A spin-based measure of the coherence of belief systems

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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

The Problem

Wir wollen der Europäischen Union nicht beitreten Nötig sind Wir wollen die Investitionen in den kriminellen ökologischen Umbau. Ausländer ausschaffen Den Lohn-Eskapaden Statt Konjunkturpakete der Topmanager muss Die Sicherheit braucht es eine Reform ein Riegel geschoben unseres Landes der Steuern, die werden. ist eine der Arbeitsplätze schafft. wichtigsten Aufgabe des Staates. Wir fordern eine 40%-Gerade in wirtschaftlich Quote für Frauen in schwierigen Zeiten ist es Verwaltungsräten. vordringlich, Familien gezielt zu entlasten Der Mensch darf nicht zu einem Ersatzteillager Werden Handelsschranken werden. Das Verbot der abgebaut, überwiegen für Präimplantationsdagnostik Mensch und Umwelt die muss bleiben negativen Folgen

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 subgroups"

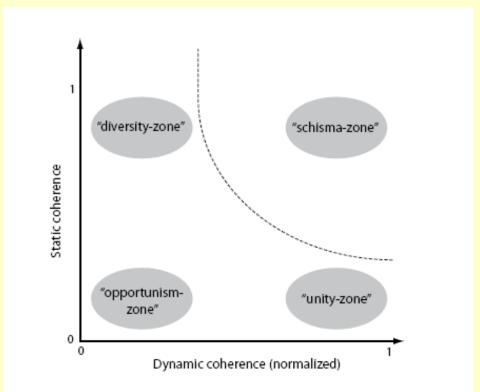


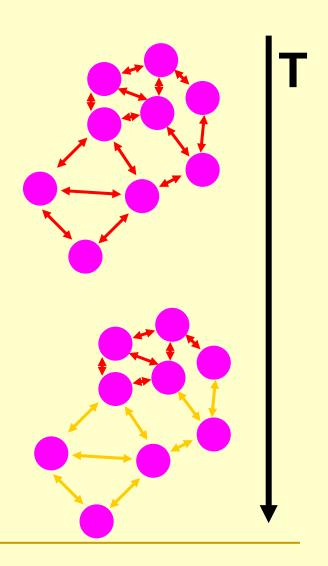
Fig. 1. Conceptual outline of a coherence measure along two dimensions.

Superparamagnetic Clustering

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

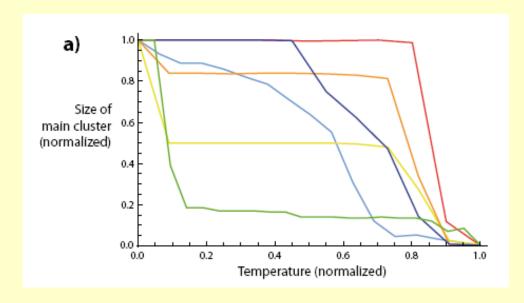
It has been extended by Ott et al. (2005) to a powerful classification tool (sequential SPC) that has several advantages:

- 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



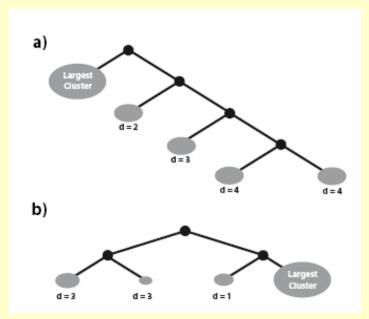
Definition of Coherence

Dynamic component



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

Static component

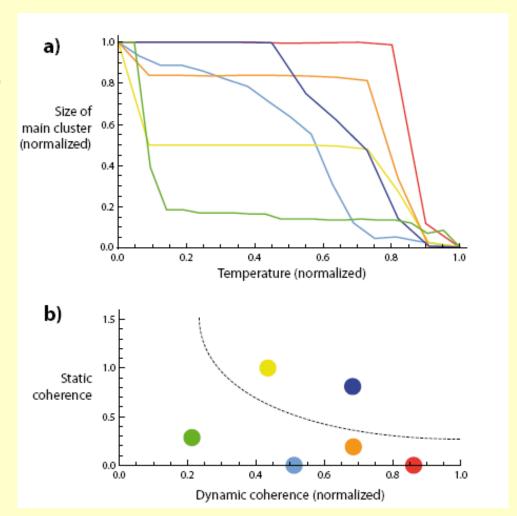


$$C_{static} = \sum_{i=1}^{k} \frac{\mathsf{d}_i}{\mathsf{d}_{max}} \cdot \frac{|c_i|}{|\bar{c}|}$$

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"



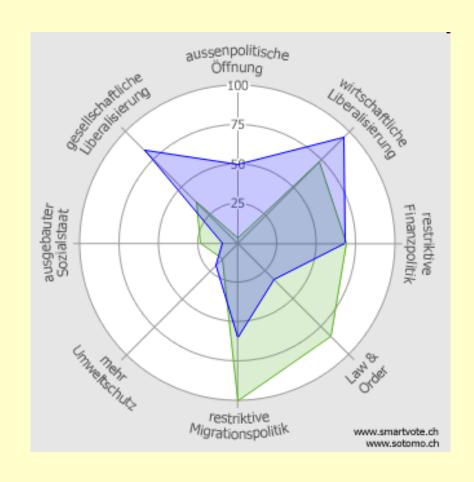
Coherence of Political Parties (1)

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)

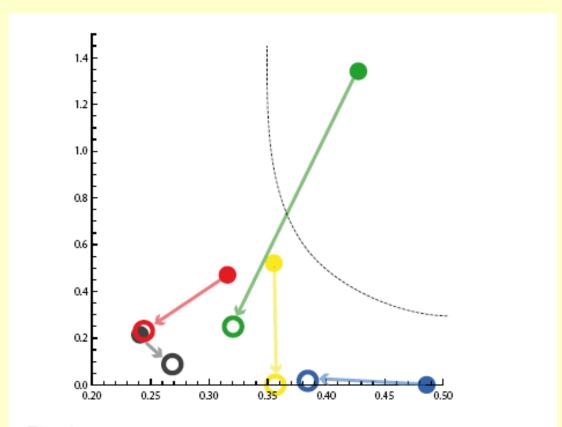


Fig. 4. The coherence of the largest Swiss parties in 2003 (filled dot) and 2007. Yellow: SVP, red: SPS, blue: FDP, black: CVP, green: GPS.

Conclusion

- Our measure of coherence captures and expands the intuition of coherence in an 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)