Continuous Opinion Dynamics

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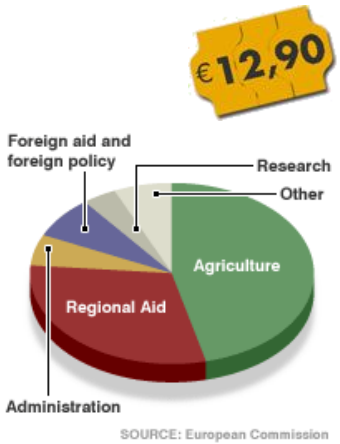
Chair of Systems Design

May 26, 2008

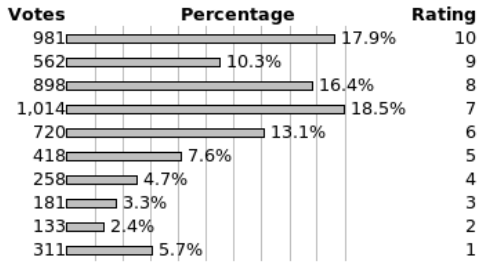
Outline

Continuous opinions

- Prices, budgets



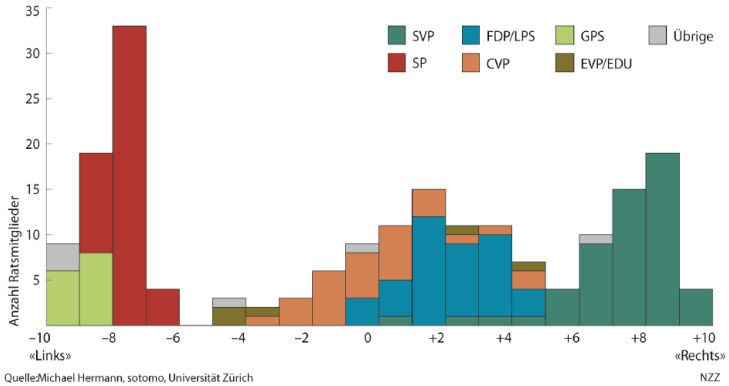
- Ratings and grades

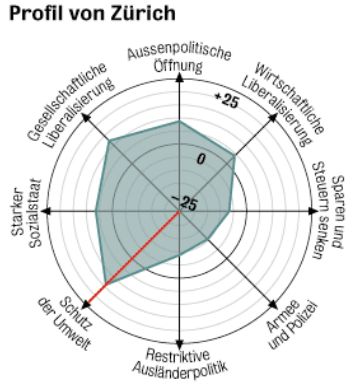


Source: IMDb.com

- Estimations: How many noodles?

- Political continuum: left—right





Source: sotomo.geo.unizh.ch, smartvote.ch

Dynamics

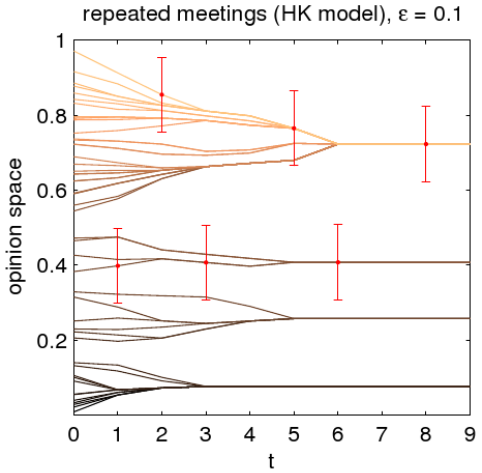
- Agents may change opinion by **averaging** the opinions of others because of
  - informational reasons (in questions of fact finding)
  - compromising (in questions of negotiation)
  - normative reasons (in questions of taste)

