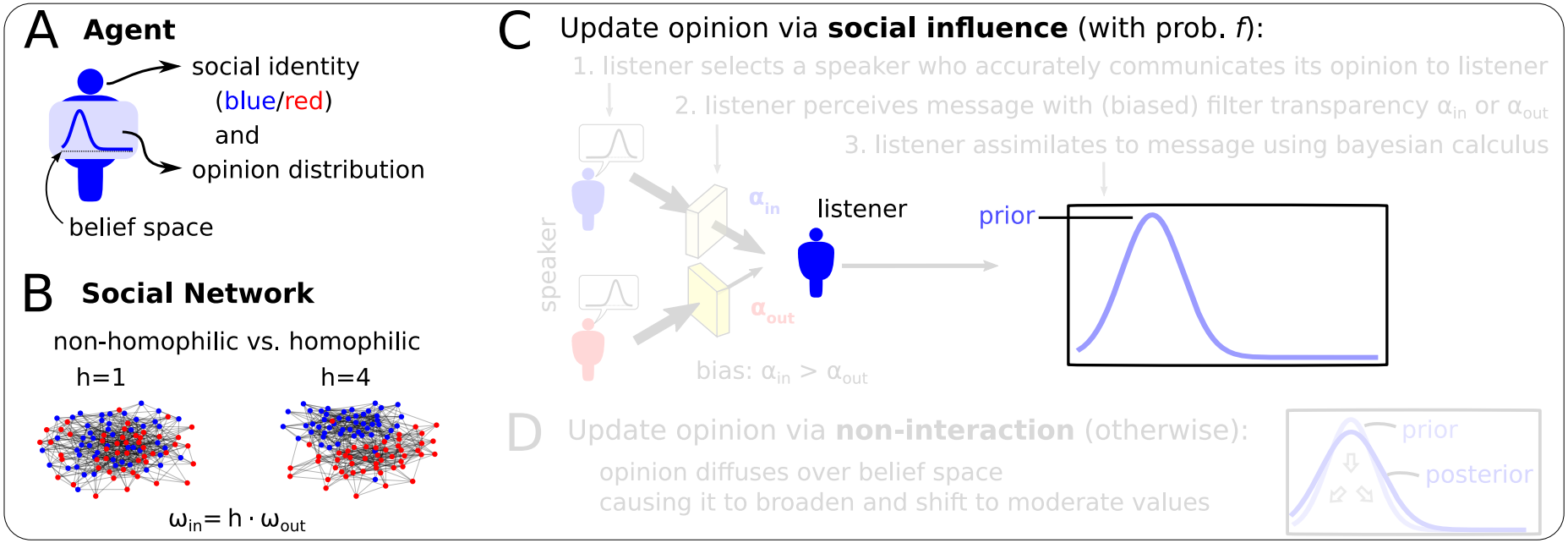
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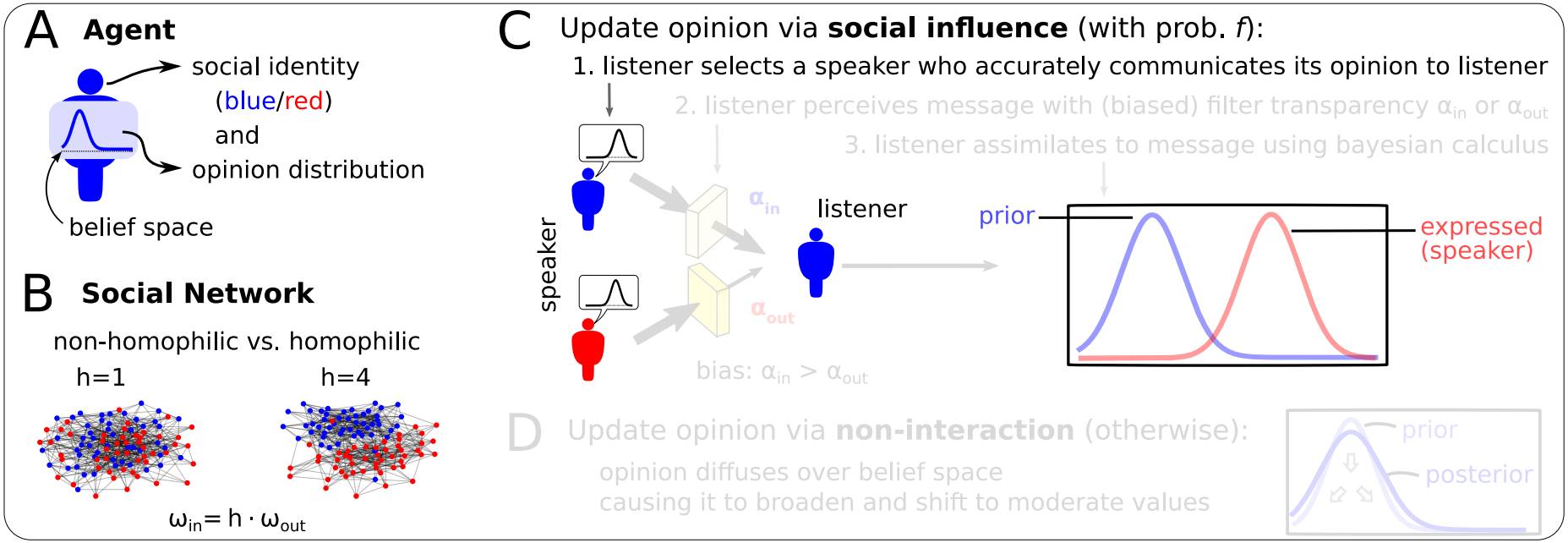
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