Measuring coherence and the topology of belief spaces:

Ideas and Projects

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Table of Contents

– Coherence in Ethics: The Problem
– An Alternative Angle Towards Coherence
– Quantifying the Intuition of Coherence
– Possible Causal Roles for Coherence
– Exemplifying the Role of Coherence: Political/Moral Beliefs
– Mapping conceptual spaces: superparamagnetic maps

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Coherence in Ethics: The Problem

Coherence in Ethics

Disagreements on moral matters can arise at home, and even within oneself. When they do, one regrets the methodological infirmity of ethics as compared with science. The empirical foothold of scientific theory is in the predicted observable event; that of a moral code is in the observable moral act. But whereas we can test a prediction against the independent course of observable nature, we can judge the morality of an act only by our moral standards themselves. Science, thanks to its links with observation, retains some title to a correspondence theory of truth; but a coherence theory is evidently the lot of ethics

(Quine 1981, 63).

Its [a conception of justice's] justification is a matter of the mutual support of many considerations, of everything fitting together into one coherent way

(Rawls 1971, 21)

Problems of Coherence in Ethics

The term 'coherence' as used by coherence theories has never been very precisely defined. The most we can say by way of a general definition is that a set of two or more beliefs are said to cohere if and only if (1) each member of the set is consistent with any subset of the others and (2) each is implied (inductively if not deductively) by all of the others taken as premises or, according to some coherence theories, each is implied by each of the others individually.

(Kirkham 1992, 104).

But even this "general definition" has its drawbacks:

- Consistency?
- Implication?
- Scaling?

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An Alternative Angle Towards Coherence

Coherence as a Matter of Degree

Coherence is a property of a …

… set of entities (= **beliefs**)

… that are interrelated in a specific way (= **similarity measure**)

This property can be understood as being of a Boolean type (i.e. a system is coherent or not) or as being a continuous variable, i.e. such that different degrees of coherence can be distinguished and correlated to different types of behaviors)

We propose latter interpretation, i.e.;

Is it possible to define "coherence" in a way such that different degrees of (in-)coherence can be distinguished?

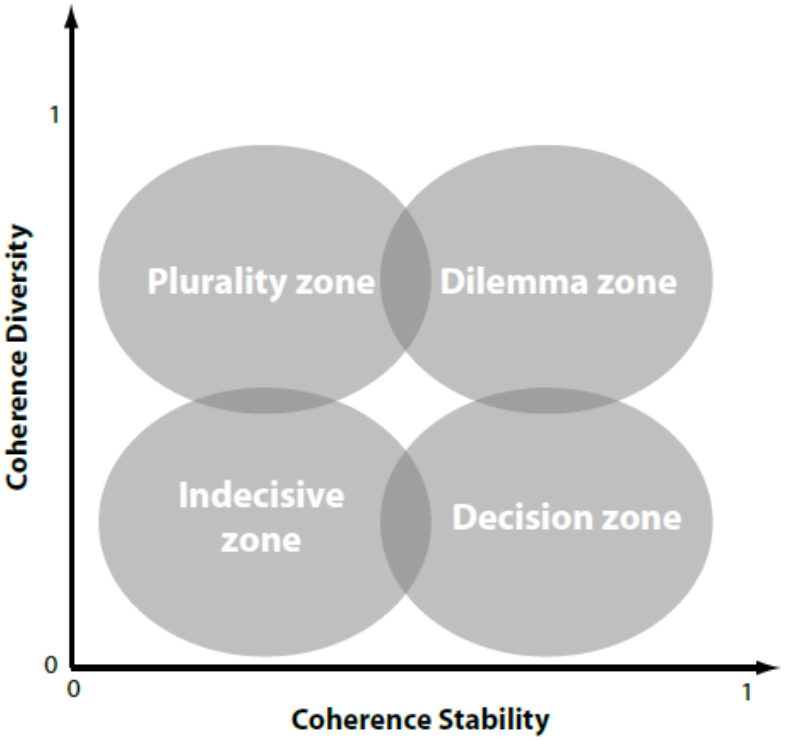
Two Dimensions of Coherence

If we understand a belief system as a network of beliefs, this network probably displays sub-structures that can be understood as clusters of beliefs with stronger mutual interrelations compared to beliefs from other clusters.

Furthermore, these structures may display some property of stability that depends on the strength of the mutual interrelations of beliefs.

