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Argumentation is key: a keyword-based study of arguments in online discourse

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Argument mining

- Automatic extraction and representation of arguments from texts
  - Identify structural components (premise, conclusion)
  - Map textual patterns to logical representation
- Classic argumentation schemes:
  - Modus Ponens ($X \rightarrow Y$, X $\vdash$ Y)
  - Modus Tollens ($X \rightarrow Y$, ¬Y $\vdash$ ¬X)

Related work

Challenges in everyday language:

- Implicit premises or conclusions (Bosc et al. 2016)
- "Defeasible" argumentation (see Walton et al. 2008)
  - *Expert opinion*
  - *Ad hominem*
  - *Common folks ad populum*
- Persuasion through rhetorical strategies (selection, arrangement, phrasing of argumentative units rather than strict logical implication (Wachsmuth et al. 2018)
- Non-standard language, especially on social media (Goudas et al. 2014)

Hypotheses

- Traditional logical representation is not sufficient for capturing everyday argumentation
- Content-specific indicators can serve as proxies to less-structured arguments
- Combining grammatical templates with content-specific words will help to bridge the gap between logics and authentic language

Examples from Brexit tweets (*Common folks ad populum*):

- *to stay , because* ***<the average person doesn't need to be left in the hands of the brexit leaders>*** *!! Are ppl really*
- *@MyronChristodou @vote_leave* ***<ordinary folk will do worst from #Brexit>*** *- except perhaps t*
- *@DrAlanGreene* ***<I'm as against #Brexit as the next man>*** *but this is nonsense*

Related corpus approaches

- Degano (2007): starts from a predefined list of explicit markers for structural argumentative elements (cf. Levinson, 1983)
- O'Halloran (2011): manual coding of claims and challenges; keyness (words, POS, domains) in coded sequences (WMatrix; cf. Rayson, 2008)

- Content-centred approaches based on keyness: argumentation as one of various usage contexts (Partington, 2003; Baker, 2004; Al-Hejin, 2015)

Data

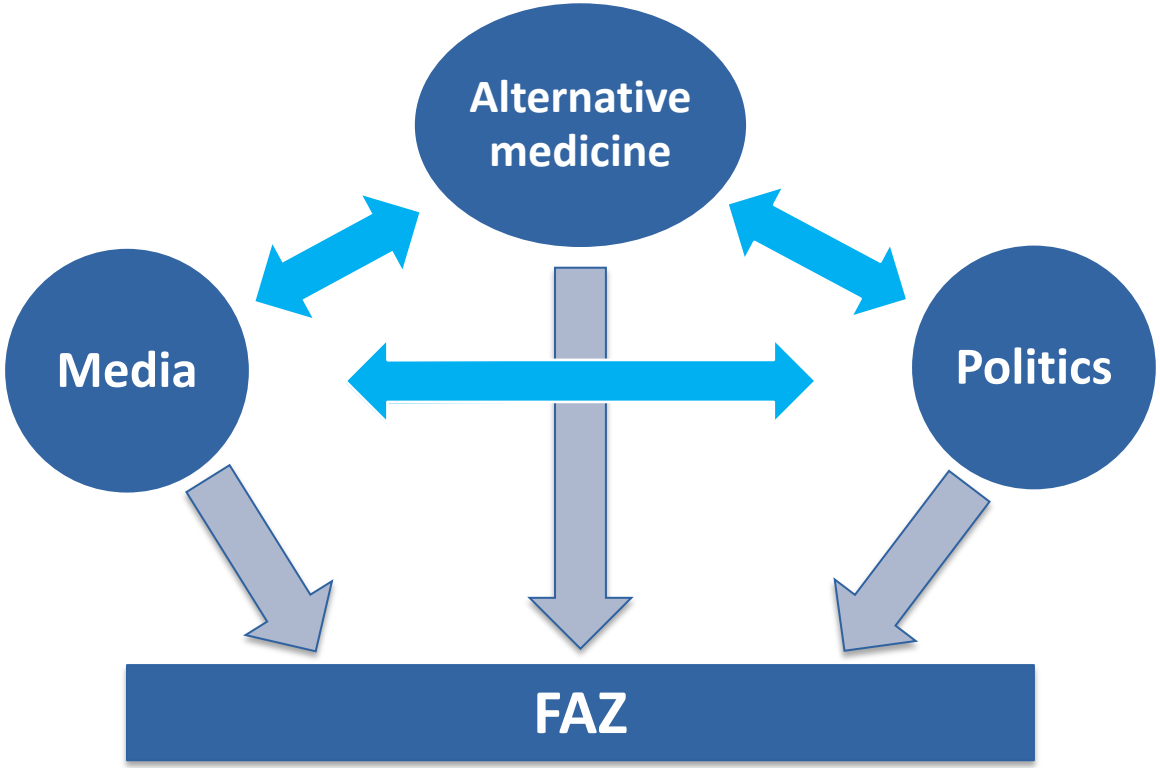
- German web corpus on multidrug-resistant organisms (**MDRO**), clinical hygiene, antibiotics-induced diseases (collected with Bootcat, Baroni & Bernardini, 2004)
- State-of-the-art tools for tagging and lemmatisation (Proisl & Uhrig, 2016; Schmid, 1995; Schmid, Fitschen, & Heid, 2004)
- Manual annotation of text-level metadata: (actor group of author and intended readership, topic)

