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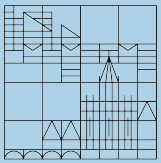

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Visual Analysis of deliberative argumentation

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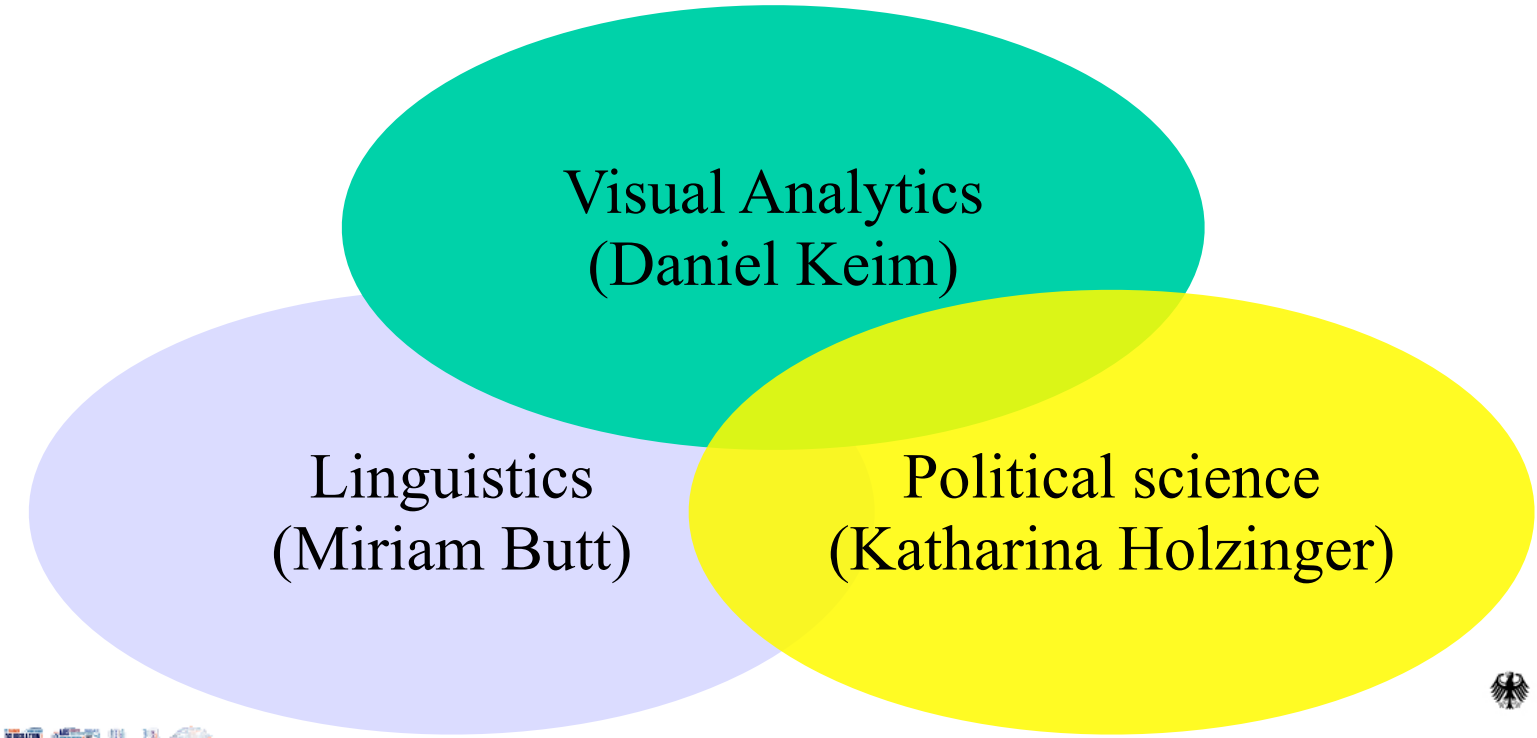
Project Background

Interdisciplinary Approach towards modelling deliberation in political communication (eHumanities)



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Motivation

- The realization of large-scale public projects is prone to creating conflicts between governments and the public sphere, particularly local residents.

- Recent example in Germany – *Stuttgart 21*
  - Proposal to revamp the Stuttgart train station
  - Public opposition made international headlines and ushered in a new Green state government.

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Motivation

- Stuttgart 21 is an example showing that the capacity of representative democracy is limited with respect to handling public policy conflicts

- Germany: participatory procedures have been adopted since the early 1990s:
  - formal procedures for citizens' participation
  - implementation of **deliberative** procedures to achieve consensus within a public discourse

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Theory of Deliberative Democracy

- A form of non-majoritarian democracy:
  collective decisions should be taken based on reason, rational argumentation and consensus via public discourse.

- Main protagonists:
  Jürgen Habermas, John Dryzek, Robert Goodin.

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Theory of Deliberative Democracy

- Theoretical claims as to effects of deliberation:
  - can overcome interest positions,
  - enhances policy satisfaction and acceptance,
  - decisions taken represent the common good,
  - increases political knowledge of citizens, …

- Empirical tests of these claims usually refer to the institutional setting of a process but rarely include the actual communication.

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Deliberative Dialog/Discourse

- The most prominent exception is the Discourse Quality Index (DQI) proposed by Steenbergen et al. (2003) to measure the degree of deliberativity of a discourse.

- Problems:
  - Requires manual coding
  - Inter Annotator agreement not very high
  - No clear guidelines on what linguistic cues exactly indicate deliberativity

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Deliberative Dialog/Discourse

- To resolve the Stuttgart 21 conflict an arbitration process was conducted which ended in dissent.

- Questions:
  - Is the Stuttgart 21 arbitration an example of a deliberative discourse?
  - How can one tell?