Therefore, we distinguish between

- **Diversity**
- **Stability**



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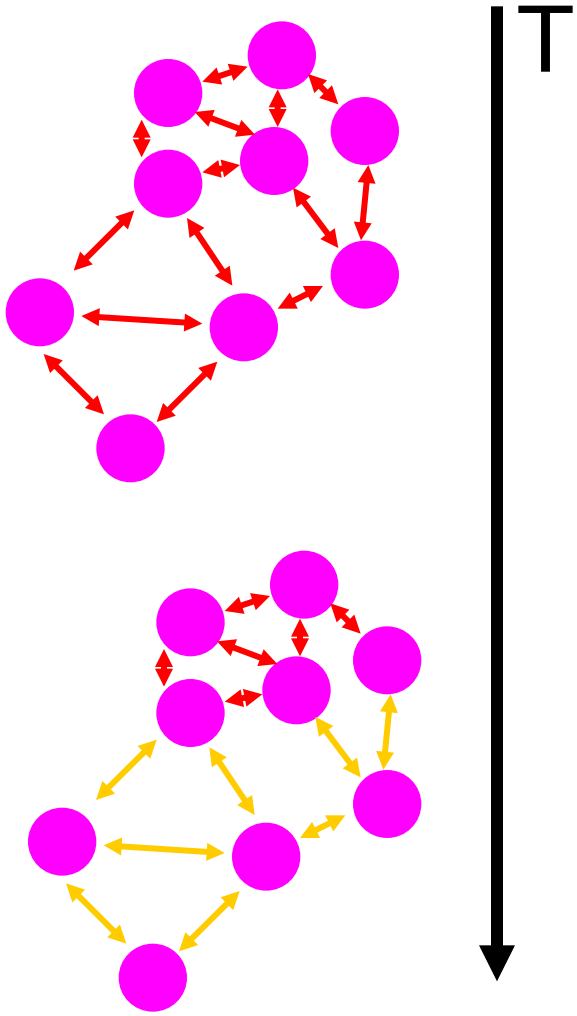
Quantifying the Intuition of Coherence

Superparamagnetic Clustering

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

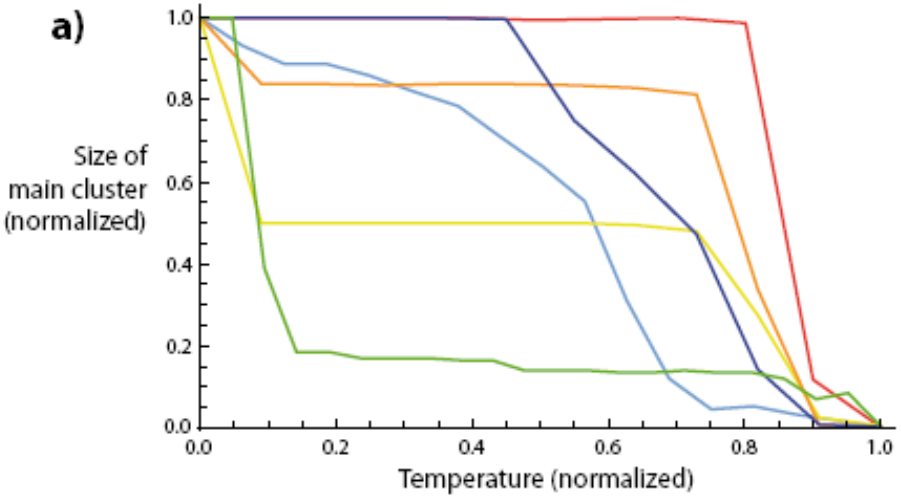
It has been extended by Ott et al. (2005) to a powerful classification tool (sequential SPC) that has several advantages:

- 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



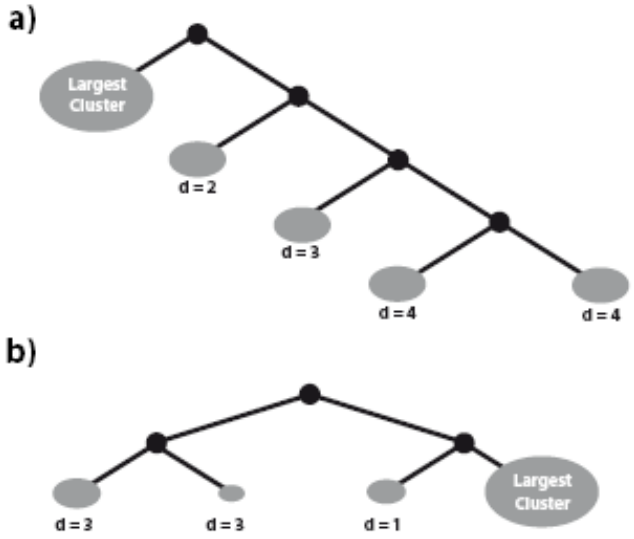
Quantified Coherence

Stability



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

Diversity



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

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Possible Causal Roles for Coherence

Moral Agency and Coherence

We assume that …

(1) moral agents have many beliefs of various types (regarding both factual and normative issues, whereas it will not be possible in all cases to draw a clear distinction between them),

(2) some of these beliefs are recruited in specific decision situations

(3) there exist at least one type of similarity between these beliefs that is relevant for the specific decision situation.

We then claim that the structure of this belief-subset, in terms of coherence, is a decisive factor in understanding the actions of moral agent with respect to the specific decision problem.

This claim requires to

(a) find correlations between different degrees of coherence and specific behavior patterns, and

(b) to show some causal relation between belief coherence and behavior

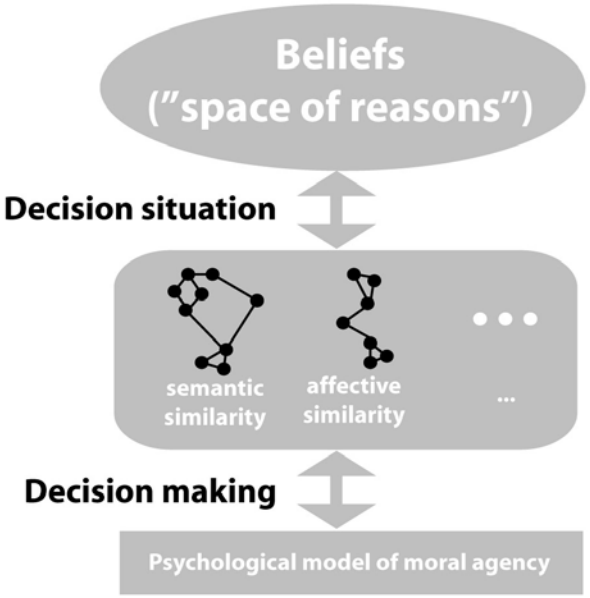
A Framework for Coherence

A moral agent possesses probably many thousands beliefs about the world and evaluations of matters of fact These beliefs serve as potential reasons in a decision making process upon moral issues.

