Towards visualizing linguistic patterns of deliberation: A case study of Stuttgart 21

Tina Bögel, Valentin Gold, Annette Hautli-Janisz, Christian Rohrdantz, Sebastian Sulger, Miriam Butt, Katharina Holzinger, Daniel A. Keim

University of Konstanz

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Deliberative communication

Concept of deliberation (Habermas 1981, 1991):

Stakeholders in a multilog...

- ... should justify their positions truthfully and rationally.
- ... should eventually defer to the better argument.
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Why is the concept relevant today?

- Large and expensive (public) projects lead to conflicts in society and politics.
- High risk for decision makers.

→ More knowledge needed on how consensus is achieved in discourse.
VisArgue

- Interdisciplinary project as part of the *eHumanities* initiative in Germany

→ **Aim:** Operationalization of deliberation in political communication
Today

How are arguments realized in discourse and what is their function?
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In particular: Interaction between causal discourse connectors and modal particles
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Challenges:

- Ambiguity of lexical items:
  - Connector *da* ‘as’ can also be a temporal or locative pronoun
  - Modal particle *eben* ‘just’ can also be a focus particle or a temporal adverbial.
  - POS tagging is not sufficient (Dipper and Stede 2006, Schneider and Stede 2012).
  - Need linguistic information.
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  - What information do modal particles contribute?
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- Patterns of argumentation:
  - Where does the reason and result parts of a causal relation start/end?
  - What information do modal particles contribute?
  - \(\rightarrow\) Use deep linguistic knowledge
Argumentation patterns

Die Fahrzeiten sind irrelevant, da sie ja so nicht gefahren werden.

Result/Conclusion

'These travel times are irrelevant, because (as you know) they are not run as specified.'
Argumentation patterns

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Result/Conclusion

‘These travel times are irrelevant, because (as you know) they are not run as specified.’

Markers of reason: da, weil, denn, zumal ‘because’

• Head of a subordinate clause
• Describes the cause of an effect stated in the matrix clause.
• Connects a result/conclusion with a reason span
Argumentation patterns

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Result/Conclusion Reason

‘These travel times are irrelevant, because (as you know) they are not run as specified.’

Modal particles:

- Truth value of the utterance is not changed, but utterance is colored by the speaker (Potts 2012)
- Modal particles express speaker stance and belief:
  - *halt, eben*: Reference to an immutable constraint
  - *ja*: Reference to the common ground
Argumentation patterns

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Result/Conclusion

Reason

‘These travel times are irrelevant, because (as you know) they are not run as specified.’

Linguistic annotation:

- Causal argumentation where the speaker reasons based on the common ground of the participants.
- DiscRel="result"
- DiscRel="reason", CI="common ground"
Processing

Data:

- Public arbitration on Stuttgart 21 → Railway and urban development project in the city of Stuttgart
- Transcribed minutes with:
  - 9 days of session, around 65 hours of discussion, 70 speakers
  - 1330 utterances, 265,000 tokens
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Annotation:

- All utterances are split into Elementary Discourse Units (EDUs)
  - Each DU describes a single event (Polanyi et al. 2004)
  - Assumption in discourse parsing: Everything between two punctuation marks is a DU (Marcu 2000)
- Automatic processing via linguistic rule set (disambiguation + annotation).
**Processing**

General **XML** corpus structure:

```xml
<utterance>
  <sentence>
    <discourse_unit>
      <lexeme/>
      ... 
      <lexeme/>
    </discourse_unit>
    <discourse_unit>
      <lexeme/>
      ... 
      <lexeme/>
    </discourse_unit>
  </sentence>
</utterance>
```

- Add morphological information to each lexical item.
- Disambiguate causal connectors and modal particles.
- Annotate the inferences on the level of the discourse unit.
Processing