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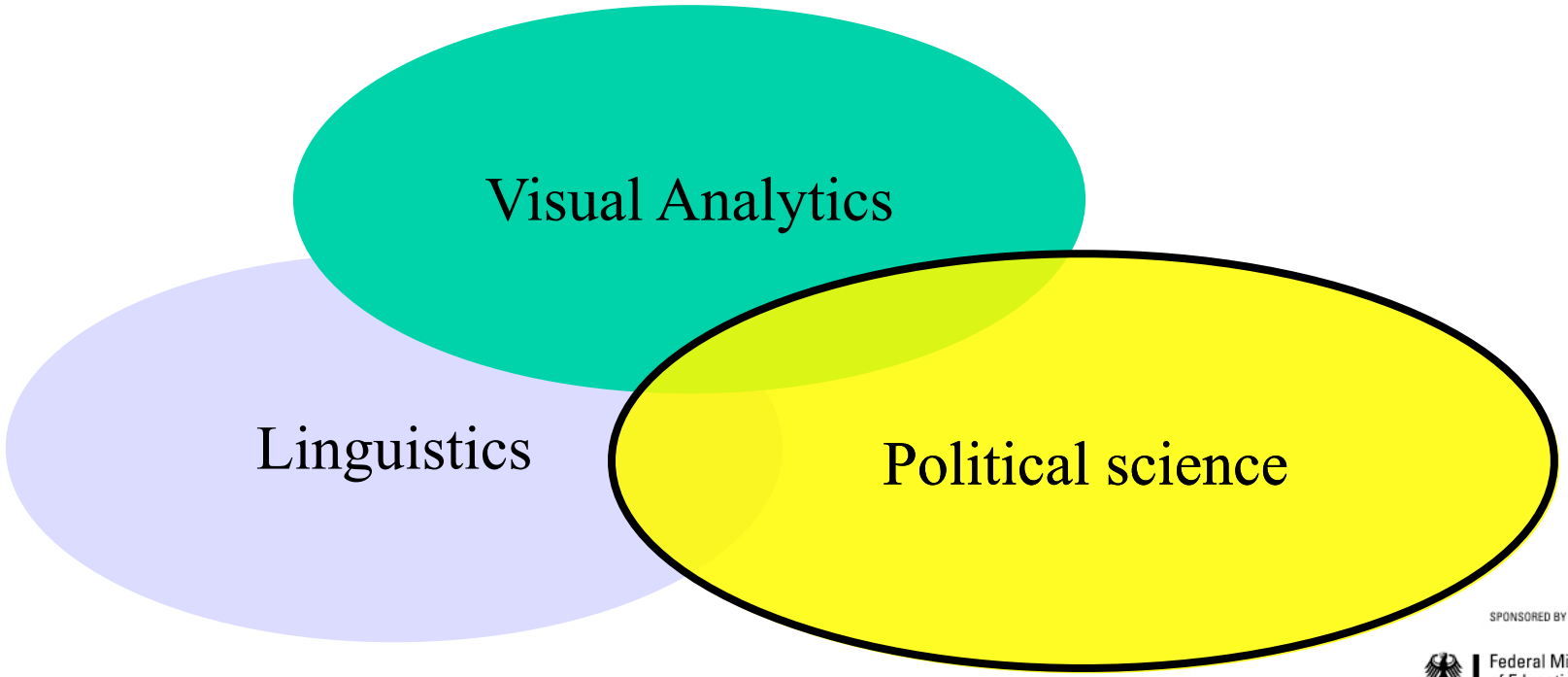
Our Approach:

- innovative interdisciplinary combination of methods



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Political Science – Methodology

- Quantitative and experimental approach
- Design experiments (simulation-gaming) to test claims of the theory of deliberative democracy
- Employ automated methods to analyze the dialogs
- Include
  - shallow text mining techniques (computer science and computational linguistics)
  - deep linguistic knowledge (linguistics)
  - interactive visual analysis (computer science)

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Political Science – Goals

- Development of an index for the quality of deliberative communication based on automated annotation

- Ability to automatically analyze participatory communicative processes like Stuttgart 21 with respect to their degree of deliberation

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Political Science – Goals

Test claims of deliberative theory:

(RQ1) Is the degree of interest conflict in a particular decision-making process correlated with the level of deliberation?

(RQ2) Can arguments indeed overcome interests?

→ new follow-up project (Sept. 2013)

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Political Science – Experiments RQ1

A group of subjects negotiates a public policy conflict (e.g., fracking).

Experimental design:

- 3 factors: conflict over facts, over values, over interests
- => hypothesis: decreasing level of deliberation
- 4 subjects (2 pro, 2 con)
- 120 repetitions
- 1 hour discussion time
- pre- and post discussion surveys

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Analysis

- The experiments result in large amounts of spoken (transcribed) material.
- How can this material be analyzed effectively?