Sub-corpora for present study:

- **Mass media articles** (1.1k texts; 1.3M tokens)
- Online sources relating to **alternative medicine** (432 texts; 926k tokens)
- National, international and regional **institutions** disseminating information to the public (417 texts, 575k tokens)

Reference corpus: 3 years of the widespread newspaper *Frankfurter Allgemeine Zeitung* (FAZ – 341k texts, 177.9M tokens)

Keyword analysis



Keyness measure: **LRC** = conservative version of the effect-size based log ratio (Hardie, 2014), taking the lower end of a Bonferroni-adjusted 99% confidence interval (cf. Evert, Dykes, & Peters, 2018)

Making sense of keyness – visualisation

Alternative vs. Media

Making sense of keyness – visualisation

- Sorting via semantic similarity helps to identify false positives: greetings (*Hallo* 'hello') and artefacts from boilerplates on the websites (*Beitrag* 'post', *zitieren* 'cite') cluster towards the left
- Other clusters indicate topic complexes/ possible connection to discourse strategies, i.e. words relating to application of medical products (*Wirkung* 'effect', *Mischung* 'mixture', *Anwendung* 'application')
- Media articles: hospitals and multidrug resistance; focus on circumstances of contracting clinical infections (*Hygiene* 'hygiene', *Intensivstation* 'intensive care unit')