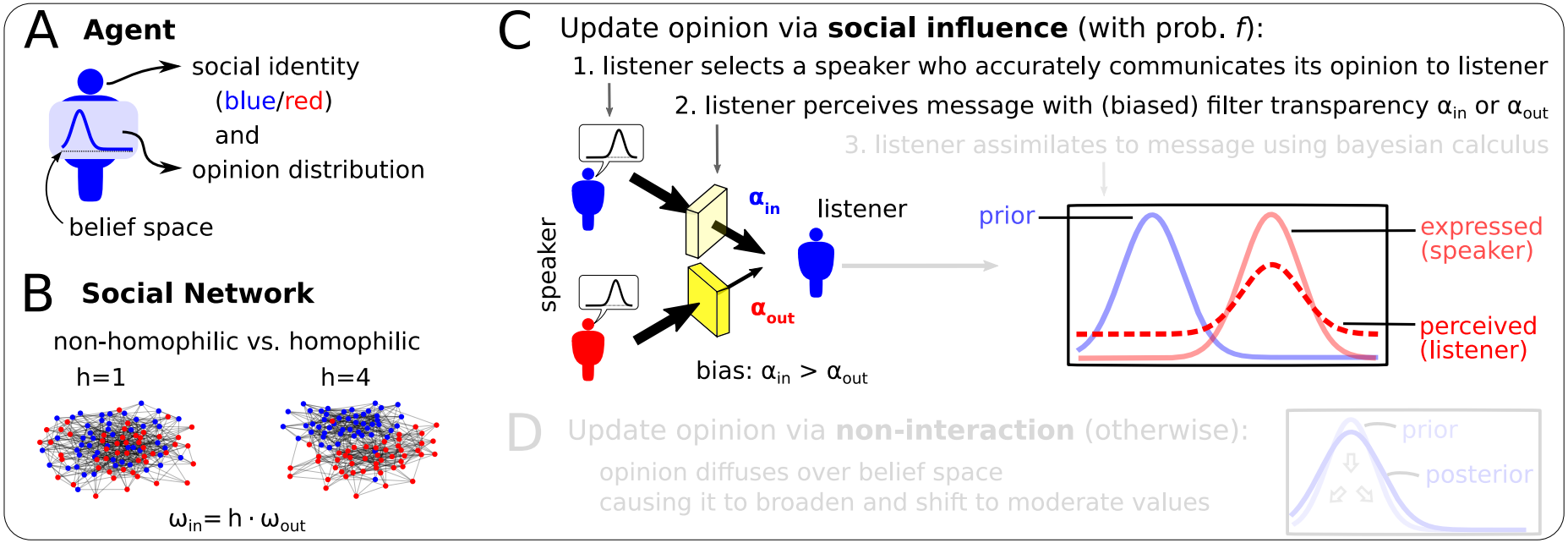
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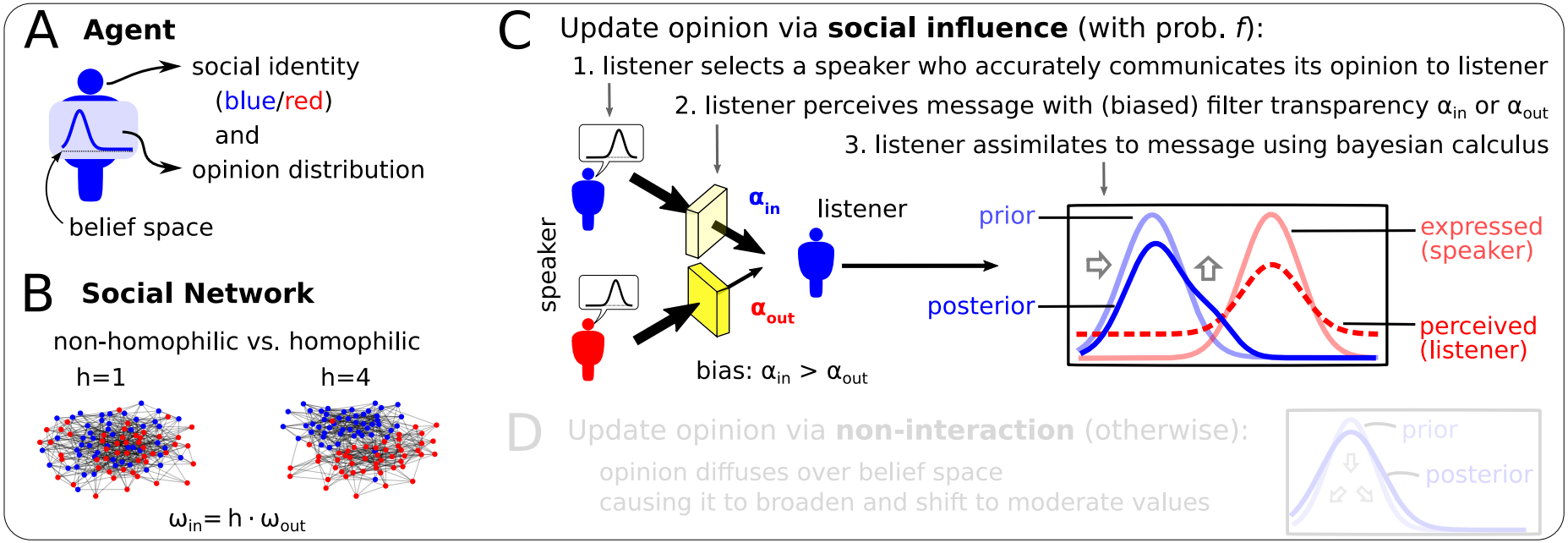
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