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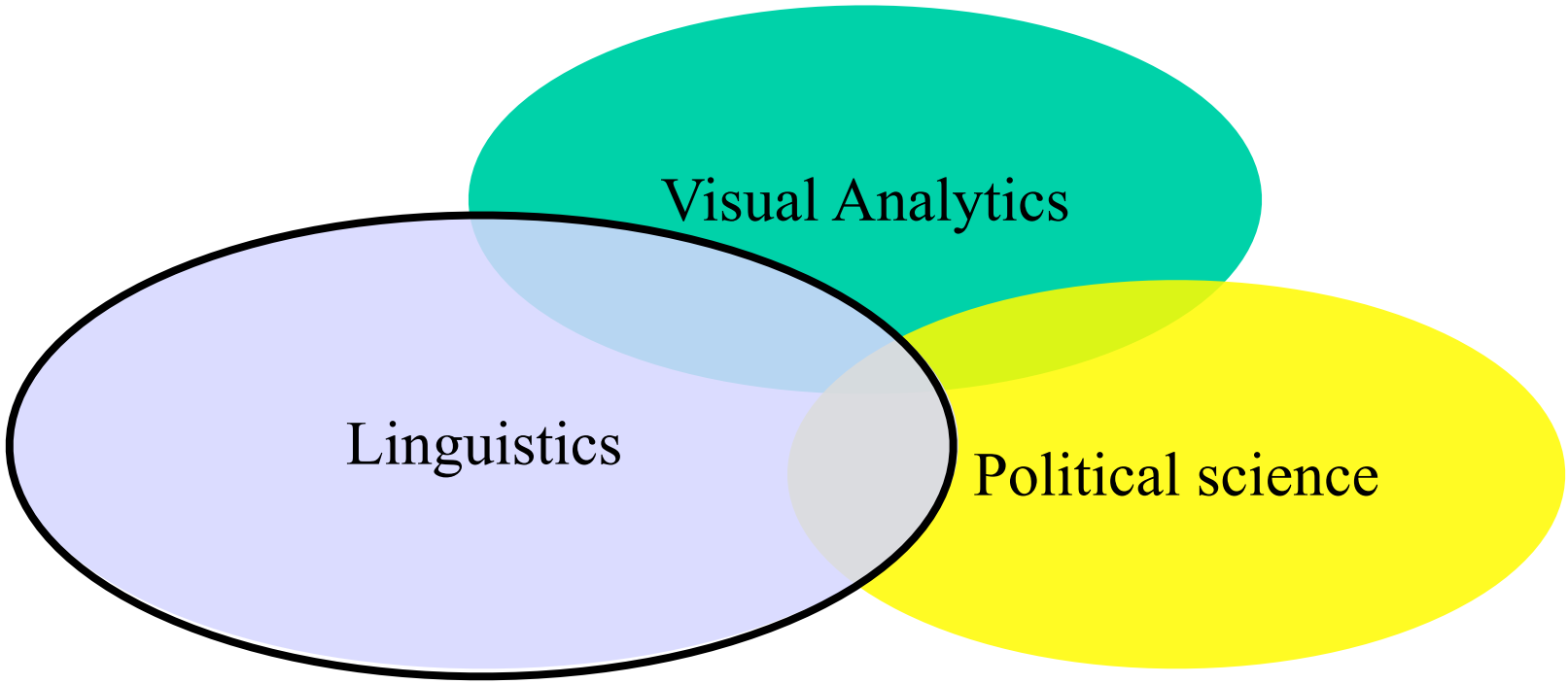
Our Approach:

- interdisciplinary combination of methods



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Tasks for (Computational) Linguistic Research

- Identify linguistic cues that indicate deliberative discourse.
- Identify candidates for automatic detection.
- Develop an annotation scheme to feed into the visual analysis.
- Take multiple annotation dimensions into account.
- Write inference rules for deliberative index.

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Challenges

- We cannot evaluate the content (**at-issue**) of the utterances.

- But we can analyze
  - the rhetorical structure of a discourse
  - key terms indicating reference to democratic or “greater good” principles (needs to be developed in close cooperation with political science)

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Linguistic Cues and Deliberativity: key terms

Research Question: Which terms are relevant?

Simulation gaming example:

Also ich bin prinzipiell eher für ein **Mehrheitswahlsystem**, weil **Wettbewerb** sehr wichtig ist für **Demokratie** und dadurch auch das **Allgemeinwohl** am besten vertreten werden kann.

So in principle I am more in favor of a **system of majority vote** because **competition** is very important for **democracy** and that way the **greater good** can also be represented in the best manner.

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Rhetorical Structure

- we cannot evaluate which argument is “better”

  (at-issue content)

- but we can evaluate
  - the overall argumentative structure of a discourse
  - the rhetorical means employed
  - the **conventional implicatures (CI)**

➢ **Basically how the information is packaged.**

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Relevant Dimensions

- rhetorical/discourse relations (e.g., *reason, concession, opposition, condition*)
- information structure (topic, focus, etc.)
- turn taking (length, structure, type)
- manifold further rhetorical devices

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Rhetorical/discourse relations

- Can build on a long tradition
- Much work done for English and German

  (cf. a.o. the Penn Discourse Bank: Joshi/Webber)
- Important for us:
  - not primarily interested in discourse coherence

    (some of the turns are quite incoherent...)
  - but in the **speech act** (illocution) of the utterance

    (cf. Stede&Pelzdus 2012)

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Information Structure

- Distribution of Topic and Focus is relatively complex in German (e.g. work by Büring)
- But: can look at **German Vorfeld,** which is topic-like

Simulation gaming example:

Die Geschwindigkeit der Entscheidungsfindung ist, scheint mir so ein bisschen, Ihr Totschlagsargument.

The speed of decision making is, it seems to me just a little, your killer argument.

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Related Effort: "Lexical Episodes"

- Visualization of what is under discussion in a stretch of dialog
  - Words that occur more often than expected in a given stretch of text.
  - The distance between instances of a word within an episode is smaller than the expected distance with respect to the entire corpus.
- Example: 3rd presidential debate between Barack Obama and Mitt Romney (Oct. 2012)

