HOW TO INFERENCE TEMPOERAL AND CAUSAL RELATIONS IN DISCOURSE?

Lecture 4
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aims of the class

1. to present a pragmatic model of discourse interpretation devoted to the computation of temporal and causal relations
2. to improve the predictions of the pragmatic model of discourse interpretation by psycho-linguistic experiments
3. to draw the implications of these experiments both on the empirical and theoretical tiers
INTRODUCTION
basic assumptions

- discourse semantics’ contributions on Discourse Relations (DRs)
  - linguistic knowledge (LK) is weaker than world knowledge (WK)
  - DRs are a by-product of WL and LK
- post-Gricean pragmatics’ contribution
  - parallelism between
    - i. conceptual information and truth-functional information
    - ii. procedural information and non-truth-functional information
the standard interpretation of (1) is Forward Inference (Narration), and the interpretation of (2) is Backward Inference (Explanation)

1. Max pushed John. He fell.

Narration is the case when no conflict occurs between LK and WK in (1)

Explanation is the case when the Narration default reading in (1) crashes

same analysis for (2): Explanation is the default reading, and Narration occurs when the default reading crashes
Directional Inferences (DIs) are not only the by-product of LK and WK: LK can defeat LK as WK can defeat LK

Procedural Information is not the only one that can trigger Directional Inferences: Conceptual Information can too (cf. the neutral effect of the French Passé Composé)

1. **Max a poussé Jean. Il est tombé.**  
   FI\textsuperscript{ok}, BI\textsuperscript{*}

2. **Jean est tombé. Max l’a poussé.**  
   FI\textsuperscript{*}, BI\textsuperscript{ok}
pragmatic vs. discourse explanation

* three possible answers

1. **discourse knowledge** (DK): DK is crucial to the determination of Directional Inference (DI)

2. **linguistic knowledge** (LK): Procedural Information (PI) is sufficient for triggering DI

3. **pragmatic knowledge** (PK): DIs are the by-product of combining linguistic information (PI and CI) and contextual information (CI)
1. MODEL OF DIRECTIONAL INFERENCES
Model of Directional Inferences (MDI)

スター three main hierarchies organising the computation of DIs
1. contextual vs. linguistic information
2. procedural vs. conceptual linguistic information
3. propositional vs. morphological procedural information
three principles

A. contextual information is stronger than linguistic information
B. procedural information is stronger than conceptual information
C. propositional information is stronger than morphological information
implications

- principle A: contextual information can defeat DIs inferred on the sole linguistic information
- principle B: tenses are stronger than concepts (causally related concepts)
- principles C: all functional material in CP is stronger than tenses in TP
principle A

1. Max a poussé Jean. Il est tombé.  

2. Jean est tombé. Max l’a poussé.  

* causal rule: (PUSH,x,y) CAUSE (FALL,y)

* contextual assumption#1: if Max pushes John, then John fell

* contextual implication#1: John fell because Max pushed him

* contextual assumption#2: John fell and then Max pushed him

* contextual implication#2: Max pushed John because John fell
principle B

- French Passé Simple (PS) and Plus-Que-Parfait (PQP)
- Procedural information by tenses either confirm or defeat conceptual information (\textit{push-fall} causal rule)

1. \textit{Max poussa Jean. Il tomba.} \hspace{1cm} \text{FI}^{\text{ok}}
   
   \hspace{0.5cm}a. Max pushed John. He fell.

2. \textit{Jean tomba. Max le poussa.} \hspace{1cm} \text{FI}^{\text{ok}}, \text{BI}^{\text{*}}
   
   \hspace{0.5cm}b. John fell. Max pushed him.

3. \textit{Max poussa Jean. Il était tombé.} \hspace{1cm} \text{BI}^{\text{ok}}, \text{FI}^{\text{*}}
   
   \hspace{0.5cm}c. Max pushed John. He had fallen.

4. \textit{Jean tomba. Max l’avait poussé.} \hspace{1cm} \text{BI}^{\text{ok}}
   
   \hspace{0.5cm}d. John fell. He had fallen.

