Concurrent Discourse Relations

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A discourse is more than its individual sentences.

Instead, each clause in a sentence relates to the context established by the previous discourse – in terms of a subject’s awareness of

- the structure of the text
- its topic
- the entities it refers to
- its semantic & rhetorical relations (discourse relations) to elements of context.
Evidence for **discourse relations** can come from **discourse connectives**:

(1) He suspected he shouldn’t interrupt the speaker with a question.

- **Nevertheless** he did.
  - ⇒ what he did **contrast**s with what he should have done
- **Instead** he should wait until the end of the talk.
  - ⇒ waiting is a preferred **alternative** to interrupting
While some situations may need an explicit connective to supply evidence for a discourse relation:

(2) He suspected he shouldn’t interrupt the speaker with a question. Φ He did.

\[ \not\Rightarrow \textit{contrast} \]

(3) He suspected he shouldn’t interrupt the speaker with a question.

\textit{Nevertheless} he did.

\[ \Rightarrow \textit{contrast} \]
While some situations may need an explicit connective to supply evidence for a discourse relation:

(4) He suspected he shouldn’t interrupt the speaker with a question. Φ He did.


\[\not\Rightarrow \text{contrast}\]

other situations don’t:

(5) He suspected he shouldn’t interrupt the speaker with a question. Φ He should wait until the end of the talk.

\[\Rightarrow \text{waiting is a preferred alternative to interrupting}\]
The Penn Discourse TreeBank (PDTB) and similar corpora assume that evidence for discourse relations can come:

- **Explicitly**, via discourse connectives, adverbials, marked syntactic forms, or other explicit signals;
- **Implicitly**, via inference based on adjacency, speaker/hearer biases, and/or world knowledge.

A clause can contain $\geq 1$ piece of explicit evidence for how it relates to the discourse context, or none at all.
Why might a clause contain >1 explicit pieces of evidence?

- Each may signal a different relation to a different part of the context;
- Each may signal a different relation to the same part of the context;
- They may redundantly signal the same relation to the same part of context;
- They may signal the same relation to a different part of context.
Multiple Pieces of Explicit Evidence

(6) The car was finally coming toward him. \(s_1\)
He finished his diagnostic tests, \(s_2\)
feeling relief. \(s_3\)
But then the car started to turn right. \(s_4\) \[Wiebe, 1993\]

Conjunction **but** signals **CONTRAST** between \(s_4\) and \(s_3\).
Adverbial **then** signals **SUCCESSION** between \(s_4\) and \(s_2\).

\[\Rightarrow \text{Different relations to different parts of context}\]
Multiple Pieces of Explicit Evidence

(7) I must wash the dishes \textit{s$_1$} \textbf{because} otherwise \textit{s$_2$} I can’t go out.

Conjunction \textbf{because} signals that \textit{s$_2$} serves as an \textit{EXPLANATION} for \textit{s$_1$}.

Adverbial \underline{otherwise} signals that \textit{s$_1$} serves as a \textit{NEGATIVE CONDITION} for \textit{s$_2$}.

$\Rightarrow$ \textbf{Different} relations to the \textit{same} part of context
(8) Is it plausible for a beginner to learn Ruby $s_1$ while at the same time learning HTML and CSS $s_2$?

Conjunction while signals that $s_2$ is \textit{synchronous} with $s_1$ (i.e., happening at the same time)
Adverbial at the same time also signals that $s_2$ is \textit{synchronous} with $s_1$.

$\Rightarrow$ \textbf{Same} relation to the \textbf{same} part of context (Redundant)
What might a single explicit piece of evidence imply?

- There is only one relation between the clause and its context — the relation explicitly signalled by the evidence;
- There are **concurrent discourse relations** between the clause and its context:
  - one relation signalled by the explicit evidence;
  - other inferrable relations.
(9) **Such problems will require considerable skill to resolve.** \( s_1 \)

**However, neither Mr. Baum nor Mr. Harper has much international experience.** \( s_2 \) [wsj_0109]

Adverbial **however** signals a **Contrast** between \( s_1 \) and \( s_2 \).

\[ \Rightarrow \text{One relation to context} \]
(10) I must wash the dishes $s_1$. Otherwise I can’t go out. $s_2$

Adverbial otherwise conveys a conditional relation between the negation of $s_1$ and $s_2$ (NEGATIVE CONDITION).

