Thesaurus-based value maps as an instrument for psychological research

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# The context of the project

The idea: novel tools to understand moral agency

A moral agent is a being who is capable of acting with reference to right and wrong. This entity "agent" interacts with three other types of entities:

- Built-in competencies that allow for agency
- A context in which the agent operates
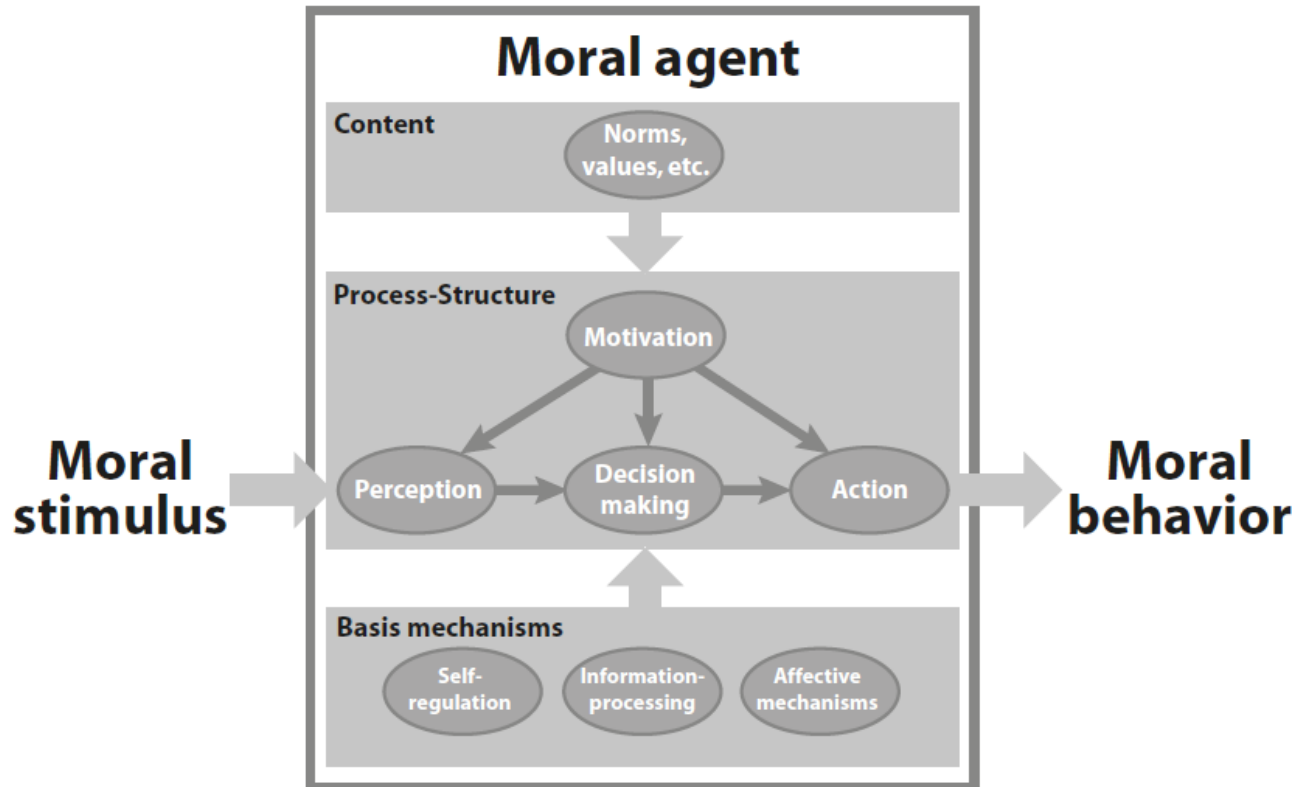- A normative frame that provides the reference for "right" and "wrong"