Making sense of keyness – annotation

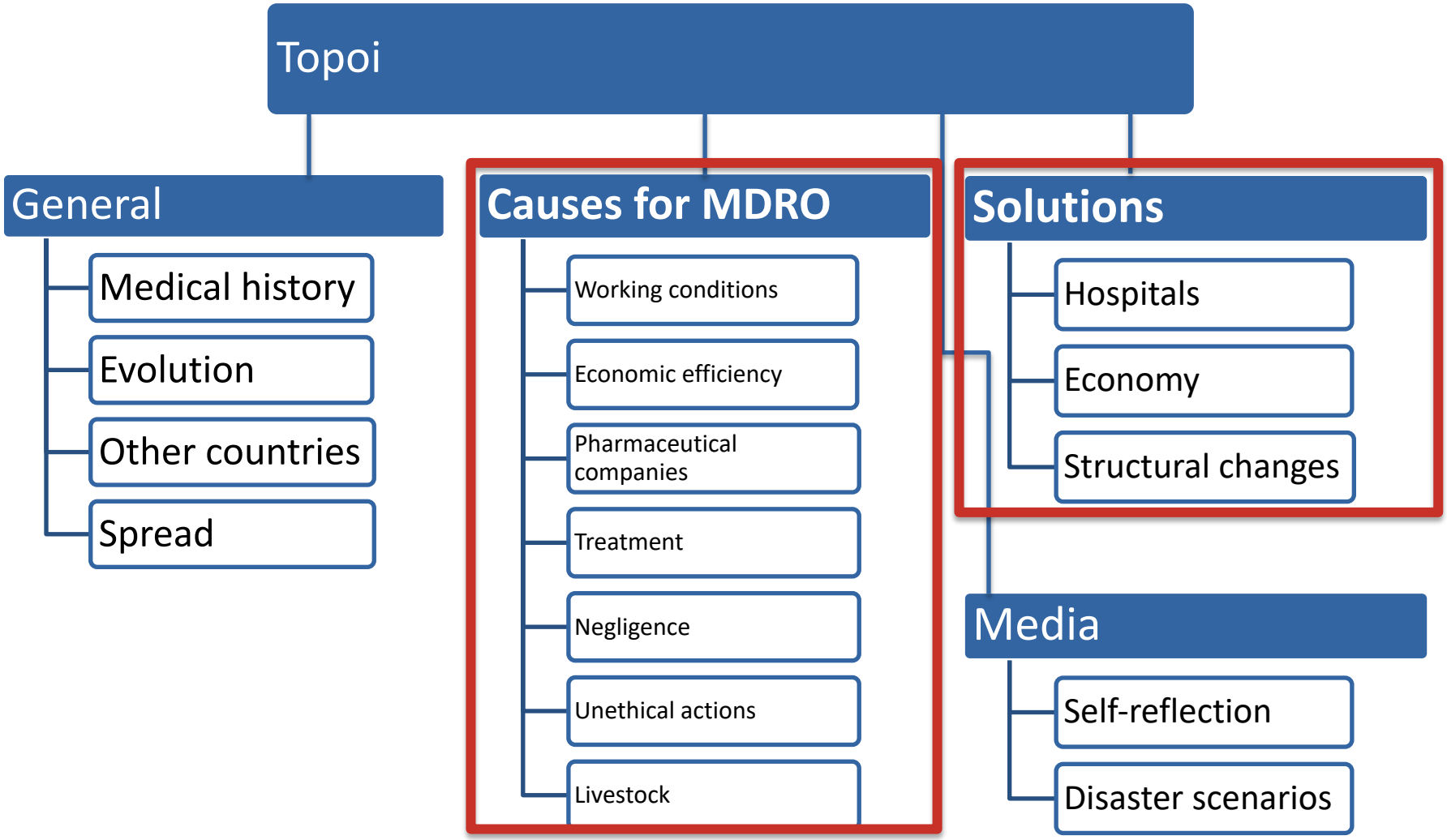
Keyword annotation: text-linguistic gold standard – metaphor, lexis, topoi (Peters 2017, Dykes 2018)

Topoi related to 2 argumentation schemes:

- argument from ***effect to cause*** (Walton, Reed, & Macagno, 2008, p. 172)
  - Major premise: Generally, if A occurs, then B will (might) occur.
  - Minor premise: In this case, B did in fact occur.
  - Conclusion: Therefore, in this case, A also presumably occurred.

- argument from ***positive consequences*** (Walton et al., 2008, p. 101)
  - Major premise: If A is brought about, then good consequences will occur.
  - Conclusion: Therefore, A should be brought about.

Annotation scheme



Making sense of keyness – annotation

Comparison	Actors	Effect – cause	Positive consequences	Other topoi	Not useful
Media / alternative	29%	12%	3%	12%	44%
Media/ politics	27%	10%	1%	8%	47%
Media / FAZ	38%	9%	6%	14%	33%
Alternative / media	7%	7%	18%	13%	55%
Alternative / FAZ	21%	9%	15%	15%	40%
Alternative/ politics	8%	6%	4%	19%	63%
Politics/alternative	32%	16%	5%	15%	32%
Politics/ media	19%	4%	9%	6%	56%
Politics/ FAZ	28%	12%	9%	15%	36%