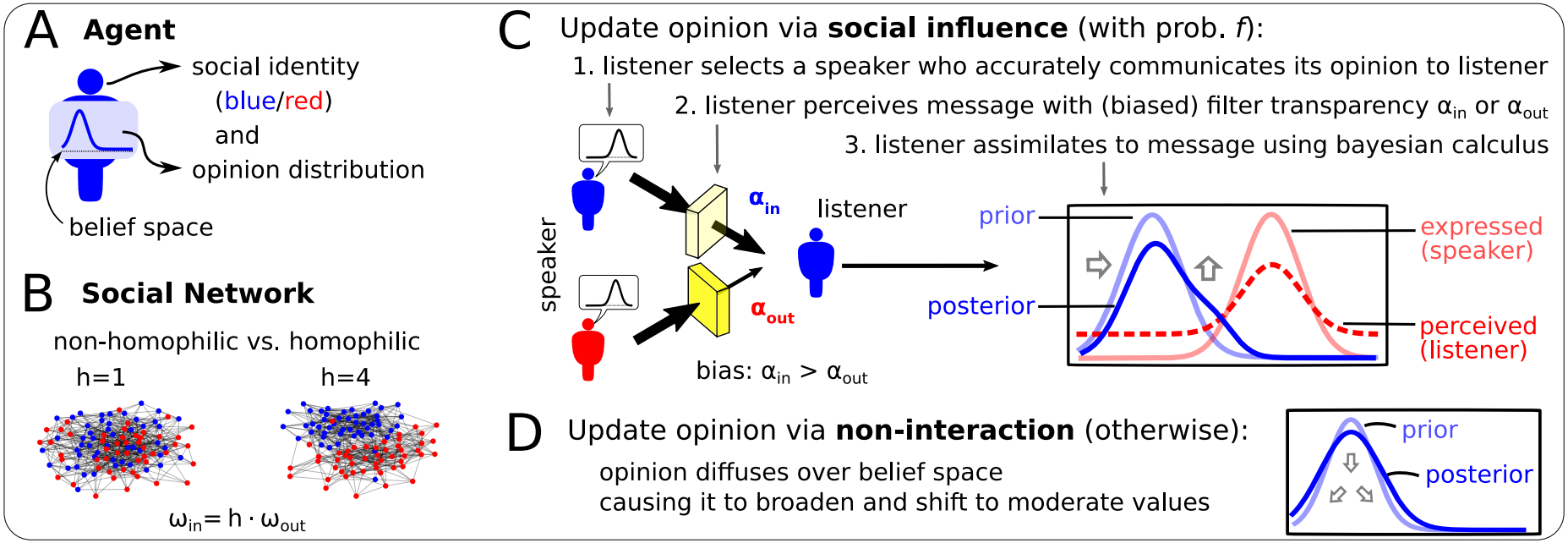
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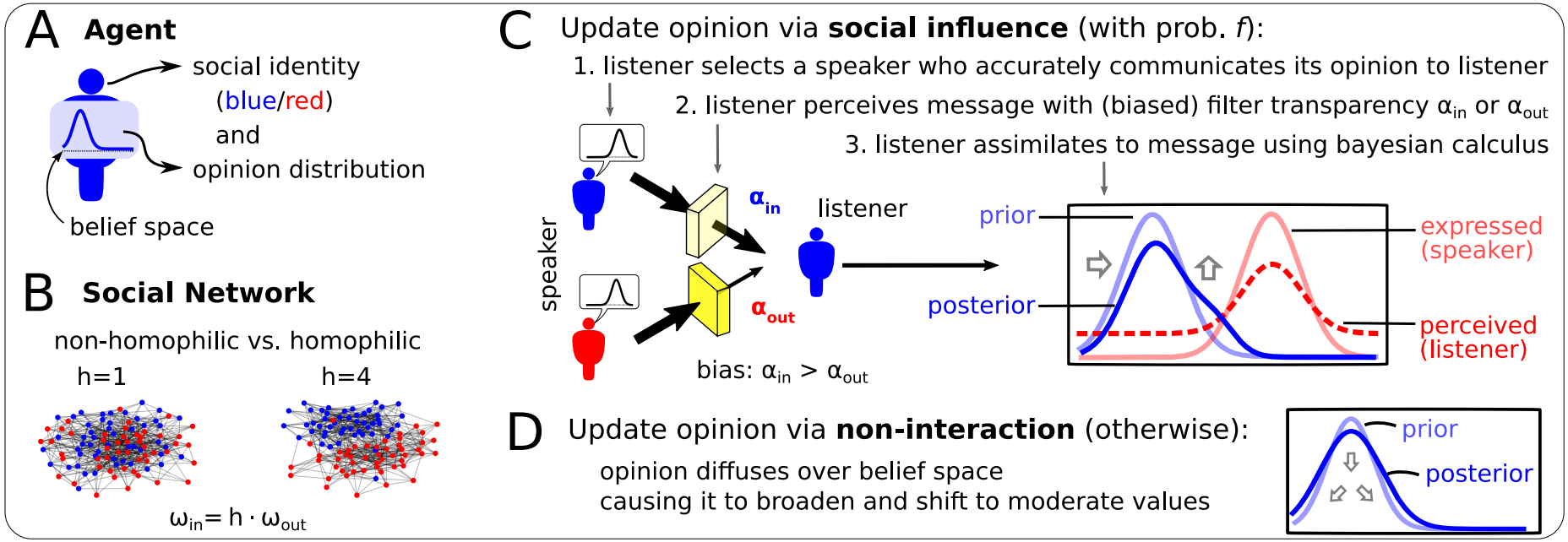
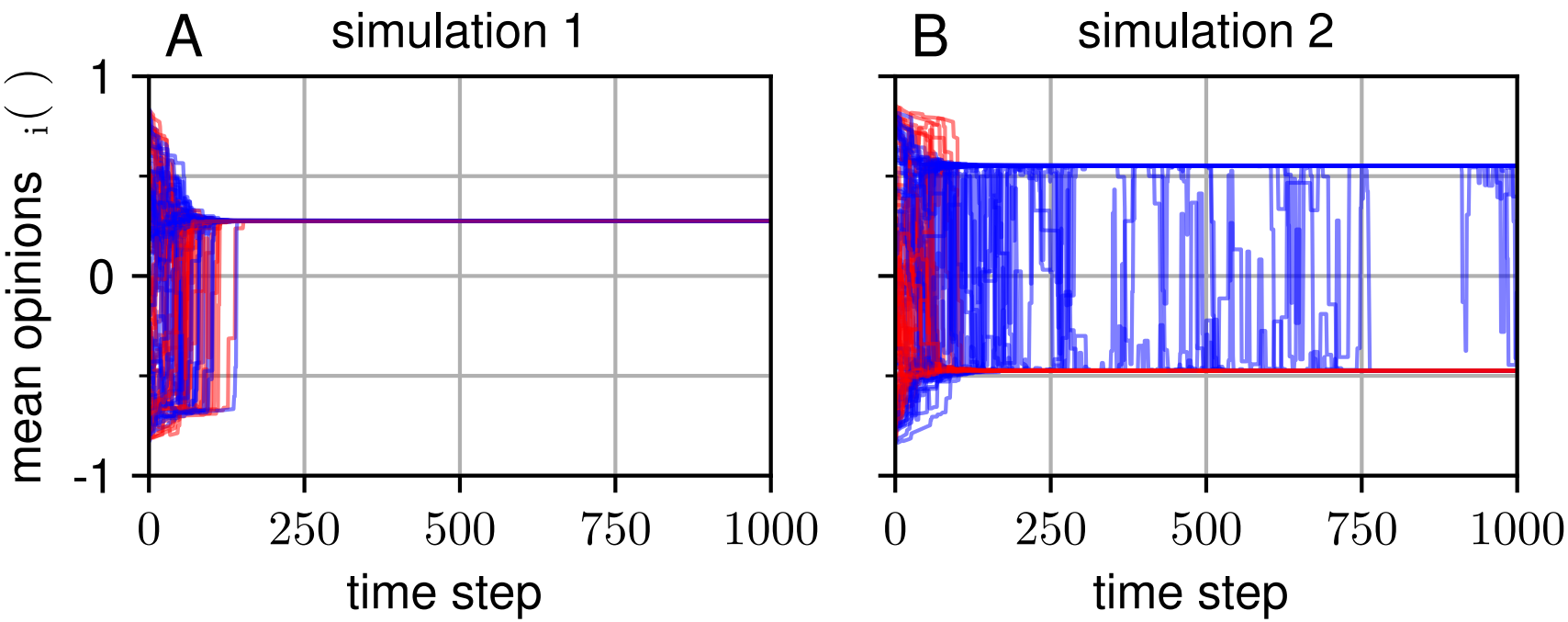


