

Choosing among alternatives: Conjunction variability comes from both inference and the semantics of discourse adverbials

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Discourse coherence relations serve to link clause-level semantics and discourse-level semantics. The typical assumption is that they are signalled either explicitly, by conjunctions (BECAUSE, SO, OR) or discourse adverbials (*therefore, however*), or else implicitly, through inference, **but not simultaneously via explicit and implicit signals**.

Recent findings challenge this simple explicit vs. implicit dichotomy in two ways: (i) A discourse relation may be inferred even when a discourse adverbial is present (Rohde et al. 2015, 2016, 2017b; see also Asr and Demberg 2013; Tatiana Scheffler, p.c.); and (ii) the available evidence may license more than one inferred relation (Prasad et al., 2014).

Our findings come from conjunction-completion experiments in which naive participants were asked to read passages such as (1), made up of two text segments joined by a gap followed by a discourse adverbial, and then asked to fill in the gap with a *conjunction* that best expressed how they took the segments to be related. Participants endorsed conjunctions whose sense differed from the discourse adverbial and which usually signal different coherence relations (Rohde et al., 2017b). For example, for passage (1) with the discourse adverbial *in other words*, participants frequently and systematically chose to insert OR as well as SO. This SO~OR substitutability is unexpected because, even if one takes their semantics to be “weak”, the two conjunctions appear neither synonymous nor representative of the same relation.

- (1) Unfortunately, nearly 75,000 acres of tropical forest are converted or deforested every day _____ in other words an area the size of Central Park disappears every 16 minutes. [SO~OR]

Rohde et al. (2017b) note other improbable substitutability pairs (e.g., BECAUSE~BUT, BUT~OR, and BECAUSE~OR) that emerged systematically across participants and across passages for particular adverbials, but they did not provide empirical evidence for what motivates these possible substitutions. Here we do so for three adverbials with related lexical semantics — *in other words*, *otherwise* and *instead* — all of which convey that the clause in which they appear provides a (disjunctive) *alternative*. Similar lexical semantics could be realised by the conjunction OR.

The passages used in the current study are simplified variants of the naturally occurring passages used in our previous studies. As well as simplifying the passages, we manipulated them systematically, in ways that alter how available different coherence relations were to the participants. The goal is to understand how properties of the passage drive preferences for the establishment of particular (sometimes co-occurring) coherence relations.

Here, we first present results for *in other words*. While its lexical semantics of disjunctive alternative, plus consequence (for its sense of entailed reformulation) can be realised with the conjunctions OR and SO, our results show that manipulating the immediately preceding segment can shift participants' preference from relations associated with OR and SO to relations of contrast or concession. We take this as evidence that adjacency affects what coherence relations participants take to be available.

We then present results for *otherwise*. Again, different properties of the passage yield preferences among the set of available coherence relations. The lexical semantics of *otherwise*, as an indicator of an alternative, permits it to appear in passages which cohere via inferences of causal reasoning, or enumeration, or contrast between a generalization and an exception. Passages that instantiate each of these inferences yield different preferences in participants' conjunction choices, showing how manipulating semantic properties of the passage can alter the availability of particular coherence relations.

We close with results for *instead*. These will show that manipulating even a single property of the segments in a passage can alter the perceived availability of different coherence relations, as evident in participants' choice of conjunction. In this case, the lexical semantics of *instead* is not realized in participants' choice of conjunction since they rarely select a marker of disjunction; rather the conjunctions reflect relations of contrast and causality that are inferrable links between the segments.

All the results we present involve explicit discourse adverbials, from a task where we ask participants to fill in the conjunction(s) that best express how the two segments in a passage link together. The reason for this use of explicit adverbials and the conjunction-completion task is that these discourse adverbials are *anaphoric* (Webber et al., 2000, 2001) and are thus not constrained by structure as to what they establish discourse relations with. The same doesn't hold of conjunctions such as AND, BECAUSE, BUT, OR and SO. So a conjunction-completion task can be used to assess links between the segments.

1 *In other words*: Inference and Adjacency

We first noticed an OR~SO split for *in other words* in the crowd-sourced conjunction-completion experiment reported in (Rohde et al., 2016). In this experiment, participants identified only their top choice of conjunction to fill in the gap. While SO dominated participants' choice in all cases, only one case lacks OR as one of the choices (Figure 1). For this and other figures in the paper, each vertical bar represents a passage with the responses from each of our participants color-coded by conjunction.