But we still infer an EXPLANATION relation holding between $s_2$ and $s_1$.

$\Rightarrow$ I must wash the dishes because I want to go out.

$\Rightarrow$ Concurrent Discourse Relations to same part of context
If there are adjacent clauses or sentences with no explicit signal of how they relate, it might imply:

- they aren’t related;
- they are related by a single inferrable (implicit) discourse relation;
- they are related by concurrent discourse relations (all implicit and inferrable).
(11) This cannot be solved by provoking a further downturn; reducing the supply of goods does not solve inflation.

Our advice is this: Immediately return the government surpluses to the economy through incentive-maximizing tax cuts, and find some monetary policy target that balances both supply and demand for money …[wsj_0553]
This cannot be solved by provoking a further downturn; reducing the supply of goods does not solve inflation.

(Implicit=so Contingency.Cause.Result,
Implicit=instead Exp.Alt.Chosen.alt)

Our advice is this: Immediately return the government surpluses to the economy through incentive-maximizing tax cuts, and find some monetary policy target that balances both supply and demand for money ... [wsj_0553]
The possibility of *concurrent discourse relations* has implications for

- **Language Technology**: When is it worth trying to extract multiple relations from text?
- Corpus annotation
- Psycholinguistics
The possibility of *concurrent discourse relations* has implications for

- Language Technology
- **Corpus annotation**: When should annotators be asked to annotate concurrent relations manually *vs.* when can automated methods make accurate decisions?
- Psycholinguistics
The possibility of *concurrent discourse relations* has implications for

- Language Technology
- Corpus annotation
- **Psycholinguistics**: What role, if any, do explicitly signals play in allowing hearers to infer other implicit relations?
The problem is that we don’t fully understand concurrent discourse relations, so:

1. Can we get evidence from corpora?
2. Can we get evidence from experiments?
3. Can we use such evidence to help automatically annotate concurrent relations and improve the ability of systems to extract information from text.
The Penn Discourse TreeBank 2.0 was released in 2008 and remains the largest manually annotated corpus of Discourse Relations in English.

It comprises annotation of the Penn WSJ corpus with:

- **Discourse Relations** between clauses whose sense or use serve as **arguments** to the relation;
- **Lexical/Phrasal Evidence** for such relations.

The PDTB does not annotate higher–level structure (RST [Mann & Thompson, 1988], SDRT [Asher & Lascarides, 2003]) or relative prominence between arguments (RST).
Other corpora annotated in the style of the PDTB:
- Bio Discourse Relation Bank [Prasad et al, 2011],
- Arabic Discourse TreeBank [Al-Saif & Markert, 2011]
- Chinese Discourse TreeBank [Zhou & Xue, 2015]
- Hindi Discourse Relation Bank [Kolachina et al, 2012]
- Turkish Discourse Bank [Zeyrek et al, 2013].

Recently started corpora in Polish (Maciej Ogrodniczuk, IPIPan) and in Portuguese (Amalia Mendes, University of Lisbon).
(13) Until the building is completed, Exxon will rent part of an existing office tower. [wsj_0784]
Three forms of annotation: PropBank

Subord clauses and adjuncts fill specific or general MOD roles (e.g., ARGM-TMP, ARGM-PRP) vs. (ARGM-ADV). Their position with respect to the verb doesn’t matter to PropBank annotation.
Three forms of annotation: PDTB 2.0

The PDTB 2.0 annotates discourse relations by labelling text spans involved in a relation:

- the text span whose sense and/or use serves as Arg1 of the relation;
- the text span whose sense and/or use serves as Arg2;
- the (optional) text span that serves as evidence for the relation;
- the $\geq 1$ senses that hold between the arguments.

(14) Until (Temporal.Asynchronous.Precidence) the building is completed, Exxon will rent part of an existing office tower. [wsj_0784]

Senses such as Temporal.Asynchronous.Precidence are arranged in an abstraction hierarchy.
PDTB 2.0 Sense Hierarchy [Prasad et al, 2008]
Discourse connectives annotated as evidence for explicit discourse relations come from well-defined syntactic classes:

- **Subordinating conjunctions**: because, though, when, if, etc.
- **Coordinating conjunctions**:
  - Ordinary conjunctions: and, but, so, nor, or,
  - Discontinuous conjunctions: either..or, neither..nor, not only..but also
- **Discourse Adverbials**:
  - PPs: as a result, insofar as, in comparison, etc.
  - Adverbs: then, however, instead, likewise, subsequently, etc.

