**Background**

**Annotating Discourse Relations (DRs)**
- Many different frameworks: PDTB, RST, DRT, SDRT, ...
- No unified scheme, no interoperability

**Idea:**
- Use CCR (Cognitive approach to Coherence Relations, Sanders, Spooren & Noordman 1992) as an intermediate language between different frameworks

**PDTB vs. CCR**
- **PDTB**
  - Hierarchical scheme with three layers/ 43 sense labels
- **CCR**
  - each DR is described according to 4 cognitive primitives: 
    - polarity, basic operation, source of coherence, order

**Mapping PDTB – CCR**

**Question**
To what extent can PDTB relations be analysed consistently using CCR dimensions?

**Method:**
- 2 annotators analysed 1197 relations independently using PDTB 3.0 and CCR, respectively
- Annotations mapped onto each other to investigate consistency of relation meanings across theories

**Results:**

<table>
<thead>
<tr>
<th>Polarity</th>
<th>pos</th>
<th>pos</th>
<th>neg</th>
<th>neg</th>
<th>pos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic op.</td>
<td>temp</td>
<td>caus</td>
<td>caus</td>
<td>add</td>
<td>add</td>
</tr>
<tr>
<td>S. of coh.</td>
<td>uspec</td>
<td>uspec</td>
<td>uspec</td>
<td>uspec</td>
<td>uspec</td>
</tr>
<tr>
<td>Order</td>
<td>uspec</td>
<td>uspec</td>
<td>uspec</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>nra</td>
<td>count</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temp.</td>
<td>75</td>
<td>3</td>
<td>11</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Asynchronous</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cont.</td>
<td>2</td>
<td>87</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Cause</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cause_Belief</td>
<td>12</td>
<td>9</td>
<td>0</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Concession</td>
<td>0</td>
<td>0</td>
<td>57</td>
<td>37</td>
<td>6</td>
</tr>
<tr>
<td>Comp.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Contrast</td>
<td>14</td>
<td>4</td>
<td>75</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Exp.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Equivalence</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Instantiation</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>71</td>
<td>6</td>
</tr>
<tr>
<td>Specification</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>55</td>
</tr>
</tbody>
</table>

Fig. 1: Distribution (%) of explicit and implicit relations, only labels where n > 20 (uspec: underspecified, NA: not applicable, nra: no relation annotated)

- Overall, 69% of the PDTB relations were consistently categorised as belonging to the target CCR class.
- Analysis of random sample of 50 disagreements: 48% of disagreements due to differences between the theories.
- Other disagreements due to difference in segmentation or interpretation of relation (14%) and to annotation errors (38%).

**Examples of differences between theories**
- The connective 'but' indicates a negative relation in CCR, but not necessarily in PDTB.
  1. *She's by a Northern-based sire. [impl. but] I think he's dead now perhaps.*
- Argumentative relations classified as causal in CCR, but additive 'Expansion' in PDTB.
  2. *I used the weight room facility for exercising. [impl. because] I exercise from physiotherapy that I had to do.*

**Spoken and written genres**

<table>
<thead>
<tr>
<th>genre</th>
<th>essays</th>
<th>summaries</th>
<th>letters</th>
<th>news</th>
<th>broadcast</th>
<th>telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>no. sent</td>
<td>6.517</td>
<td>1.167</td>
<td>911</td>
<td>38.963</td>
<td>1.507</td>
<td>27.17</td>
</tr>
</tbody>
</table>

Fig. 2: Data: 4 WSJ genres (Webber 2009) and 2 SPICE genres

**Examples**
- Spoken: more Cause.Result relations
  3. *(Telephone)* I ordered it so *I'd better not forget about it*
- Spoken: more Expansion.Conjunction relations
  4. *(Broadcast)* Indeed I would *be and I believe that there's tremendous goodwill out there*
- Written: more Comparison.Contrast relations
  5. *(WSJ)* A few blue-chip stocks posted strong gains *while the majority of shares ended little changed*

**Problems for annotating spoken language**
- No clear-cut distinction between connectives and discourse markers (esp. for and, but, so)
  6. *(5)* But *you know. So listen, enough of me.*
- PDTB: no sense for reinforcement relations
  7. *(4)* That's finished. *That story is finished.*
- PDTB: no difference between conclusions and causal effects
  8. *(6)* She's a bay mare, fifteen two hands high *so she's not very big*

**Differences between Broadcast and Telephone**
- **Broadcast** more frequent in broadcast
- **Cause** more frequent in telephone conversation

**Cognitive dimensions and speech acts**

**Representatives:** speaker is committed to the truth of the proposition
**Directives:** speaker attempts to get the hearer to do something
**Expressives:** speaker’s attitudes/emotions towards the proposition

- Over 90% of DRs in Representatives
- Similar distribution across the 3 most frequent speech acts

**References**
Prasad et al., 2008. The Penn Discourse Treebank 2.0. Proceedings of LREC '08, Marrakech.