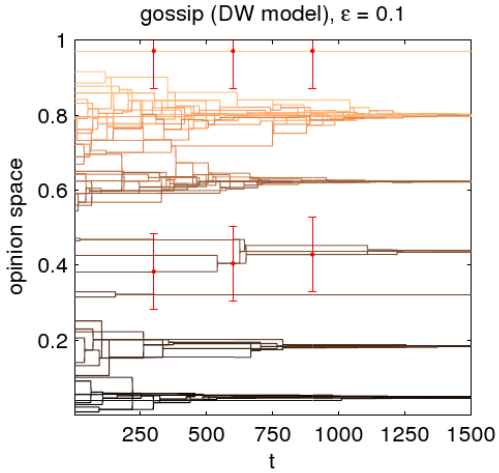
    $\Longrightarrow$ Agents adjust **towards opinions of others**
- Mathematics of averaging agents
  - Opinions stabilise if[1]
    - ★ agents have self-confidence
    - ★ confidence is mutual
    - ★ both properties do not fade away
  - Huge ammount of literature on finding consensus
    - ★ Important in coordination (swarming) of mobile autonomous agents
    - ★ Related to synchornisation

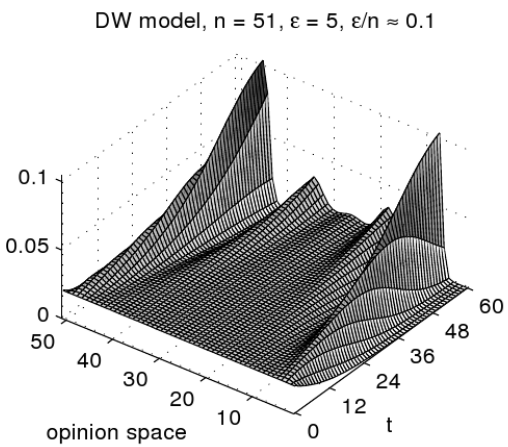
[1] Lorenz, Physica A, 2005

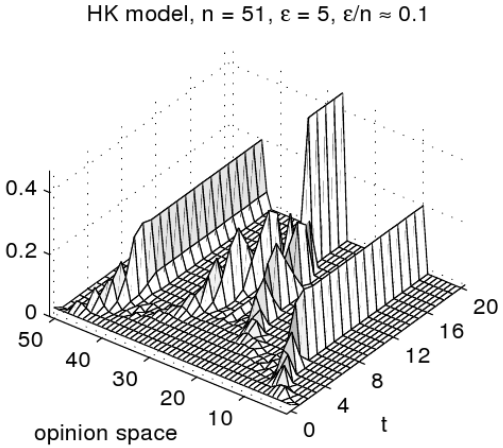
Outline

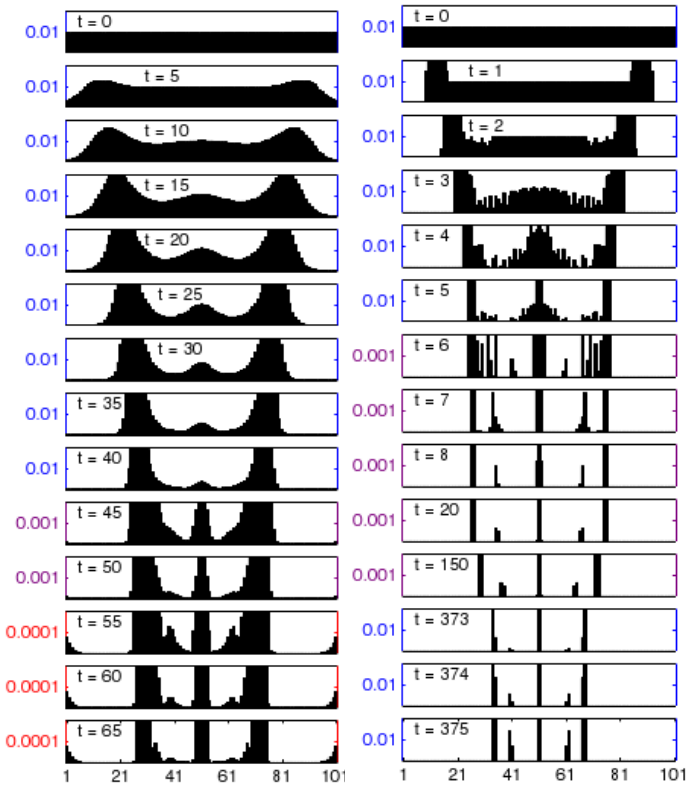
Bounded confidence models[2]