All these entities interact in rather complex ways, see Christen & Alfano (in press).
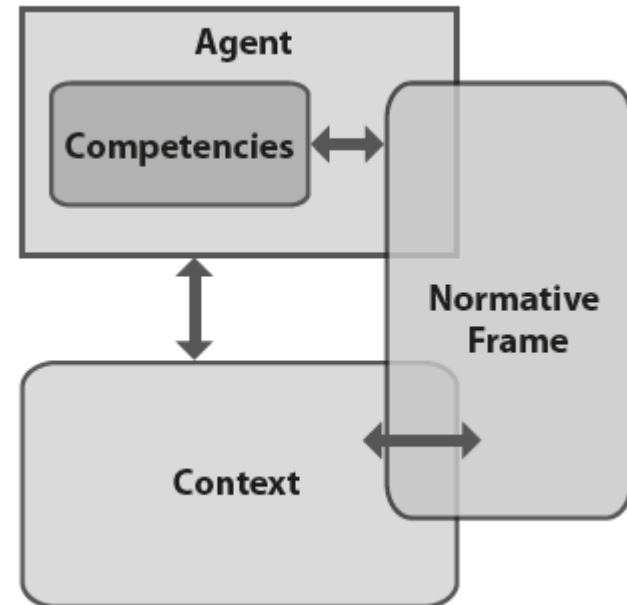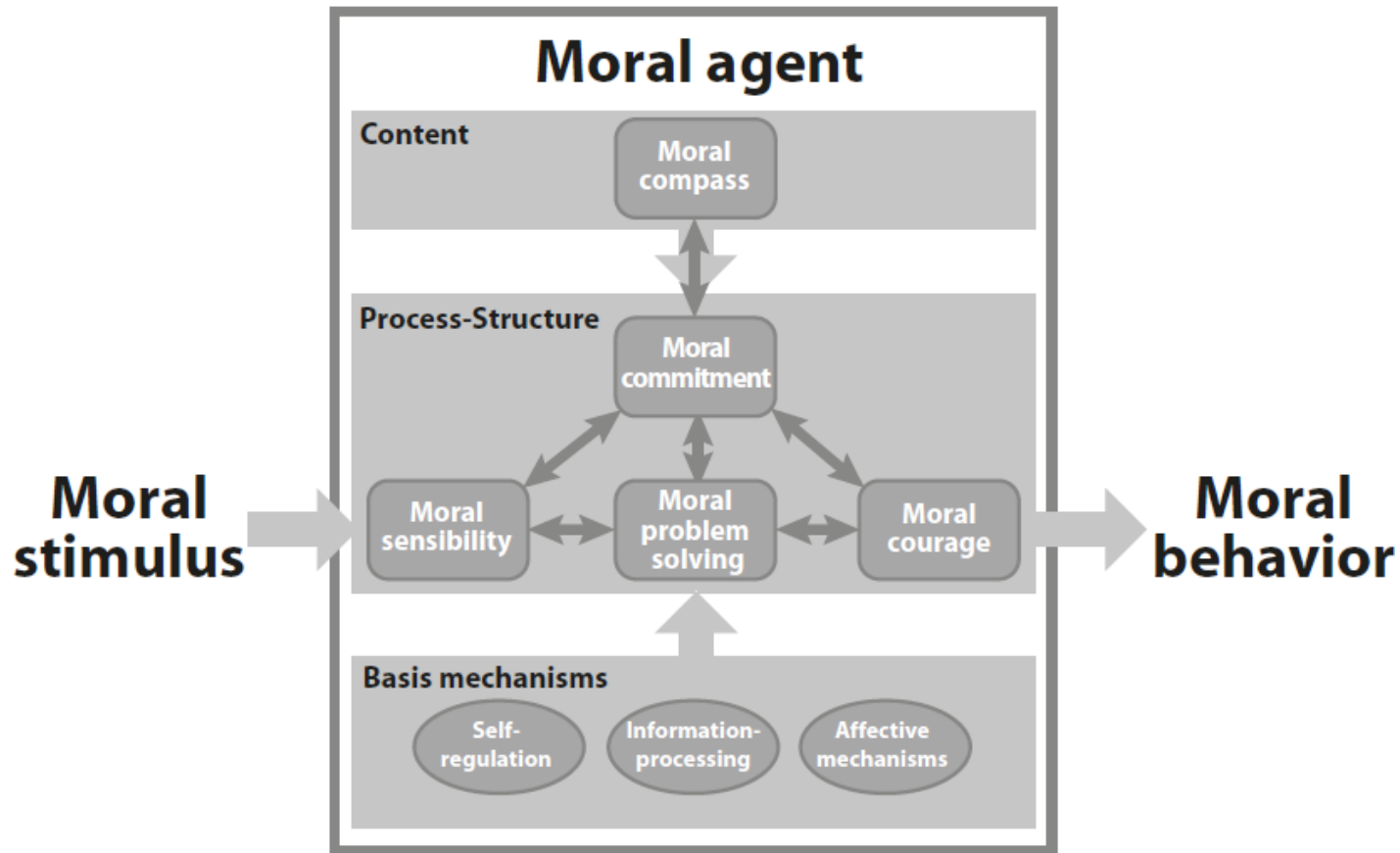
Stage models of moral behavior

We work with an adaptation of classical stage models of moral decision making (Rest 1986, Narvaez 2005):

Our working model: Moral Intelligence

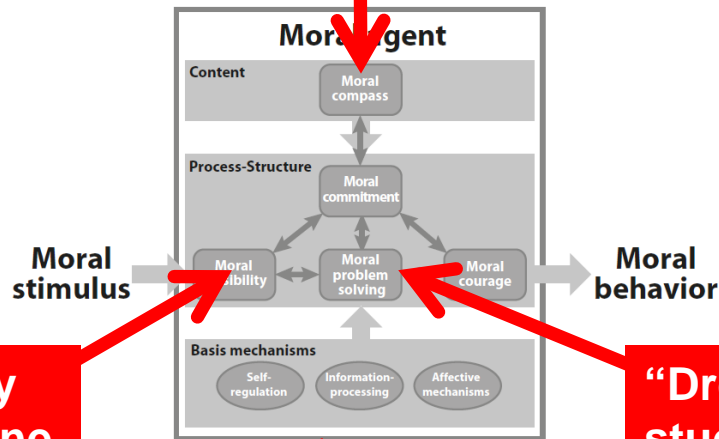Tanner & Christen, in press

Projects we are working on

Value space study to find potential entities of the moral compass

Moral sensibility tools for medicine and finance

"Drone dilemma" study on the relation of decision making and moral reasoning

"Serious Moral Games" as an integrative tool for measuring and training moral competences.

The idea of "mapping the moral space"

What are maps?

Maps are abstract, usually 2-dimensional representations of real (or abstract) spaces that involve entities, a metrics (i.e. a notion of distance between the entities), and interrelations among entities. A few basic principles are:

- Creating maps always involve **choices** on what to show and what not to show depending on the function of the particular map.

- Creating a map always involves the solution of a **classification problem** that relate map-symbols with the entities of the space one wants to map (e.g., single trees versus woods).

- Distance relations on maps are **incomplete** with respect to distance relations in the real space and may need additional symbols such that the map is not misleading (e.g., structural contour lines).

Attempts to "map the moral space"

A "map" of the moral space would involve:

- Entities that can potentially be an object of moral concerns (~values: states/ goals that individuals or groups/institutions consider to be achievable)
- A feasibly number of entities, i.e. they should emerge out of a classification (e.g., the moral foundations of Haidt, currently 6 classes)
- A distance notion between the entities (that's why the moral foundations theory does actually not impose a map).
- A problem the map should help to understand.

An alternative way to create such a map would be to define "value dimensions" that span up a space in which non-moral entities are placed (e.g., Inglehart–Welzel cultural map of the world; the entities are countries)

