Leviathan model

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Blaise Pascal and Puy de Dôme

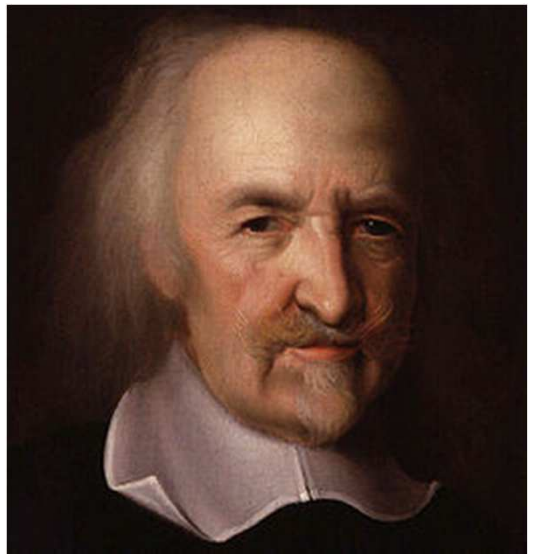
- A new model: the air has a weight
- Is the air lighter on montains ?
- Question answered by experiments on Puy de Dôme

B. Pascal 1623 - 1662

Inverting Minsky's view ?

- Modelling frames a new question that did not make any sense before
- This question can be answered by a new measurement, that did not have any meaning either
- The whole process is creating a new reality that did not exist previously…
- Would A derive from A* ?

Model of a violent society



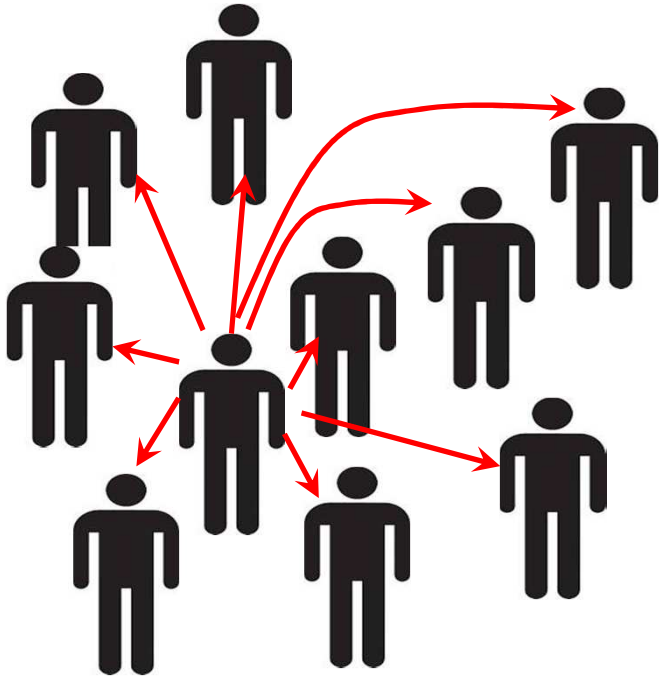
T. Hobbes 1588 - 1679

- The natural state is war of each man against all the others. Because of vanity.
- (..) every man looketh that his companion should value him at the same rate he sets upon himself, and upon all signs of contempt or undervaluing, naturally endeavours, as far as he dares (…), to extort a greater value from his contemners, by damage;

  T. Hobbes, Leviathan, chapter 13.

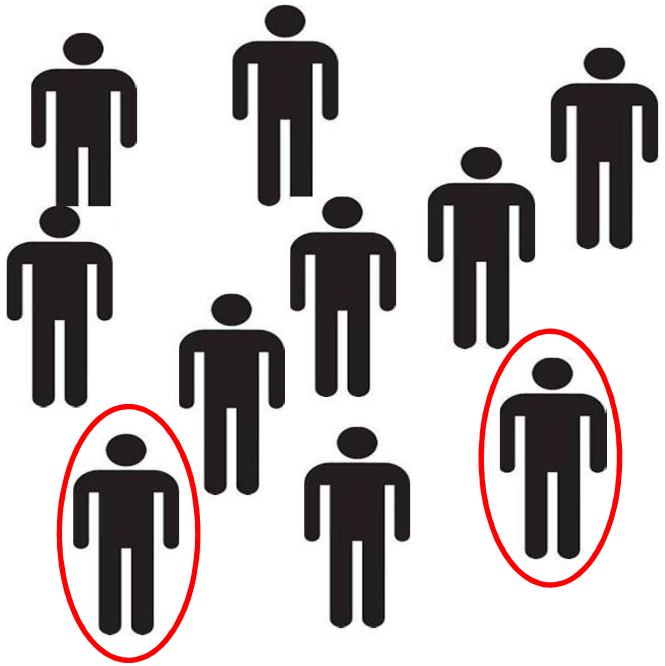
State variables

- *N* individuals
- Each agent *i* defined by its opinion about the others a_{ij}



Dynamics

- Repeat: Choose random pair (i, j)
  - Vanity (i, j)



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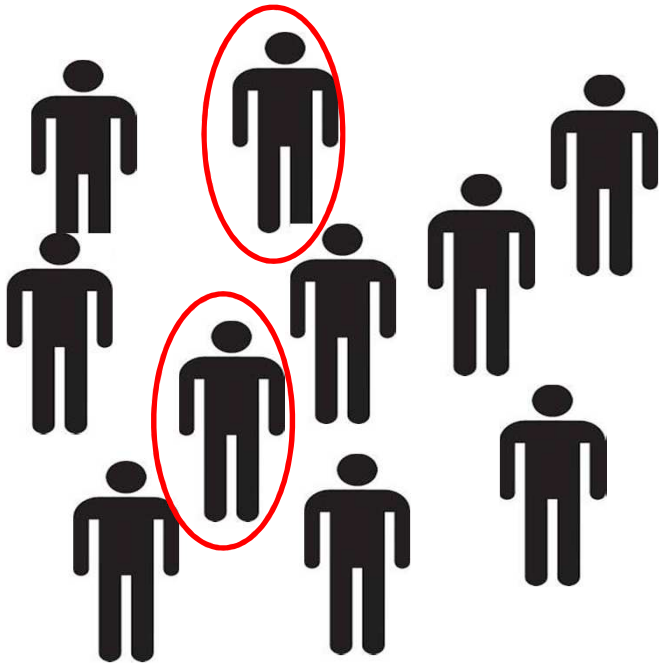
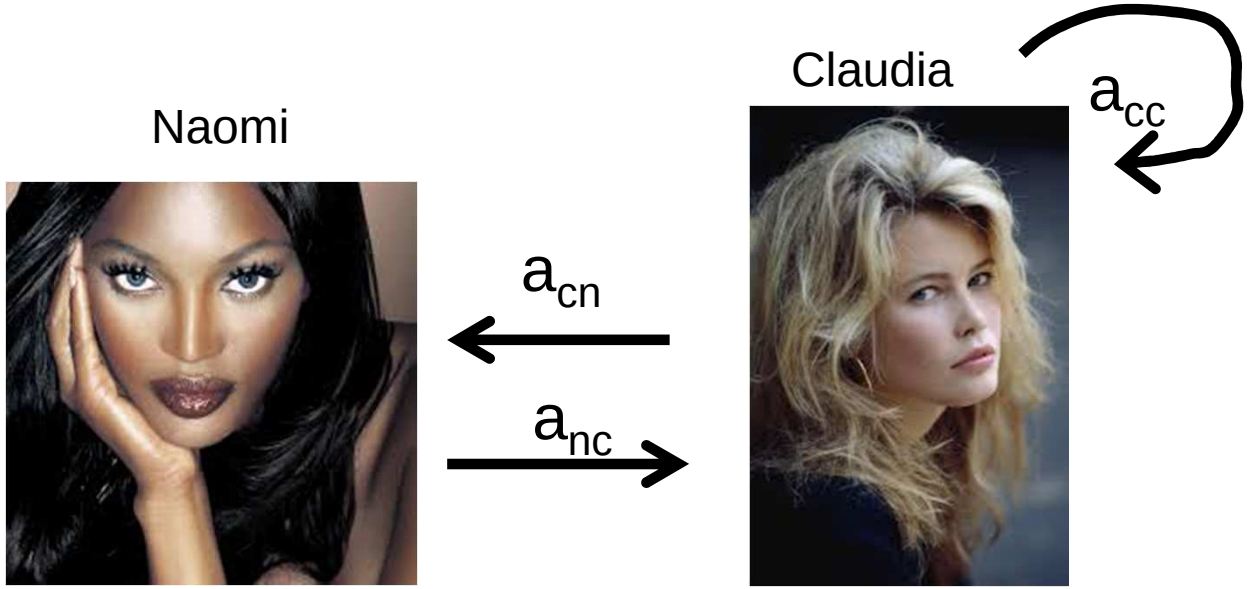
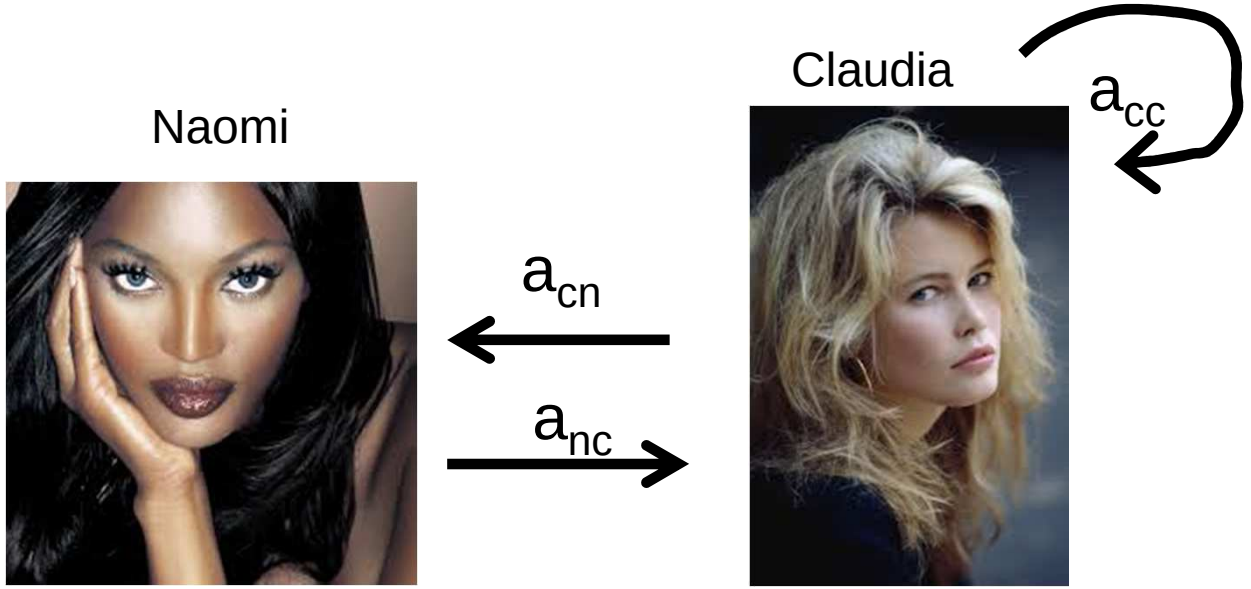