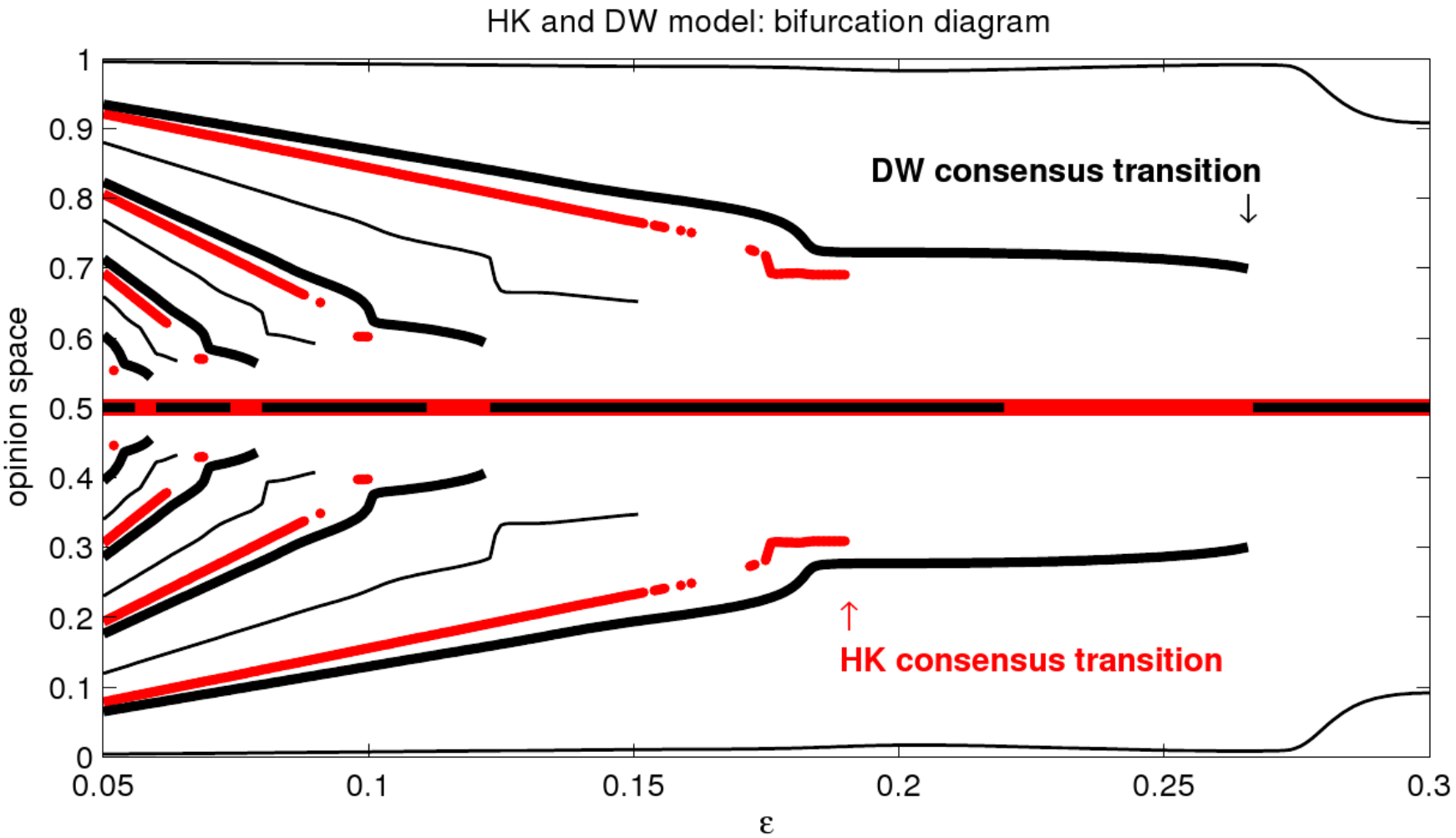






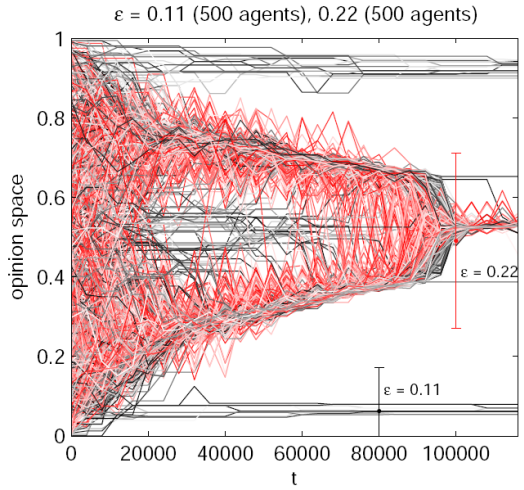
[2] Krause, 1997; Deffuant et al, 2000; Hegselmann-Krause, 2002; Weisbuch et al, 2002