Schwartz value map

Probably the most known "value map" emerged out of the research of Schwartz (function of the map: understanding psychological compatibility of values).
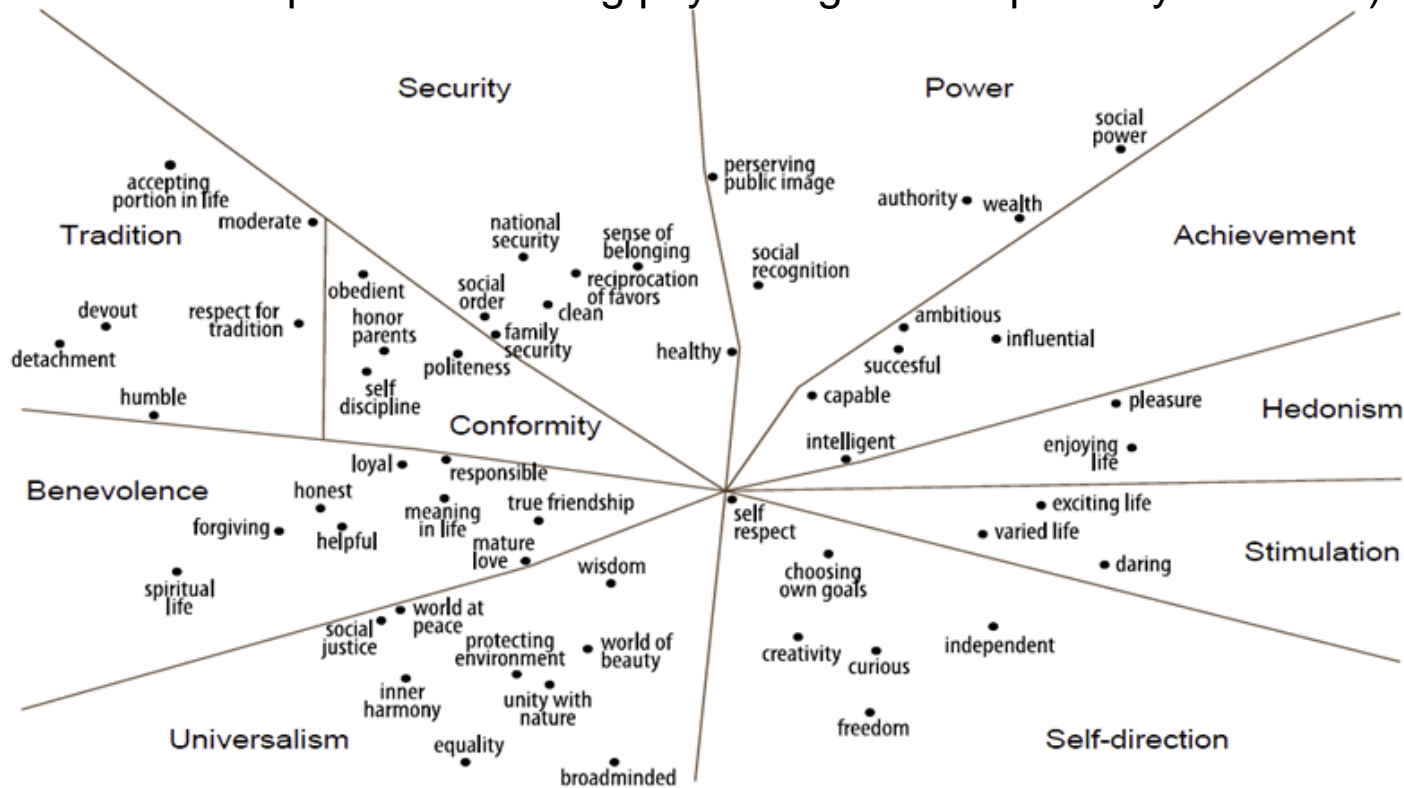

Fig. 2. The empirical structure of human values (Schwartz 1992).

Methodology

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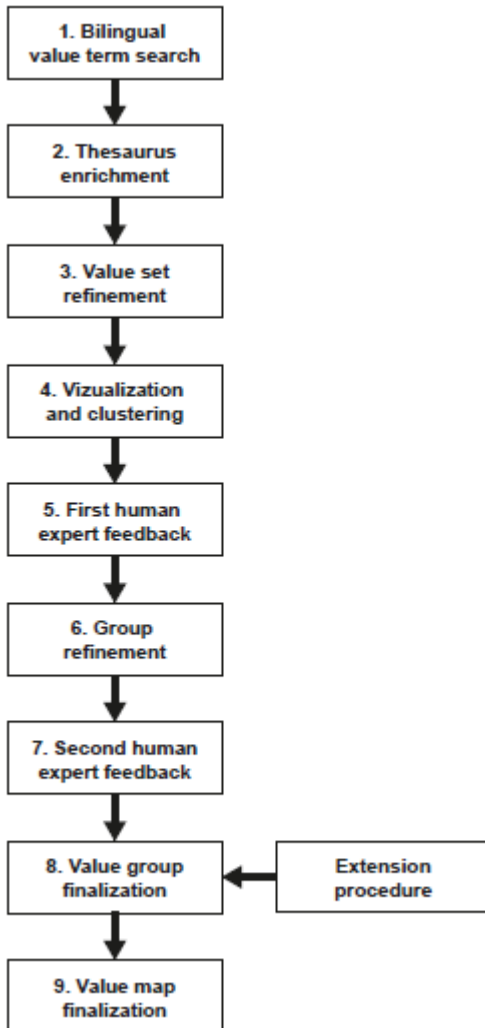
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What is a Thesaurus?

A Thesaurus is a database of word similarities reflecting (written) language practice:

You are writing a text and you use the word "X" – but "X" does not quite say what you want to say: then you go into the Thesaurus and look for suggestions with words that have somehow a similar meaning and that fit better into your text.

Thus, we believe that a Thesaurus that emerged within decades of language use is somehow "crystallizing" word similarities based on actual use of the language. It's broader than "WordNet", that labels the semantic relations among words, whereas the groupings of words in a thesaurus does not follow any explicit pattern other than meaning similarity.

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1. Bilingual value term search
2. Thesaurus enrichment
3. Value set refinement
4. Vizualization and clustering
5. First human expert feedback
6. Group refinement
7. Second human expert feedback
8. Value group finalization ← Extension procedure
9. Value map finalization

Procedure (overview)

We used a "bottom-up" approach, i.e. we did not start with a classification, but we looked for value terms in all possible sources (literature, internet-lists, etc.) such that we had always a bilingual "match".