- Optimal discourses violate less constraints
principle C

* addition of temporal and causal connectives

* prediction: DI is given by the connective

1. *Max poussa Jean et il tomba.*
   a. Max pushed John and he fell.

2. *Jean tomba et Max le poussa.*
   b. John fell and Max pushed him.

3. *Max poussa Jean parce qu'il était tombé.*
   c. Max pushed John because he had fallen.

4. *Jean tomba parce que Max l'avait poussé.*
   d. John fell because Max had pushed him.

* (1) and (4) are more optimal than (2) and (3), because PI (tenses and connectives) converge

* in (2) and (3), conflicts between PI occur
to explain principle C, we add a new concept to MDI, that is, *directional features*

- computation of DIs is based on atomic information encoded in directional features
- four type of directional features
  - i. weak forward features [ff]
  - ii. weak backward features [bf]
  - iii. strong forward features [FF]
  - iv. strong backward features [BF]
two new principles

D. a strong feature wins over a weak feature or a string of weak features
E. a weak feature or a string of weak features must be licensed by a strong feature
* a strong feature must be accessible to license a DI
algorithm of DI assignation

1. assign a directional feature to utterance U1 in function of directional features carried by U1’s expressions
2. if possible construct a contextual assumption on the basis of conceptual information accessible at this stage
3. assign a directional feature to utterance U2 in function of directional features carried by U2’s expressions
4. compute DI of discourse [U1-U2]
5. license DI *via* an accessible contextual assumption, and if not, apply the same procedure to the next utterance
Jean tomba parce que Max l’avait poussé

1. assignation of a directional feature to U1
   \textit{tomba}: \texttt{[ff]}_PS
   U1: \texttt{[ff]}_U1

2. no contextual assumption available from CI (\textit{fall})

3. assignation of a directional feature to U2
   (i) \textit{parce que}: \texttt{[BF]}_PQ, (ii) \textit{avait V-é}: \texttt{[bf]}_PQP, (iii) \textit{poussé}: \texttt{[bf]}_PUSH
   U2: \texttt{[BF]}_PQ \& \texttt{[bf]}_PQP \& \texttt{[bf]}_PUSH = \texttt{[BF]}_U2

4. computation of \([U1-U2]\text{'s' DI}
   \texttt{[ff]}_U1 \& \texttt{[BF]}_U2 = \texttt{[BF]}_{U1-U2}

5. license DI \textit{via} an accessible contextual assumption
   \textit{if Max pushes John, then John falls}
   U1-U2: \texttt{[BF]}_{U1-U2}
2. EMPIRICAL IMPROVEMENTS

a. causal discourse and the cause-consequence order
b. experimental data
linguistic properties of causality

what makes causality accessible to inference is the mention of the result state and its patient

the explicature of both the agent and the causal event is specific to causative constructions

1. l’enfant a coulé le bateau  the child sank the boat.
2. le bateau a coulé  the boat sank
3. Marie a fait manger les enfants  M. made the children eat.

in causal discourse, cause and consequence are explicit, but the canonical order is consequence-cause (4), and not cause-consequence (5)

4. Le bateau a coulé. La torpille l’a atteint à la proue.
   a. The boat sank. The torpedo reached it with the prow.
5. La torpille a atteint la proue. Le bateau a coulé.
   b. The torpedo reached the boat with the prow. It sank.
hypotheses

1. consequence-cause discourses are not the reverse of cause-consequences discourses
2. consequence-cause discourses offer optimal order for pragmatic causal inferences

* arguments
  a. connectives distributions (lecture 3)
  b. experimental data on causal discourses
experimental data on causal discourses

★ first experiment
★ elicitation task: 40 eventive sentences of 8 syllables
★ 20 students: elicitation of a cause
★ 18 students: elicitation of a consequence

★ second experiment
★ 10 pairs of sentences selected
★ 5 pairs of highly associated propositions (>50%)
★ 5 pairs of weakly associated propositions (<50%)
★ 2 x 5 pairs of control sentences