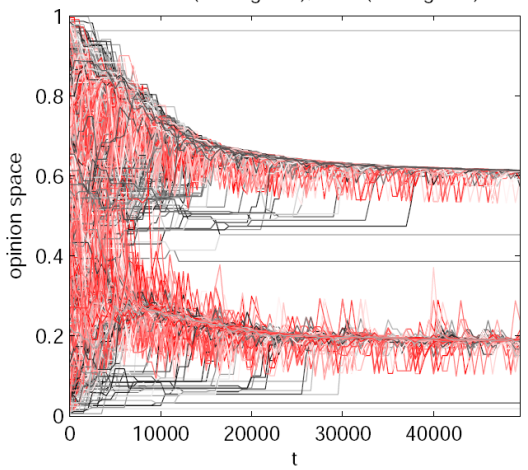
Bifurcation diagrams[3]

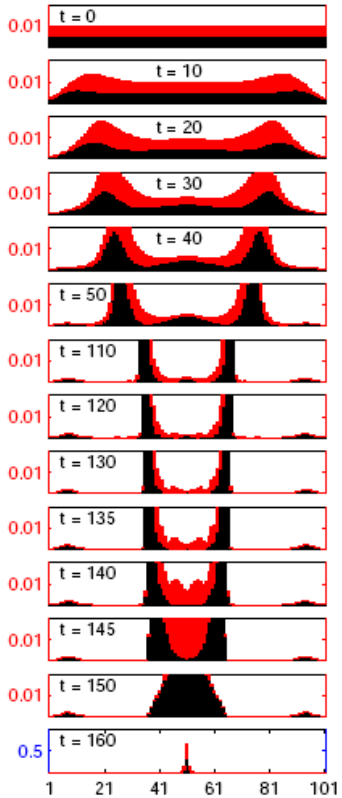


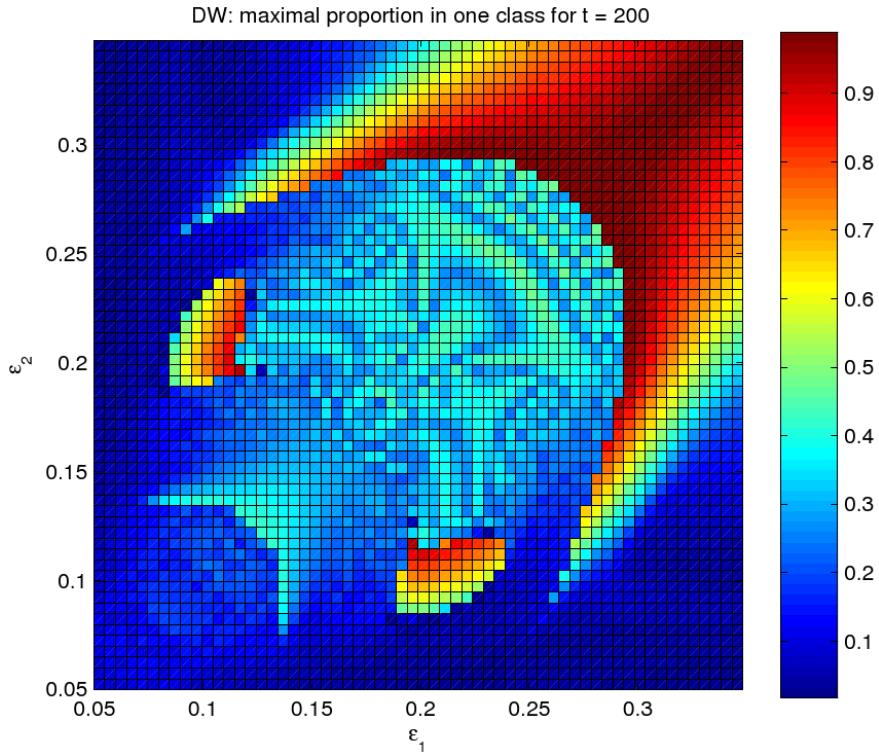
[3]Idea: Ben-Naim et al, 2003; this version Lorenz, IJMPC, 2007