Each term was then associated with a word-bag representing all the synonyms of the term (broadly understood). This imposes a distance relation (basically: word-bag-overlap).
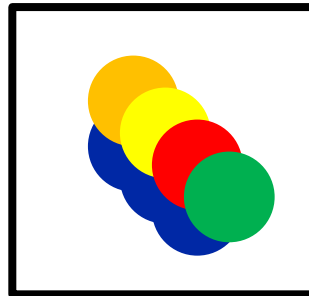
Databases:
- Thesaurus.com (English)
- Woxikon.de (German)

The procedure also involves a mechanism to expand the map if new terms join the list.
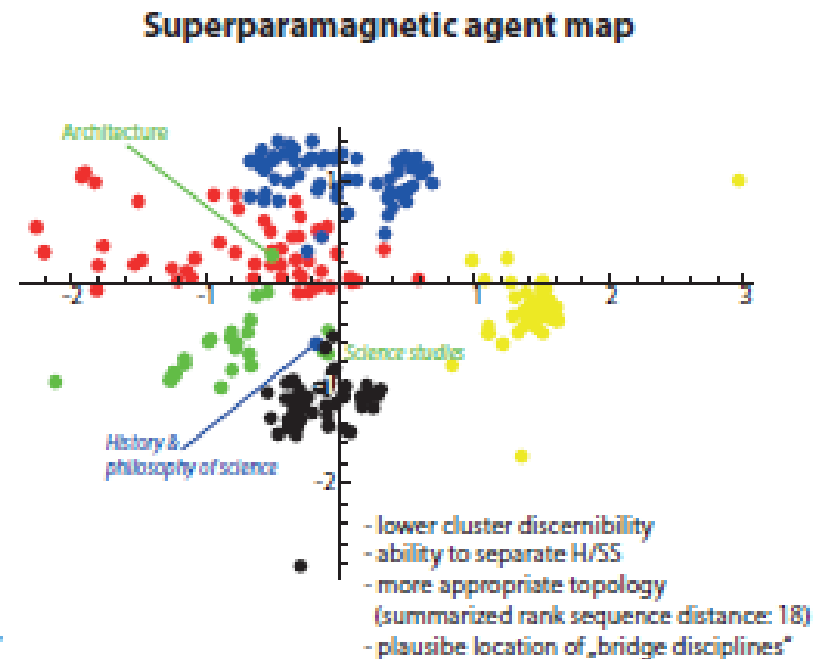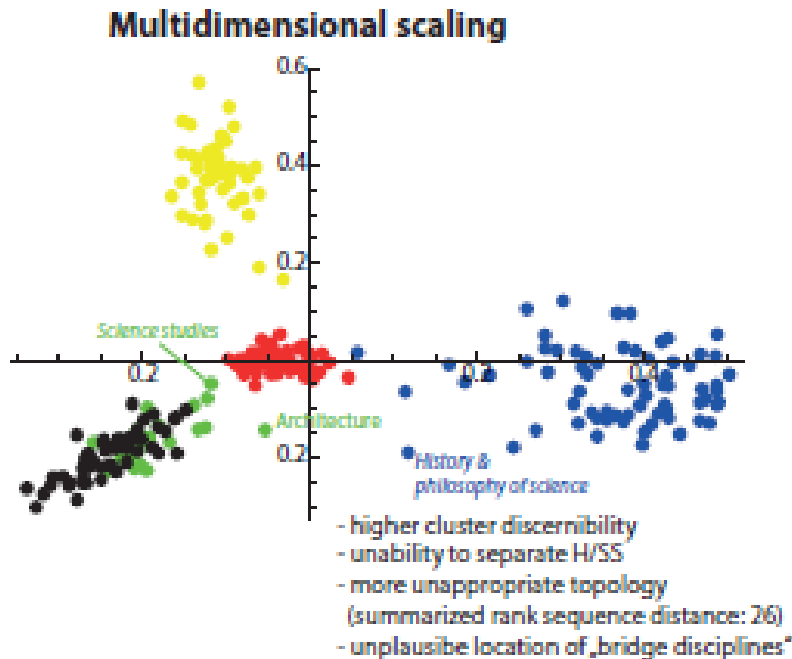
The idea of a superparamagnetic agent map

For visualization we used superparamagnetic agent maps (Ott & Christen 2011), a self-organization-based tool that preserves the topology of the high-dimensional space (including an iterative procedure: in the local environment of each point of the map: diminish only those distances of points that are also close in the real space)

Some preliminary results of another ongoing study to demonstrate the advantages of the map (1)

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 of another ongoing study to demonstrate the advantages of the map (2)

Comparison MDS and SAM for Humanities disciplines

Subgroup literature disciplines as plausibility check:
- MDS is unable to display clear structure
- SAM finds plausible sub-structures / bridges
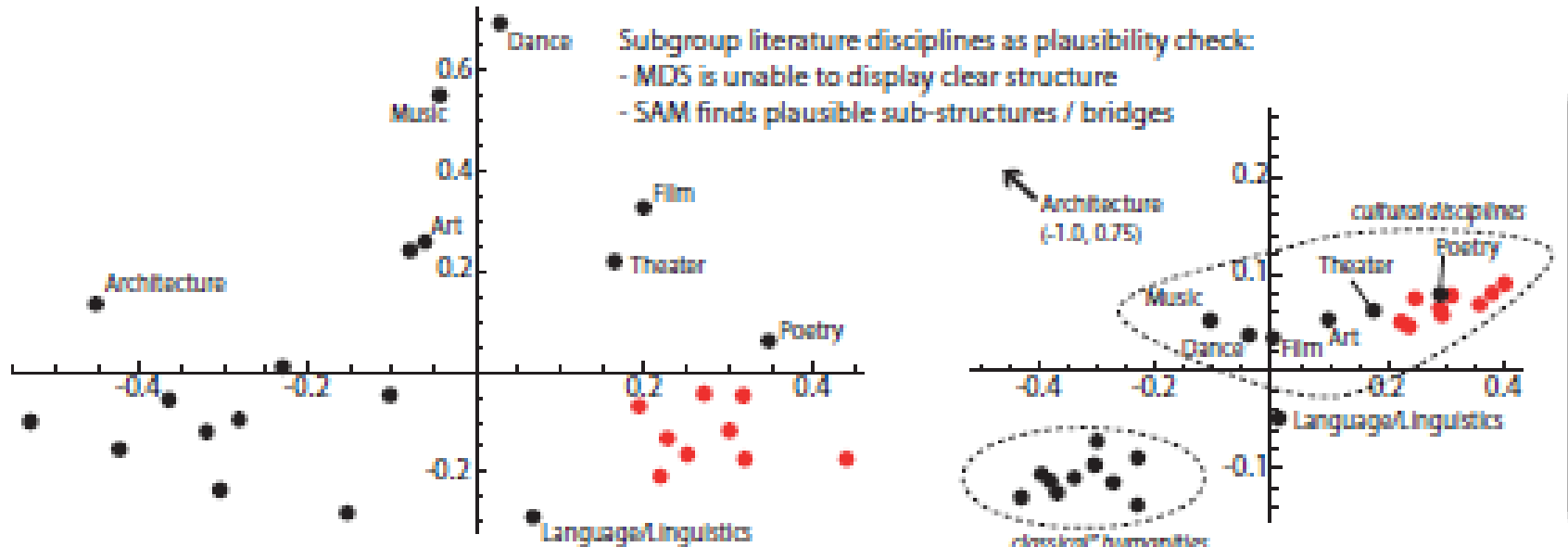
Intermediate map (step 4)

After an iterative procedure to optimize the visualization and a clustering step (SSC) an intermediate map of all 460 values has been created.