Implicit relations inferred between adjacent sentences are annotated by inserting ≥1 implicit connectives between the spans and labelling them with the sense(s) that have been inferred.
(15) Mr. Lane’s final purpose isn’t to glamorize the Artist’s vagabond existence.

He has a point he wants to make, and he makes it, with a great deal of force. [wsj_0039]
(16) Mr. Lane’s final purpose isn’t to glamorize the Artist’s vagabond existence.

(Implicit=rather **Exp.Alt.Chosen_alt**)  
He has a point he wants to make, and he makes it, with a great deal of force. [wsj_0039]
Concurrent relations can hold between arguments in the PDTB 2.0 because senses are only disjoint if:

- they are defined as inverses:
  
  **Reason** vs. **Result**: A **Reason** for B ⇔ B **Result** of A
  
  **Precedence** vs. **Succession**: A **Precede** B ⇔ B **Succeed** A
  
  **Expectation** vs. **Contra-expectation**

- or their definitions are incompatible:
  
  **Reason** (Arg2 ≤ Arg1) vs. **Precedence** (Arg1 < Arg2)
  
  **Factual present** vs. **Factual past**
  
  **Factual present** vs. **Unreal present**

**But most senses are compatible.**
PDTB annotators were allowed to assign up to two compatible senses as holding between arguments to an explicit connective.

999/18459 explicit connectives (5.4%) were so labelled.

(17) In the coming decade U.S.-Japanese relations will be tested, as Tokyo comes to terms with its new status as the region’s economic behemoth. (wsj_0043)

- **Temporal.Synchrony** ⇒ *(repeated)* testing of relations occurs at the same time as *coming to terms with new status*

- **Contingency.Cause.Reason** ⇒ *coming to terms with new status* is reason for *(repeated)* testing of relations

Such multiple assignments are probably under-annotated.
An earlier experiment with one explicit connective allowed annotators to use the paired label TEMPORAL/CAUSAL as well as TEMPORAL or CAUSAL alone, when annotating the 184 relations headed by *since* in the WSJ corpus [Miltsakaki et al, 2005].

**T/C FREQUENCY**

<table>
<thead>
<tr>
<th>Sense</th>
<th>Annot 1</th>
<th>Annot 2</th>
<th>PDTB 2 frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>since</em></td>
<td>11.3% (21)</td>
<td>8.6% (16)</td>
<td>5.4% (10)</td>
</tr>
</tbody>
</table>

Concurrent relations may be under-annotated in the PDTB2 because paired senses weren’t an option and annotators weren’t encouraged to consider concurrent relations. They were just told that they could assign $\geq 1$ sense label.
In addition, 530/16053 implicit connectives (3.2%) were annotated with concurrent relations, either by labelling one connective with \( \geq 1 \) sense (359 tokens)

(18) **Prosecutors alleged that she was trying to bolster students’ scores to win a bonus under the state’s 1984 Education Improvement Act.** (implicit=\textit{because}) **The bonus depended on her ability to produce higher student-test scores.** (wsj\_0044)

- **Expansion.Restatement.Specification** \( \Rightarrow \) \textit{Arg2} describes bolstering students scores to win a bonus in more detail
- **Contingency.Cause.Reason** \( \Rightarrow \) \textit{Arg2} is the reason for trying to bolster students’ scores.
Concurrent relations annotated in the PDTB 2.0

or by labelling each sense with its own implicit connective (171 tokens):

(19) **This cannot be solved by provoking a further downturn; reducing the supply of goods does not solve inflation. Our advice is this: Immediately return the government surpluses to the economy through incentive-maximizing tax cuts, and find some monetary policy target that balances both supply and demand for money.** *(wsj_0553)*

- implicit=so, Contingency.Cause.Result \((\text{Arg}_2 \equiv \text{result of Arg}_1)\)
- implicit=instead, Expansion.Alternative \((\text{Arg}_2 \equiv \text{chosen alternative to Arg}_1)\)
Concurrent relations annotated in the PDTB 2.0

(20) CBS expects to make modest profits, but rivals contend that it will take a beating. ABC lost $75 million on the 1988 Winter Games, partly because of its $309 million rights fee. [wsj_1057]

