#### Dynamics of Social Networks of Belief Networks

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# Many ways to think about 'networks of networks'

A network of elements, which themselves are networks.

Hierarchical organization: a network of subnetworks (modules)

Multiple inter-dependent networks

# How to model societal dynamics?







### social influence

#### Asch conformity experiment (1951)





#### https://www.youtube.com/watch?v=NyDDyTIIDhA#t=97

#### Under the 'social' condition



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Error: Less than  $1\% \rightarrow \sim 37\%$ 

#### Under the 'social' condition



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75% at least one incorrect answer

#### Smoke Room Experiment



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#### Models that emphasize conformity



But if you've ever tried to convince another human being...







#### Humans strive for "internal consistency"



Leon Festinger

"The most fundamental values in a culture will be coherent with the metaphorical structure of the most fundamental concepts in the culture."

Lakoff, George. Metaphors We Live By (p. 22).

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- Children are born bad, in the sense that they just want to do what feels good, not what is right.
- Therefore, they have to be made good.

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- The parents' job is to nurture their children and to raise their children to be nurturers of others.

#### A belief system:

#### a set of **coherent** ideas

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This core set of beliefs can explain a lot of behaviors and positions.

# Confirmation bias & Cognitive dissonance

#### Confirmation bias


#### Confirmation bias



Existing belief biases search for information, interpretation, memory, and so on.





#### The fox and the grapes



# We need to incorporate this.

## I. Let's focus on how individuals behave.



2. Let's focus on social structures















#### Common ways to model beliefs





#### Common ways to model beliefs

#### Spins





#### Common ways to model beliefs

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## Maybe we should have a network.



#### Social Knowledge Structure (SKS) model



Greenwald et al. 2002

## social balance theory



## social balance theory



"The enemy of my enemy is my friend."



#### 'consistent'



## 'inconsistent'

# Combining peer influence with coherence





## Model



#### Internal consistency



## (social balance)

#### Social influence



#### Spin model

## Total energy

$$E_m^{(i)} = -\frac{1}{N_\Delta} \sum_{j,k,l} a_{jk} a_{kl} a_{jl} \qquad E_m^{(s)} = -\frac{2}{k_{\max} N(N-1)} \sum_{q \in \Gamma(m)} \vec{S}_m \cdot \vec{S}_q,$$

"coherentism" "peer influence"  
$$H = \sum_{m \in M} \left[ J E_m^{(i)} + I E_m^{(s)} \right]$$

## Two energies

Individual:  $\langle E^{(i)} \rangle = \frac{1}{|M|} \sum_{m \in M} E_m^{(i)}.$ 

society:  $\langle E^{(s)} \rangle = \frac{1}{|M|} \sum_{m \in M} E_m^{(s)},$ 

#### Phase transition



# Even a homogeneous society may spontaneously become unstable

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Homogeneous population

╋

Unstable belief system

# Even a homogeneous society may spontaneously become unstable

## Homogeneous population

## Unstable belief system



## Consistency of Zealots



## Consistency of beliefs (balance in the belief network)

# How well can we convert the cult?



More nuanced, complex 'truth' may have hard time convincing a cult with strong coherence and less truth.


## It can become almost impossible to convert a cult



## Summary

- "Network of networks" as a framework to model social changes.
- We need to consider internal consistency as a key part of the opinion / social dynamics model.
- Such consideration can provide explanations of many social phenomena.



Nathaniel Rodriguez



Johan Bollen