INFORMATION DENSITY AND THE USE OF DISCOURSE CUES

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Theory: Grice's *maxim of quantity [1]* requires speakers to chose the one among possible forms that is **as informative as necessary** for communicating the intended meaning and not to exceed that. The Uniform Information Density [2] further considers incremental perception of language stimuli by the interlocutor as a basis of **how information should be distributed** across utterances. We apply this theory to the choice of writers on **when to use a discourse connective** between two sentences in construction of discourse relations given that linguistic features of the first sentence can be predictive of the relation sense.

Hypothesis: highly informative discourse connectives should appear in cases where *relational surprisal* would be high if the connective is not used.

$$\text{Surprisal encountering Arg2} = -\log p(Arg2|Arg1) = -\log p(Arg2|R, Arg1) - \log p(R|Arg1)$$

Given R is the relation between *Arg1* and A*rg2*, i.e., $p(R|Arg1, Arg2) = 1$

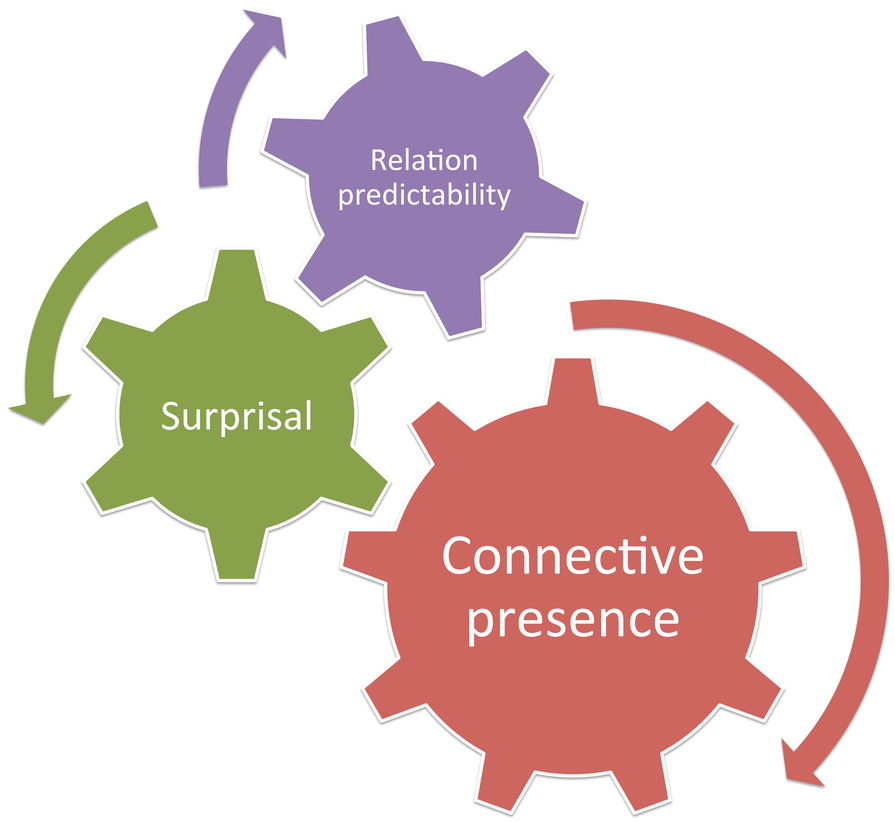
Corpus study: Chosen alternative relations often have some type of negation in their Arg1 [3]. By analysis of the Penn Discourse Treebank [4] we investigate whether:

1. Negation in arg1 is a strong marker of the relation sense (**n**ormalized **p**oint-wise **m**utual **i**nformation analysis [5])
2. Relational surprisal wrt. this feature is higher in explicit than implicit cases