Value-Map English after Four Machine Iterations and Clusterings

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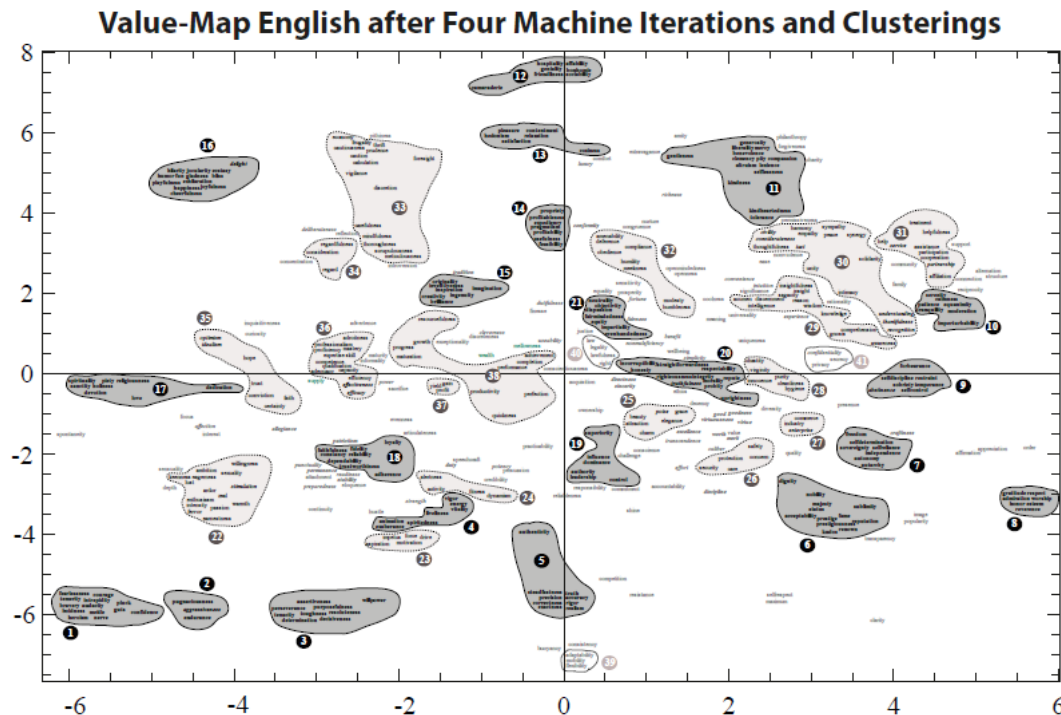
Expert Evaluations (steps 5 / 7)

Human expertise has then been used (in total 9 experts per language; emerging from philosophy, psychology or English/German literature) to refine the classification:

1. Step 5: Five out of six experts had to agree with a classification. The groups then have been chosen such that inter-language match is preserved.

All remaining values have then been attributed to the "best" group in terms of synonym-overlap.

2. Step 6: All six experts per language had to agree in attributing a certain value to a group. In case of disagreement, best-match to the enriched groups has been calculated and the value has been rejected if a certain threshold has been missed.

Results and result evaluation

Result: 78 groups have been identified (excerpt below)

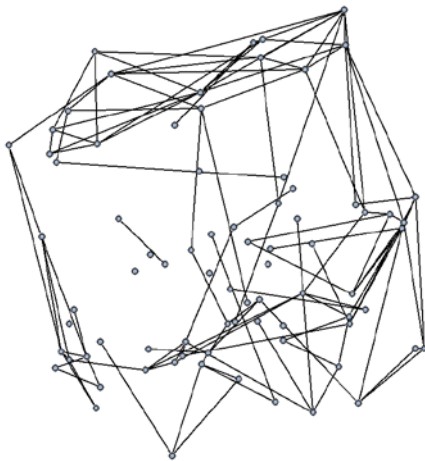| Language-typical elements English	English values with German translations	rel. CS	rel. CS	German values with English translations	Language-typical elements German
	aggressiveness, pugnaciousness, toughness	0.86	0.29	**aggressivität**, härte, kampfeslust	herausforderung, widerstandsfähigkeit
benevolence, kindheartedness, kindness, thoughtfulness	**altruism**, charity, philanthropy, sacrifice, selflessness	1.12	0.86	**altruismus**, aufopferung, nächstenliebe, philantropie, selbstlosigkeit	gastfreundschaft, hilfsbereitschaft
realism	**authenticity**, clarity, truth, truthfulness	0.89	0.91	**authentizität**, klarheit, wahrhaftigkeit, wahrheit	gewissheit, glaubwürdigkeit, prägnanz
sovereignty	**authority**, influence, persuasion, power	0.28	0.60	**autorität**, einfluss, macht, überzeugungskraft	bestimmtheit, durchsetzungsver-mögen, kaltschnäuzigkeit, signifikanz

How to measure the quality of a map?