Initialise agents:

- Social identities are blue/red; groups are evenly sized.
- Opinions are gaussian with fixed width and random mean

Results I

Society with fixed bias ($\alpha_{\text{in}} = 0.8$, $\alpha_{\text{out}} = 0.3$) and fixed homophily ($h = 4$)



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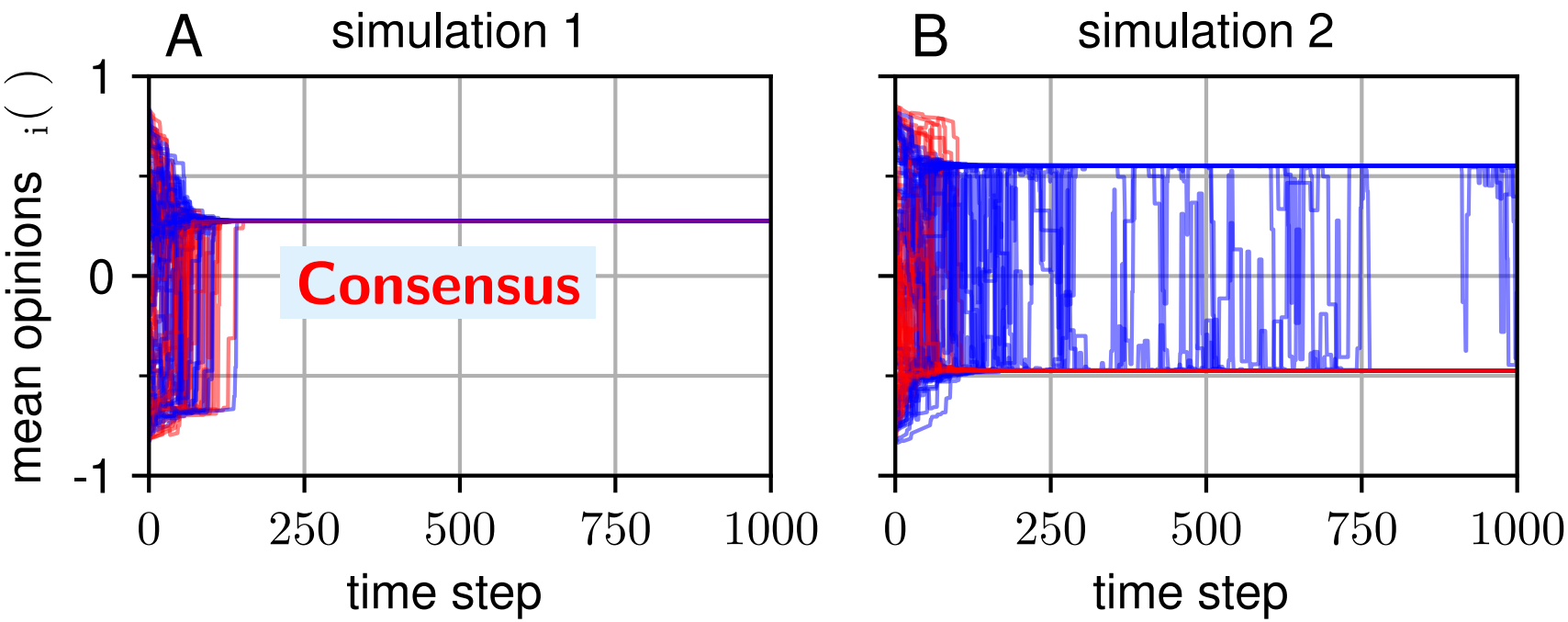