★ design (E Prime software): the subject reads the prompt, reads the second propositions and type ‘e’ for ‘likely’ and ‘p’ for ‘unlikely’.
## selected propositions for the 2\textsuperscript{nd} experiment

<table>
<thead>
<tr>
<th>strength of association</th>
<th>proposition#1</th>
<th>proposition#2 (consequence)</th>
<th>% ans.</th>
<th>propositions#2(cause)</th>
<th>% ans.</th>
</tr>
</thead>
<tbody>
<tr>
<td>strong</td>
<td><em>Paul a pris ses médicaments</em></td>
<td><em>il va guérir</em></td>
<td>50</td>
<td><em>il était malade</em></td>
<td>94</td>
</tr>
<tr>
<td></td>
<td><em>le gendarme a beaucoup couru</em></td>
<td><em>il est essoufflé</em></td>
<td>85</td>
<td><em>il poursuivait quelqu’un</em></td>
<td>94</td>
</tr>
<tr>
<td></td>
<td><em>Jérôme a arrosé les plantes</em></td>
<td><em>elles poussent mieux</em></td>
<td>50</td>
<td><em>elles avaient besoin d’eau</em></td>
<td>55,5</td>
</tr>
<tr>
<td></td>
<td><em>Jean s’est acheté des lunettes</em></td>
<td><em>il voit mieux</em></td>
<td>70</td>
<td><em>il avait des problèmes de vue</em></td>
<td>50</td>
</tr>
<tr>
<td></td>
<td><em>le vase de cristal est tombé</em></td>
<td><em>il s’est cassé</em></td>
<td>70</td>
<td><em>quelqu’un l’a fait tomber</em></td>
<td>50</td>
</tr>
<tr>
<td>weak</td>
<td><em>Marie s’est tordu la cheville</em></td>
<td><em>elle doit se soigner</em></td>
<td>20</td>
<td><em>elle faisait du sport</em></td>
<td>16,6</td>
</tr>
<tr>
<td></td>
<td><em>la barque a heurté le rocher</em></td>
<td><em>elle a coulé</em></td>
<td>35</td>
<td><em>il y avait du courant</em></td>
<td>16,6</td>
</tr>
<tr>
<td></td>
<td><em>Marie a lu sans ses lunettes</em></td>
<td><em>elle n’a rien vu</em></td>
<td>15</td>
<td><em>elle voit bien de près</em></td>
<td>22,2</td>
</tr>
<tr>
<td></td>
<td><em>le chien a attrapé des puces</em></td>
<td><em>on va l’emmener chez le vétérinaire</em></td>
<td>20</td>
<td><em>il s’est roulé dans l’herbe</em></td>
<td>16,6</td>
</tr>
<tr>
<td></td>
<td><em>Véronique s’est lavé les mains</em></td>
<td><em>elle va passer à table</em></td>
<td>25</td>
<td><em>elle avait jardiné</em></td>
<td>22,2</td>
</tr>
</tbody>
</table>
results

i. with high associated pairs of propositions non significant difference in reading time occurs

ii. with weak associated pairs of propositions a significant difference in reading time occurs

* the **causal** reading (consequence-cause) is quicker than the **inferential** one (cause-consequence)

a. consequence-cause: 164,80 ms
b. consequence-cause: 308,84 ms
some new hypotheses

**H1**: causal backward readings are the *default* interpretation

- ok weak associations, *strong* associations

**H2**: causal backward readings are the result of pragmatic inference at the level of *implicatures* (implicated conclusions)

- *P1 because P2 inferred though premisses \{P1; P2; P2 causes P1\}

**H3**: causal backward readings are the result of pragmatic inference at the level of *explicatures*

- free enrichment process (research for relevance)
thanks a lot to...

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references

* Moeschler J. (2005), How to infer temporal relations in discourse?, in *Actes SEM_05*, Biarritz, 14-15 November 2005, 133-142