Heterogeneous bounds of confidence[4]







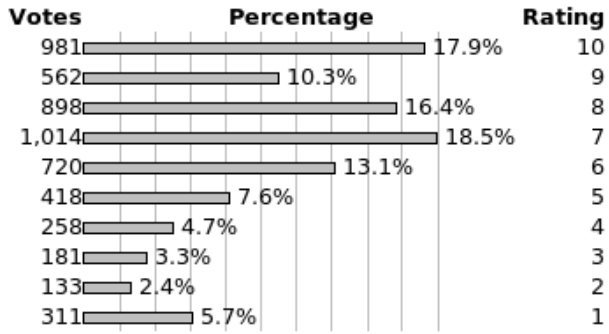


[4] Lorenz, arXiv, 2008

Outline

Opinion dynamics about movie quality

- On IMDb.com 1,086 movies got more than 20,000 votes (1=awful,...,10=excellent)
- Probabilistic view: Cinemagoer's initial opinion is a **random variable**
- Mini social theory: Final opinion is the **average** of opinions of peers.

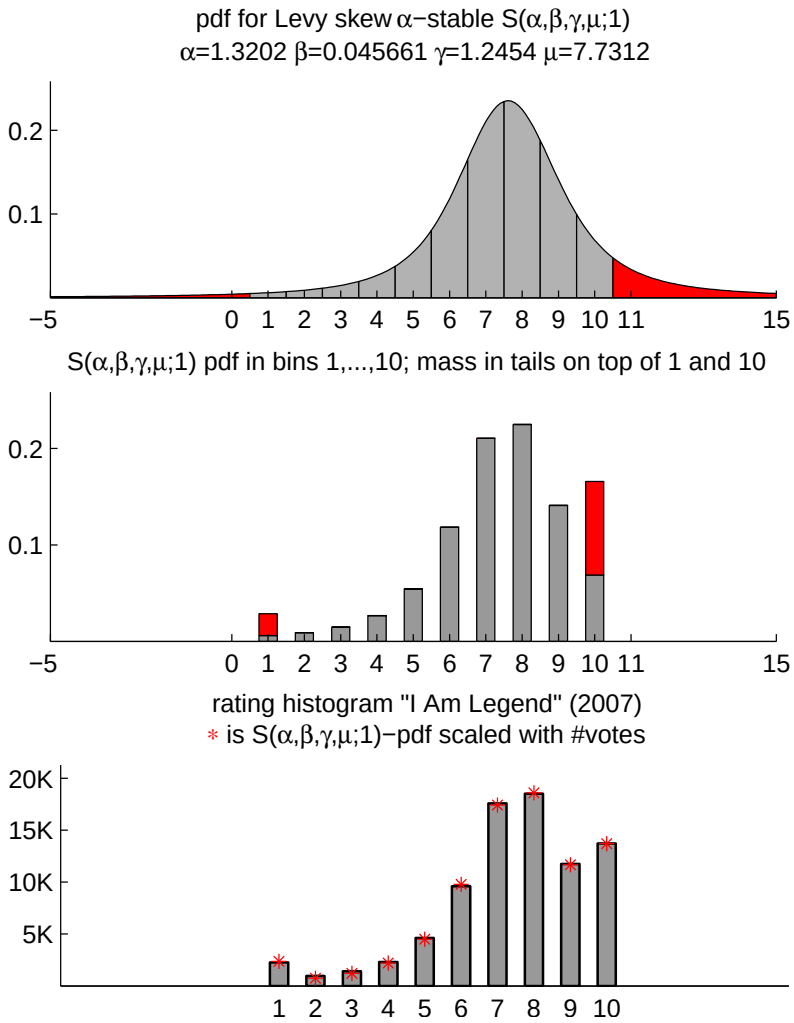