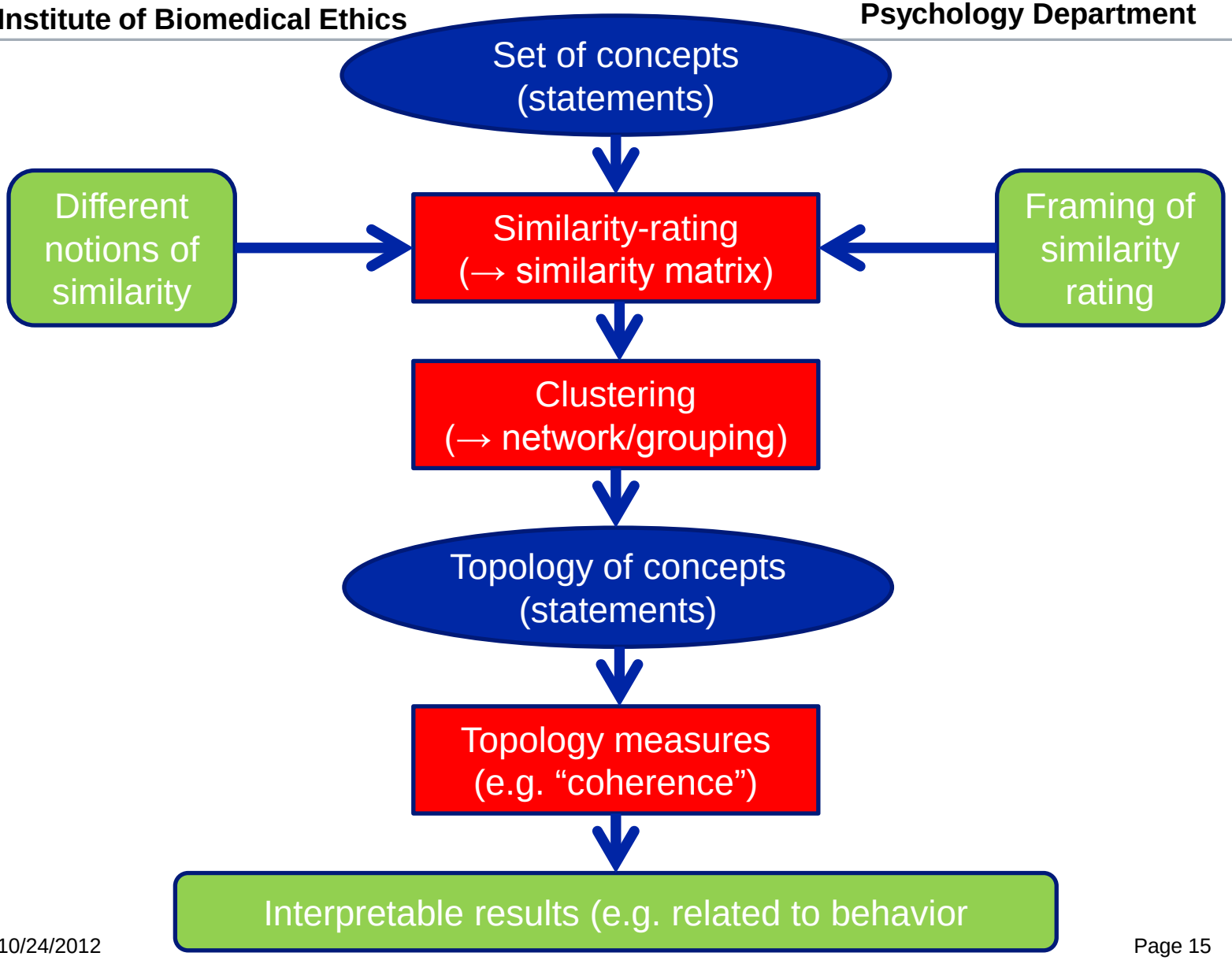
A specific decision problem recruits a subset of those beliefs that may be activated both through fast and intuitive processes and through deliberation.

Several similarity measures for this subset of beliefs are possible, in particular:

