Implicitness of Discourse Relations

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Introduction

**Discourse relations** in a text are relations between propositions which are usually expressed as independent clauses or sentences.

- Additive
- Temporal
- Causal
- Adversative...
Introduction

Expectation for a **specific type of** discourse relation?
Introduction

Expectation for a specific type of discourse relation?

Previous Experimental Work
Introduction

Expectation for a specific type of discourse relation?

Previous Experimental Work

A new corpus-based approach
Continuity Hypothesis: readers expect a sentence to be causally congruent and continuous with respect to its preceding context.

-- Segal et al. 1991, Murray 1997

Causality Hypothesis: readers start out assuming the relation between two consecutive sentences is a causal relation.

-- Sanders 2005
Continuity & Causality

Gary's daughter was sick so he took her to the hospital.
Gary's daughter was sick so he took her to the hospital.

Gary took his daughter to the hospital because she was sick.
Continuity & Causality

**Forward**

Gary's daughter was sick \(\text{cause}\) so he took her to the hospital \(\text{consequence}\)

**Backward**

Gary took his daughter to the hospital \(\text{consequence}\) because she was sick \(\text{cause}\)
Continuity & Causality

**Forward**

Gary's daughter was sick so he took her to the hospital

cause

consequence

**Backward**

Gary took his daughter to the hospital because she was sick

consequence

cause
Continuity & Causality

**Causal**

**Forward**

Gary's daughter was sick  so  he took her to the hospital
cause  consequence

**Backward**

Gary took his daughter to the hospital  because  she was sick
consequence  cause

**Concessive**

Gary's daughter was sick  but  he sent her to the kindergarten
cause  neg-consequence
Continuity & Causality

**Background**

Gary's daughter was sick so he took her to the hospital.

**Related work**

Gary's daughter was sick because she was sick.

**Method**

Gary took his daughter to the hospital but he sent her to the kindergarten.

**Results**

Gary sent his daughter to the kindergarten although she was sick.

**Forward Causal**

- Gary's daughter was sick, so he took her to the hospital.

**Backward Causal**

- Gary took his daughter to the hospital because she was sick.

**Concessive**

- Gary's daughter was sick but he sent her to the kindergarten.

- Gary sent his daughter to the kindergarten although she was sick.
Continuity & Causality

**Forward**

Gary's daughter was sick so he took her to the hospital

- cause
- consequence

**Backward**

Gary took his daughter to the hospital because she was sick

- consequence
- cause

**Concessive**

Gary's daughter was sick but he sent her to the kindergarten

- cause
- neg-consequence

**Backward**

Gary sent his daughter to the kindergarten although she was sick

- neg-consequence
- cause
Experimental Studies

*Segal et al. (1991):* tendency to identify continuous relations between adjacent sentences

*Murray (1994):* more reading facilitation by signals of discontinuity (continuity is already expected)

*Murray (1997):* more salient effect of inappropriate discontinuous discourse markers + tendency to choose causal sentence completion

*Kuperberg et al. (2011):* semantic processing difficulty (bigger N400) reading causally unrelated sentences.
Experimental Studies

Murray (1997)

**Sentence completion:** completions were consistent with the connective.

Ronny cleaned up the house for his girlfriend’s visit. [so, also, nevertheless] ....
Experimental Studies

Murray (1997)

**Sentence completion:** more causal completions than adversative or additive.

Ronny cleaned up the house for his girlfriend’s visit.

...
Natural Data Exploration

How to relate natural production data to reader’s expectations?
Natural Data Exploration

How to relate natural production data to reader’s expectations?

**Uniform Information Density (Frank & Jaeger 2008):** humans tend to spread information evenly across a text. Optional discourse markers should be omitted or decreased to avoid a valley in the information density.
Natural Data Exploration

How to relate natural production data to reader’s expectations?

Fig. from Jaeger 2010
Natural Data Exploration

How to relate natural production data to reader’s expectations?