- implicit=because, Contingency.Cause.Reason
- implicit=previously, Temporal.Asynchronous.Succession

(21) Accessories not only sell faster than whole bikes, they also offer profit margins nearly double the 25% to 30% or so on sales of complete cycles. To get a piece of the business, Nike Inc., Beaverton OR, introduced a line of mountain-bike shoes. [wsj_0367]

- implicit=thus, Contingency.Cause.Result
- implicit=for example, Expansion.Restatement.Specification
In 2014, the National Science Foundation (NSF) granted funding to create an enriched version of the PDTB that contains

- an extended and simplified sense hierarchy;
- discourse relations annotated **within** sentences (e.g., between conjoined verb phrases, conjoined clauses, free adjunct and matrix clause, etc.);
- relations annotated across paragraphs;
- **concurrent discourse relations**.

We aim to deliver the PDTB 3.0 to the community in mid-2017.
The sense hierarchy retains the same four Level-1 senses.

Rare and/or difficult-to-annotate Level-3 senses have been eliminated.

Level-3 is now only used to encode the direction of asymmetric relations:

- \texttt{CONDITION.Arg1-as-cond}
- \texttt{CONDITION.Arg2-as-cond}

Additional senses have been added for annotating intra-sentential relations.
PDTB 3.0 Sense Hierarchy: Revised Contingency sub-tree

- **Cause**
  - Reason
    - (Arg1-as-result)
  - Result
    - (Arg2-as-result)
- **Cause+Belief**
  - Reason+Belief
  - Result+Belief
- **Cause+SpeechAct**
  - Reason+SA
  - Result+SA
- **Purpose**
  - Arg1-as-goal
  - Arg2-as-goal

- **Condition**
  - Arg1-as-cond
  - Arg2-as-cond
- **Condition+SpeechAct**
  - Arg1-as-negcond
  - Arg2-as-negcond
- **Negative-condition**
  - Arg1-as-negcond
  - Arg2-as-negcond
- **Negative-condition+SpeechAct**

New rels in **blue**
Examples of new Contingency relations

**Purpose.Arg2-as-goal:**
(22) These “active suspension systems” electronically **sense road conditions** and **adjust a car’s ride** [wsj_0956]

**Condition.Arg1-as-cond**
(23) **Give television a chance to cover live any breaking of the law**, and **no second invitation will be required**. [wsj_0290]

**Negative-Condition.Arg1-as-negcond**
(24) The National Institutes of Health policy would require researchers to **cut financial ties with health-care businesses** – or **lose their government money**. [wsj_0975]

⇒ If they didn’t cut their financial ties . . . , they’d lose their money.
PDTB 3.0 Sense Hierarchy: Revised Expansion sub-tree

- Conjunction
- Disjunction
- Specification
  - Arg2-as-detail (specification)
  - Arg1-as-detail (summarization)
- Equivalence
- Exception
  - Arg1-as-excpt
  - Arg2-as-excpt
- **Substitution**
  - Arg1-as-subst
  - Arg2-as-subst

- **Manner**
  - Arg1-as-manner
  - Arg2-as-manner

- **Instantiation**

New relations in **blue**.
Examples of new Expansion relations

**Substitution.Arg1-as-subst**

(25) ERC International Inc., . . . , is **refining its defense niche, not retreating from it.** [wsj_0799]

**Substitution.Arg2-as-subst**

(26) “We’ve got to **get out of the Detroit mentality and be part of the world mentality,**” declares Charles M. Jordan, . . . [wsj_0956]

**Manner.Arg2-as-manner**

(27) Some residents **defied orders and returned to “red” buildings to retrieve goods.** [wsj_1435]
PDTB 3.0 Sense Hierarchy: Revised Comparison sub-tree

- Contrast
- **Similarity**
- Concession
  - Arg1-as-denier (Expectation)
  - Arg2-as-denier (Contra-Expectation)
- **Concession + SpeechAct**
  - Arg2-as-denier + SpeechAct

New relations in **blue**.
Examples of new Comparison relations

Comparison.Similarity

(28) Just as the 1980s bull market transformed the U.S. securities business, so too will the more difficult environment of the 1990s,” says Christopher T. Mahoney, a Moody’s vice president. [wsj_0128]

Concession+SA:Arg2-as-denier+SA

(29) Congress closed this loophole last year, or thought it did. [wsj_1574]
Concurrent relations in the PDTB 3.0

Only the annotation of conjoined verb phrases (VPs) is complete.