Vanity of Claudia



$$a_{cn} := a_{cn} + \omega(a_{nc} - a_{cc})$$

Vanity of Claudia

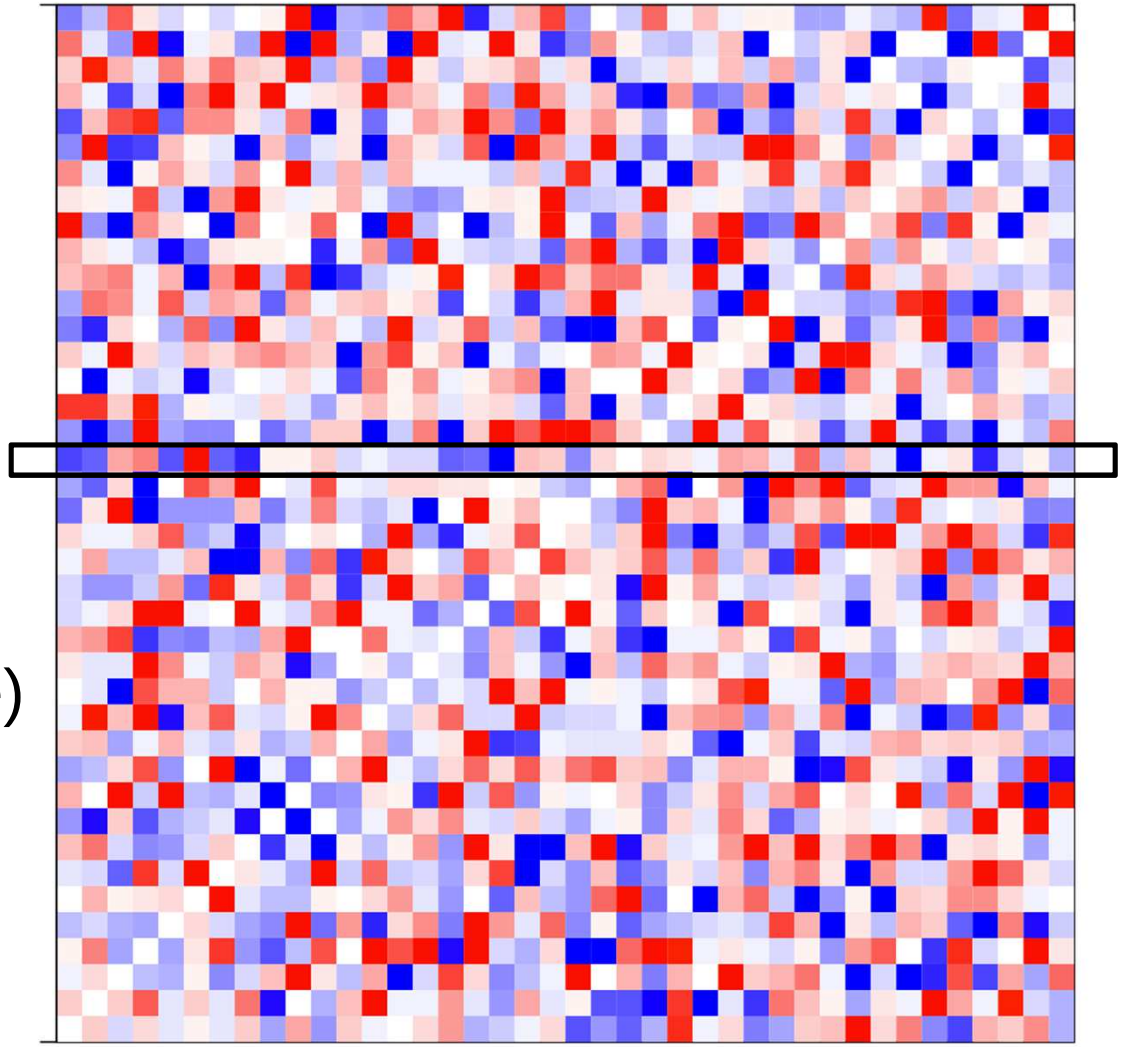


$$a_{cn} := a_{cn} + \omega(a_{nc} + \delta_t - a_{cc})$$

random noise
between $-\delta$ and $+\delta$

Matrix representation

opinions of
Naomi
about others
(red = positive
Blue =negative)



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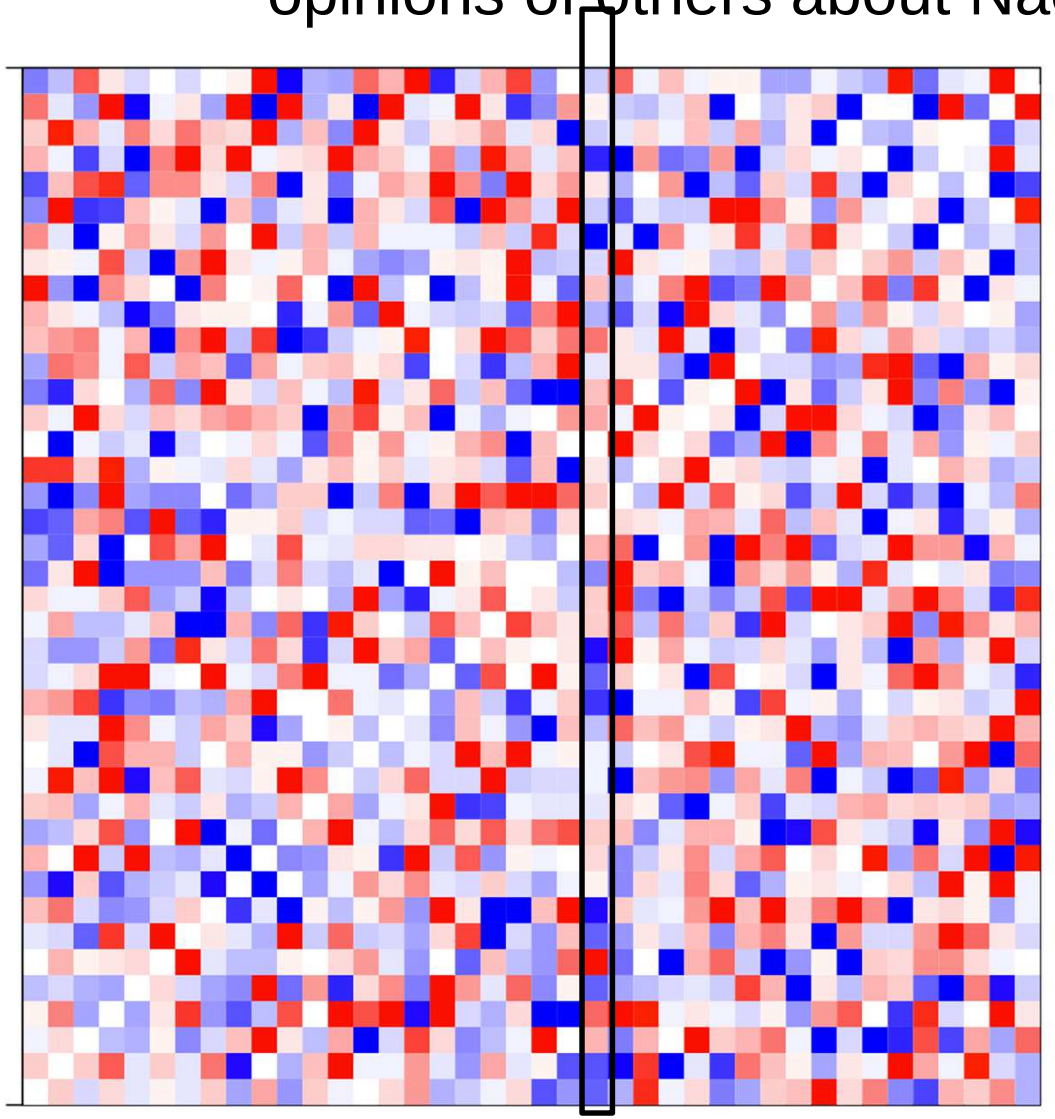
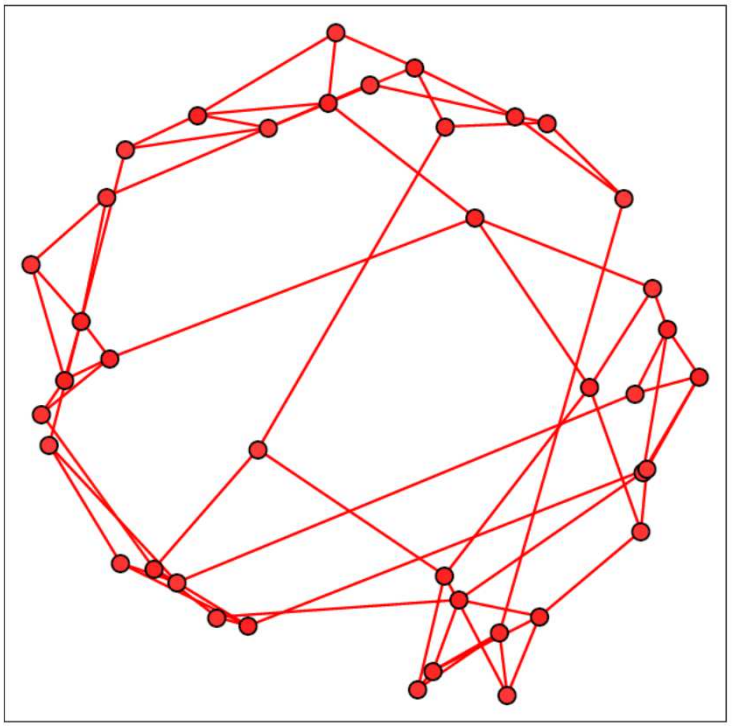
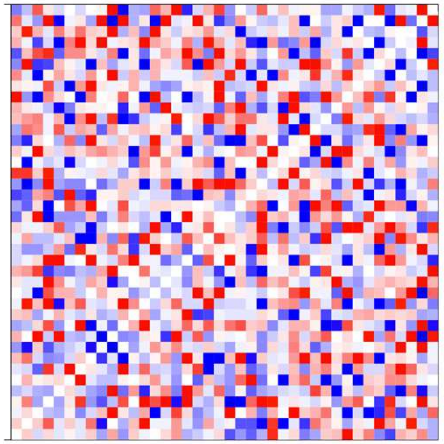