Fig. from Jaeger 2010
Our Hypotheses

Implicit
- Continuous
- Causal
- Forward temporal

Explicit
- Discontinuous
- Adversatives
- Backward temporal
Penn Discourse Tree Bank

<table>
<thead>
<tr>
<th>Relations in 25 sections of WSJ</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicit</td>
<td>18459</td>
</tr>
<tr>
<td>Implicit</td>
<td>16224</td>
</tr>
</tbody>
</table>

• Explicit relations:

The federal government suspended sales of U.S. saving bonds *because* Congress hasn’t lifted the ceiling on government debt.”

• Implicit relations:

“The market was dragged up by the scruff of its neck by Wall Street and by market markers getting caught short. [ *but* ] No one wants stock on their books.”
Implicitness Measure

Implicitness (relation) = \frac{\# \text{ implicit occurrences of the relation}}{\# \text{ all occurrences of the relation}}
Raw Frequencies of Relation Senses
Implicitness of Relation Senses

Background
Related work
Method
Results

Concession
Contrast
Pragmatic concession
Pragmatic contrast
Cause
Condition
Pragmatic cause
Pragmatic condition
Alternative
Conjunction
Exception
Instantiation
List
Restatement
Asynchronous
Synchronous
All differences between blues and reds were significant.
• Forward subtypes are more implicit than backward subtypes
• Positive subtypes are more implicit than negative subtypes
Implicitness of Relation Senses

- Only considering ordered arguments still forward is more implicit
- More re-ordering of backward relations (p<0.001)
- Temporal linearity ~ presence of the cue (chi-square)
Local Factors (IC Verbs)

Rohde & Horton (2010)

**IC verbs** in a sentence trigger expectation for a reason to come next.

Dawn **amazed** Malcom...

She was playing the piano with her eyes closed. He applauded her talents.
Local Factors (IC Verbs)

Questions:

- Do IC verbs precede reason relations?
- Do they give rise to the implicitness?

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<tr>
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<th>Total</th>
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<tr>
<td>Implicit: reason relations</td>
<td>2462</td>
<td>153 (manually checked)</td>
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<tr>
<td>Explicit: reason relations</td>
<td>1324</td>
<td>96 (manually checked)</td>
</tr>
<tr>
<td>Implicit: all relations</td>
<td>15682</td>
<td>910 (automatically extracted)</td>
</tr>
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Local Factors (IC Verbs)

- Do IC verbs precede reason relations? Yes, 14% probability of a reason after an IC verb vs. 11.7% after other verbs (p<0.01)

- Do they give rise to the implicitness?

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Local Factors (IC Verbs)

- Do IC verbs precede reason relations? **Yes**, 14% probability of a reason after an IC verb vs. 11.7% after other verbs (p<0.01)

- Do they give rise to the implicitness? **No**, 61% implicitness given IC verb vs. 65% given other verb.

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Conclusions

By applying UID we connected natural production data to cognitive theories:

✓ Continuous relations are expressed more implicitly than discontinuous ones.

✓ Forward temporal ordering is left implicit over different types of relations.
Conclusions

By applying UID we connected natural production data to cognitive theories:

- Continuous relations are expressed more implicitly than discontinuous ones.
- Forward temporal ordering is left implicit over different types of relations.
- Causal relations are one of the most implicit relation types, but, there exist other continuous types of relations which tend to appear with no explicit marker more than causal relations.
- Causal relations are more probable in presence of IC verbs, but, these verbs don’t give rise to the implicitness (in terms of connective omission)
Conclusions

For future:

- Other markers of causality and continuity (e.g., AltLex:”the reason is”)
- Different types of continuity (according to Segal et al. 1991)
- Inter-relation neighborhood (Pitler et al. 2008)
- More accurate investigation of IC verbs (e.g., passive tense)
Thank You!

“In silence there is eloquence. Stop weaving and see how the pattern improves.” — Rumi
Thank You!

References:


Images were taken from public domain images.google.com