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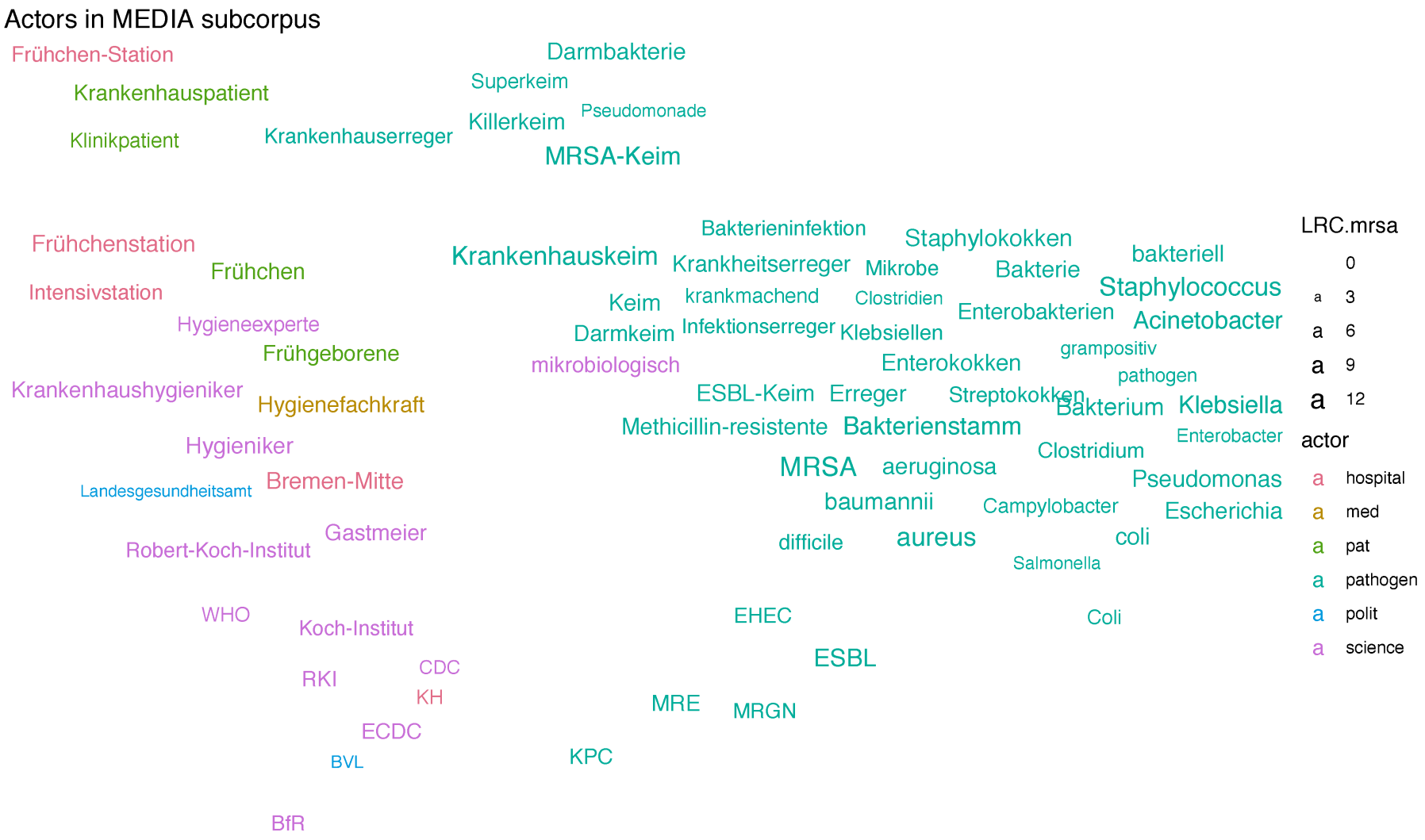