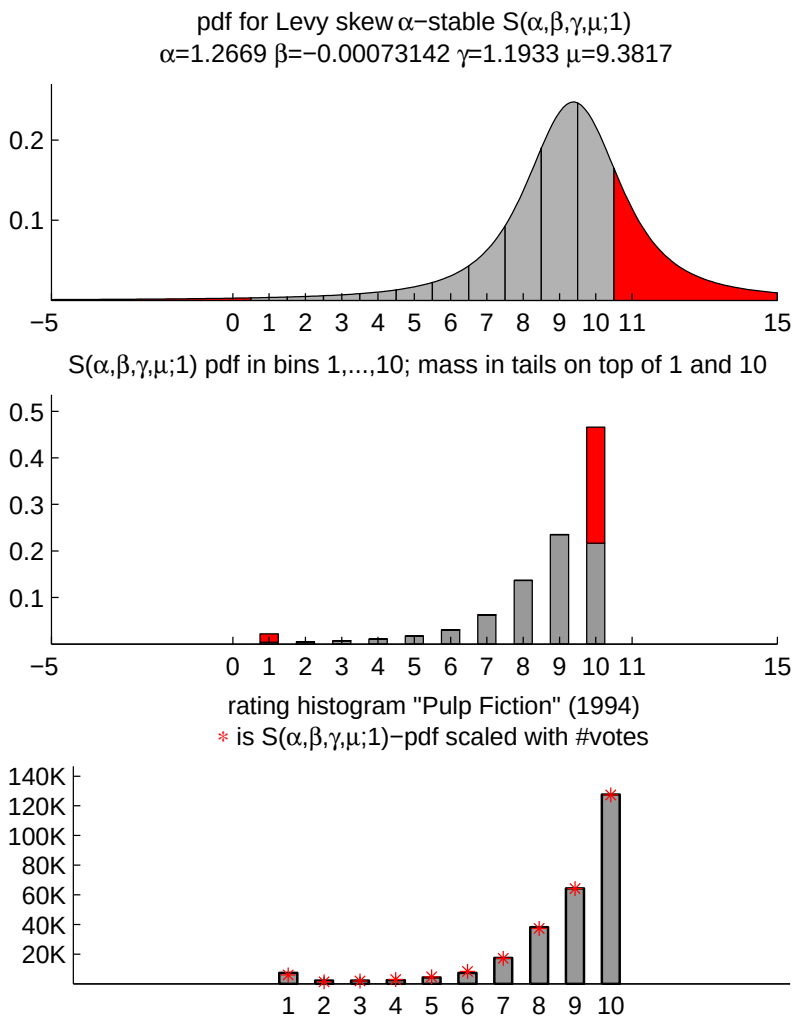
  - Probabilistic theory: Aggregate distribution should be close to a **Levy skew α-stable distributions** distribution.
    - has characteristic function

$$\varphi(t;\alpha,\beta,\gamma,\mu) = \exp\left[\mu - |\sigma t|^{\alpha}\,(1 - i\beta\,\mathrm{sign}(t)\tan(\frac{\pi\alpha}{2})\right].$$

    - $\alpha \in]0,2]$, , $\beta[-1,1]$, $\gamma \in [0,\infty[$, and $\mu \in]-\infty,\infty[$

