
A spin-based measure of the coherence of belief systems

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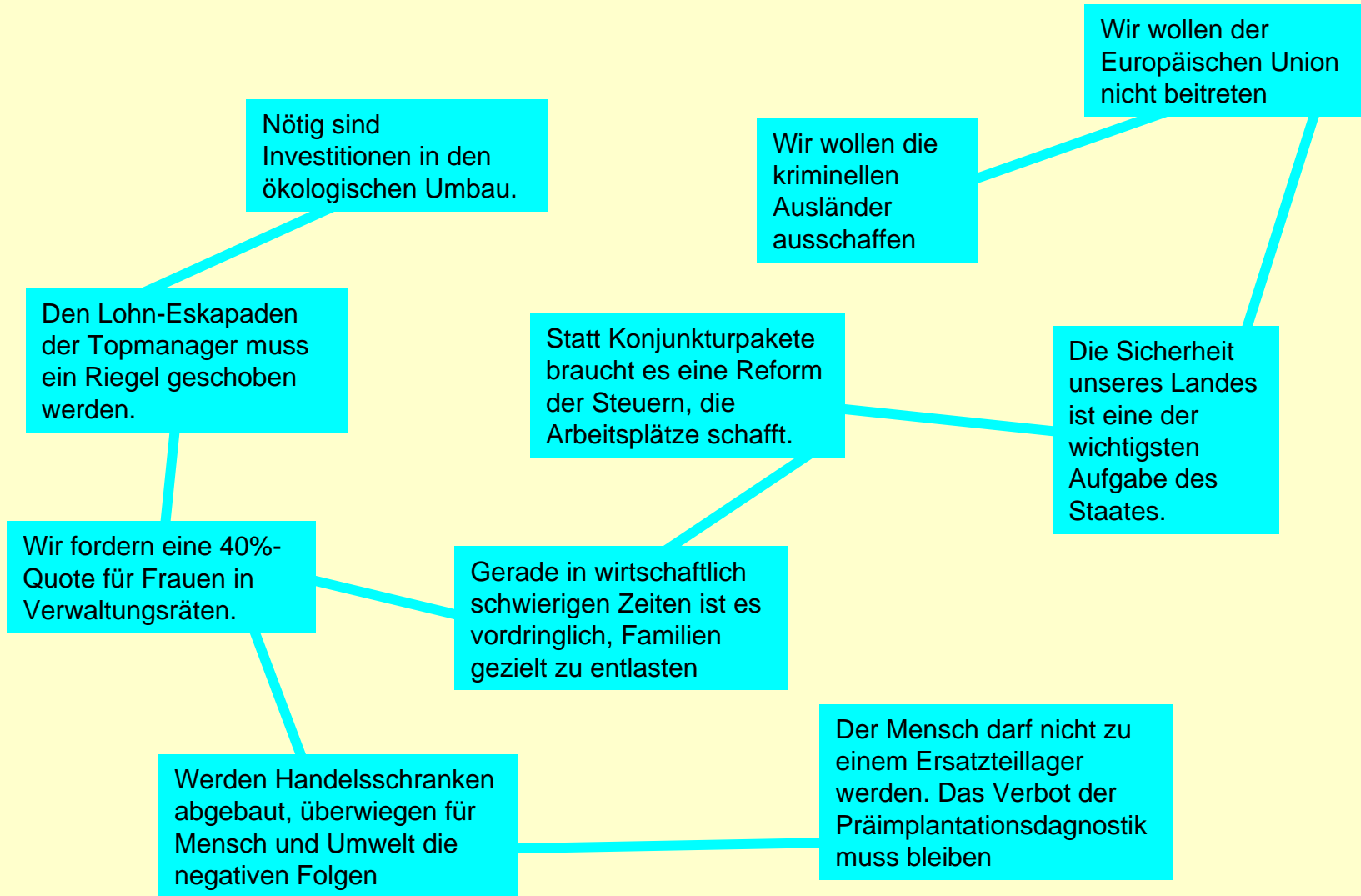
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Overview

- The problem
 - An intuition of coherence
 - Superparamagnetic clustering
 - Defining coherence
 - Coherence of toy systems
 - Application: Coherence of political parties in Switzerland
 - Conclusion
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The Problem



An Intuition of Coherence

Coherence of belief systems requires a definition of:

- The entities that are coherent (= representatives of beliefs)
- A measure of “closeness” of two such entities.