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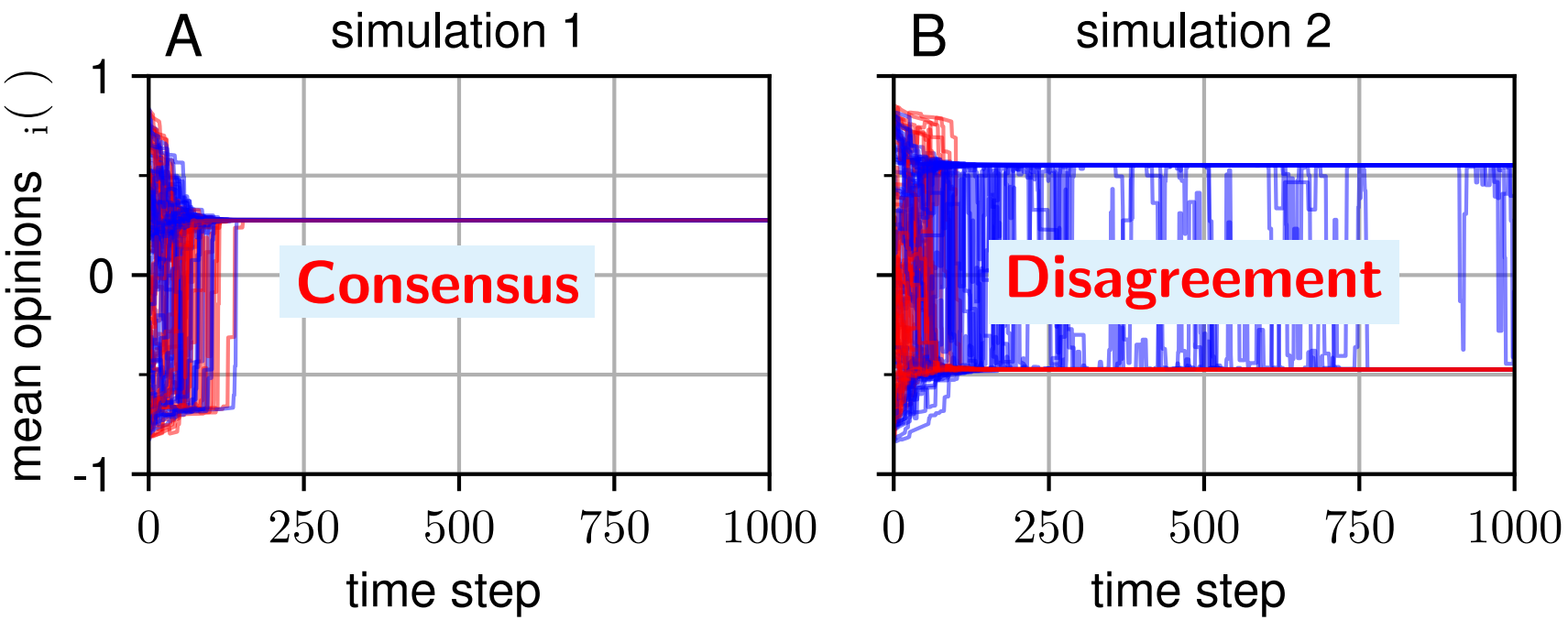
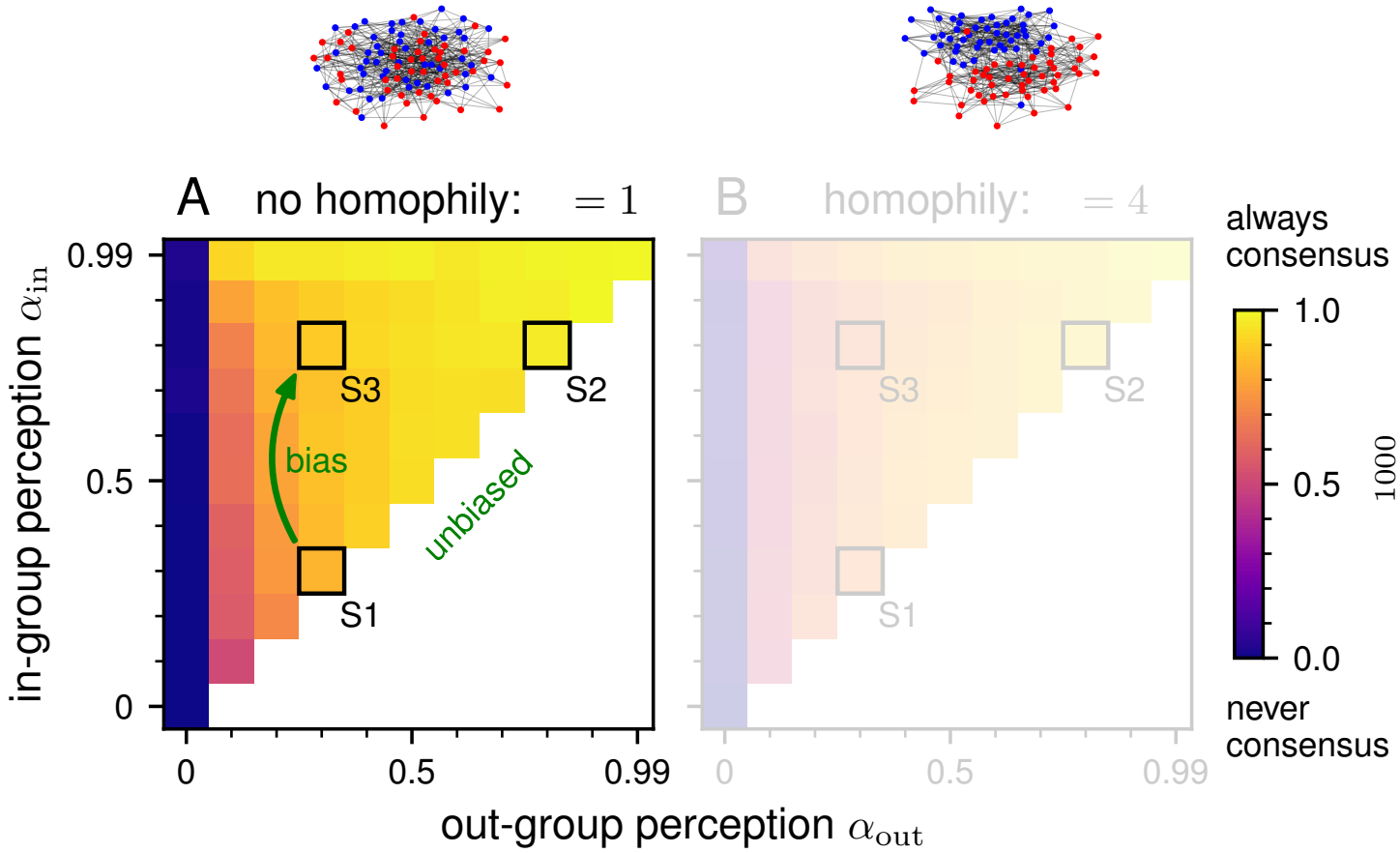
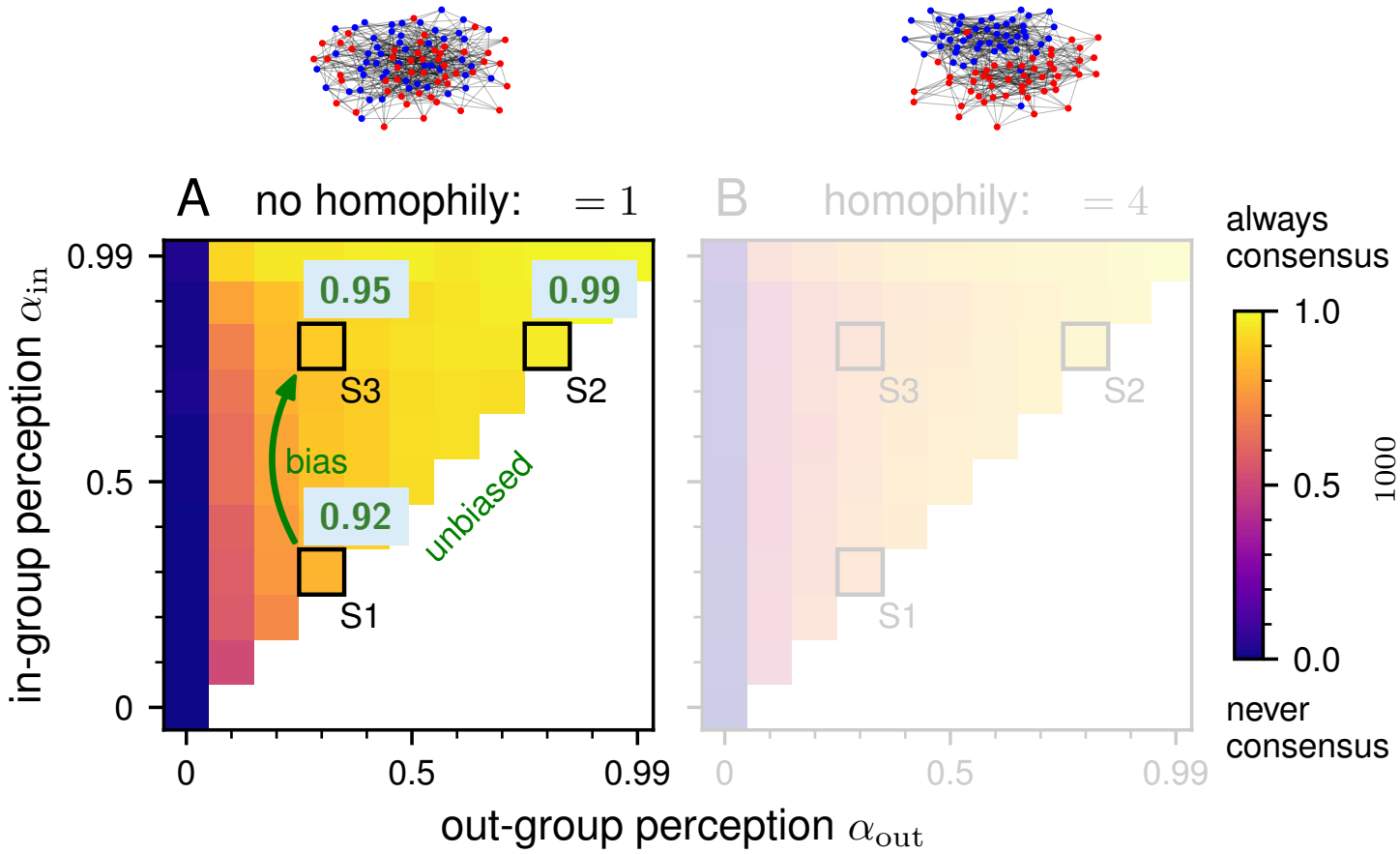