For each pair of points: calculate the aberration of their distance in the map to the distance in the real space (normalized with the longest distance in each case). The higher this value, the lower is the quality of the map in preserving the real distance relations.
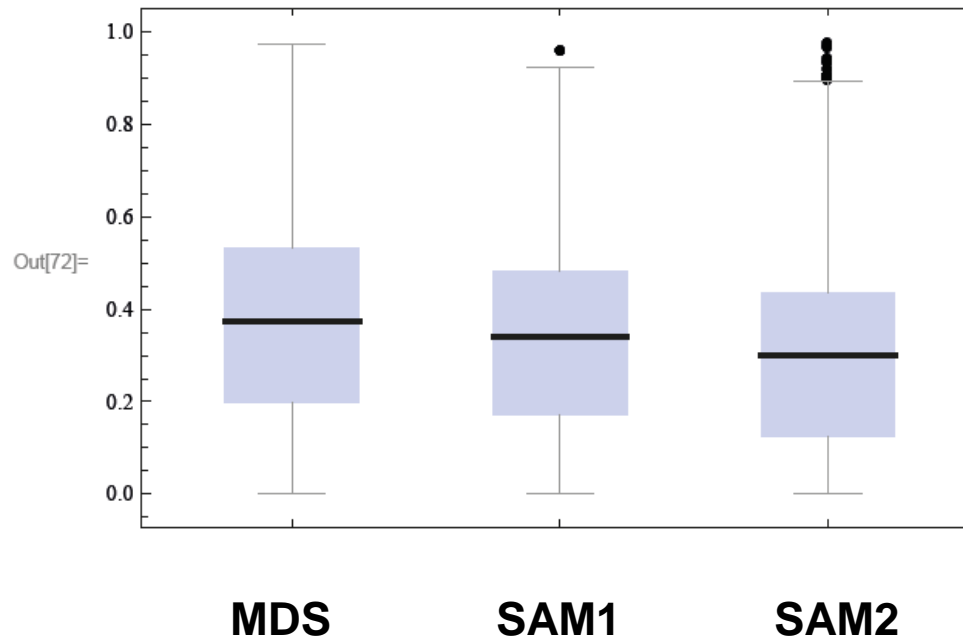
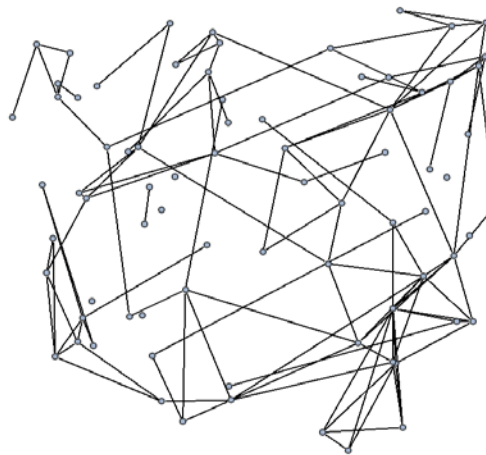

MDS   SAM1   SAM2

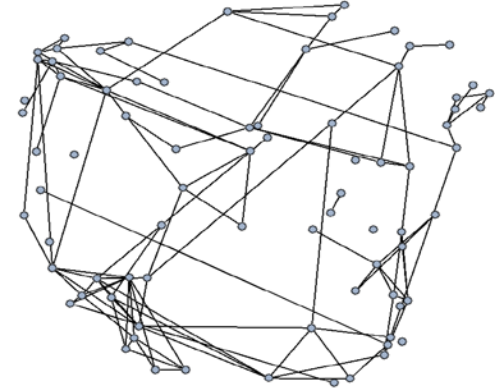# What does this mean for the map?

We show the maps (MDS vs. SAM1/2), where those points are connected whose distances in the original space is among the 5% closest.

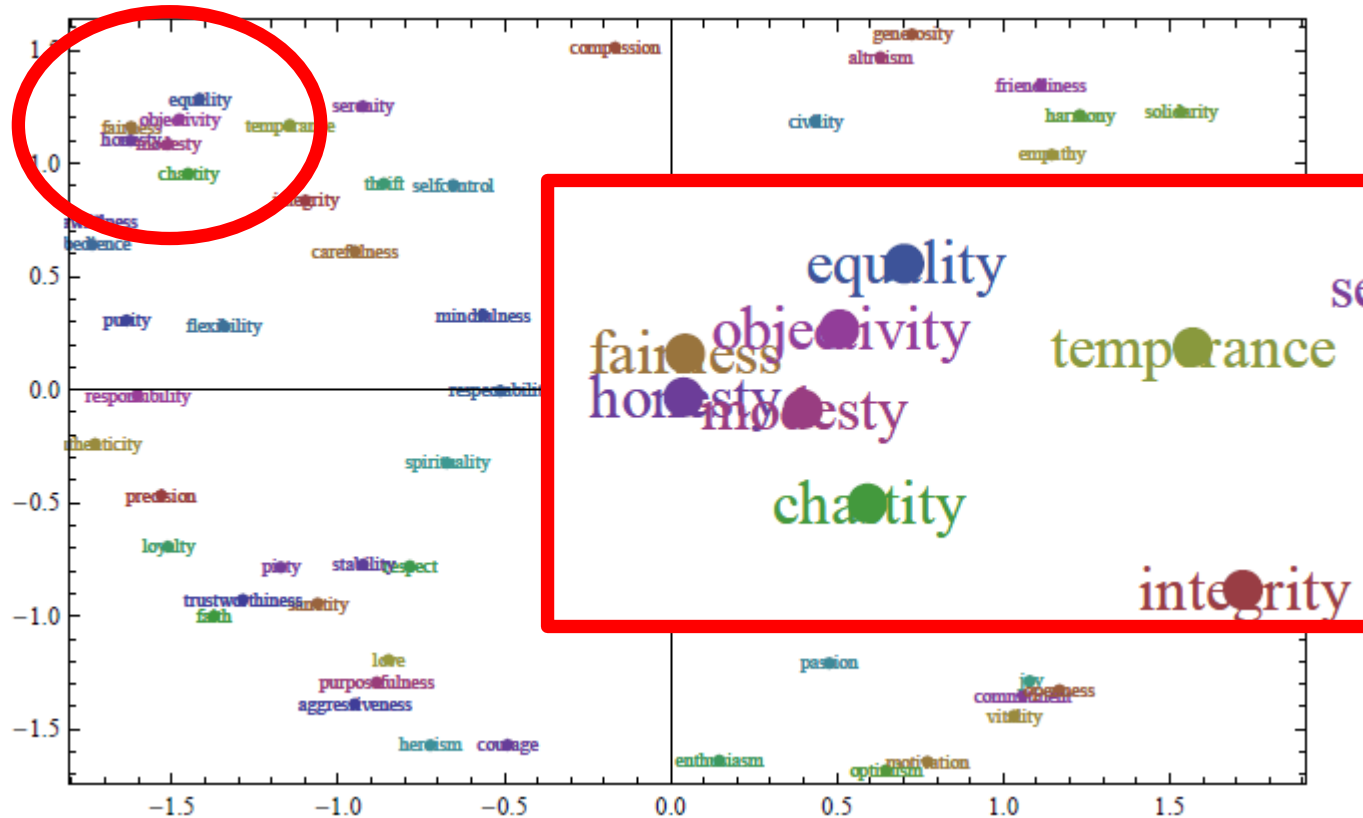**MDS**   **SAM1**   **SAM2**

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Spotting cultural difference: equality/gleichheit: English