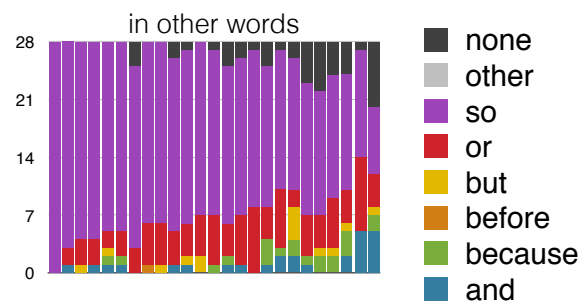


Figure 1: Stacked bar chart for participants' (N=28) conjunction completions in passages with *in other words* (Rohde et al., 2016)

The current study considered OR~SO splits associated with participants' identifying OR or SO or both as their top choice of conjunction. One possibility is that this split, as in passage (1), arises from two simultaneous sources: the lexical semantics of *in other words* and an inference of causal consequence. The latter derives from the segments themselves, whereby the second (reformulation) segment (i.e., the disappearance of an area the size of Central Park) is entailed by the first segment (the deforestation of 75,000 acres). One might therefore speculate that *in other words* would always license OR via its lexical semantics and SO via the entailment relationship. But this is not always the case,

- (2) Unfortunately, nearly 75,000 acres of tropical forest are converted or deforested every day. *I don't know where I heard that _____* in other words an area the size of Central Park disappears every 16 minutes.

Here BUT has become more available. That is, the substitutability of SO~OR in (1) appears to depend on the two segments being immediately adjacent.

Starting with 16 passages containing *in other words*, we created minimal pairs which varied in the presence/absence of a meta-linguistic comment, as in the pair (1)–(2) and the pair in (3)–(4).

- (3) Typically, a cast-iron wood-burning stove is 60 percent efficient _____ in other words 40 percent of the wood ends up as ash, smoke or lost heat.
- (4) Typically, a cast-iron wood-burning stove is 60 percent efficient. *How this is measured is unclear* _____ in other words 40 percent of the wood ends up as ash, smoke or lost heat.

For each passage, our 28 participants selected their preferred conjunctions, half seeing the passage variant with no intervening comment, and half seeing it with a comment.

Results Figure 2 shows the results. As predicted, participants selected SO/OR in the no-intervening-content condition, whereas with intervening content, the selection of OR decreases, while BUT (and occasionally BECAUSE) increase.¹ In the figure, the pair (1)–(2) corresponds to passage C and the pair in (3)–(4) to passage O. The latter shows no selection of OR, and a sharp drop in the selection of SO. We posit that increases in BUT associated with the intervening content indicate either an interruption of the meta-linguistic tangent or an intention to signal a contrast with the negative affect of the tangent itself (e.g., “I don’t know where...”, “frustrating way of putting it”, “How this is measured is unclear”). We speculate that an increase in BECAUSE in the with-intervening-content condition may arise when the intervening material implies that the situation is somehow surprising, which in turn merits explanation (e.g., “it’s an UNUSUAL role for her”, “Their ability to actually work sensitively is perhaps QUESTIONABLE”, “It’s STRANGE to think of a planet being born”). These hypotheses will themselves need to be tested.

Primary conjunction choice with 'in other words'

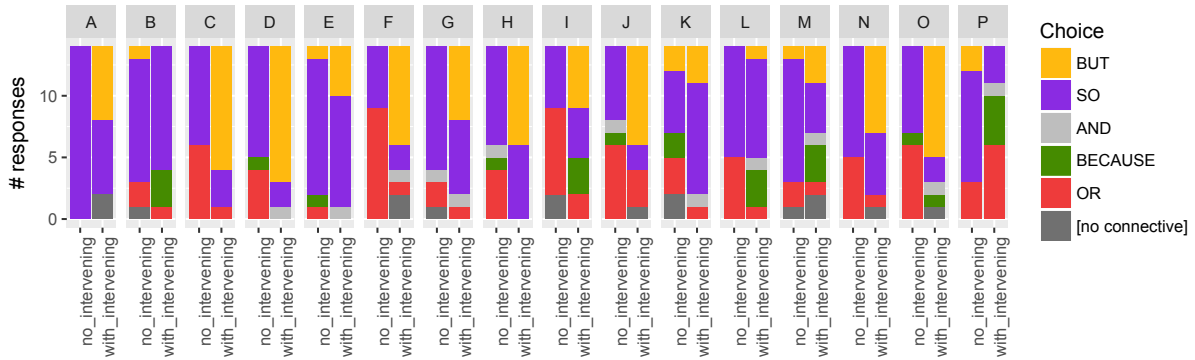


Figure 2: Distribution of first choice for participants’ conjunction completions in passages with *in other words*. Each participant saw only one variant.