Results II


A
no homophily: $= 1$
B
homophily: $= 4$
S1
S2
S3
bias
unbiased
in-group perception α_{in}
out-group perception α_{out}
0
0.5
0.99
always consensus
never consensus
1.0
0.0
1000

-
-

Results II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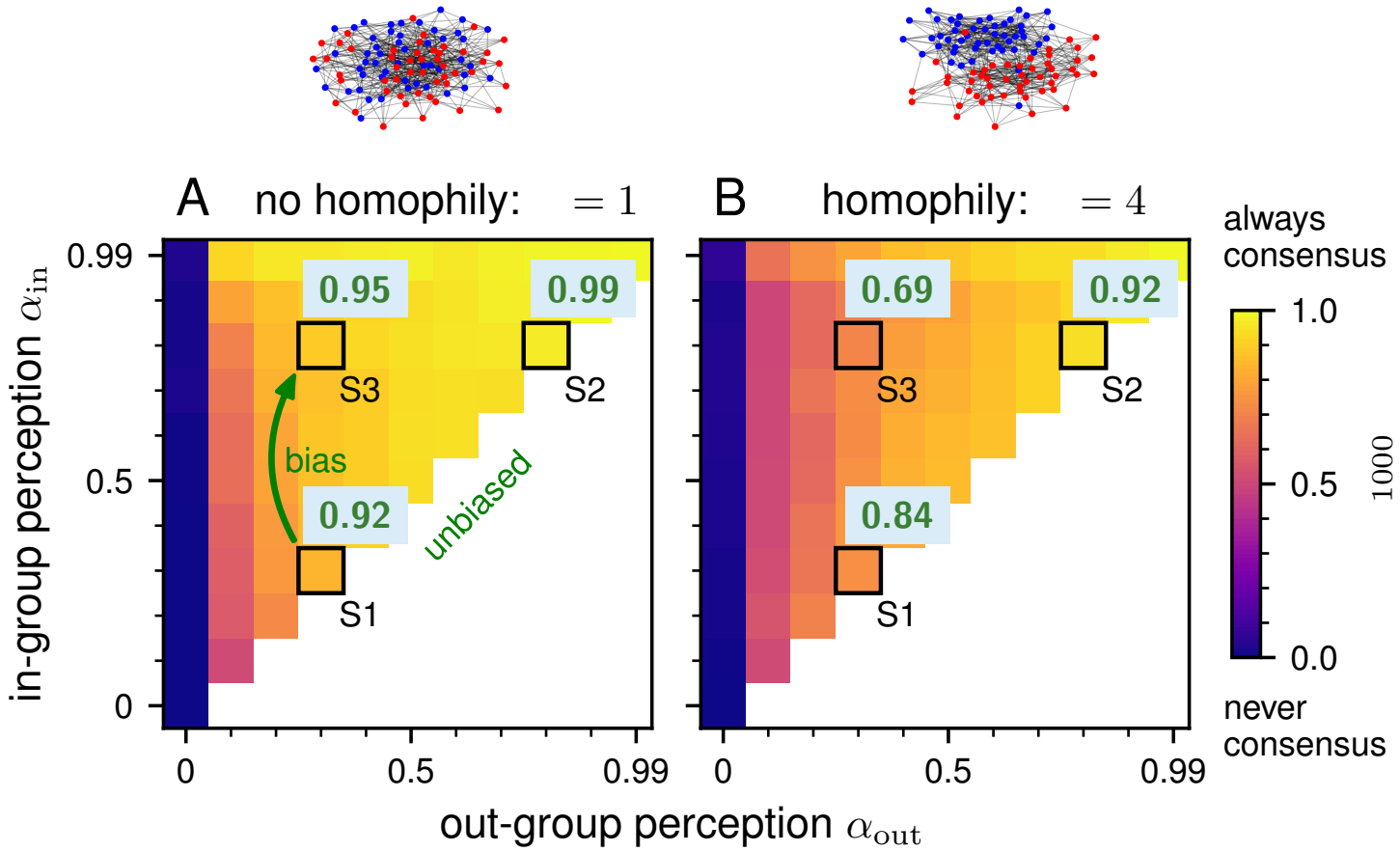

- Homophily & bias combined impede consensus in a society ...
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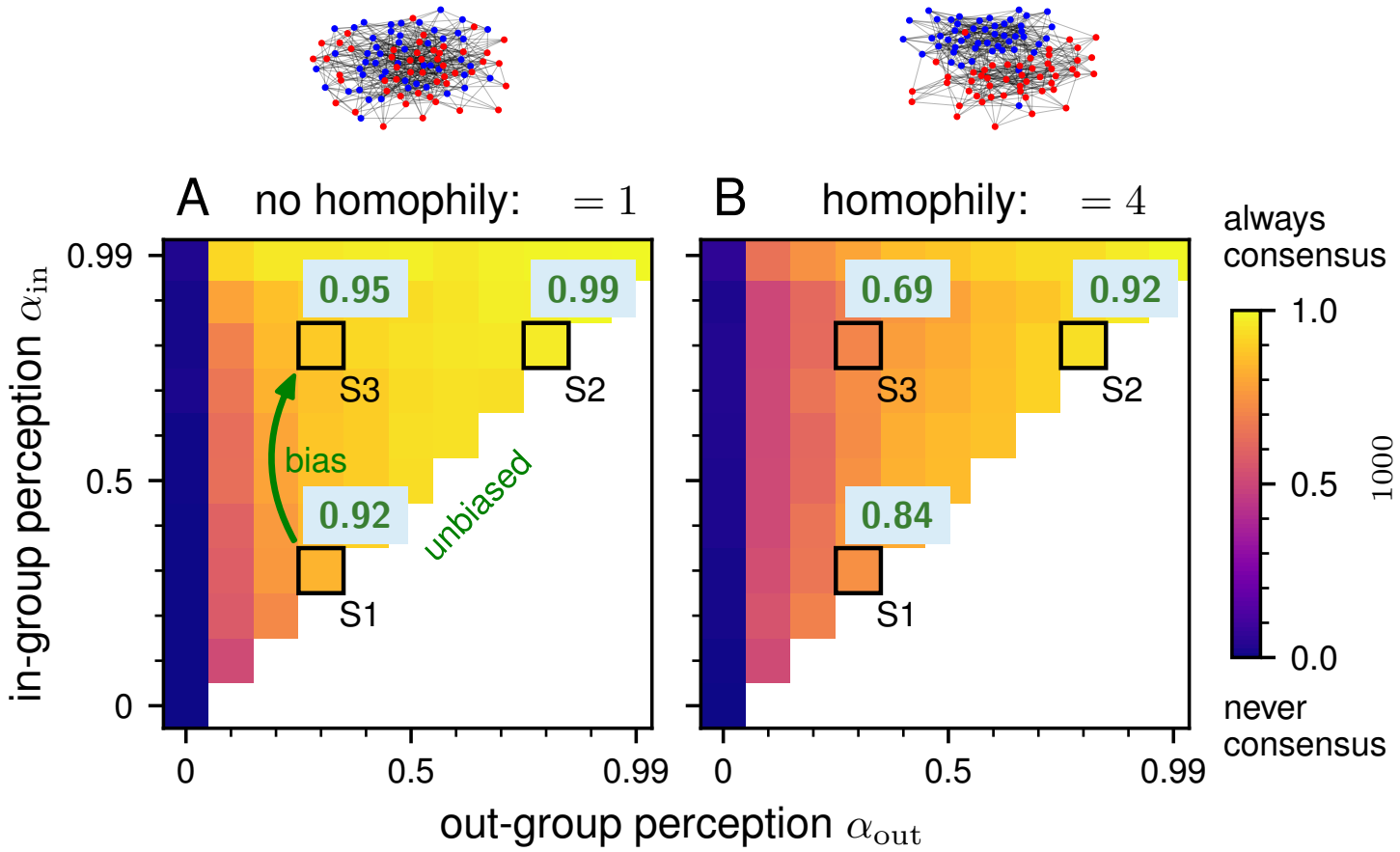