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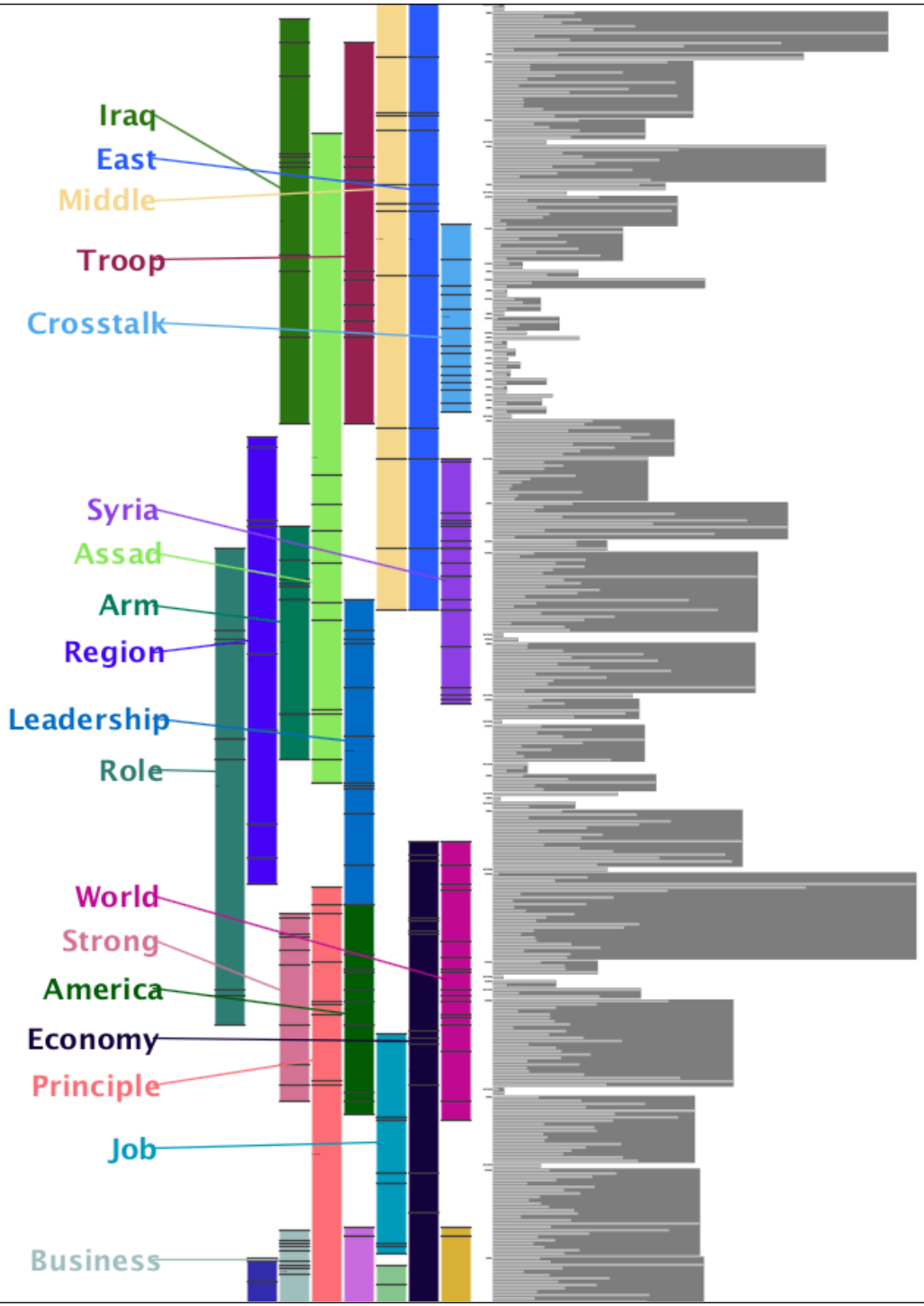
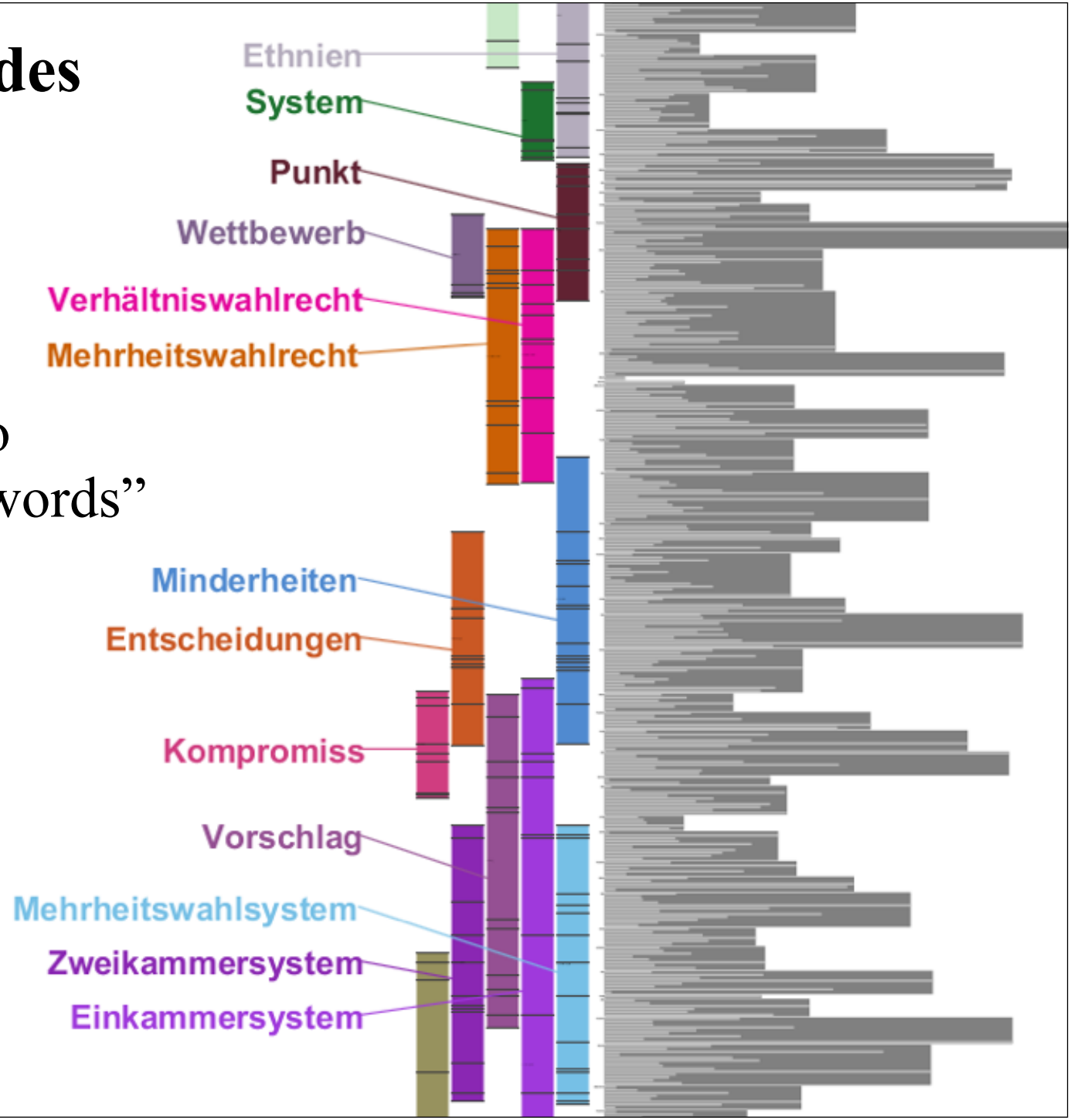
Lexical Episodes