Coherence includes two components:

- Dynamic: “stability under pressure”
- Static: “Diversity of sub-groups”

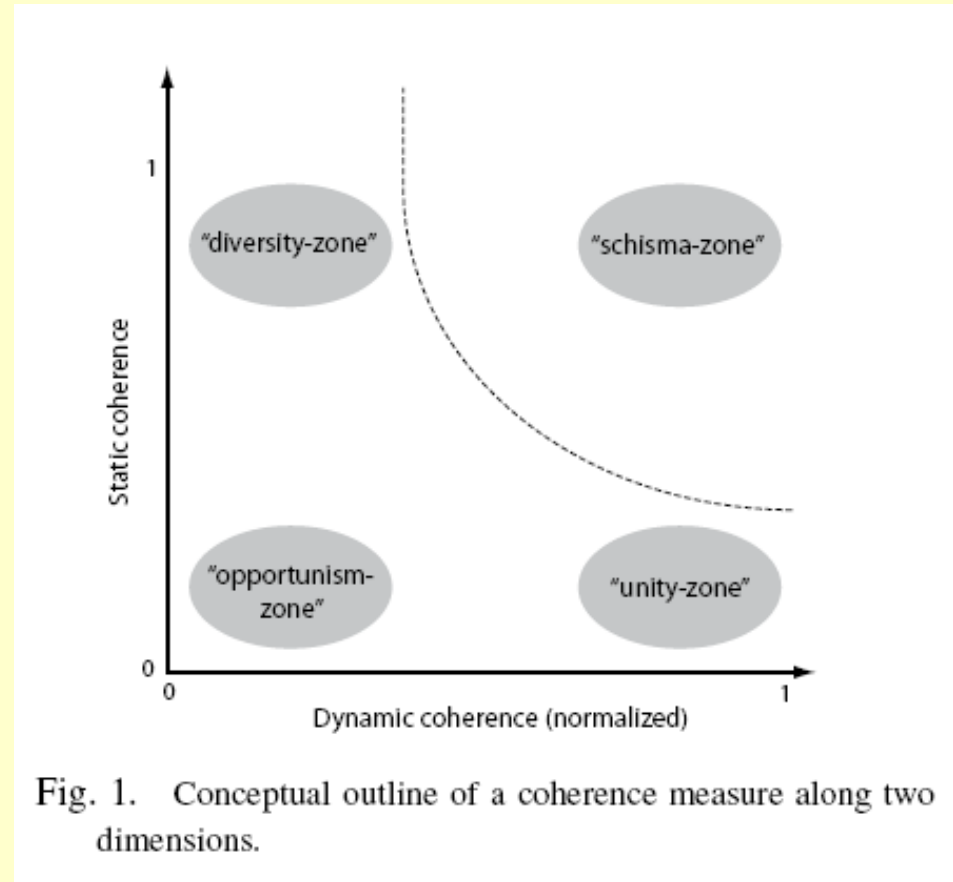


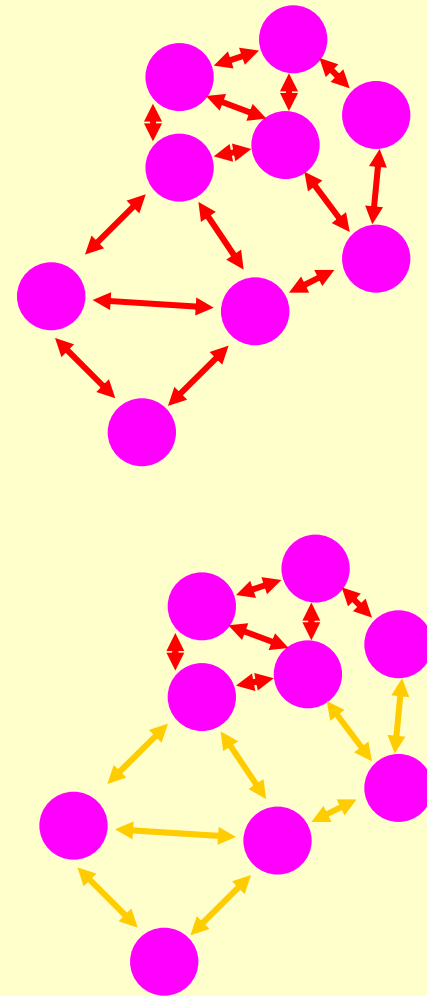
Fig. 1. Conceptual outline of a coherence measure along two dimensions.