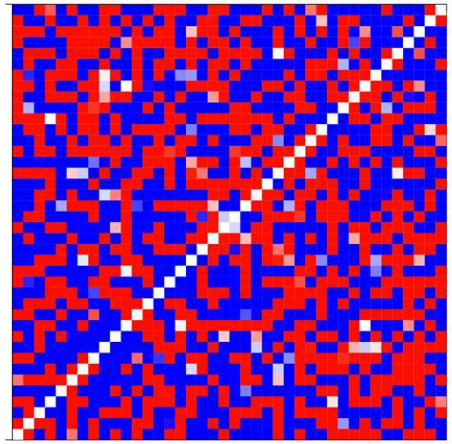
Network representation

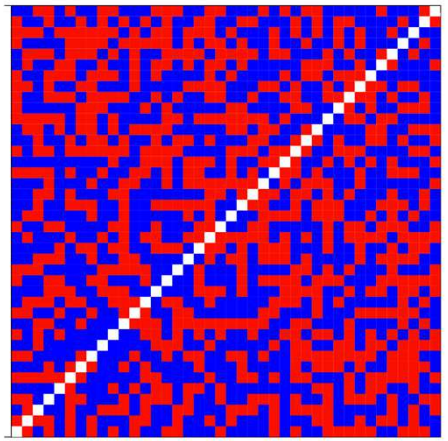
Each dot represents an agent.
The links represent positive opinions (at least on one side), the more red The higher.

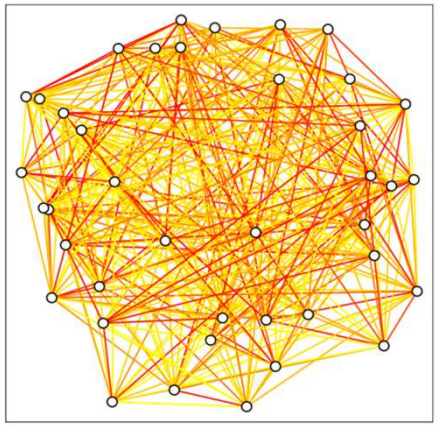


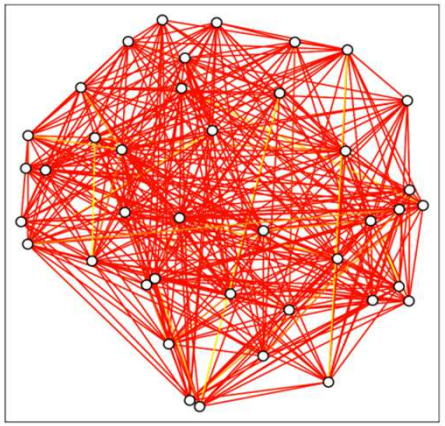
Vanity only

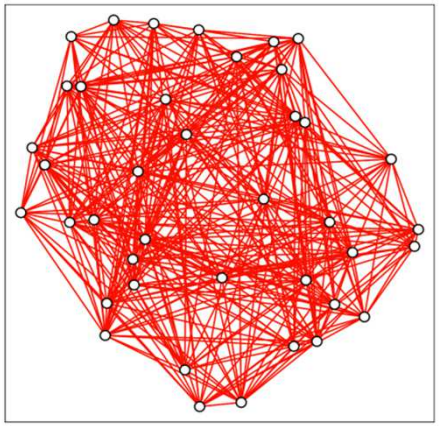












t = 200

t = 500

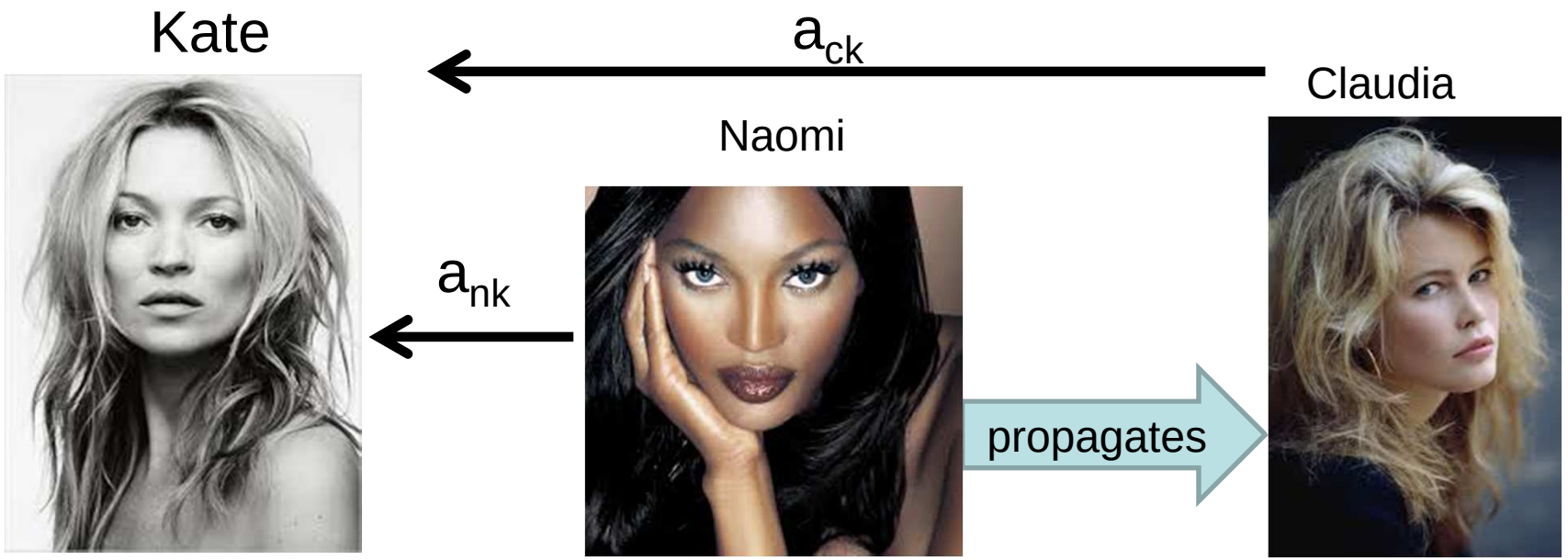
t = 1000

. ω = 0.4, ρ= 0, N = 40

Gossiping individuals

- Gossips respresent about 60% of our conversations
- Individuals having opinions about each other and exchanging about them