Fully annotated structure:

```xml
<sentence id="102">
  <discourse_unit id="1" discrel="result">
    <lexeme id="1" morph="Ich+NN">Ich</lexeme>
    <lexeme id="2" morph="mögen+V.Subj">möchte</lexeme>
    <lexeme id="3" morph="an+PREP an+CIRC an+VPR">an</lexeme>
    <lexeme id="4" morph="diese+DEM diese^WEAKGEN+DEM">diesen</lexeme>
    <lexeme id="5" morph="Punkt+NN">Punkt</lexeme>
    <lexeme id="6" morph="nochmal+AD">nochmal</lexeme>
    <lexeme id="7" morph="zur^zu_PREP">zur</lexeme>
    <lexeme id="8" morph="Differenzierung+NN">Differenzierung</lexeme>
    <lexeme id="9" morph="bei#tragen+V">beitragen</lexeme>
  </discourse_unit>
  <discourse_unit id="2" discrel="reason">
    <lexeme id="1" morph="da+AD da+CONJ da+VPRE" connector="kausal">da</lexeme>
    <lexeme id="2" morph="wie+CONJ wie+WAD wie+RELAD">wie</lexeme>
    <lexeme id="3" morph="sie^CAP+PPRO">Sie</lexeme>
    <lexeme id="4" morph="sehen+V">sehen</lexeme>
  </discourse_unit>
  <discourse_unit id="3" discrel="reason">
    <lexeme id="1" morph="in+PREP">in</lexeme>
    <lexeme id="2" morph="die_dem+DEM die_art+ART die_rel+REL">dem</lexeme>
    <lexeme id="3" morph="Dokument+NN">Dokument</lexeme>
    <lexeme id="4" morph="??">Friedensschluss</lexeme>
    <lexeme id="5" morph="zur^zu_PREP">zur</lexeme>
    <lexeme id="6" morph="Verfassungsgebung+NN">Verfassungsgebung</lexeme>
    <lexeme id="7" morph="vorgelegt">vorgelegt</lexeme>
    <lexeme id="8" morph="werden+V">wurde</lexeme>
  </discourse_unit>
  ...
</sentence>
```
System Evaluation

Relation identification is a notorious problem

- Bögel et al. (2014): Is an EDU correctly identified as a reason or result/conclusion phrase?
- Gold standard: Manually annotated by two linguistic experts
  - 238/666 EDUs marked as being part of the reason of a causal relation
  - 180/666 EDUs marked as result/conclusion

<table>
<thead>
<tr>
<th></th>
<th>Precision</th>
<th>Recall</th>
<th>F-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reason</td>
<td>0.88</td>
<td>0.75</td>
<td>0.81</td>
</tr>
<tr>
<td>Result</td>
<td>0.81</td>
<td>0.94</td>
<td>0.87</td>
</tr>
<tr>
<td>ø</td>
<td>0.84</td>
<td>0.84</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Table: Results for relation identification
Corpus annotation

BUT: Where do we go from here?
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✓ Identification of clausal relations and their spans
✓ Identification of speaker stance
✓ Identification is reliable
Corpus annotation

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✓ Identification of speaker stance
✓ Identification is reliable

? How are arguments exchanged across the discourse?
? What topics are being discussed?
? Do individual speakers follow specific principles of argumentation?
? Can we draw conclusions as to the deliberative quality of the discourse?
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✓ Identification is reliable

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→ One way: Use methods from information visualization.
Visualizing argumentatativity

- At-a-glance overview of argument patterns across the discourse.
- Instances of argumentation can be analyzed in their context.
- Get a detailed view on the underlying data structure.
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Schematically:
Conclusions

Stuttgart 21 arbitration:

- Role of the mediator clearly inferable from the patterns of conventional implicatures (reference to common ground).
- Long chains of causal argumentation can lead to high level of persuasion (e.g. Volker Kefer, 04.11.2010)
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In general:
- Operationalization of deliberation is driven by deep linguistic knowledge.
- Visualization as a means of drawing conclusions of argumentation patterns across long multilogs.
Thank you!

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References


Relation identification module

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→ Example: Part of the relation identification rule:

   IF result connector not in first EDU of sentence AND result connector not preceded by other connector within same sentence THEN mark every EDU from sentence beginning to current EDU with reason.
   
   ELSIF result connector in first EDU of sentence THEN mark every EDU in previous sentence with reason UNLESS encountering another connector.
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⇒ Total number of rules in the relation identification module: 20.
The span of reason and result

Markers of result/conclusion: *daher, darum, deshalb, deswegen* ‘therefore’
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→ Introduction of a clause that describes the overall effect of a cause contained in the preceding clause/sentence.
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→ Introduction of a clause that describes the overall effect of a cause contained in the preceding clause/sentence.

Das habe ich nicht gesagt, *daher* ist Ihr Vorwurf nicht richtig.

‘I did not say that, therefore your accusation is not correct.’