- Each grey box is a turn
- Each word has a color
- Interaction possible
  (mouse over, zooming)



Lexical Episodes

Could also use to determine “key words”



Rhetorical Devices

- The German example we just saw has a different interpretation if the parenthetical is removed.

Die Geschwindigkeit der Entscheidungsfindung ist Ihr Totschlagsargument.

The speed of decision making is your killer argument.

- How you **package** an utterance rhetorically is of extreme importance in argumentation.

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Rhetorical devices

- expression of speaker/hearer belief
- evidentiality
- establishment of common ground
- triggering of presuppositions
- expression of subjectivity vs. objectivity
- hedging, etc.

How do these play out in German? – Just some examples...

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Modal Particles

- Spoken German makes extensive use of modal particles

From Stuttgart 21

und in München und Nürnberg wohnen **ja wohl doch** doppelt so viele Leute wie in Stuttgart und Ulm zusammen

and **isn't it the case** that in Munich and Nürnberg twice as many people live as in Stuttgart and Ulm taken together

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Modal/Discourse Particles

- Quite a bit of research on particles in German (Zimmerman 2011 provides an overview)
- Precise meaning contribution difficult to pin-point
- Particles are ambiguous – occur in different contexts with different meanings.
- But can build on some existing analyses, e.g.

  ja, doch, wohl, halt, eben

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Modal/Discourse Particles

Zimmermann: discourse particles contribute to the CI (conventional implicature) meaning:

[[ja]](p) = p is true and speaker believes p is uncontroversial

From Stuttgart 21:

weil **ja** Lokomotiven auch für eine längere Zeit eingekauft werden als für 10 Jahre.

because **(it's clear)** that train engines are bought for a longer time span than for 10 years

Modal/Discourse Particles

[[halt]](p) = resigned acceptance of p by speaker due to perceived unalterable state of affairs (based on Karagjsova)

From Stuttgart 21:

Dann rüste ich **halt** den Kopfbahnhof auf.

Then **(in that case)** I'll upgrade the railway terminal.

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Modal/Discourse Particles

With a causal connector, *halt* takes on a meaning of justification via the invocation of an immutable constraint due to “this-is-the-way-the-world-is”.

From Stuttgart 21:

weil **halt** in dem Bereich auch die meisten Autos unterwegs sind.

because that area is also frequented by the most cars.

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Causal Connectors

- But not all causal connectors are created equal.
- Differ on scale of "speaker involvement" (subjectivity)

  (e.g., Pander Maat and Degand 2001)

  also > *folglich* > *denn* > *infolgedessen* > *nämlich* > *so* > *somit* > *schließlich* > *deshalb* > *daher* > *darum*

- our initial results do not quite confirm this scale

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Causal Connectors: *weil* vs. *denn*

- *denn:* indirect assertion of causal relation, related to speaker knowledge (epistemic) (e.g., Scheffler 2005)
- *weil*: assertion of objective direct causal relation

Wir haben den Zug aber wieder eingestellt, **weil** die Nachfrage zu gering war.
We terminated that train **because** the demand was too low.

denn der normale Gedanke beim Güterverkehr ist ...
because the normal reasoning with respect to freight traffic is ...

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Other Relevant Linguistic Cues to Explore

Position of verb in embedded clauses of attitude verbs (Scheffler 2009)

- V2 (second position in clause): expression of doubtfulness or uncertainty of outcome

Ich hoffe, dass Peter heute noch **kommt**. (neutral expectation)

I hope that Peter is still coming today.

Ich hoffe, Peter **kommt** heute noch. (doubtful of event happening)

I hope, Peter is (really) still coming today.

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Other Relevant Linguistic Cues to Explore

- Level of politeness in discussion

  (cf. Stanford politeness corpus)
- Level of tolerance in discussions

  (Mukherjee et al. 2013)
- and more...

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Annotation Scheme

no existing annotation scheme that fits our purpose

- linguists tend to work on one of the relevant dimensions (particles or connectors or information structure), but very seldom on all dimensions that are relevant to us
- annotation scheme has to be able to take at least the different factors just sketched into account

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Annotation Scheme – Methodology

- build on state-of-the-art where possible
- work bottom-up using linguistic cues that can be identified reliably and automatically
- inference rules collect up relevant information and provide an analysis that goes beyond the individual cues

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Inference Rule: Example

- if causal connector *weil* plus the modal particle *ja* ➔ invocation of common ground as reason
- if causal connector *weil* plus the modal particle *halt/ eben* ➔ invocation of immutable constraint due to "this-is-the-way-the-world-is" as reason
- etc.