Superparamagnetic Clustering

Superparamagnetic clustering SPC (Blatt et al. 1996) is inspired by a self-organization phenomenon in magnetic spin-system.

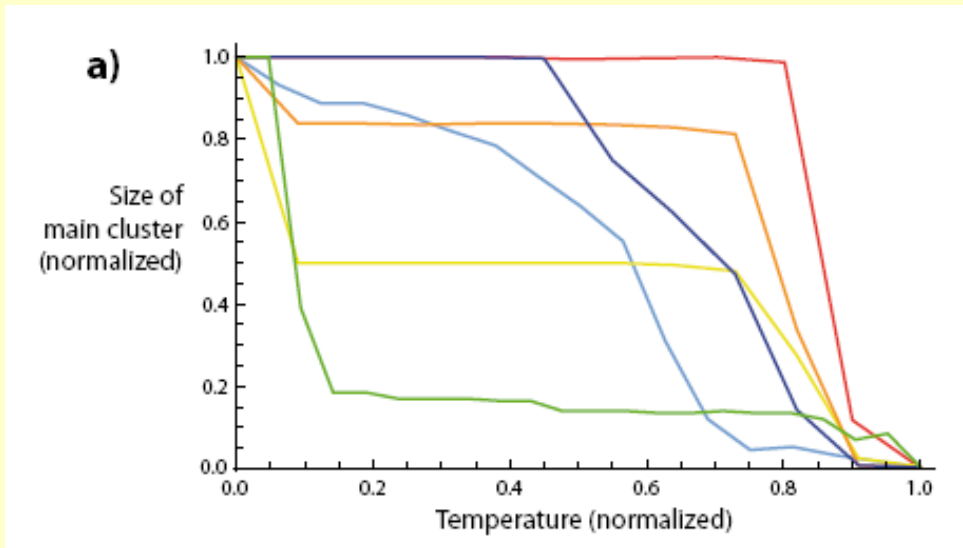
It has been extended by Ott et al. (2005) to a powerful classification tool (sequential SPC) that has several advantages:

- No pre-definition of number and size of clusters required
- Temperature as “stability parameter”
- Natural hierarchy of sub-groups
- Choice of distance function allows adaptation to specific problem



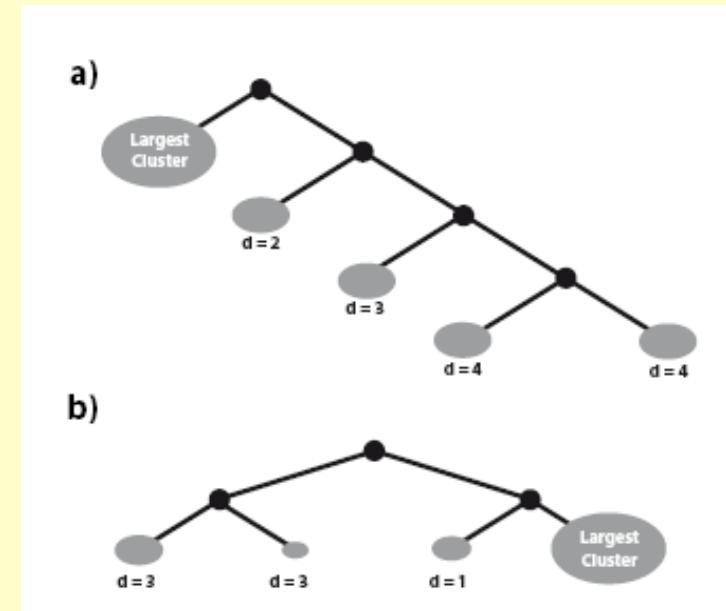
Definition of Coherence

Dynamic component



$$C_{dynamic} = \sum_{i=0}^{l-1} \frac{CS(i\Delta T) + CS((i+1)\Delta T)}{2nl} \quad (3)$$