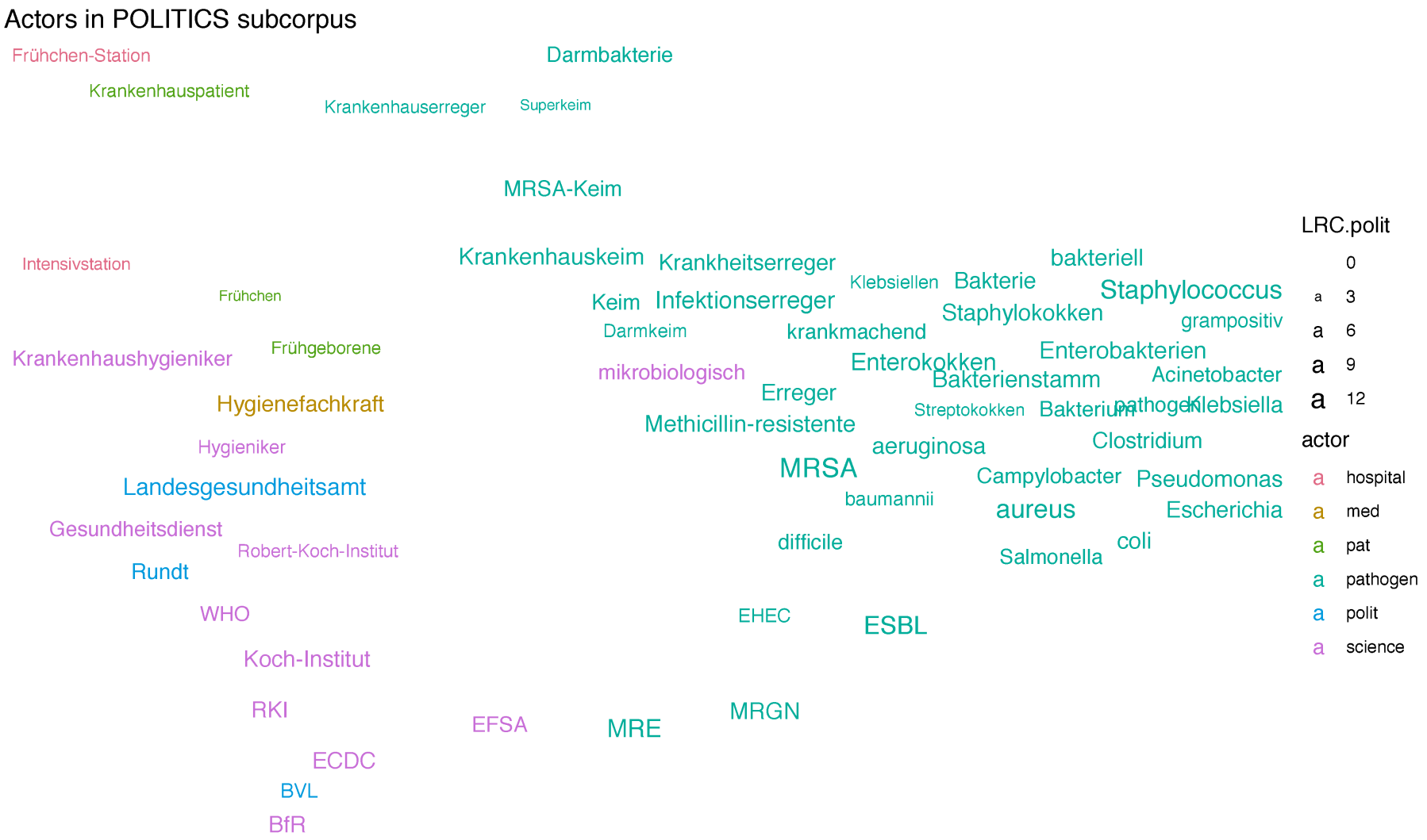
Actors across sub-corpora