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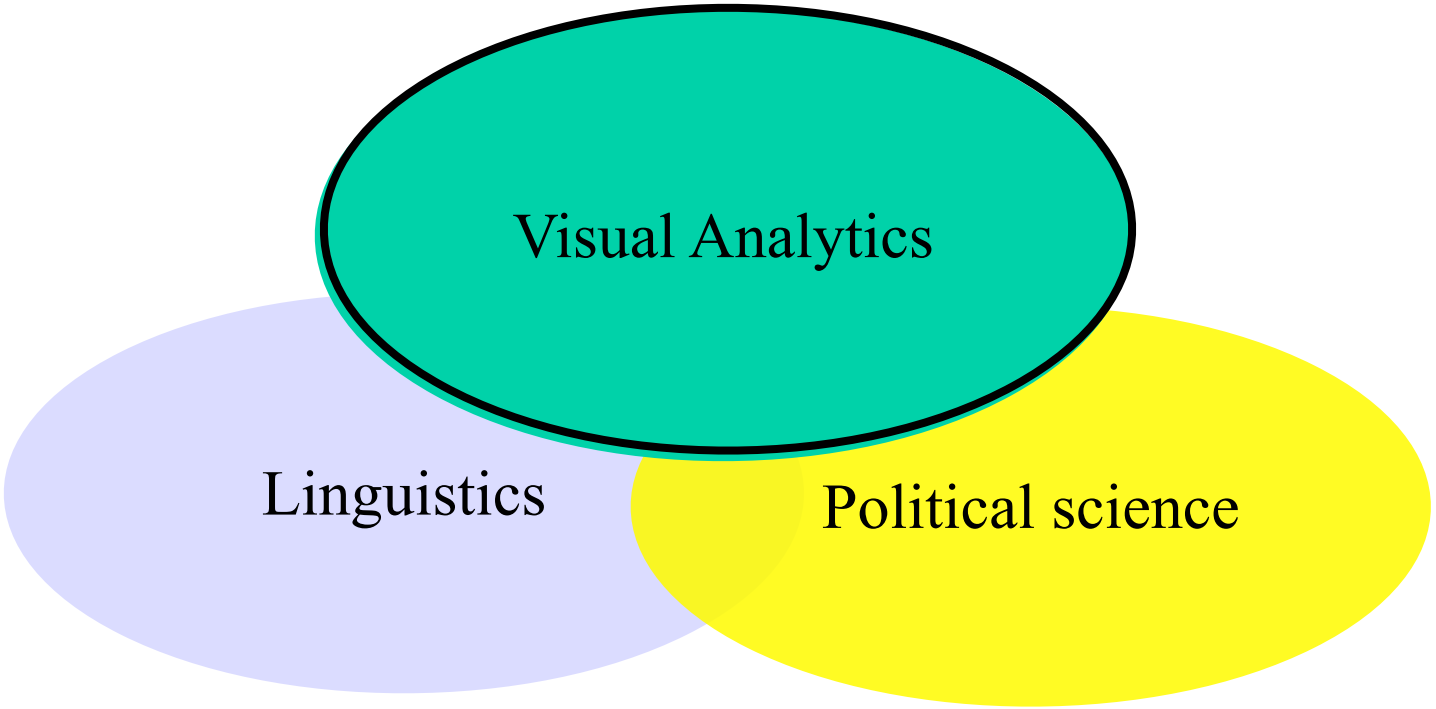
Our Approach:

- interdisciplinary combination of methods



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Tasks for Visual Analytics Research

- Support the development of an automated measure of deliberation
- Support the visual analysis of deliberative mediation processes
- Support the visual analysis of linguistic phenomena

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Machine: Quantitative Measures
(scalable, „objective“)

Text Features

- Average word length
- Frequency distribution of pronouns
- Branching factor of sentence syntax parse tree
- Relative frequency of foreign words
- …

Meta Features

- Utterance frequency of persons
- Order of persons
- …

Semantic Gap

Human: Qualitative Judgements
(not scalable, „subjective“)

Semantic Judgements

- Negotiation vs. Argumentation
- Degree of Deliberation
- Eloquence
- Persuasiveness
- Fairness
- Emotionality

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Challenges for Computer Science Research

- System Architecture
- Design
- Algorithms
- Evaluation

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System Architecture

- Infrastructure for Visual Discourse Analysis
  - Modular
  - Understandable
  - Flexible
  - Extendible
- Flexible Workflows
- Open-source Release envisioned

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Design

- Visualization
  - What information to show?
  - How to show it?
- Interaction
  - Which interactions to offer?
  - How to make them intuitive?