2 Otherwise: Inference from semantic features of segments

We first noticed unexpected BECAUSE~BUT~OR splits for *otherwise* in the same crowd-sourced conjunction-completion experiment as with *in other words* (Rohde et al., 2016). (See Figure 3.)

Although in this earlier study, participants only identified their top choice of conjunction, our goal here was to test the hypothesis that such splits arose from a combination of the lexical semantics of *otherwise* and inference from the segments themselves of either causal reason or contrast.

¹Passage P in Figure 2 is an outlier. We speculate that participants took the *in other words* clause to link to the intervening material itself.

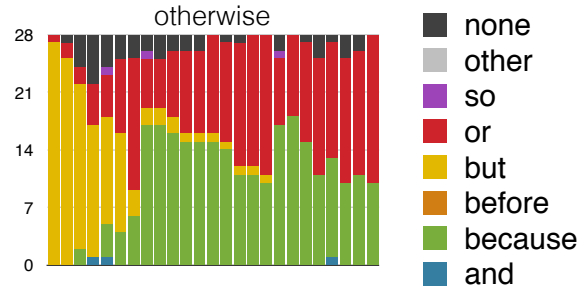


Figure 3: Stacked bar chart for conjunction completion passages involving *otherwise*, from (Rohde et al., 2016)

These inferences are linked to different uses of *otherwise*: in ARGUMENTATION, to provide a reason for a given claim, as in (5); in ENUMERATION, when the speaker first gives some preferred or more salient options, with *otherwise* introducing some alternative options, as in (6); and in expressing an EXCEPTION to a generalization that covers all but the specified disjunctive alternative(s), as in (7).

- (5) Proper placement of the testing device is an important issue _____ otherwise the test results will be inaccurate.
- (6) A baked potato, plonked on a side plate with sour cream flecked with chives, is the perfect accompaniment _____ otherwise you could serve a green salad and some good country bread.
- (7) Mr. Lurie and Mr. Jarmusch actually catch a shark, a thrashing 10-footer _____ otherwise the action is light.

Rohde et al. (2017b) showed that passages like these permit the establishment of disjunction alongside another relation. In (5), *otherwise* delivers the disjunctive alternative “if not placed properly”, alongside the inferred relation that the second segment conveys a reason for the first. Here Rohde et al. showed participant judgments of OR and BECAUSE, but not BUT.

In (6), *otherwise* delivers a disjunctive alternative that is another element of the enumeration, but stands in contrast with it (as less preferred or salient). Here Rohde et al. showed pairings of OR and BUT, but not BECAUSE.

In (7), *otherwise* delivers an alternative situation – an incident in which John Lurie and Jim Jarmusch catch a shark. On infers that, except for this incident, the right segment (that the action in the film is light) is an appropriate generalization. Here Rohde et al. showed only BUT (and the less specific AND) convey that this generalization contrasts with the first segment’s exception. There is neither causal reasoning nor a disjunction between alternatives since the scenarios described in both segments hold simultaneously.

Note that because of several overlaps in conjunction choice, some conjunctions cannot be unambiguously associated with one use of *otherwise*: While BECAUSE may unambiguously signal that a participant has inferred ARGUMENTATION, OR might indicate inference of either ARGUMENTATION or ENUMERATION.

We chose 16 passages for each use of *otherwise*. (While this was based on our judgment, we also elicited participant judgment through paraphrase selection, not discussed here.) For each passage, we asked participants to select the conjunction that best expressed how its two segments were related, and then any other connectives that they took to express the same thing.

Results On aggregate, our assigned use type correlate strongly with the connectives chosen by the participants – specifically, of the 448 judgments on ARGUMENTATION passages (28 participants × 16 passages), 411 were BECAUSE or OR or both ($\approx 92\%$). On EXCEPTION passages, 364 of the 448 judgments were BUT, AND or both BUT and AND ($\approx 81\%$). On ENUMERATION passages, 426 of the 448 judgments were BUT, AND or OR, or some subset thereof ($\approx 95\%$).

Turning to individual passages, participant choices are shown in Figures 4-6. For ARGUMENTATION (Figure 4), the effect is uniformly strong, with all passages showing BECAUSE or OR as participants' top choice, with OR or BECAUSE chosen as equivalent (shown in the columns labelled "second"). For EXCEPTION (Figure 5), BUT is consistently the participants' top choice.