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- ... but sometimes they *accelerate* consensus formation

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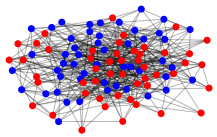
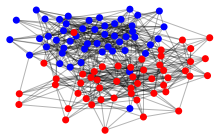
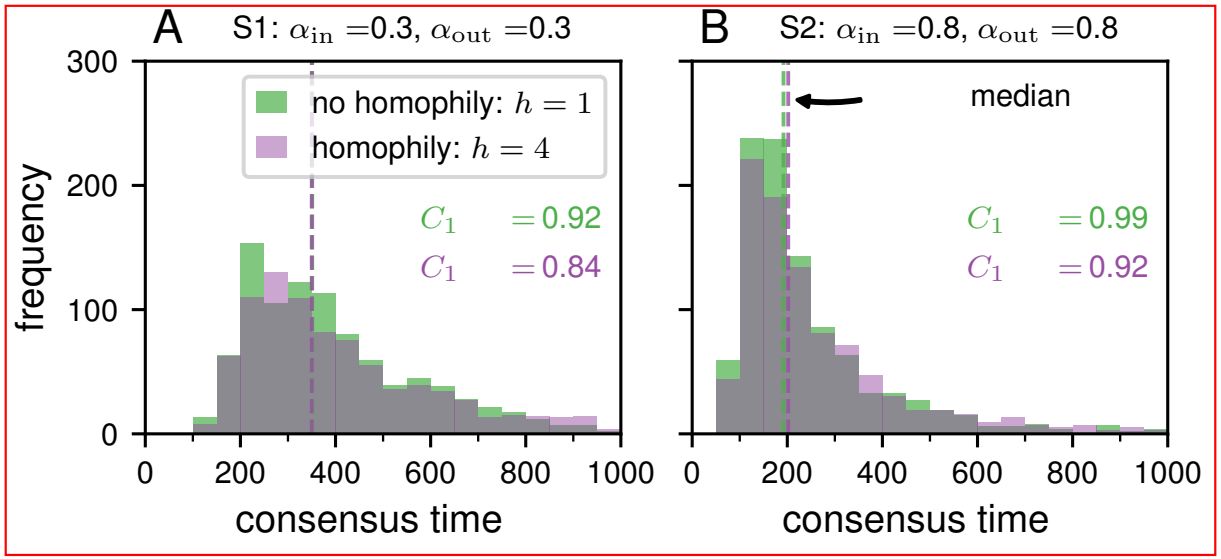
 → non-homophilic $h = 1$  → homophilic $h = 4$



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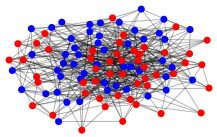

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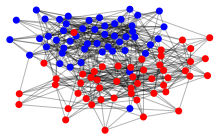

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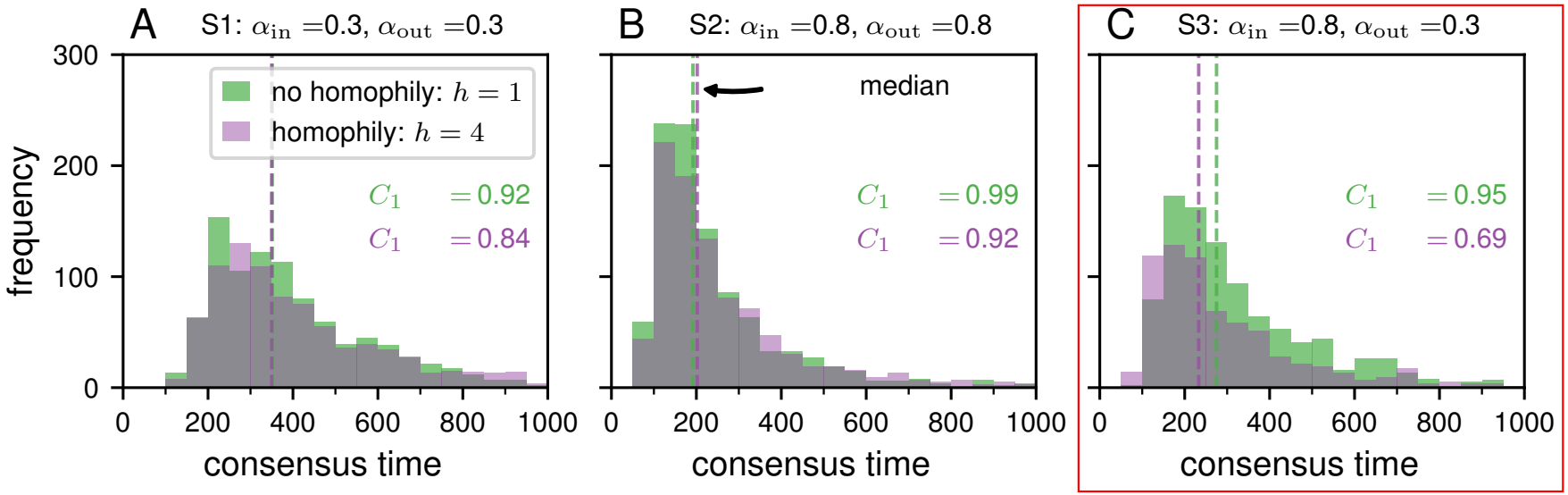