Of 4633 conjoined VPs, 1047 have been annotated with concurrent discourse relations (23%)

<table>
<thead>
<tr>
<th>Sense</th>
<th>Frequency</th>
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<tbody>
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<td>Conjunction + Result</td>
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<tr>
<td>Conjunction + Precedence</td>
<td>378</td>
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<tr>
<td>Conjunction + Arg2-as-subst</td>
<td>51</td>
</tr>
<tr>
<td>Conjunction + Arg2-as-detail</td>
<td>44</td>
</tr>
<tr>
<td>Result + Arg1-as-manner</td>
<td>41</td>
</tr>
<tr>
<td>OTHER</td>
<td>131</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1047</strong></td>
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</table>
Pairs of a conjunction and a discourse adverbial are not uncommon (Google N-grams).

<table>
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<td>instead of</td>
<td>27030733</td>
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<td>Instead of X</td>
<td>8420547</td>
<td>instead of X</td>
<td>15729184</td>
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<table>
<thead>
<tr>
<th>And instead of</th>
<th>8033</th>
<th>and instead of</th>
<th>1053928</th>
</tr>
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<tbody>
<tr>
<td>But instead of</td>
<td>101505</td>
<td>but instead of</td>
<td>1510409</td>
</tr>
<tr>
<td>So instead of</td>
<td>71646</td>
<td>so instead of</td>
<td>78585</td>
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<td>[Conn] instead of</td>
<td>181184</td>
<td>[conj] instead of</td>
<td>2642922</td>
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<tr>
<td></td>
<td>(∼1.2%)</td>
<td></td>
<td>(∼16.8%)</td>
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</tbody>
</table>

**Total:** ∼11.7% of instead tokens co-occur with and/but/so
Discourse Adverbials (Google N-grams)

**Zipfian distribution:** Sentence-initial, complete phrase
Adverbials and their Preferred Conjunctions

- Google N-grams show that all discourse adverbials occur most frequently alone,
- but next to a conjunction, some adverbials show preferences

**Google N-grams**

- **Therefore**
- **Nevertheless**
- **Otherwise**
- **For example**
Adverbials and their Preferred Conjunctions

- while Google N-grams show that other adverbials have a more even distribution.

![Graphs for different adverbials and conjunctions]
Funded by small grant from **Nuance Foundation** (Aug 2014 - Feb 2017)

Overall goal: Characterize discourse adverbials in terms of the concurrent relations they co-occur with.

Because judgments of concurrent relations may vary and be hard to get, we are using:

- a large number of judges (via **crowd-sourcing**)
- **indirect evidence** of what, if any, conjunctions judges would use to express the sense(s) in which a clause is connected to context.

Later move to more direct judgements of sense(s).
ConnText: Phase 1 Stimuli

- Explicit passage: Author-given Conjunction removed from passage
- Implicit passage: Author didn’t use a Conjunction

![Chart showing the comparison between Explicit and Implicit passages for different conjunctions]

- After all
- In fact
- In general
- Instead
Logically, she should be dead // ______________ instead, she feels fine, caring for her daughters and walking a pedometer-measured two miles a day.

Conjunction:
- So
- Before
- Because
- None at all
- Or
- But
- And
- Other word or phrase

Once you have made your selections, press submit to complete the trial. To share additional comments about this trial, please click here.

Submit
Logically, she should be **dead // but instead**, she feels fine, caring for her daughters and walking a pedometer-measured two miles a day.

Conjunction:
- So
- Before
- Because
- None at all
- Or
- But
- And
- Other word or phrase

Does 'but' sound okay?
- I could say it this way
- It sounds strange here

Once you have made your selections, press submit to complete the trial. To share additional comments about this trial, please [click here].