Confined and discretized stable distribution





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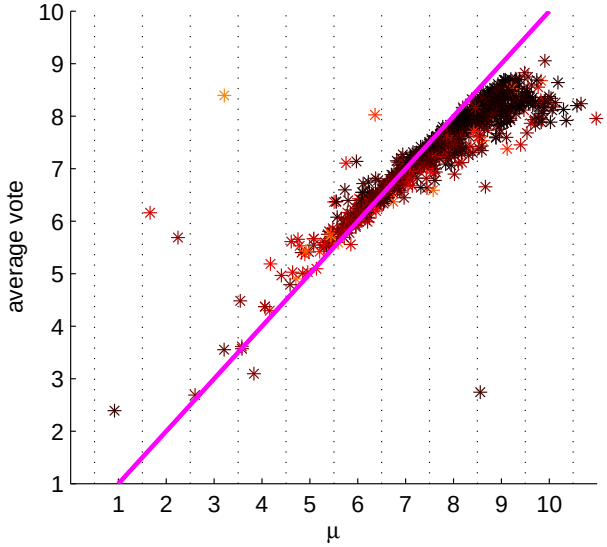
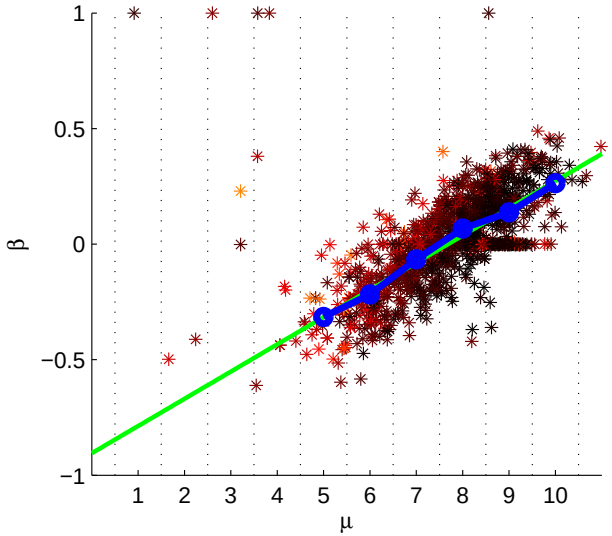
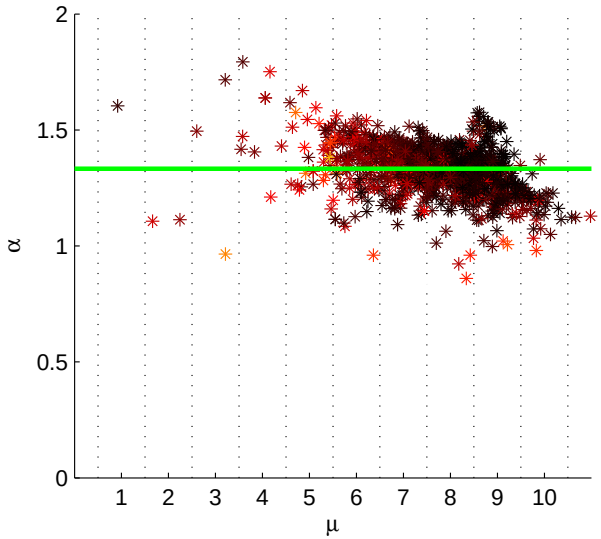
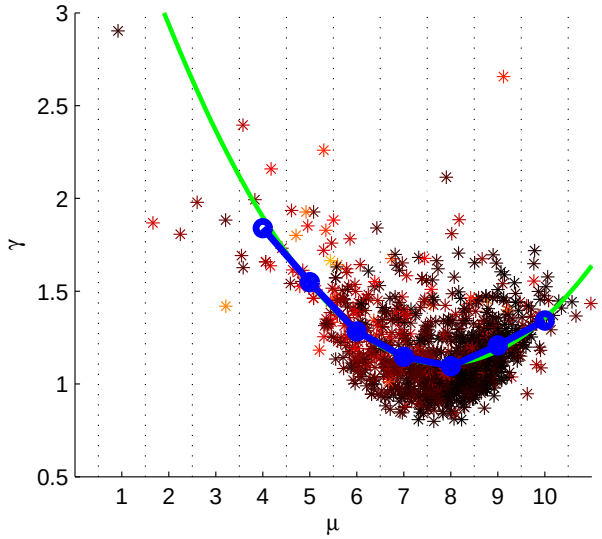
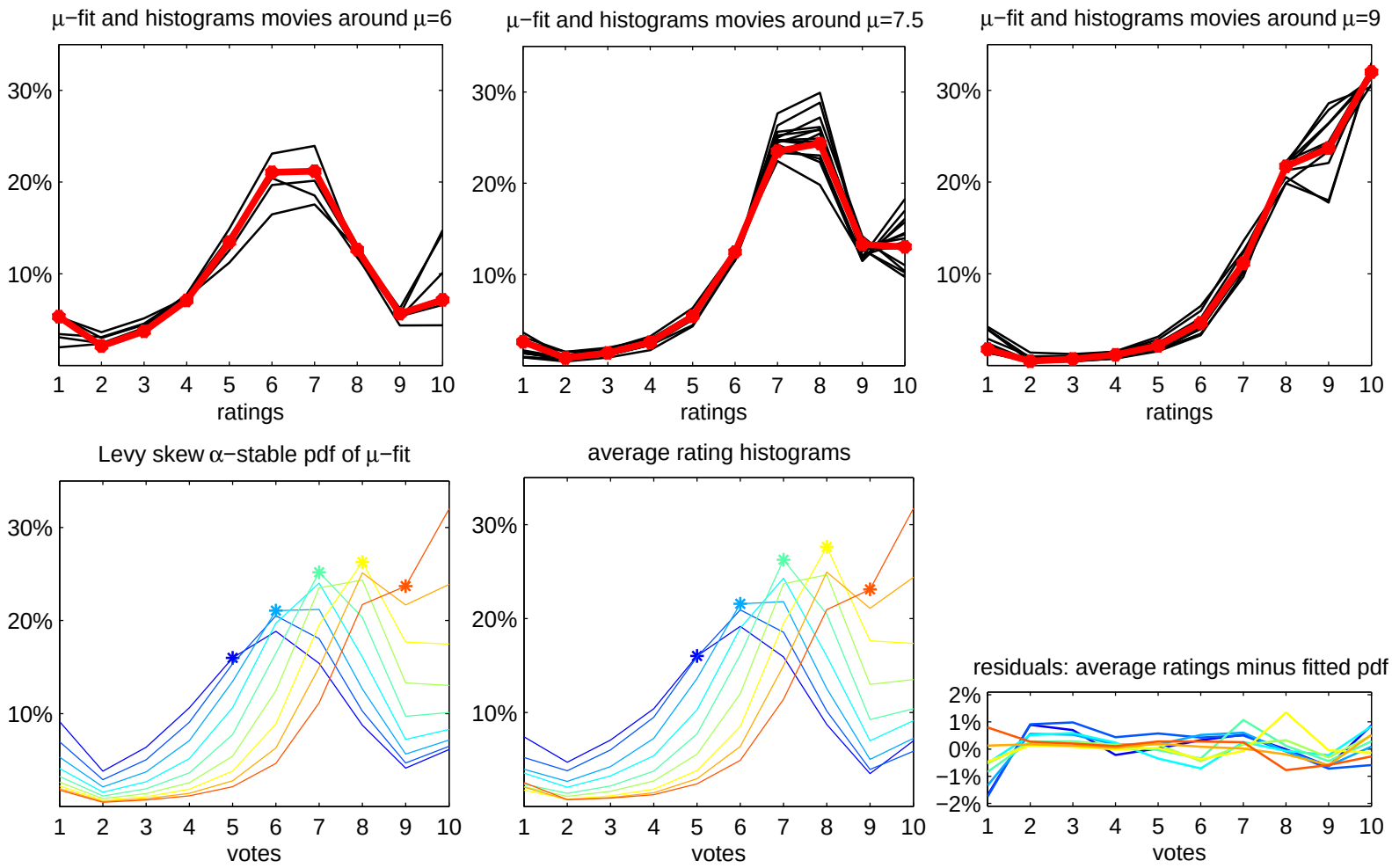








One parameter fit



Outline

Conclusion

- Continuous opinion dynamics is different from discrete opinion dynamics
- Averaging dynamics
  - and bounded confidence: Gives a hint on the formation of political parties without a priori definition of parties
  - could explain the 'Gaussian-like' shapes of movie rating histograms, but initial distributions must have fat tails

References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