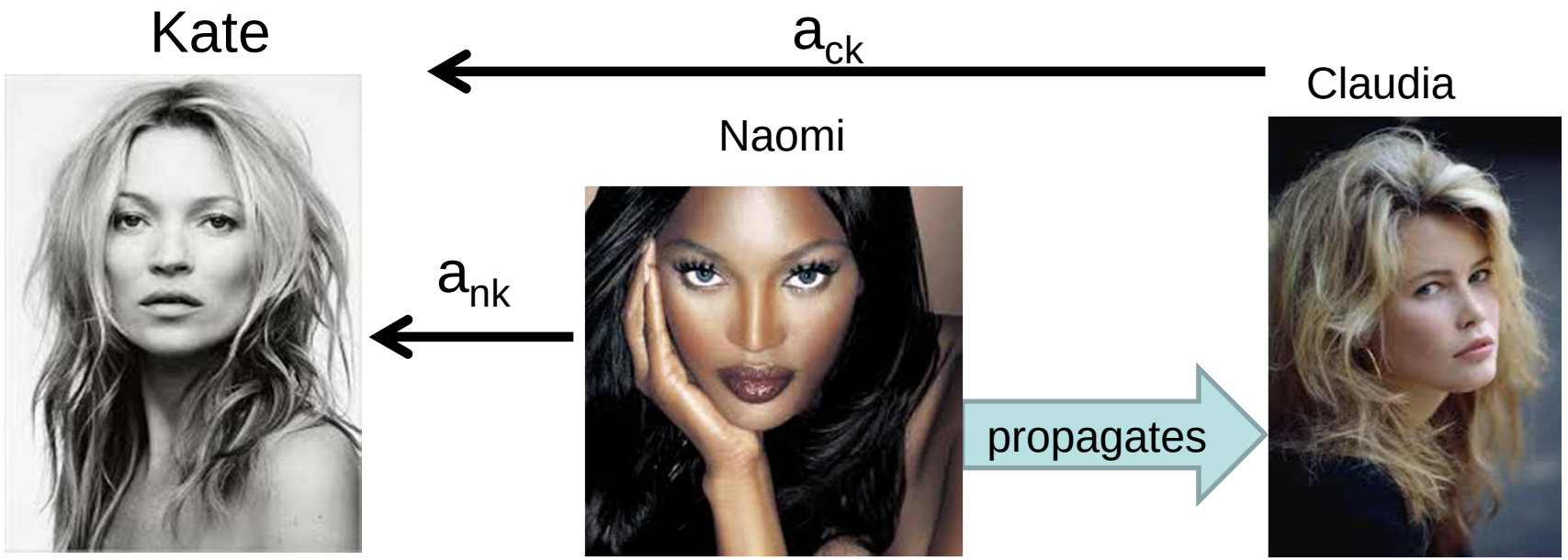
Starting point



$$a_{ck} := a_{ck} + \rho\left(a_{nk} - a_{ck}\right)$$

Claudia's opinion about Kate gets closer to Naomi's opinion about Kate

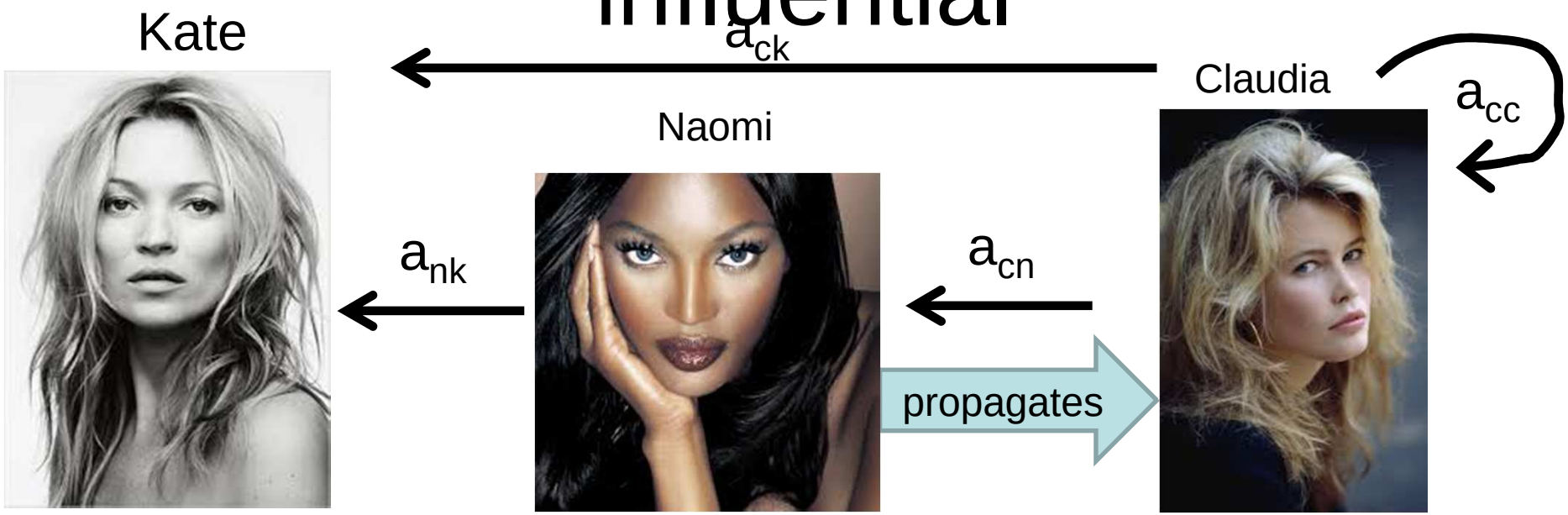
Errors in opinion evaluation



$$a_{ck} := a_{ck} + \rho\left(a_{nk} + \delta_t - a_{ck}\right)$$

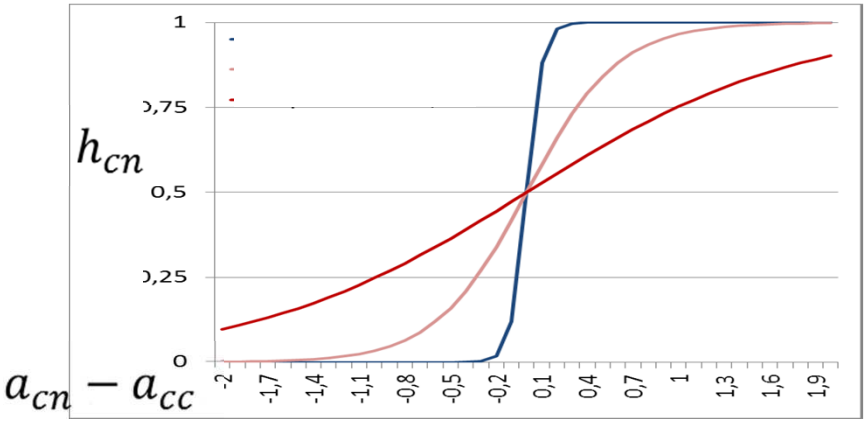
random noise
between $-\delta$ and $+\delta$