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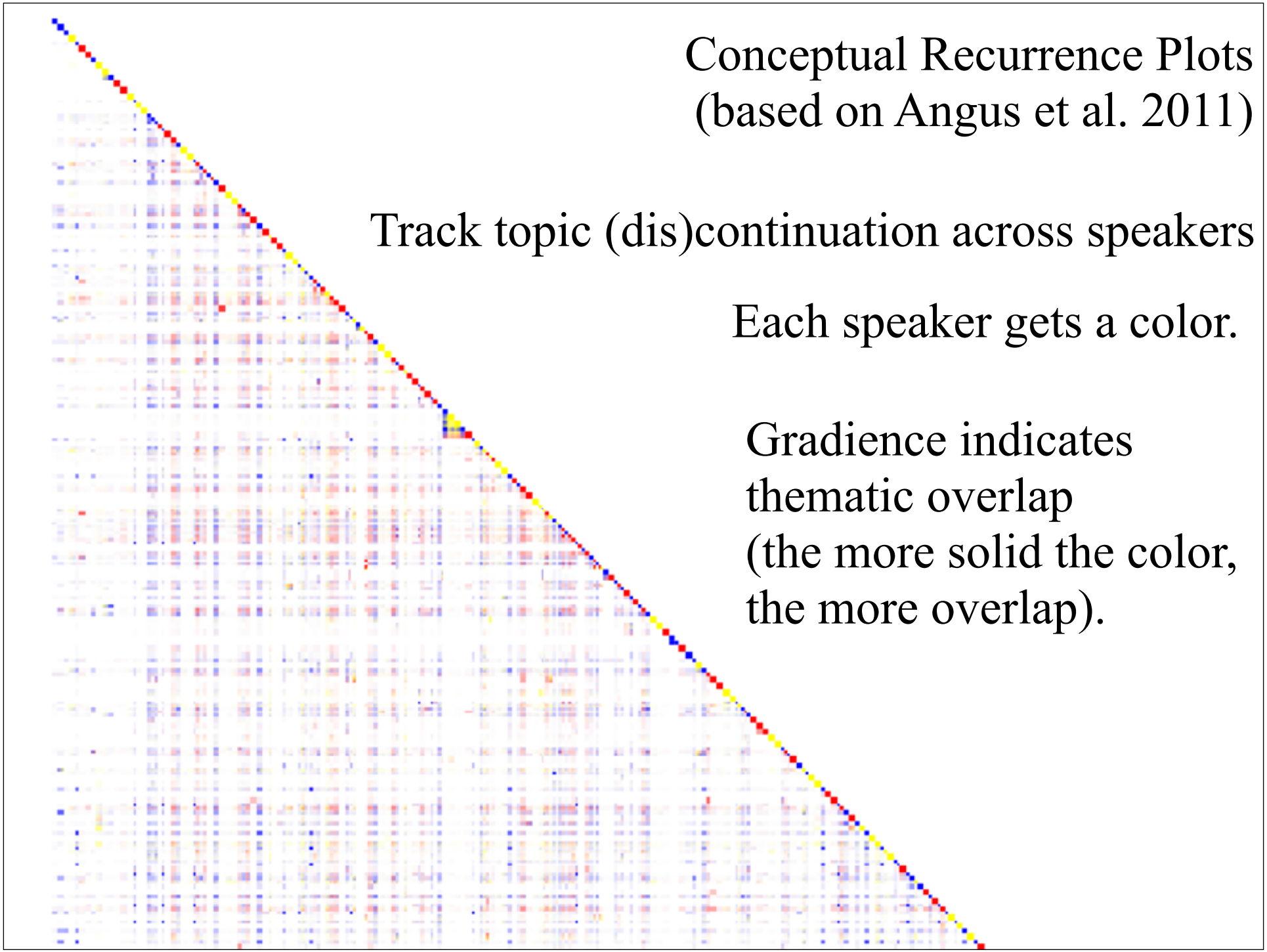
Conceptual Recurrence Plots
(based on Angus et al. 2011)
Track topic (dis)continuation across speakers
Each speaker gets a color.
Gradience indicates
thematic overlap
(the more solid the color,
the more overlap).

Algorithms

- Automated Processing/Analysis
  - What kind of information to extract from the data?
  - Where are novel methods required?
  - How to design efficient and effective solutions?
- Visualizations
  - How to achieve optimal layouts efficiently?
  - How to dynamically adapt layouts to interactions?