Static component

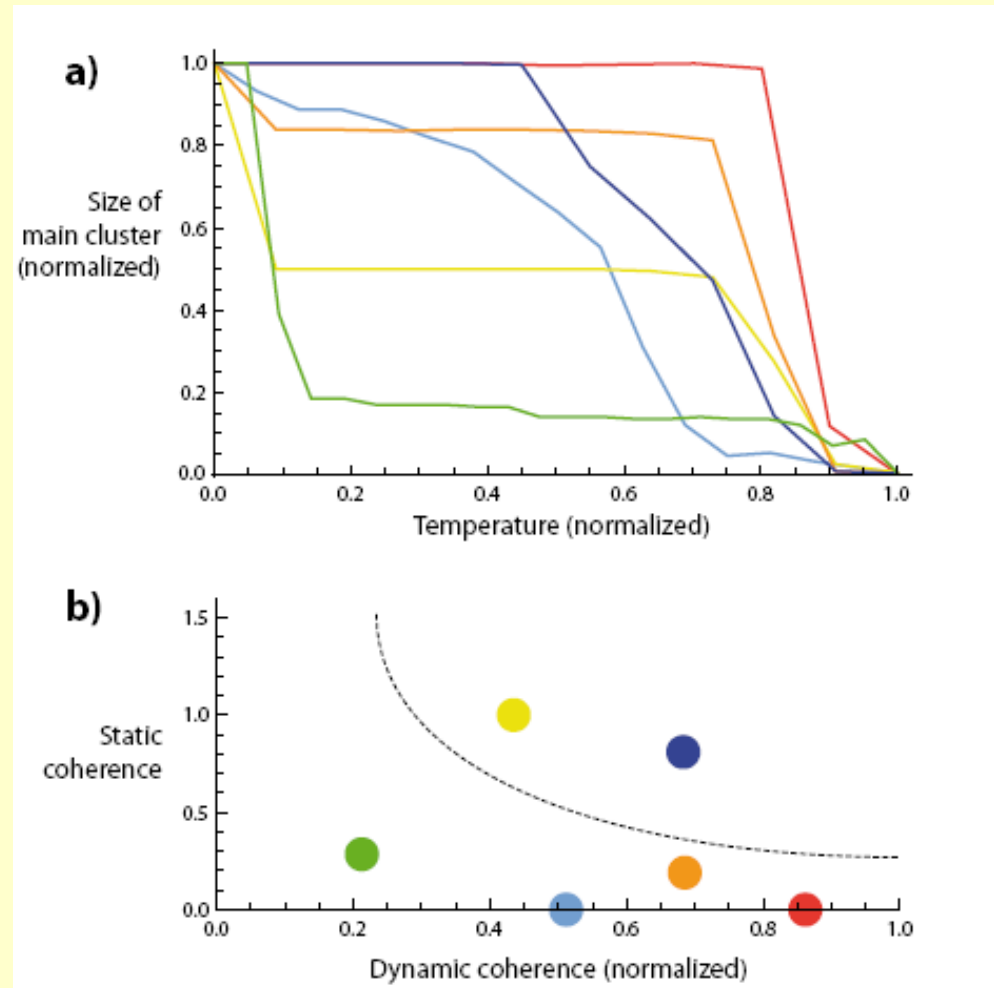


$$C_{static} = \sum_{i=1}^k \frac{d_i}{d_{max}} \cdot \frac{|c_i|}{|\bar{c}|}$$

Coherence of Toy Systems

Fife cases:

- Red: One homogeneous group
- Orange: One large and one small homogeneous group
- Yellow: Two equally sized homogeneous groups
- Green: Small homogeneous group embedded in “noise”
- Blue: One large and many smaller homogeneous groups
- Light blue: “Gaussian group”