Highly valued agents are more influential

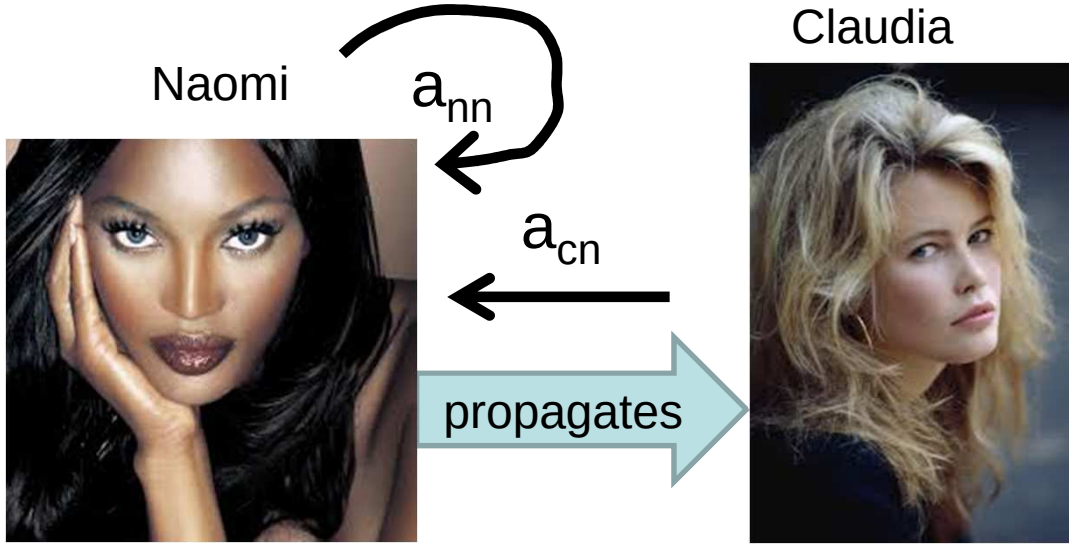


$$a_{ck} := a_{ck} + \rho . h_{cn} \left(a_{nk} + \delta_t - a_{ck} \right)$$

$$h_{cn} = \frac{1}{1 + \exp\left(-\frac{a_{cn} - a_{cc}}{\sigma} \right)}$$

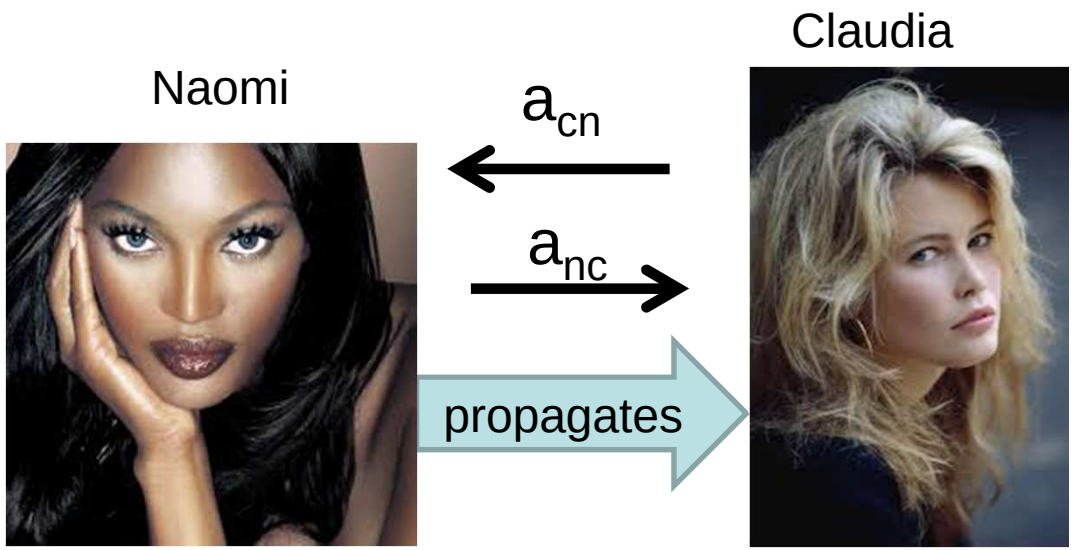


Naomi talks about herself



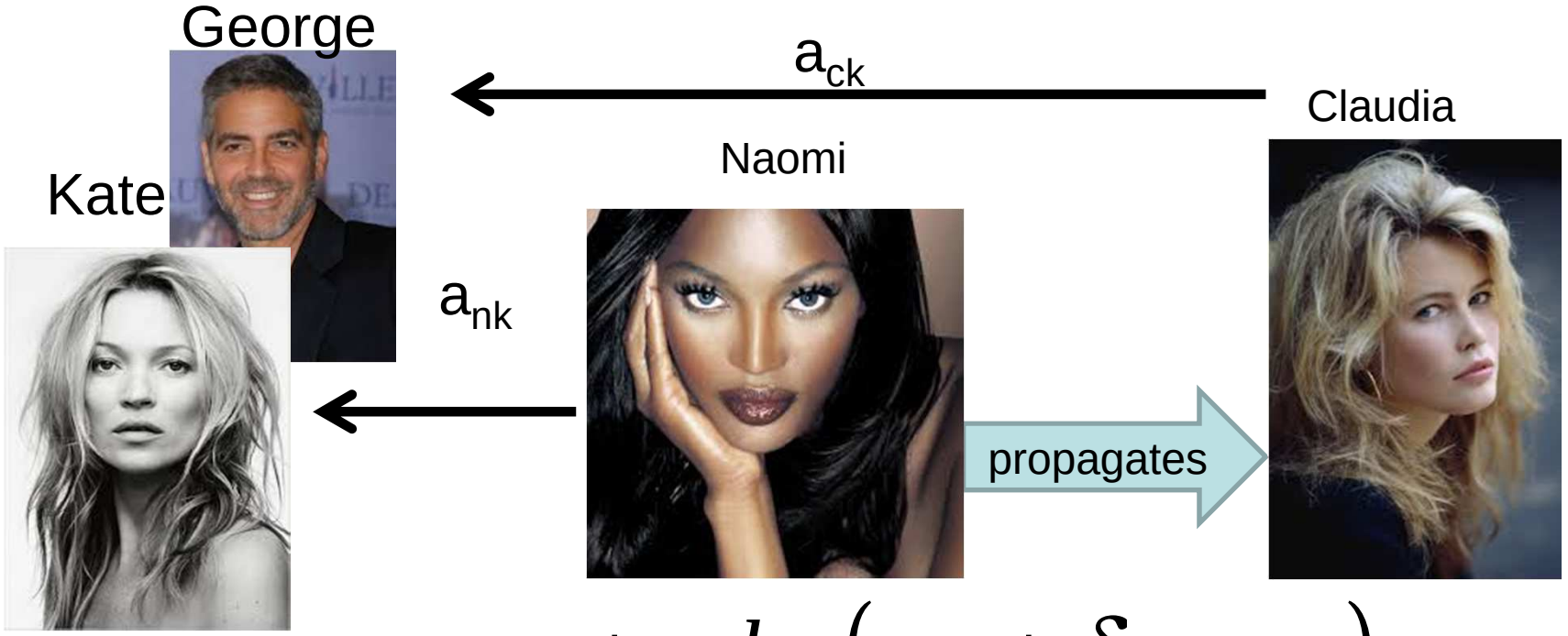
$$a_{cn} := a_{cn} + \rho.h_{cn}\left(a_{nn} + \delta_t - a_{cn}\right)$$

Naomi talks about Claudia



$$a_{cc} := a_{cc} + \rho.h_{cn}\left(a_{nc} + \delta_t - a_{cc}\right)$$

Naomi talks about others



$$a_{ck} := a_{ck} + \rho.h_{cn}\left(a_{nk} + \delta_t - a_{ck}\right)$$

Dynamics

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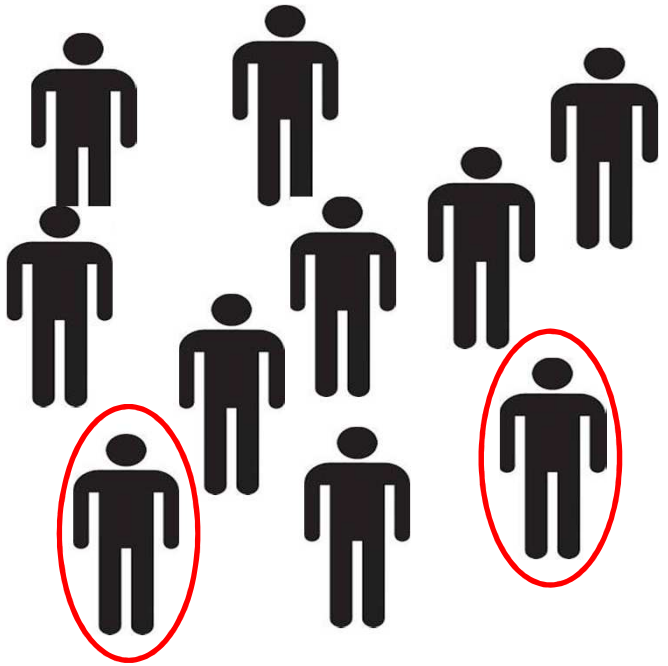
  - Opinion propagation (i, j)
  - Vanity (i, j)



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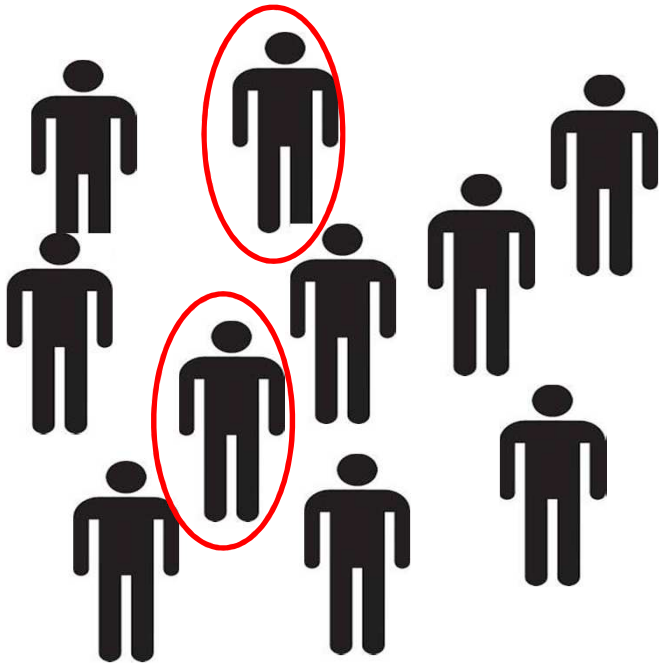
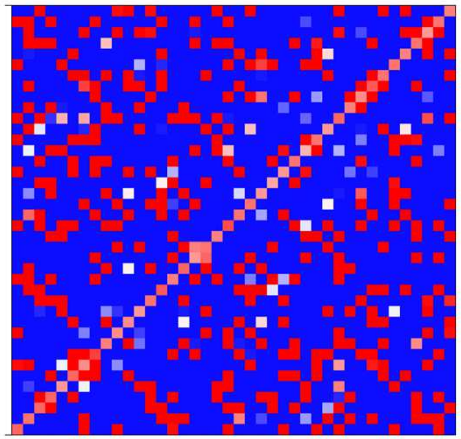