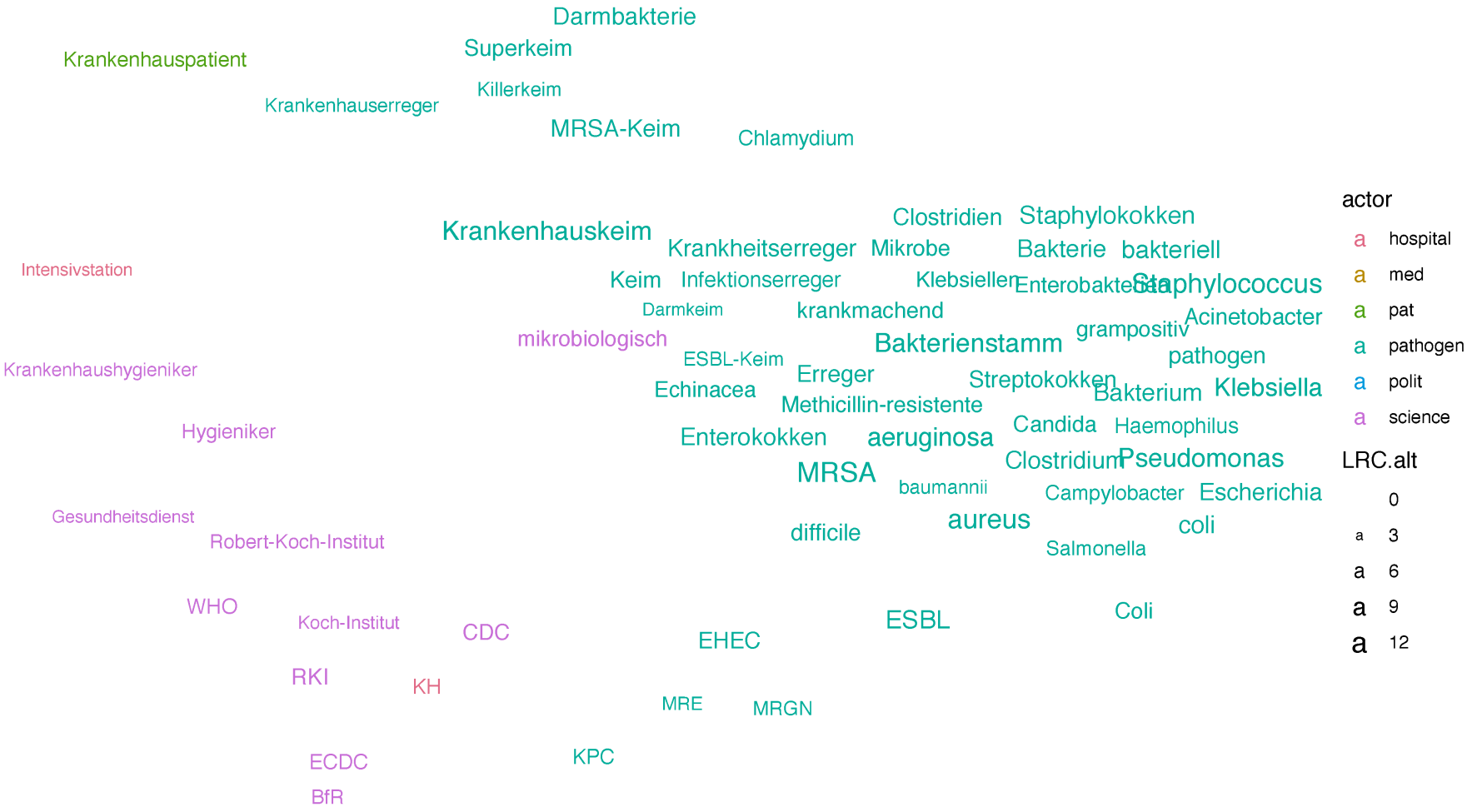


Actors across sub-corpora



Actors across sub-corpora

Actors in ALTERNATIVE subcorpus



Keywords for Argumentation Mining

- Linguistic patterns, but not directly tied to word level
  - In aggregation, sizeable number of indicators for both schemes per sub-corpus
  - Corpus queries to bridge the gap between lexis and logical content

- Corpus-linguistic approach: CQP query language (Evert & Hardie 2011)
  - Phrase/ clause structure patterns defined by POS sequences
  - Word lists representing lexico-semantic categories (keywords)
  - Argument indicators from thesaurus (Dornseiff 2004)
  - Iterative development informed by regular concordance analysis

Query: Arg. from Positive Consequences

```
@1:[lemma = $solution_nouns
   | lemma = $solution_verbs
   | word  = "beste[rnms]?|ideal.*|perfekt.*"]+
(
  /np[] | /vp[] | /ac[] | /advp[] |
  [ word = "," | pos="KO.+|P.+|AP.+|ART"]
)*
@0:[lemma = $alt_solns]+
(
  /np[] | /vp[] | /advp[] | /ac[] |
  [ word = "," | pos="KO.+|P.+|AP.+"]
)*;
```

Wordlists for semantic grouping

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Positive consequence keywords per sub-corpus/ wordlist filler in the example query (unique results; altmed+media; pol+media):

[altmed]