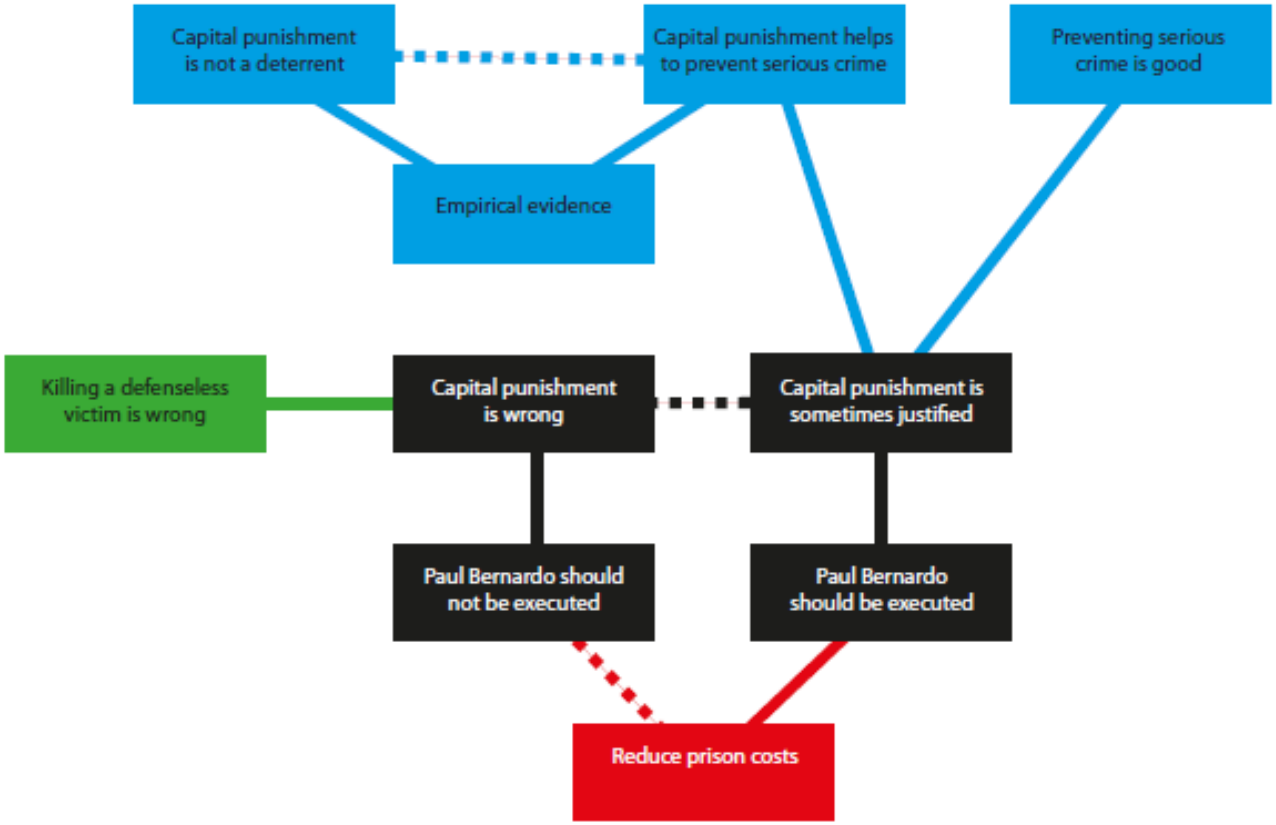
- Semantic similarity
- Affective similarity



Technically, both measures can be combined and weighted individually in order to assess those different aspects of similarity and their weight towards the coherence of a decision-specific belief system.


Set of concepts (statements)
Different notions of similarity
Similarity-rating (→ similarity matrix)
Framing of similarity rating
Clustering (→ network/grouping)
Topology of concepts (statements)
Topology measures (e.g. “coherence”)
Interpretable results (e.g. related to behavior

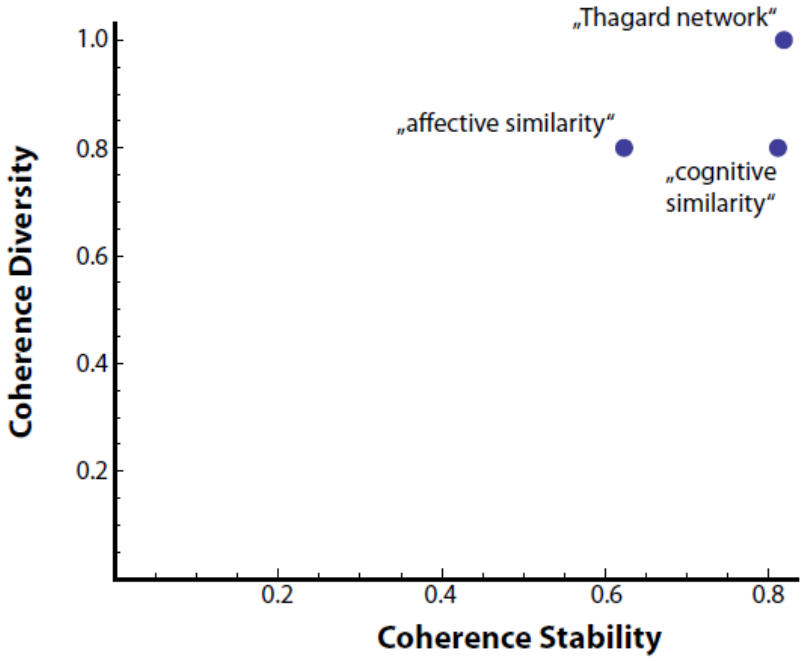
An exemplification using Thagard's example



"Cognitive" and "affective" similarity

Cognitive cluster:
"Capital punishment helps to prevent serious crimes", "Preventing serious crime is good", "Capital punishment is sometimes justified", "reduce prison costs", "execute Paul Bernardo"

Affective cluster:
"Capital punishment is not a deterrent", "Preventing serious crime is good", "killing a defenseless victim is wrong", "capital punishment is wrong", "execute Paul Bernardo"



Methodological setup for similarity assessment: Ongoing "map of science" study

We want to have a similarity assessment task that is:

- Suitable for web-interface
- "Bottom-up" (i.e. not "holistic" like a task that involves, e.g., having all concepts printed on paper and let people sort on tables"
- Robust for order-effects (i.e. we want to give the subject the freedom to stop the survey whenever he/she likes).