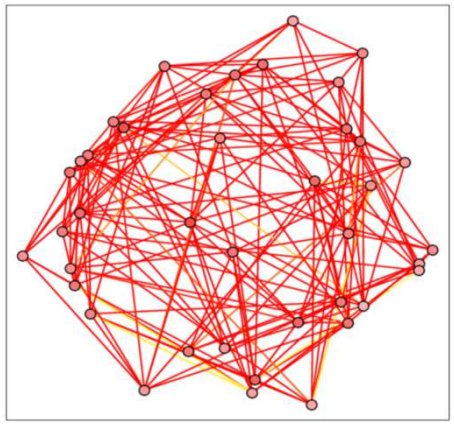
Parameters

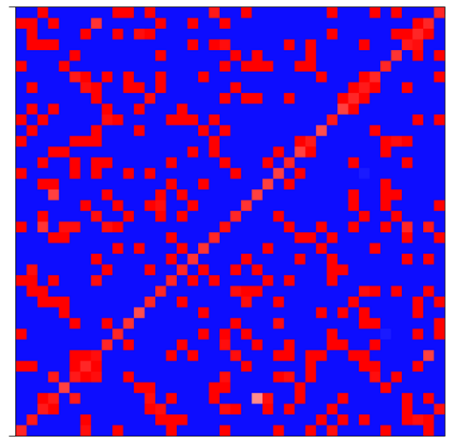
- ω vanity intensity
- ρ opinion propagation intensity
- k number of acquaintances in gossips

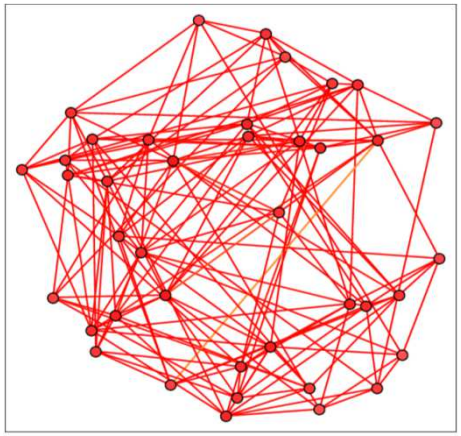
- δ intensity of noise
- σ parameter of influence function in opinion propagation

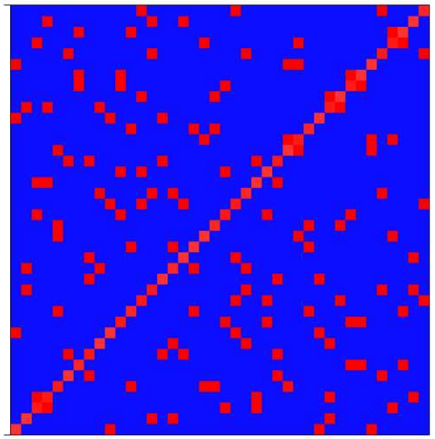
Equality

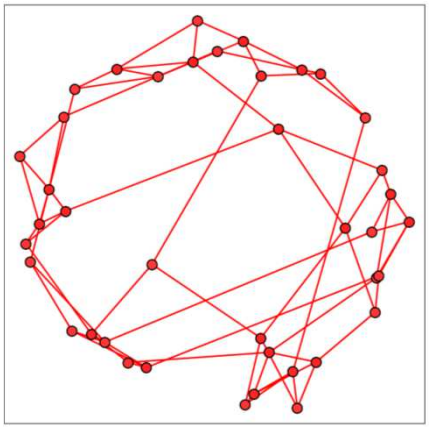












t = 500

t = 1000

t = 50000

N = 40, ω = 0.3, ρ= 0.01, σ= 0.35, k = 5, δ= 0.2.
clustering coefficient: 0.25 (random 0.08), shortest path 3.05 (random 5.02)

Why positive self-opinions ?

- The agents are much influenced by the ones they value positively (influence function *h*)
- The agents have a positive opinion of those who have a good opinion of them because of vanity
- Hence, an agent is more influenced by agents with a positive opinion of it
- This influence tends to increase its self-opinion

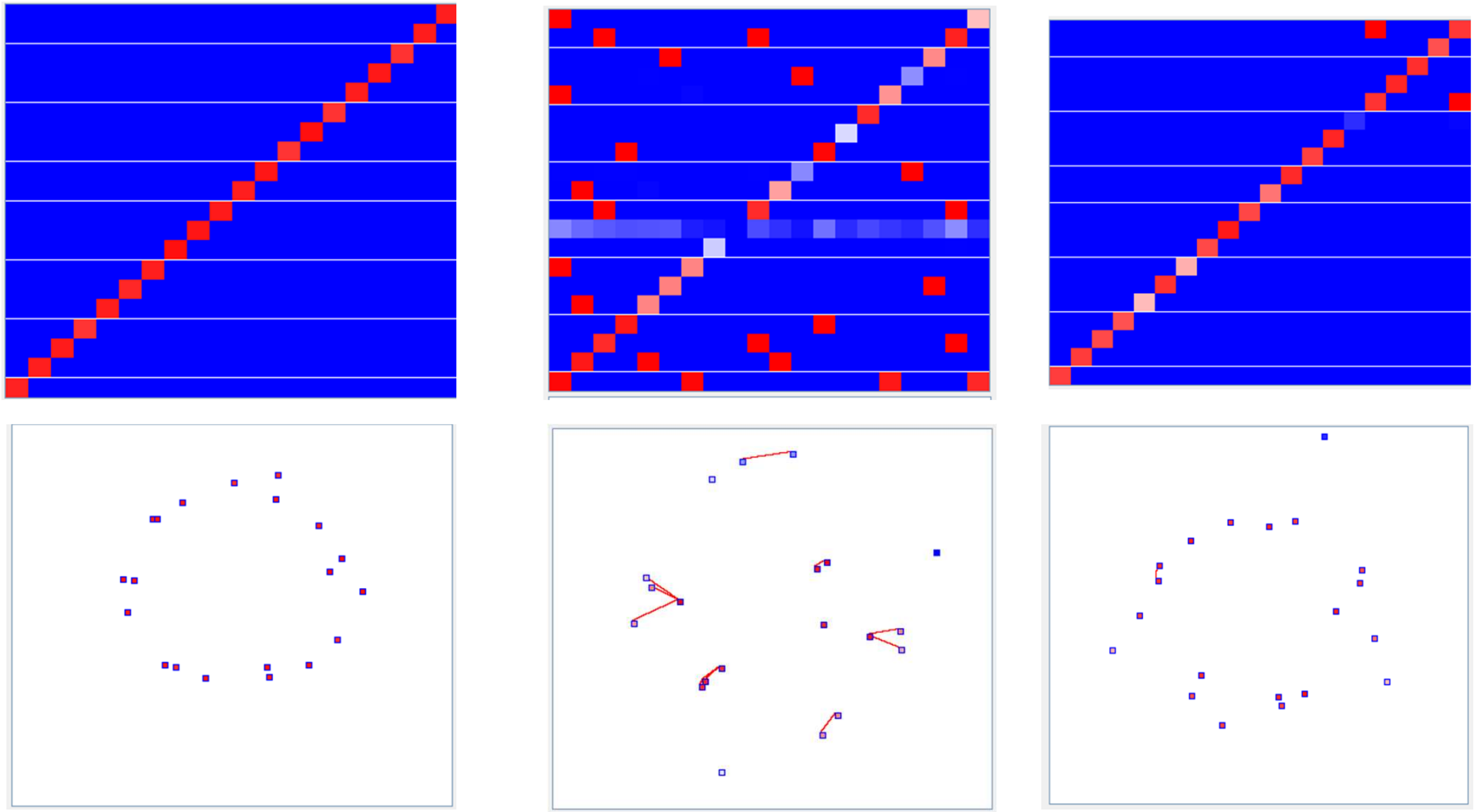
Why more negative than positive ?

- Agents have a higher self-opinion than the average opinion about them (positive self-opinion whereas average opinion is negative)
- Hence agents often consider themselves undervalued, and they decrease again their opinion of others by vanity

Loosing friends until equilibrium

- The number of friends decreases, because initially almost same number of friends as enemies
- the agents have a high self-opinion (close to 1)
- Hence the opinions of friends is likely to be under their self-opinion
- In this case they punish them by vanity and the friends do the same
- Friends are lost progressively until their number leads to a low enough positive self opinion