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Cultural difference: equality / Gleichheit: German

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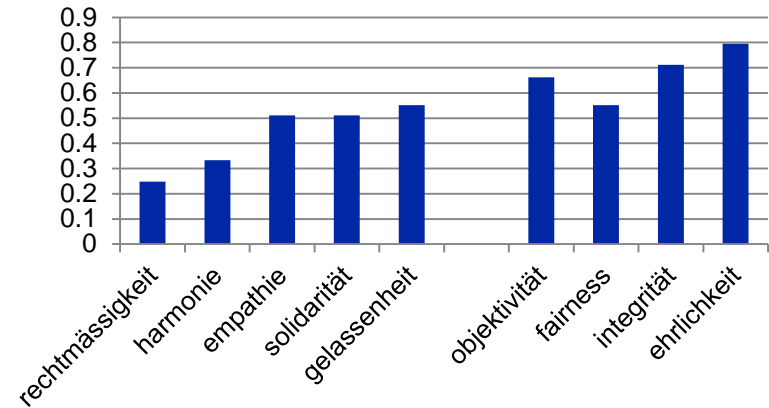
The map indeed captures differences in language use

Closest English groups to "equality"
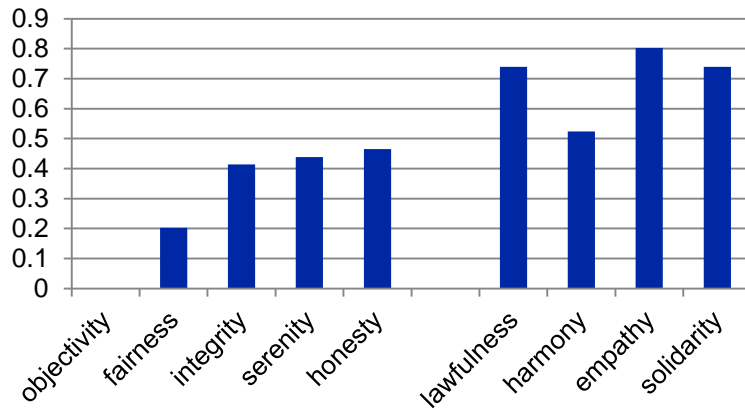
Closest German groups to "Gleichheit"

Next steps

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Follow-up studies

Work in progress incudes:

1) Does the thesaurus-based similarity match with direct similarity rating across groups (using a sorting paradigm as in the discipline study)?

2) Does closeness (on the map) imply higher accessibility (Higgins)?

3) To what extend are the values "morality laden" and is this dependent from the context (social sphere) in which he values are used? (i.e., how foundational are these values groups?)

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Two social spheres: Medicine and Business

For medicine and business, we identified 14 value orientations (partly overlapping) based on expert interviews and smaller surveys.

Those values (described using exemplary types of actions) have been rated (by students and professionals, n=317/208) along 4 dimensions:

1. moral/universal – non-moral/non-universal
2. communion – agency
3. collaborative – competitive
4. consequentialist – principle-focused

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Methodology

We used Mann-Whitney and Kolmogorov-Smirnov as two complementary nonparametric tests (former has a higher power for refusing the null-hypothesis, latter is more sensitive for the form of the distribution, e.g. bimodality). Based on these tests, we performed two types of classifications for each dimension:

1) We classified two values X and Y as being in the same group, if either the Mann-Whitney- or the Kolmogorov-Smirnov-test does not distinguish them (i.e., $p > 0.05$) for a specified dimension.
2) We used superparamagnetic clustering either the p-values of the Mann-Whitney- or the Kolmogorov-Smirnov-test as similarity measure for each dimension.

In this way, two values X and Y could be maximally 12 times (2 measures x 3 dimensions x two classification methods) in the same group. In this way, a count matrix is generated in which each matrix element stands for the number of times the two associated values have been put in the same group

Result (only medicine)