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Exemplifying the Role of Coherence: Political Beliefs / Moral Beliefs

Political Beliefs

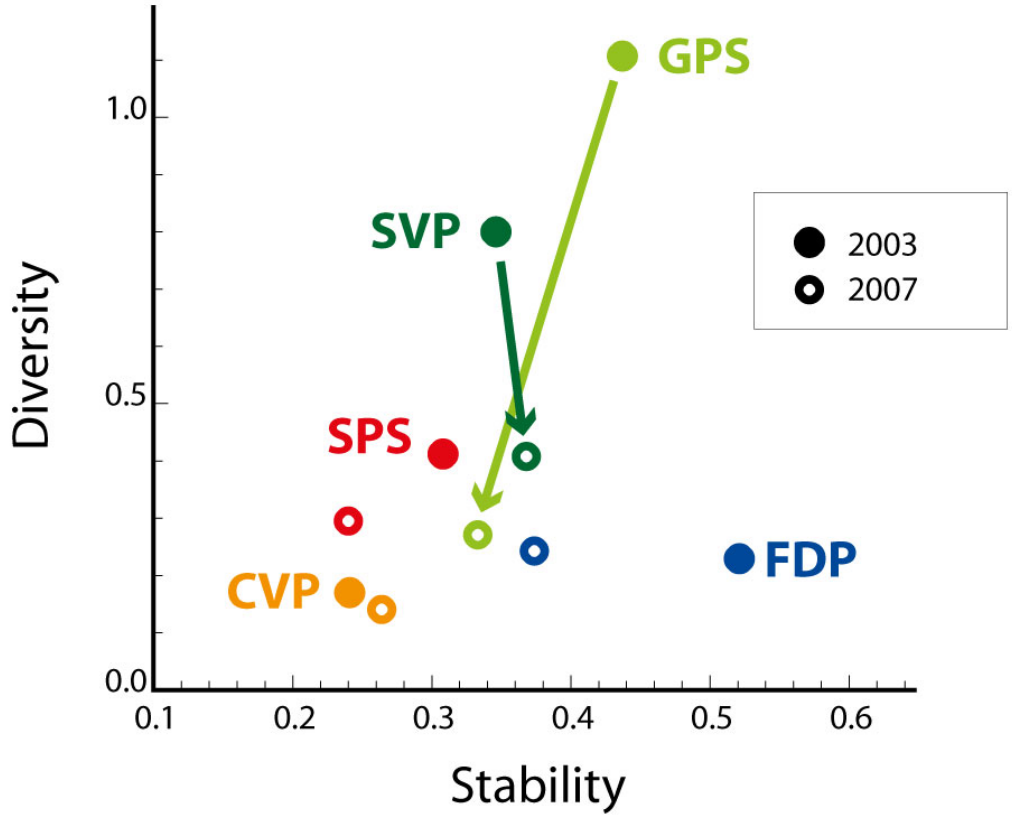
In our example, the sub-group of agent-beliefs whose coherence is of interest consists of beliefs upon political issues (e.g. “I support nuclear power”, “Less money should be spent on the military” etc.) for which survey data from the “smartvote” project was available.

The question of interest was, to which extent the degree of coherence may explain two recent party splits in Switzerland (Green Party: 2004, Swiss People’s Party: 2008).

Due to this question, not the single beliefs, but the belief-holders (i.e. party members) are the “natural” units that form a (more or less) coherent system

The mutual comparison of survey data among all candidates of a party both in 2003 and 2007 using a standard distance measure results in a distance matrix that serves as input for the clustering algorithms.

Coherence and Party Stability (1)



Coherence and Party Stability (2)