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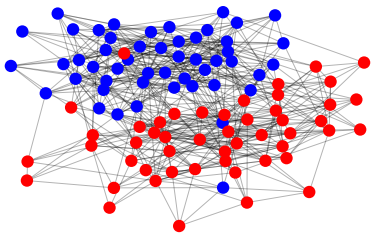
Summing up



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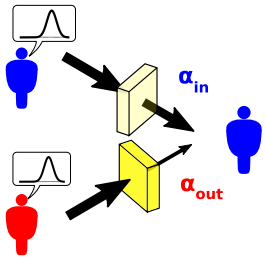
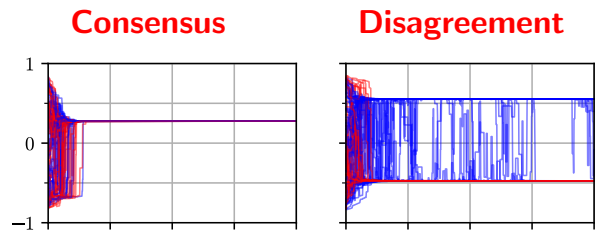


in-group favouritism bias

ABM



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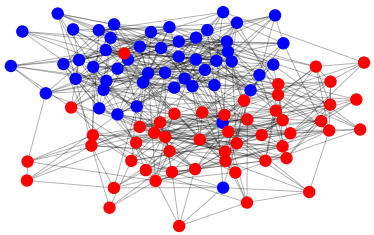

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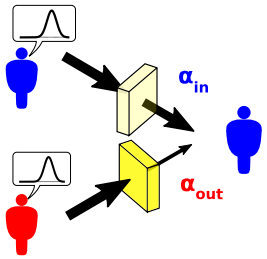

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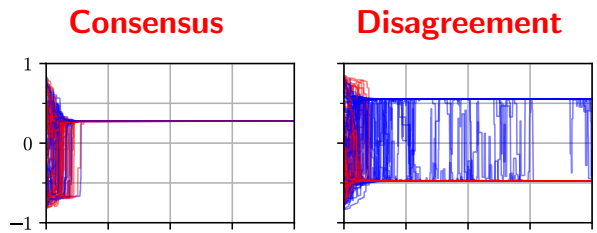

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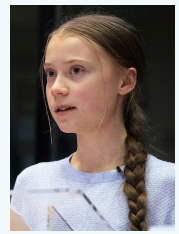

When social identity is relevant in a public debate

- it negatively affects consensus formation in general
- it may nevertheless sometimes facilitate *fast* consensus

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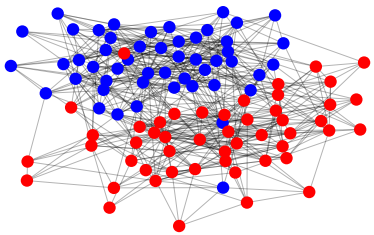

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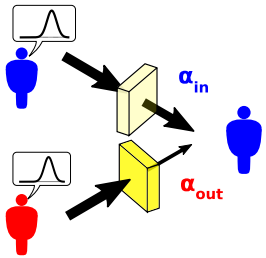
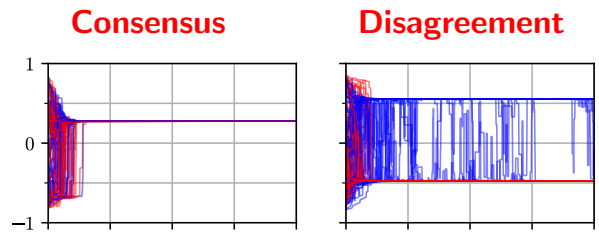
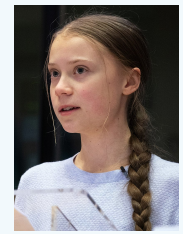


in-group favouritism bias

ABM →



> We young people need to say that we must hold the older generations accountable for the mess they have created [. . .]
>
> – Greta Thunberg, Fridays for Future



When social identity is relevant in a public debate

- it negatively affects consensus formation in general
- it may nevertheless sometimes facilitate *fast* consensus

$\longrightarrow$ Is highlighting social identity (young vs. old generation) in the debate on climate change useful in accelerating consensus?

References I

Related work:

- Martins (2009)
- Sobkowicz (2018)

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Sobkowicz, P. (2018). "Opinion Dynamics Model Based on Cognitive Biases of Complex Agents". In: *Journal of Artificial Societies and Social Simulation* 21.4, p. 8. ISSN: 1460-7425. DOI: 10.18564/jasss.3867.

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Tajfel, H. (Apr. 1974). "Social Identity and Intergroup Behaviour". In: *Social Science Information* 13.2, pp. 65–93. ISSN:

Update rule

- Opinion of agent i: $x_i(b, t)$, where $b \in \mathcal{B}$ belief space $\mathcal{B}$.
- Perception of the opinion of a speaker j:

$$p_i\left(x_j(b,t)\right) = \alpha_i(j) \cdot x_j(b,t) + (1 - \alpha_i(j)) \cdot \mathcal{U}(b) \ ,$$

  where $\alpha_i(j)$ is α_{in} if i and speaker j are in-group members and α_{out} else. $\mathcal{U}$ is the uniform distribution.
- Update rule after interaction (before normalisation):

$$x_i(b, t+1) \quad \sim \quad x_i(b,t) \cdot p_i\left(x_j(b,t)\right)$$

- Update during non-interaction (diffusion):

$$\text{integrate for one time step}: \quad \frac{\mathrm{d}}{\mathrm{d}t} x_i(b,t) = \kappa \cdot \frac{\mathrm{d}^2}{\mathrm{d}b^2} x_i(b,t)$$

Parameters

Table: Model parameters and the default values.

Parameter	Description	Value
N	nr. of agents	100
k	average node degree of an agent	10
S	nr. of social identities (here, evenly sized groups)	2
$\mathcal{B}$	belief space	$\{-0.995, -0.985, \ldots$ $\ldots 0.995\}$
f	frequency of an agent to interact (listen) in a time step	0.2
κ	diffusion constant of the opinion distribution, when the agent does not interact	0.0002
σ_0	variance of initial gaussian opinion distributions for all agents	0.2
h	level of homophily in the network	1 (no homophily), 4 (homophily)
α_{in}	perceived informativeness of in-group member	$\in [0, 1[$
α_{out}	perceived informativeness of out-group agent	$\in [0, 1[$
σ_{cons}	threshold of the standard deviation of agent mean opinions that defines consensus at time τ ($\sigma = \frac{1}{N} \cdot \left(\sum_{i \in \{1 \ldots N\}} \left(b_i(\tau) - \overline{b}(\tau)\right)^2\right)^{0.5} < \sigma_{\text{cons}}$)	0.01