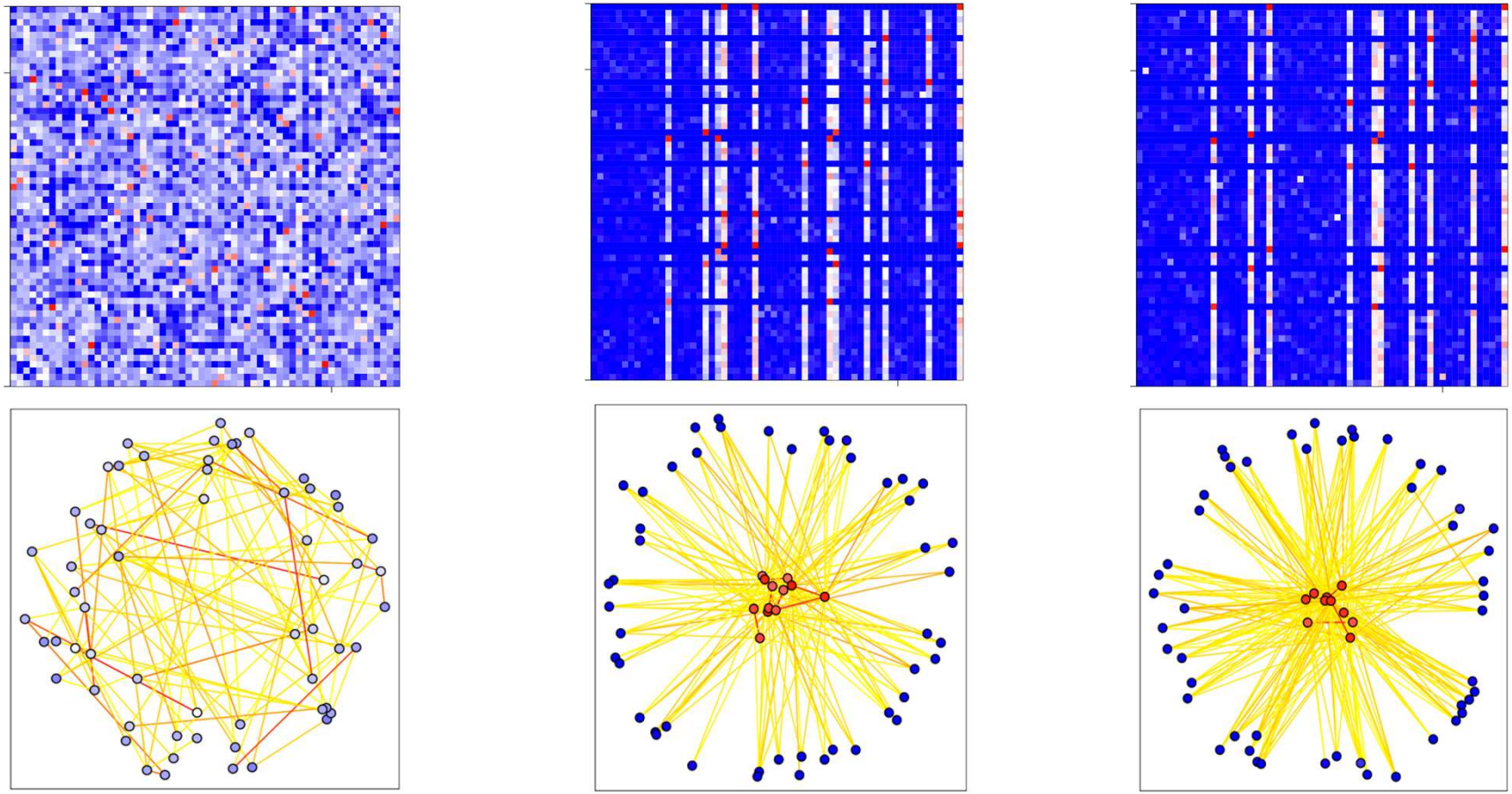
Loosing all friends and depression



Cycles of depression

- When the slope of function *h* reaches a threshold, even a single friend cannot be kept
- When all the agents have no friend, their initially high self-opinion decreases because nobody likes them and it falls to -1
- Then they can recover some friends because others can have a higher opinion than their self opinion.
- Their self opinion increases than they loose their friends again.

Elite



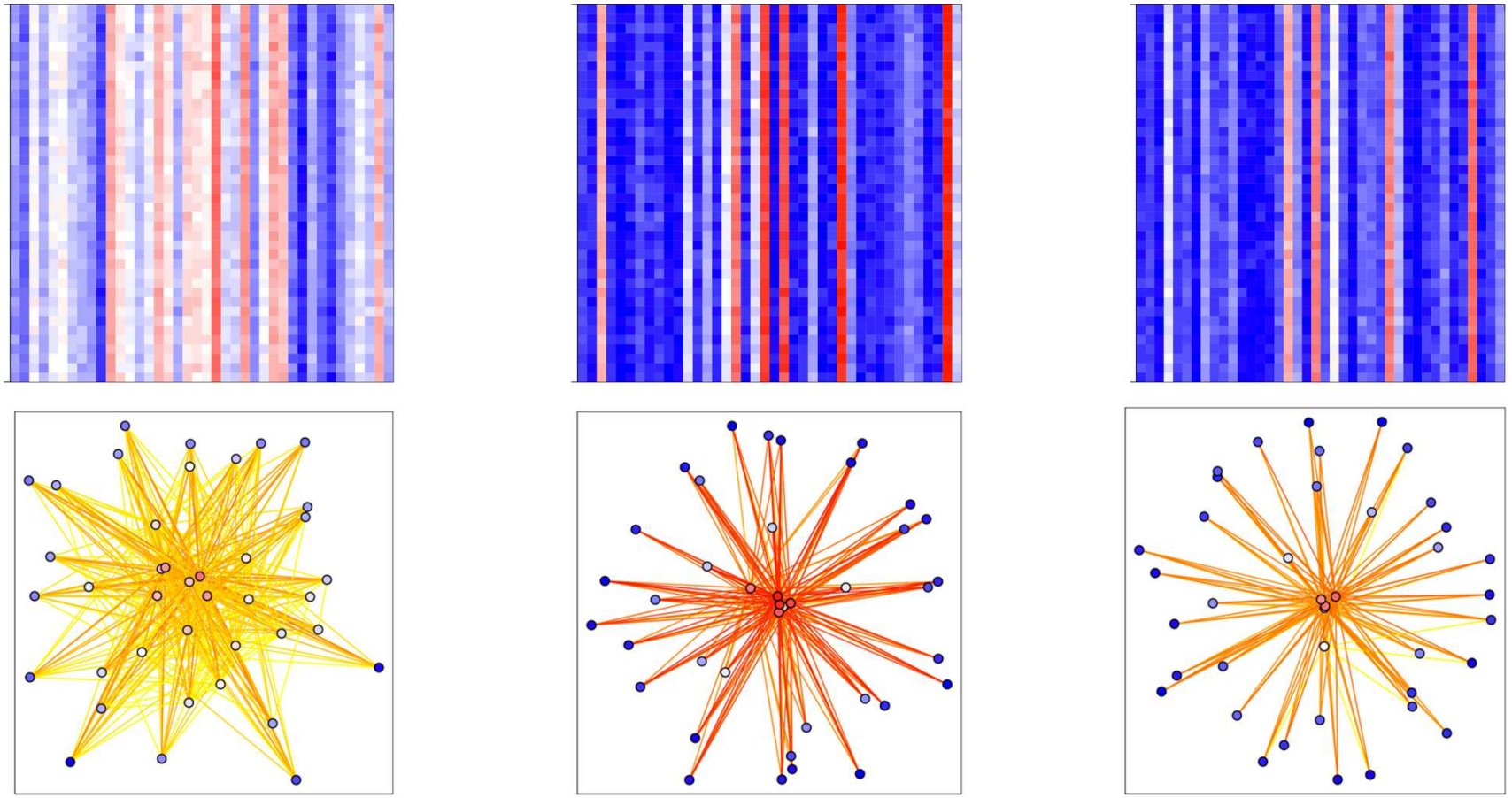
t = 1000 t = 5000 t = 50000

N = 60, ω= 0.3 and ρ= 0.1, δ= 0.2, σ= 0.3, k = 5.

Elite pattern

- ρ is a bit higher, thus the number of friends vary more strongly, some have none (slaves), some have one (masters).
- Masters have a high self-opinion which is progressively transmitted to the slaves but not completely because the masters criticise each other, as a result slaves have a moderately positive opinion of masters
- Masters have a self opinion which is not too high and they can keep their friend