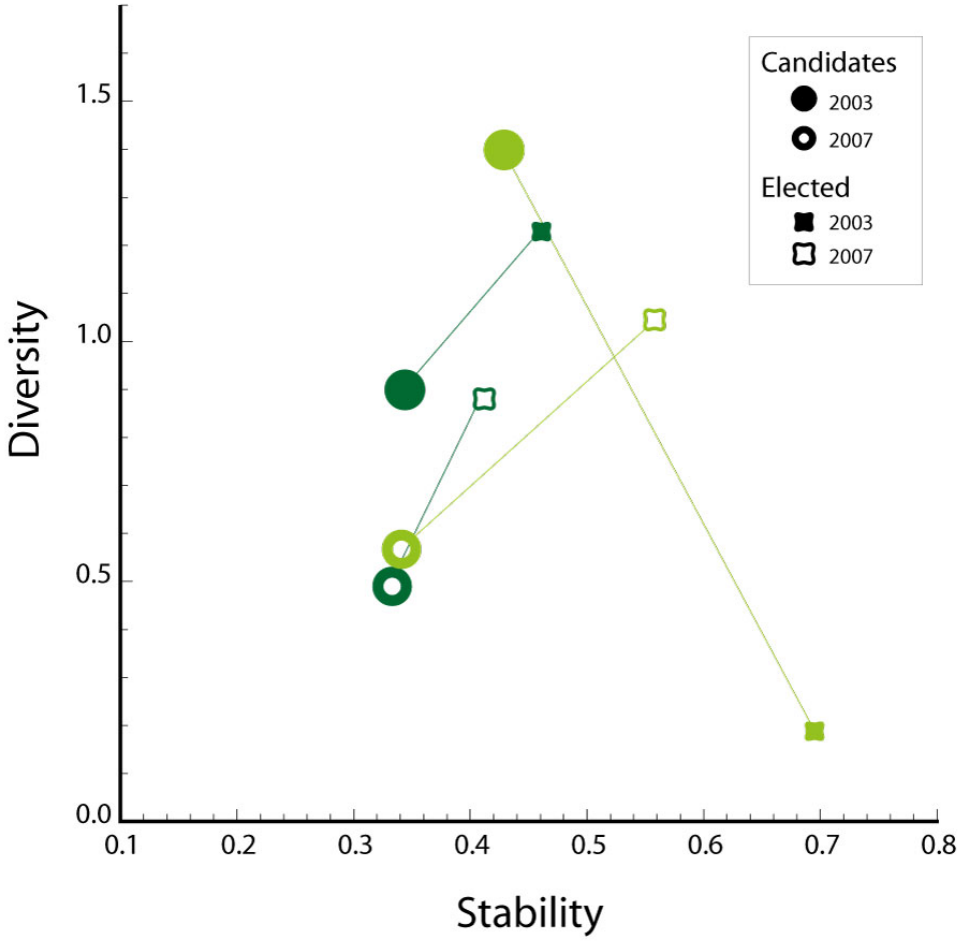


Table 2. Comparison of alternative measures for intra-party polarization with our coherence measure.

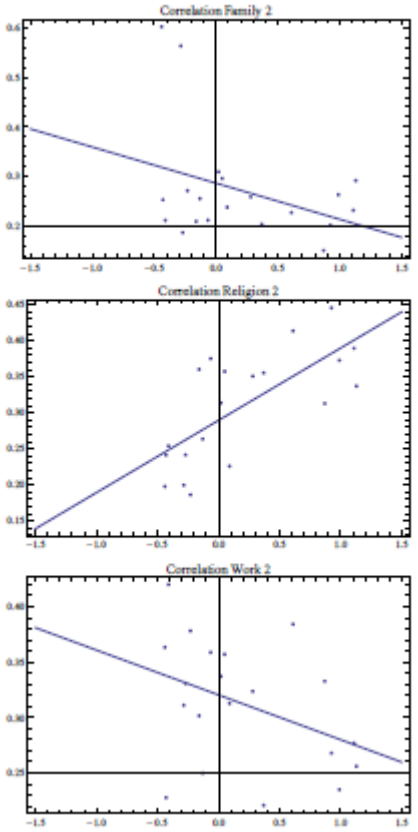
Method	Result per party										Suggestions		
	CVP		FDP		GPS		SPS		SVP				
	2003	2007	2003	2007	2003	2007	2003	2007	2003	2007	split	in risk	stable
A	30	13	14	17	3	2	3	2	17	16	CVP	FDP	GPS
Trend	-7		3		-1		-1		-1			SVP	SPS
B (K)	-.565	.008	.198	.353	.889	.456	2.04	1.38	1.25	.377	CVP	(SVP)	FDP
B (V)	.177	.156	.160	.161	.140	.121	.127	.121	.067	.114			(GPS)
Trend	.573/-.021		.155/.001		-.433/-.019		-.651/-.006		-.877/.047				(SPS)
C (K)	-.893	-.288	.321	-.534	4.73	1.51	2.44	1.46	1.44	1.38	CVP	FDP	GPS
C (V)	.075	.019	.028	.035	.025	.019	.016	.031	.045	.021			SVP
Trend	.605/-.056		-.855/.007		-3.22/-.006		-.979/.015		-.059/-.024				(SPS)
D	.052	.025	.007	.015	.085	.041	.064	.073	.057	.088	GPS	SVP	FDP
Trend	-.027		.008		-.044		.009		.031			SPS	(CVP)
E	.722	.777	.798	.884	.942	.932	.903	.926	.815	.853	(FDP)	(CVP)	SPS
Trend	.055		.086		-.010		.023		.038				GPS
													SVP
Coherence Analysis											GPS	SVP[a]	CVP
(overall party coherence and comparing candidates with elected MPs)											SVP[b]		CVP
													SPS
Real world											GPS	SVP	CVP
(the SVP did split shortly after the 2007 elections)													FDP
													SPS

Stability of moral beliefs: World Value Survey Items for Family values, religion and economic justice (ongoing):

We made a stability analysis for eight countries where complete data for all items related to family, religion, and work/justice for three waves (mid 1990s, around 2000, mid2000s) were available: ARG, IND, JPN, MEX, MDA, ZAF, ESP, USA and correlated the stability measure with the world bank stability index.

We find a positive correlation to religion, negative correlation to family/work.

Interpretation: "coherence instability" with respect to religion is bad, but not with respect to family or economic values.