Submit
Phase 1: Participants

- Recruited 70 participants with U.S. addresses through Mechanical Turk: Equal number of men/women.
- Each annotated 50 passages (27 explicit passages, 23 implicits).
- Removed participants who worked very quickly or had a high level of disagreement with other participants: Analysis based on remaining 58 judgments / passage.
Phase 1: Explicit passages

<table>
<thead>
<tr>
<th>Author/Participant</th>
<th>AND</th>
<th>BECAUSE</th>
<th>BUT</th>
<th>OR</th>
<th>SO</th>
</tr>
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<tbody>
<tr>
<td>and</td>
<td>189</td>
<td>14</td>
<td>81</td>
<td>5</td>
<td>33</td>
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<td>because</td>
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<td>17</td>
<td>4</td>
<td>23</td>
<td>5</td>
<td>9</td>
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</table>

Participants and authors often agree on conjunctions.
Phase 1: Explicit passages

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<td>17</td>
<td>4</td>
<td>23</td>
<td>5</td>
<td>9</td>
</tr>
</tbody>
</table>

But not always: Differences are also of interest.
Phase 1: Explicit response distribution for *Instead*

<table>
<thead>
<tr>
<th>Author Participant</th>
<th>AND</th>
<th>BUT</th>
<th>Total</th>
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<tbody>
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<tr>
<td>none</td>
<td>2</td>
<td>2</td>
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</tr>
</tbody>
</table>

Author-selected AND got participant so responses.
Do participants attributing meaning select more specific in preference to underspecified *and*?
Phase 1: Explicit response distribution for *After all*

<table>
<thead>
<tr>
<th>Author Participant</th>
<th>AND</th>
<th>BECAUSE</th>
<th>BUT</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>and</td>
<td>18</td>
<td>6</td>
<td>30</td>
<td>54</td>
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<tr>
<td>because</td>
<td>9</td>
<td>51</td>
<td>51</td>
<td>111</td>
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<tr>
<td>but</td>
<td>25</td>
<td>0</td>
<td>128</td>
<td>153</td>
</tr>
<tr>
<td>or</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>so</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>other</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
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<td>5</td>
<td>1</td>
<td>17</td>
<td>23</td>
</tr>
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</table>

Participants chose *because* for Author-selected AND and BUT. Does anything else show that *after all* prefers *because*?
Phase 1: Implicit passages – Results per adverb

<table>
<thead>
<tr>
<th>Participant</th>
<th>after all</th>
<th>in fact</th>
<th>in general</th>
<th>instead</th>
</tr>
</thead>
<tbody>
<tr>
<td>and</td>
<td>50</td>
<td>87</td>
<td>118</td>
<td>20</td>
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<tr>
<td>because</td>
<td>245</td>
<td>35</td>
<td>86</td>
<td>38</td>
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<tr>
<td>but</td>
<td>16</td>
<td>83</td>
<td>50</td>
<td>103</td>
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<tr>
<td>or</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>so</td>
<td>4</td>
<td>3</td>
<td>21</td>
<td>119</td>
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<tr>
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<td>0</td>
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<tr>
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<td>26</td>
<td>20</td>
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</table>

With *after all*, participants do favor *because*.

(With the other three adverbials, responses are more varied.)
(30) It has never worked before / _____ after all, nothing ever works until it works.

(31) Yes, I suppose there’s a certain element of danger in it, that you can’t get around / _____ after all, there’s a certain amount of danger in living, whatever you do.

Choose from: And Because But Or [other] None
(32) It has never worked before because after all, nothing ever works until it works. (21/58 responses)

(33) Yes, I suppose there’s a certain element of danger in it, that you can’t get around / because after all, there’s a certain amount of danger in living, whatever you do. (22/58 responses)
Next steps

- Have data from same 28 participants on another 16 discourse adverbials (phase 2)
- Phase 2 data have been analysed and a paper has been submitted to LAW 2016.
- Currently crowdsourcing Phase 3 data on a final set of 35 adverbs from 25 participants.
- Though results are interesting, still need to distinguish actual concurrent discourse relations from redundant evidence for the same discourse relation.
- We are therefore designing a Phase 4 experiment that makes a more direct link between participant judgments and their inferred sense(s).
It has been customary to assume that the semantic relation between a clause or sentence and its context either is marked explicitly or involves inference.

Evidence from corpus annotation and crowdsourcing, however, suggests that often both are involved.

We have called the result concurrent discourse relations.
Our work on corpus annotation has shown where expert annotators infer more than one sense holding between a clause and its context, where the clause itself may contain no discourse connective or $\geq 1$ discourse connective.

Our crowd-sourcing experiments have used many more judges. However, because they are not experts, we must use indirect means of assessing whether they take $\geq 1$ discourse relations to hold between a clause or sentence and its context.

These experiments are revealing interesting patterns of responses that should be taken into account in relation extraction tasks.