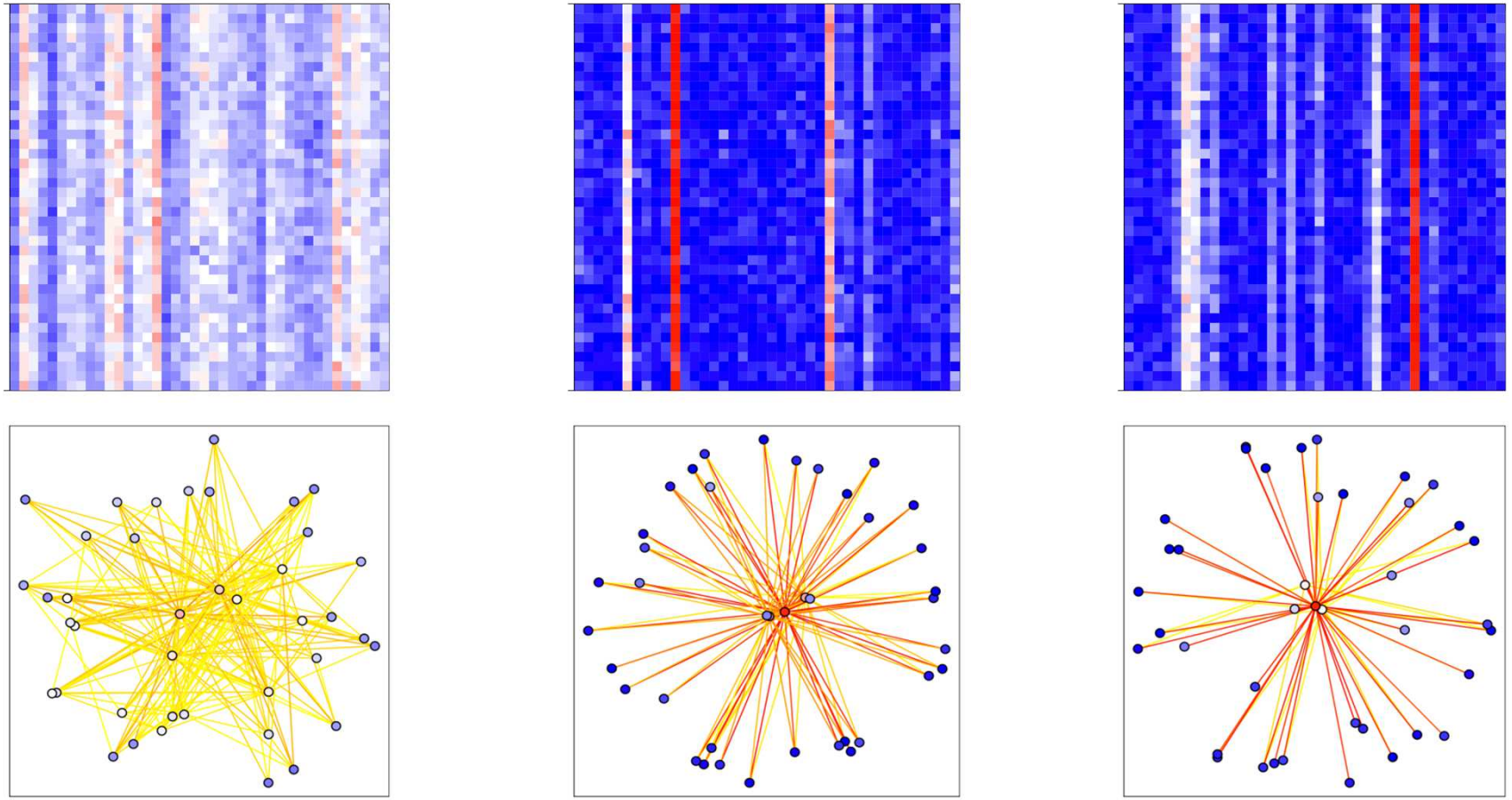
Hierarchy



t = 5000 t = 20000 t = 50000

N = 40, ω= 0.2 and ρ= 0.5, δ= 0.2, σ= 0.3, k = 10.

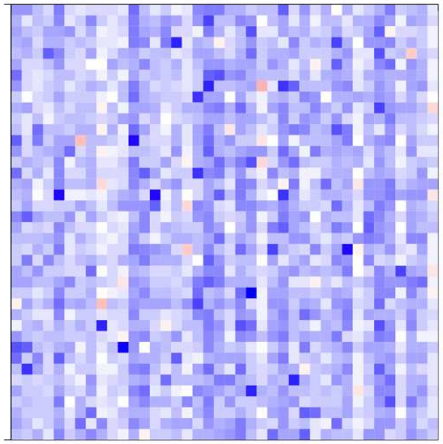
Dominance

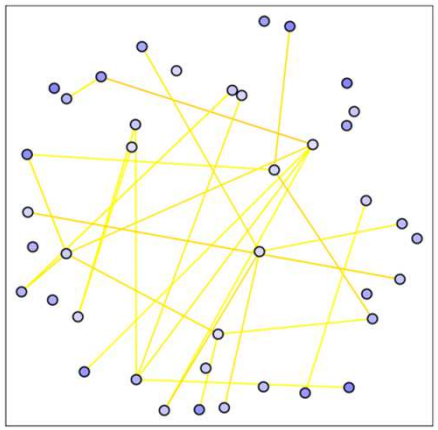


t = 5000 t = 10000 t = 50000

. ω = 0.4, ρ= 0.8, N = 40, δ= 0.2, k = 2, σ= 0.3.

Crisis





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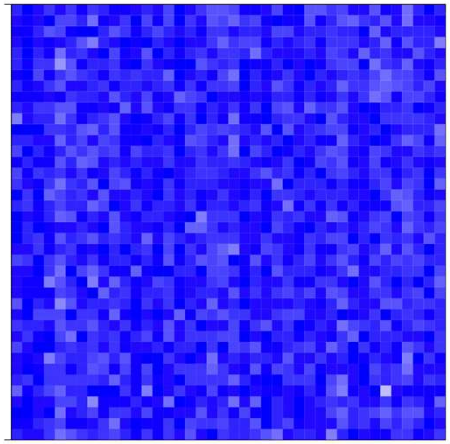

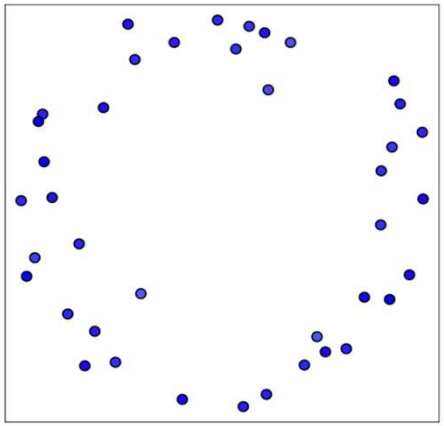

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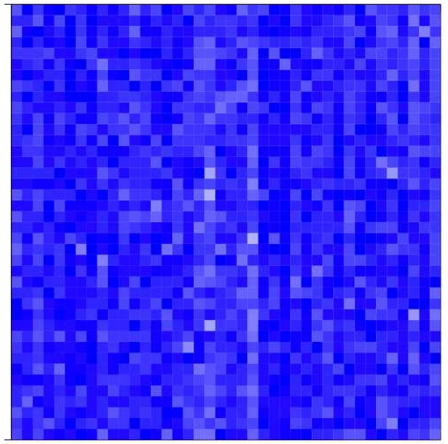
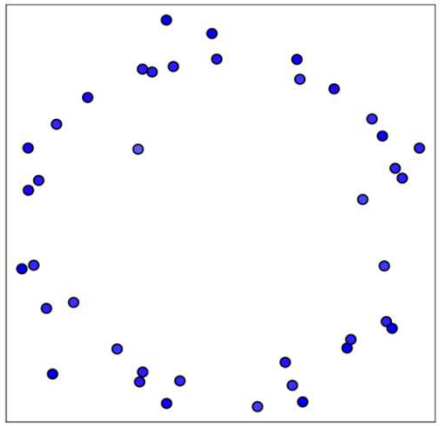




t = 50000

. ω = 0.4, ρ= 0.35, N = 40, δ= 0.2, k = 2, σ= 0.5.

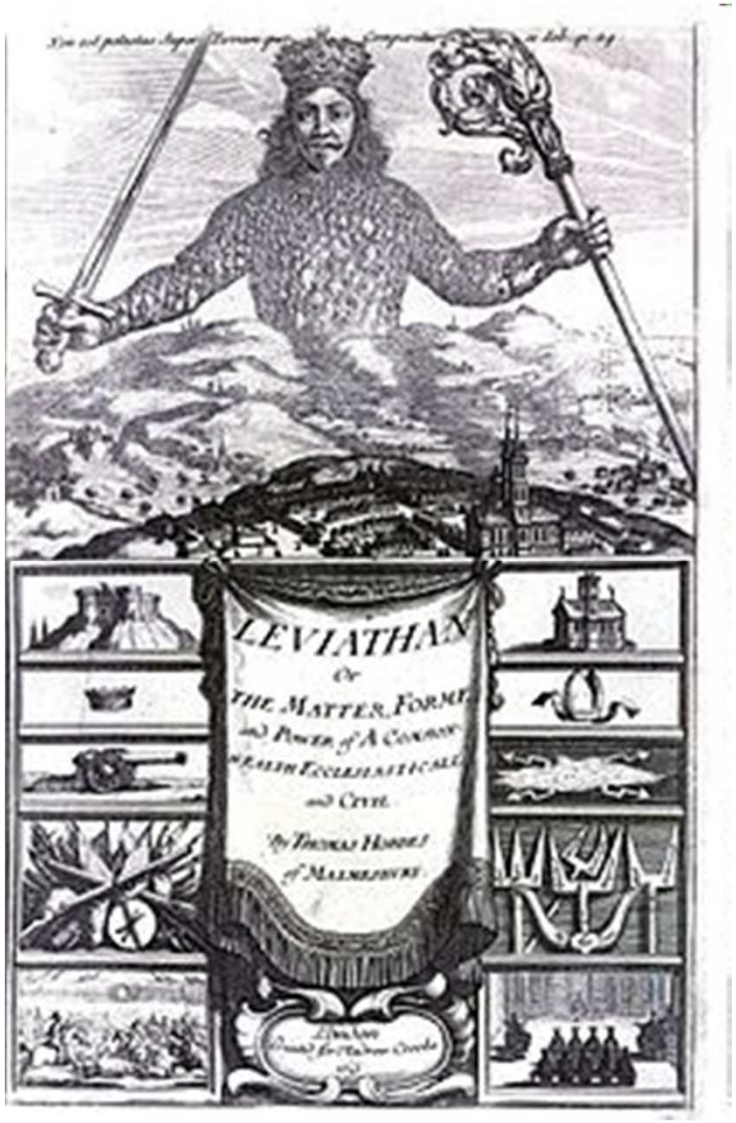
Other patterns when gossips is higher

- ρ is higher, the opinions about one agent tend to homogenize
- There can be a dominant agent which is viewed positively by all the others. Generally it is unstable
- There can be crisis situations where everybody sees everybody negatively (and has a negative self-opinion)

Discussion

- The model includes a very simplistic representation of self (as self-opinion)
- The model suggests:
  - a new mechanism for explaining the positivity bias
  - that the positivity bias should be higher when vanity is higher and lower when gossiping is higher
  - that breakdowns of positivity bias take place
- The model is limited to small groups because everybody meets with everybody

Thanks !


LEVIATHAN
Or
THE MATTER, FORME
and POWER of A COMMON-
wealth Ecclesiasticall
and Civil
By THOMAS HOBBES
of MALMESBURY