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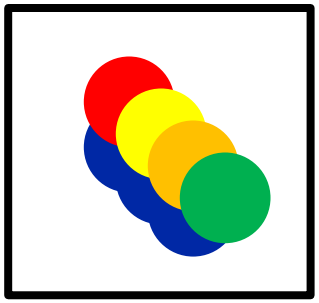
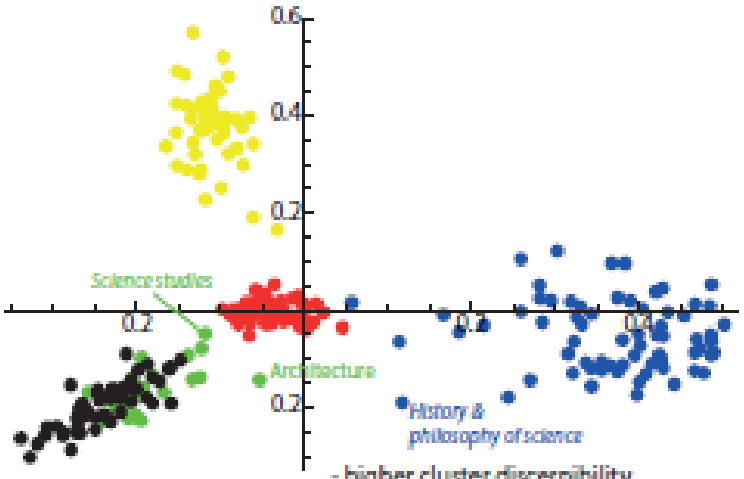
Mapping conceptual spaces

The idea of a superparamagnetic agent map



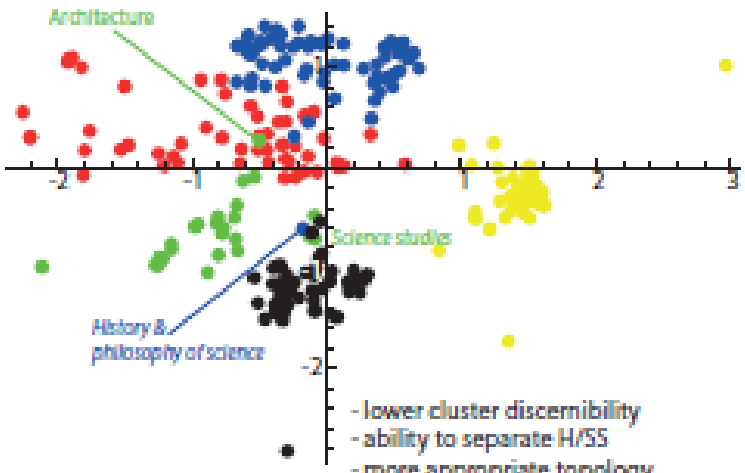
Some preliminary results (also with respect to visualization: superparamagnetic agent maps)

Multidimensional scaling



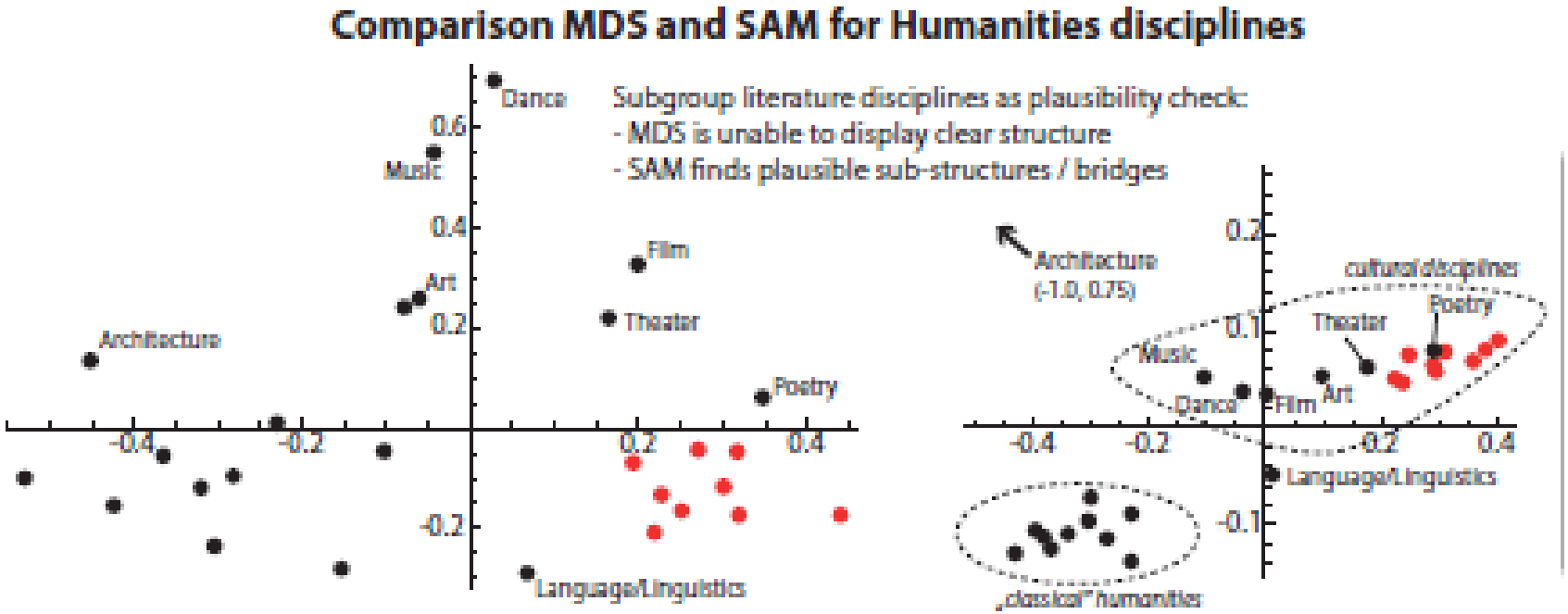
- higher cluster discernibility
- unability to separate H/SS
- more unappropriate topology (summarized rank sequence distance: 26)
- unplausibe location of „bridge disciplines"