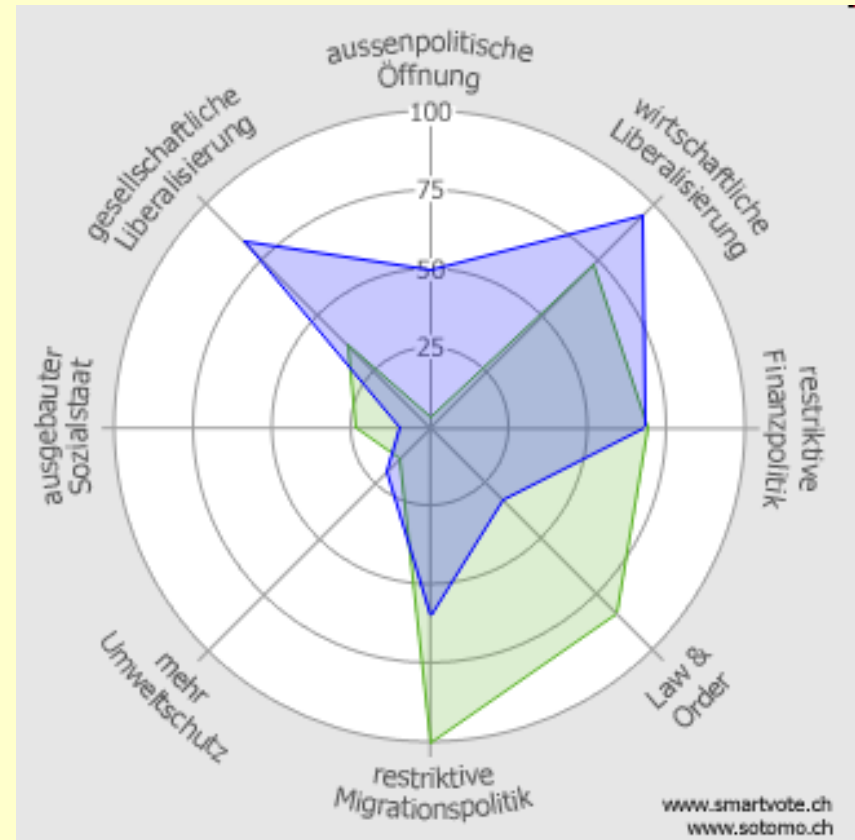
Coherence of Political Parties (1)

The “Smartvote”-Project:

A web-based tool to compare the own political profile with the political profile of candidates.

For the national votes 2003 and 2007, a large fraction of the candidates of the five largest Swiss parties have given their opinions on 72 questions:

	2003	2007
FDP	70%	92%
CVP	68%	86%
SPS	78%	96%
SVP	46%	82%
GPS	51%	88%



Coherence of Political Parties (2)

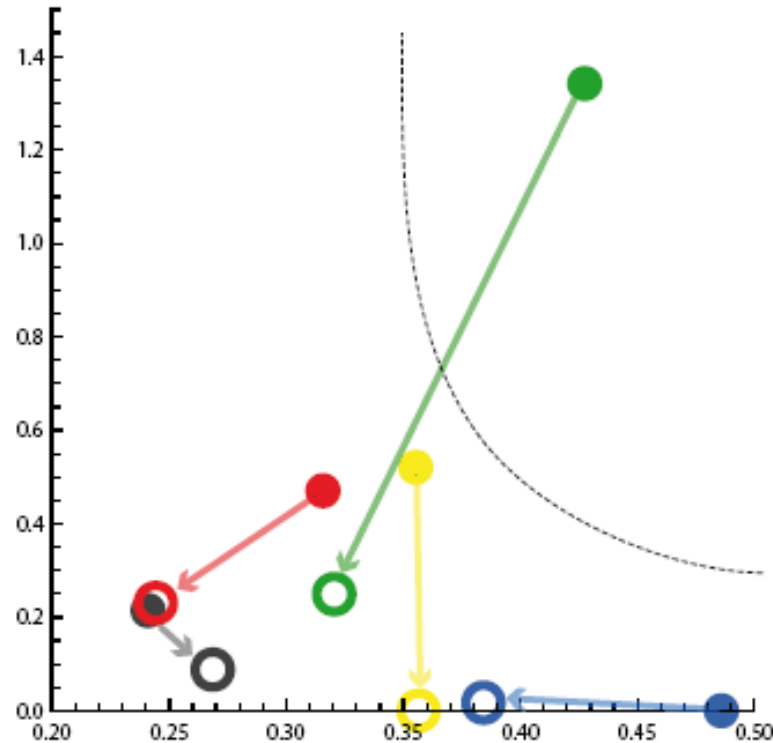


Fig. 4. The coherence of the largest Swiss parties in 2003 (filled dot) and 2007. Yellow: SVP, red: SPS, blue: FDP, black: CVP, green: GPS.

Conclusion

- Our measure of coherence captures and expands the intuition of coherence in a useful way for questions in social science and humanities
 - There are some conceptual issues that are currently under investigation (different normalization, different network-complexity measures)
 - The measure is successful in explaining changes in social systems (but not all changes can be explained)
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