we calculated for each single value using univariate linear regression, whether a pairwise correlation among the four dimensions can be detected:
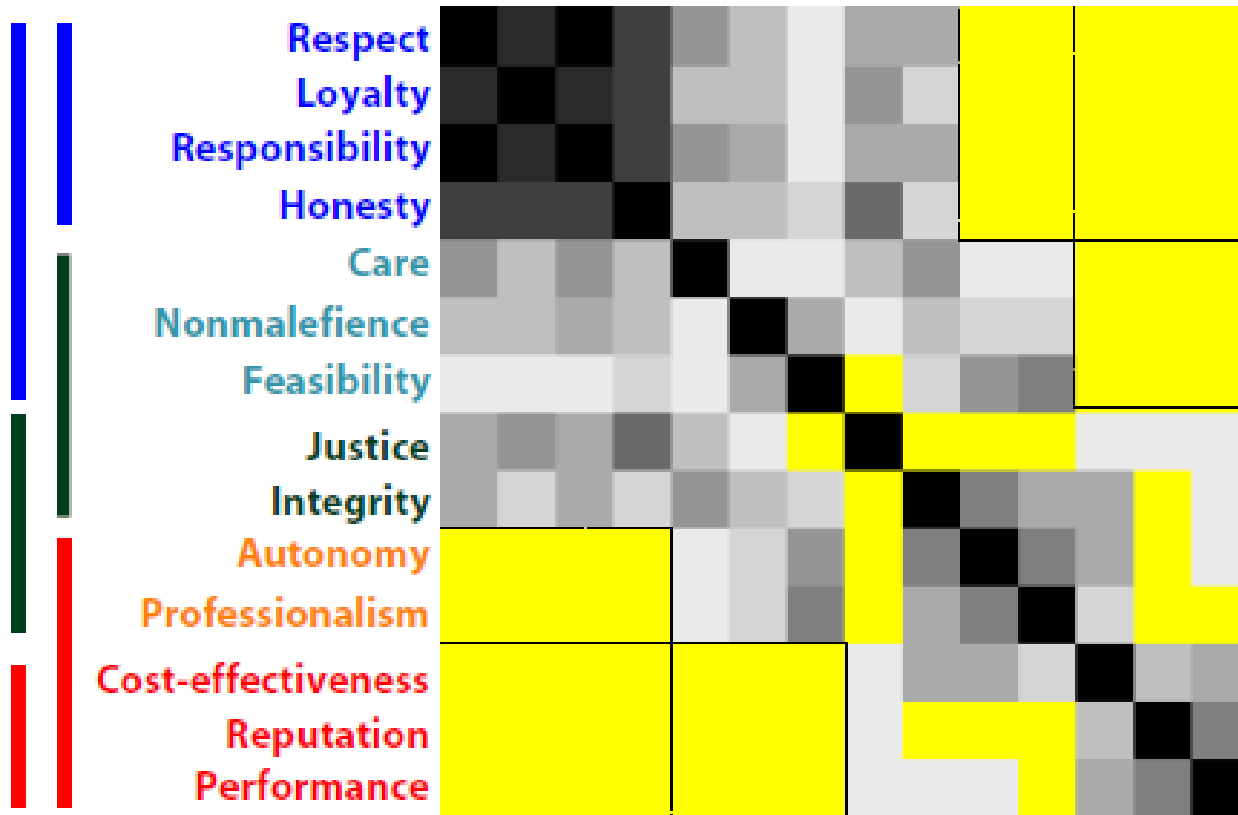
- The dimensions B and C were significantly correlated ($p < 0.05$) for all values (mean estimated slope: -0.32)
- The dimensions A and C were significantly correlated in 13 out of 14 cases (mean estimated slope: 0.27)
- The dimensions A and B were significantly correlated in 10 of 14 cases (mean estimated slope: -0.25).
- The dimension D was in the majority of the cases not correlated to any other dimension (A-D: in 7 cases, B-D: in 9 cases, C-D: in 11 cases).

We thus can conclude that the dimensions A, B and C describe the distinction between "moral" (universal with reference to right and wrong, community-oriented, and cooperative) and "non-moral" (non-universal and no reference to right and wrong, self-oriented, competitive) values as predicted, whereas D is (as expected) not attributable to this distinction.
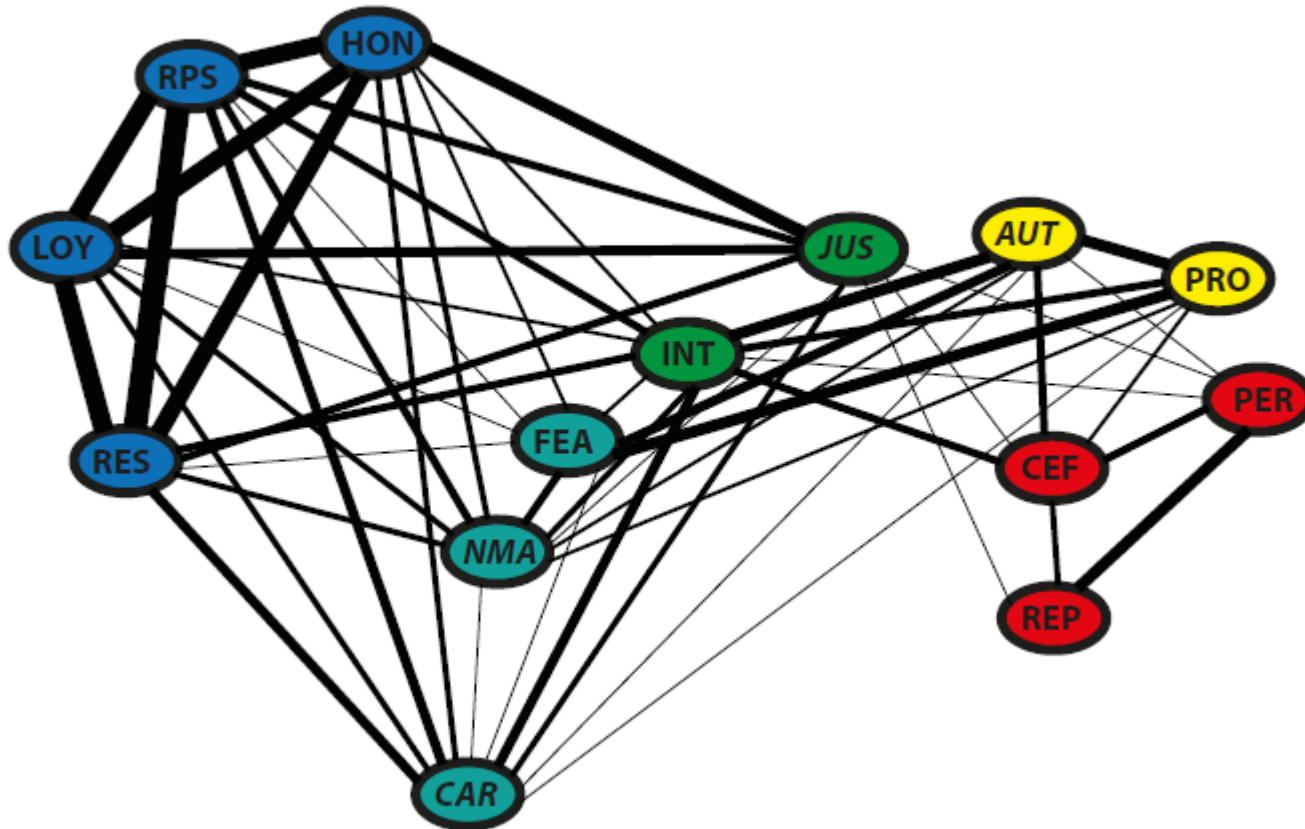
Result (2)

Details in: Christen et al, in preparation

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Result (3)

Details in: Christen et al, submitted/in preparation

Collaborators:

- Darcia Narvaez, University of Notre Dame
- Darcia's lab, in particular Ellen Roof and Olivia Godby
- Carmen Tanner, University of Zurich
- Thomas Ott, Zurich University of Applied Sciences

Thank you!