Superparamagnetic agent map



- lower cluster discernibility
- ability to separate H/SS
- more appropriate topology (summarized rank sequence distance: 18)
- plausibe location of „bridge disciplines"

Some preliminary results (also with respect to visualization: superparamagnetic agent maps)



Mapping the value space

Based on an literature and internet search we created a set of ~450 English value terms (denoting goals individuals or organizations want to achieve) such that for each term we have a German parallel term (intercultural study)

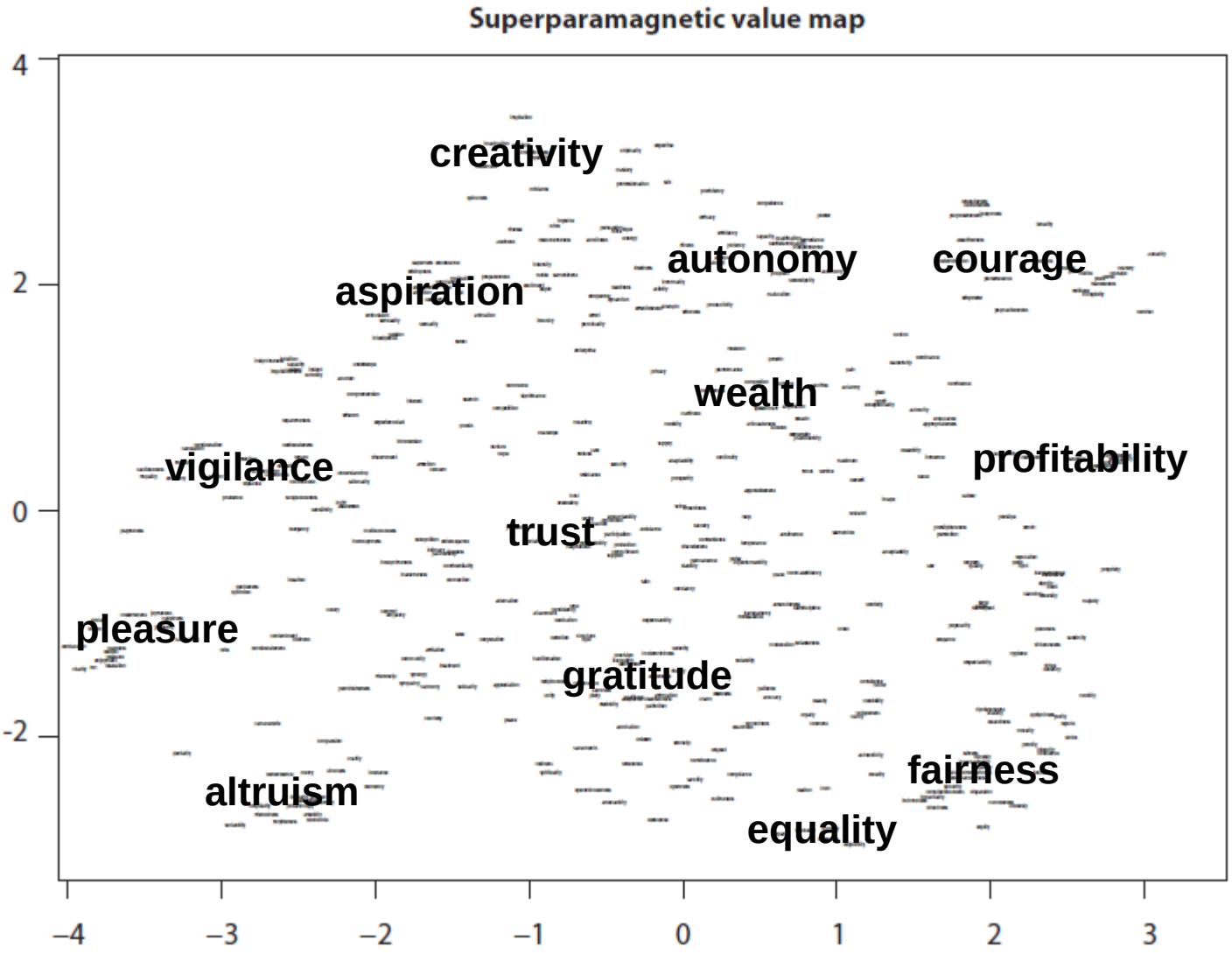
For each term we created its synonym-set: all terms that are considered as (broadly construed) synonyms based on a large Thesaurus database.

Idea: Synonyms are “crystallized” linguistic similarities based on language use over many decades.

The overlap of synonym sets defines a similarity measure between terms. This measure is the input of a superparamagnetic agent map.

The map will serve as a “benchmark” for value similarity for allowing for the following comparisons:

- Language use in different times (text mining using the Google data set)
- Individual similarity rating & correlation to moral identities


Superparamagnetic value map
creativity
autonomy
courage
aspiration
wealth
profitability
vigilance
trust
pleasure
gratitude
fairness
altruism
equality
4
2
0
-2
–4
–3
–2
–1
0
1
2
3

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Thank you!