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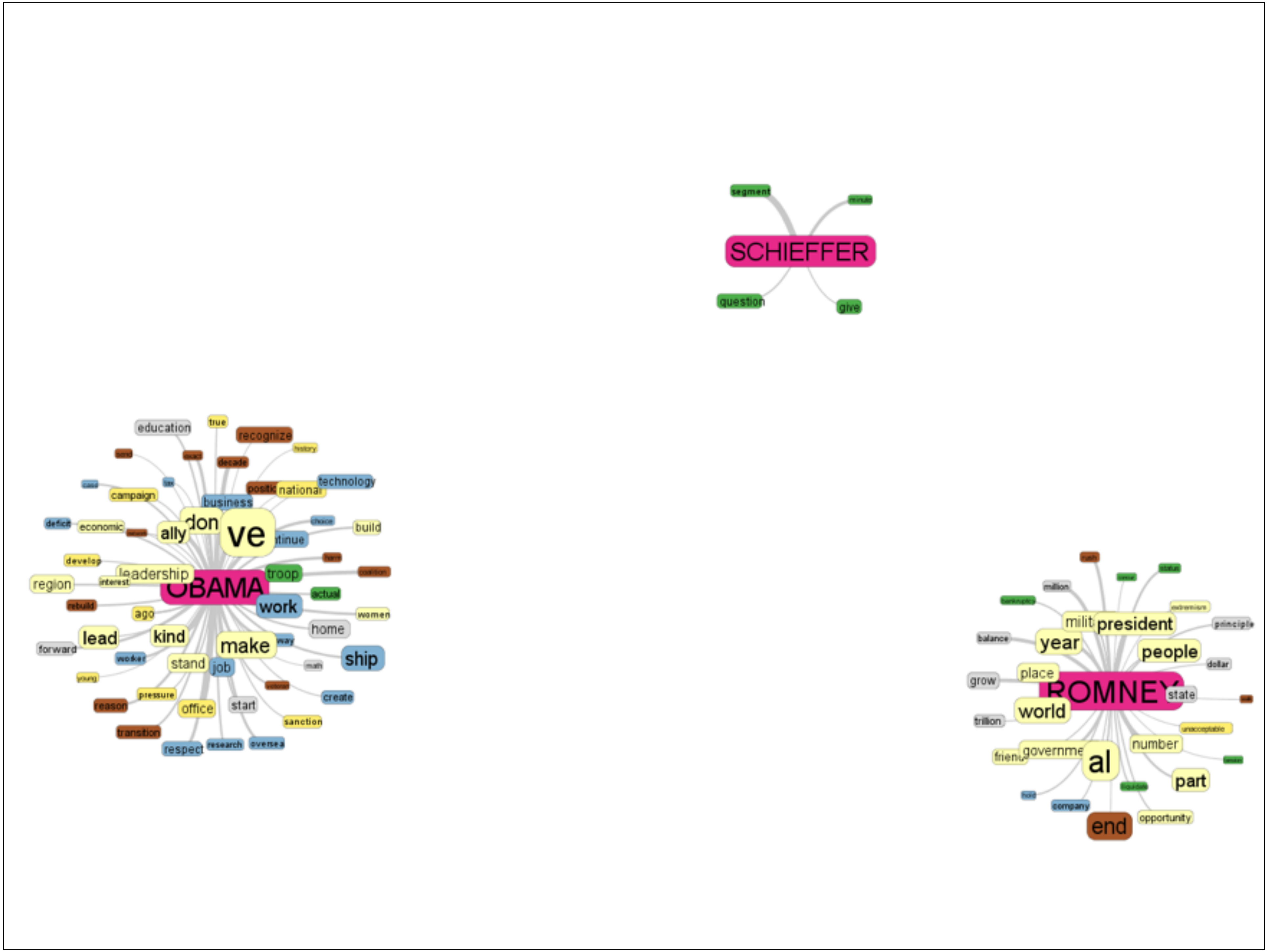
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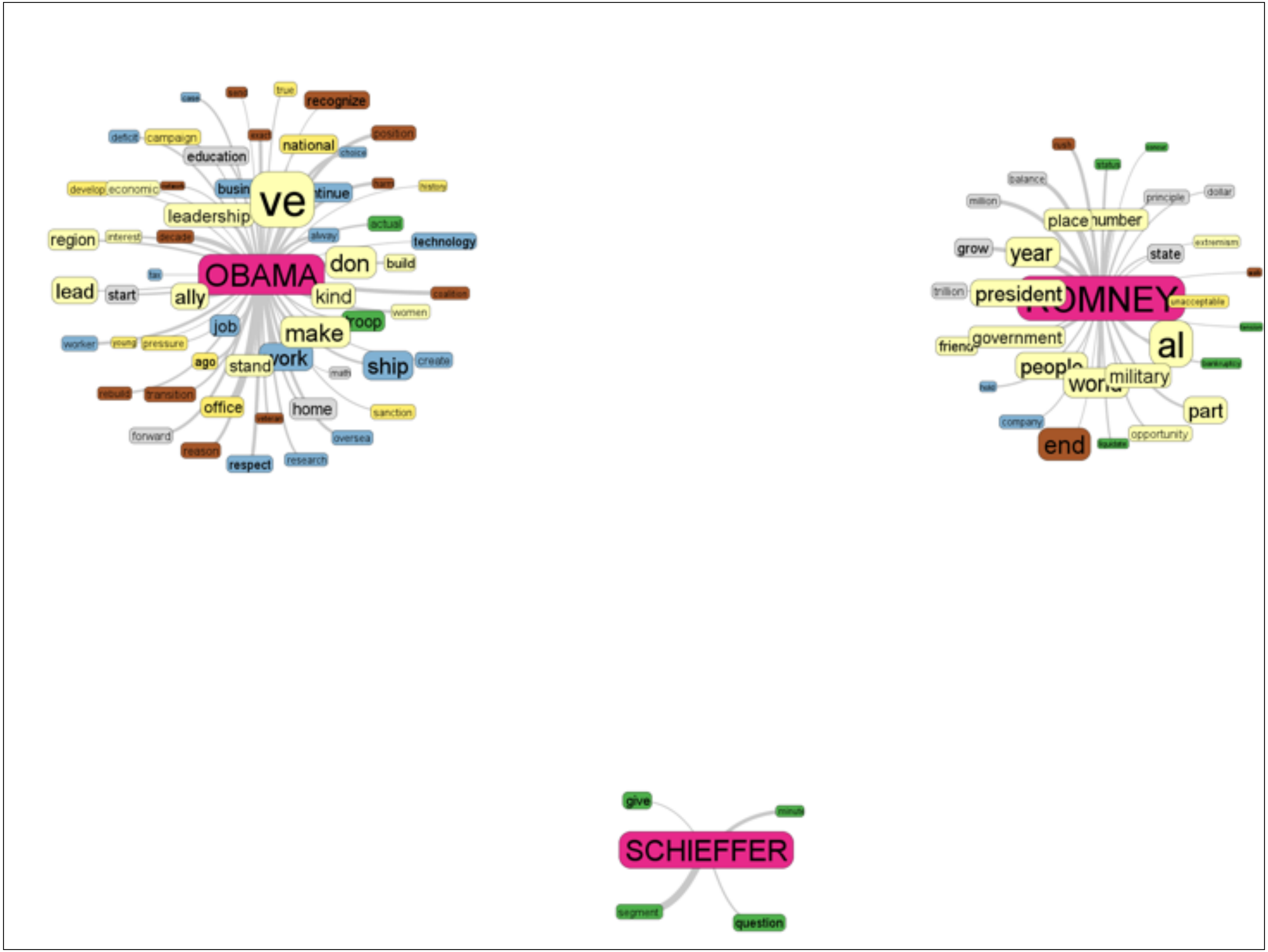

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Evaluation

- Benchmark
  - How to create valid benchmarks for the evaluation of automated preprocessing/analysis methods?
- User Studies
  - How to design insightful studies on the usability of single visualizations and the overall system?

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Summary

- Multi-faceted problem:
  - Understanding the connection between the degree of deliberativity of a dialog and actual argumentative strategies
  - Using linguistic cues to measure the degree of deliberativity of a dialog?
  - Using visual analytics to understand the structure of a deliberative dialog.

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More details on the Powerwall tomorrow!

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