Ätherisch ‚aetheric' (28); *Teebaumöl* ‚tea tree oil'(16); *Silber* ‚silver' (15); *Probiotik/ Senföl/ Vitamin* ‚probiotics/ mustard oil/ vitamin'(9); *Bockshornklee* ‚fenugreek' (8); *Thymian* ‚thyme' (7); *Homöopathie/ Öl* ‚homeopathy/ oil' (6) …

[media]

Bakteriophage ‚bacteriophage', *Krankenhaushygiene* ‚clinical hygiene', *desinfizieren* ‚disinfect' (10); *Hygienemaßnahme* ‚hygiene measure', *Phagen* ‚phages' (9); *Desinfektion* (7) …

[pol]

Leitlinie ‚guideline', *antimikrobiell* ‚anti-microbial' (25); *Niedersachsen* ‚Lower Saxony' (16); *signifikant* ‚significant' (15); *Umsetzung* ‚implementation' (14); *Hygienemaßnahme* ‚hygiene measure' (13); *Intervention* (12); *Antibiotika-Resistenzstrategie* ‚antibiotic resistance strategy', *Krankenhaushygiene* ‚clinical hygiene', *regional* (8); *Anforderung* ‚requirement', *Minderung* ‚reduction', *Therapietreue* ‚compliance' (5)

Examples

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[altmed]

Da er zu diesem Zeitpunkt in einem homöopathischen Krankenhaus tätig war , kam er irgendwann auf die <**Idee**, diese Bakterienspuren **homöopathisch** zu verabreichen> mit sensationellen Heilerfolgen.

*Because he was working in a homeopathic hospital at the time, he eventually came up with the <**idea** of administering these bacteria traces **homeopathically**> – with sensational success'*

[media]

Schon seit Jahren <**zeigen** Holland und Dänemark wie man durch ein konsequentes **Screening** aller neuer Patienten und besonderer Behandlung der erkannten „Risikopatienten“> , den Anteil mit antibiotikaresistenten Keimen drastisch reduzieren kann

*Holland and Denmark have been <**showing** for years how to drastically reduce the amount of multi-resistant organisms by consistent **screening** of all new patients and special treatment of „high risk patients“>*

[pol]

Die Publikation zeigt zum ersten Mal über einen mehrjährigen Zeitraum, dass im Vergleich zu anderen Regionen , die <**Umsetzung** einer **Präventionsstrategie** in allen Krankenhäusern einer Versorgungsregion> die absolute Anzahl von MRSA-Infektionen signifikant innerhalb von 2 Jahren senkt und niedrig halten kann.

*The publication is the first one to show over a period of several years that the <**implementation** of a **prevention strategy** in all hospitals of a region> can reduce and control the absolute number of MRSA infections within 2 years*

Conclusion

- Considerable overlap of solution keywords in media articles and politics
  - Media: overall KW candidates more on hospital level – screenings, clinical hygiene, intensive care unit
  - Politics: stronger focus on infrastructure – guideline, regional, resistance strategy
- Alternative medicine more focused on „unique“ solutions – barely reflected in the media/ political sub-corpora
- Logical perspective: very similar representations

Conclusion

Future work:

- Modularity enables transfer of logical/ grammatical templates to other corpora. Queries as templates to be „filled“ with content-specific wordlists
- Consultation with professionals in the field (co-operation with department of Palliative Medicine at Erlangen‘s University Hospital)

Queries balance grammatical and semantic flexibility in patterns

Each query: one linguistic instantiation of a given argumentation scheme

Combination of query pattern and content-specific lexical features to capture everyday argumentation

Qualitatively informed approach to handle variable and noisy data

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Appendix

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Given corpus

Reference corpus

Calculation of keywords through different measures

Group keywords using linguistic categories

Explore the various levels of granularity yielded by the different measures

Examine the categories through a sample of concordances

Goal: identification and manual deepening of discourse patterns in topic-specific corpora

Syntactic macros

```
IMPORT macro_advp.txt

## A determiner phrase
MACRO dp(0)
(
[pos = "ART|PIS|PPOSAT"]?
(
  /advp[]
)*
[pos = "N."]+
)
;

## A prepositional phrase

MACRO pp(0)
(

[pos = "APPR.*"]
/dp[]
)
;
# pronoun or pronoun + verb
MACRO pron(0)
(
```

A glimpse at the **/np[]** macro