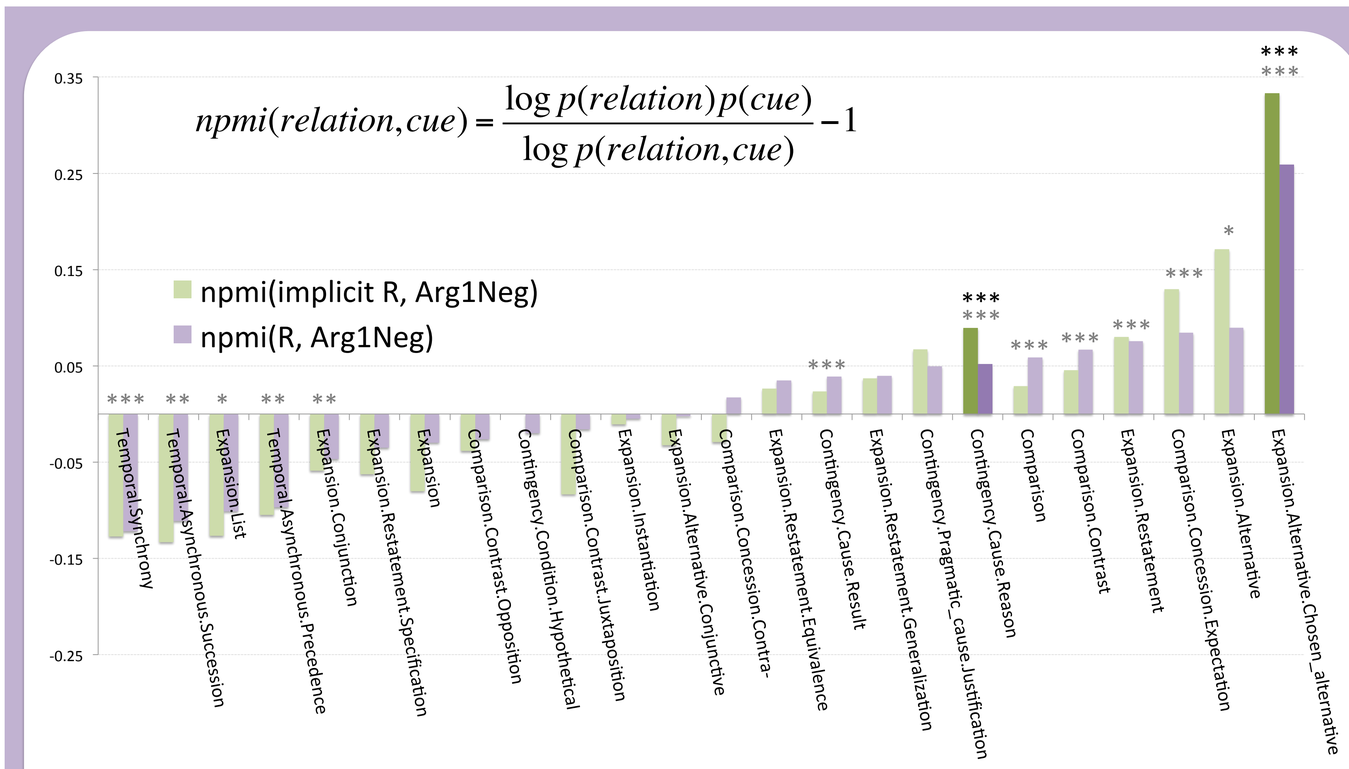
***Chosen Alternative* relations with Arg1Neg from PDTB:**

"They didn't panic during the first round of selling this morning. **Instead**, they bought on weakness and sold into the strength, which kept the market orderly." --- *Explicit*

"I would say this is not bad news; [instead] this is a blip" --- *Implicit*



The UID mechanism applied to incremental inference of discourse relations suggests that the predictability of a relation can be considered as a factor for dropping explicit discourse connective.



*** Correlation between presence of negation and the relation sense --- Binomial test against prior *p(relation)*.

*** Correlation between presence of negation and absence of connective --- Chi-square test of significance.

Arg1Neg	Arg2Neg	Explicit	Implicit	Total
FALSE	FALSE	14857	12155	27012
FALSE	TRUE	1975	2153	4128
TRUE	**FALSE**	**2126**	**1758**	**3884**
TRUE	TRUE	500	518	1018
All		19458	16584	36042

- Negation in the first argument of a discourse relation changes the distribution of upcoming discourse relations.
- In particular, the *Chosen Alternative* relation is more expected following a negation. Therefore, the explicit connector can be omitted.
  P(*Chosen alternative*|Arg1Neg)
  - Explicit: 1.5%
  - Implicit: 5.3%

  (Significant diff. at $p < 0.001$)
- Relational surprisal affects writers' choice of inserting / omitting discourse connectors.

Reference:
[1] Grice (1975) *Logic and conversation.*
[2] Levy and Jaeger (2007) *Speakers optimize information density through syntactic reduction.*
[3] Webber (2013) *What excludes an alternative in coherence relations?*
[4] Prasad, Dinesh, Lee, Miltsakaki, Robaldo, Joshi, and Webber (2008) *The Penn Discourse Treebank 2.0*.
[5] Asr and Demberg (2013) *On the information conveyed by discourse markers.*

The poster is available at *http://coli.uni-saarland.de/~fatemeh* & **AMLaP 2014, Edinburgh, Scotland.**

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