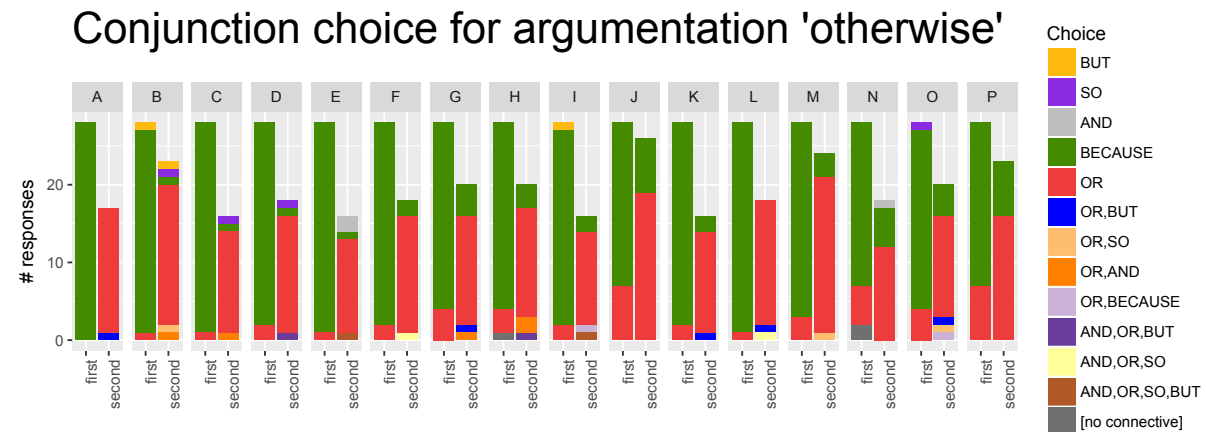


Figure 4: Distribution of first and second choice conjunctions for 'argumentation' *otherwise*. Labels in the legend such as "OR,BUT" are for multiple second choices.

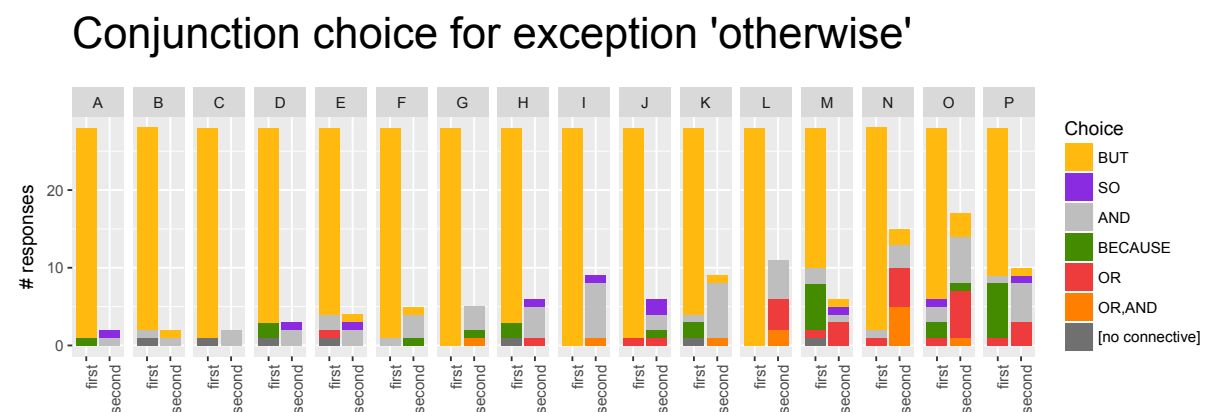


Figure 5: Distribution of first and second choice conjunctions for 'exception' *otherwise*. The label "OR,AND" in the legend implies both as second choices.

There are a few deviations (passages L through P in Figure 5) from this near uniform endorsement of BUT for EXCEPTION. But they would require too much space to discuss, and in any case, suggest further experimentation. Just for example, in passage M (see (8)) and P (see (9)), participants rarely identified any conjunction as conveying the same sense as BUT. However, when they selected BECAUSE as their top choice, they also selected OR as conveying the same sense. As noted above, BECAUSE and OR predominate with *otherwise* used in ARGUMENTATION. This raises the question as to what in passages M and P leads some participants to infer ARGUMENTATION and others, either EXCEPTION or ENUMERATION.

- (8) Democrats insist that the poor should be the priority, and that tax relief should be directed at them _____ otherwise they lack a cogent vision of the needs of a new economy. (Passage M)
- (9) He said that the proposed bill would give states more flexibility in deciding whether they wanted

to use the Federal money for outright grants to municipalities or to set up loan programs _____ otherwise it left last fall's Congressional legislation unchanged. (Passage P)

Finally, though the pattern for ENUMERATION (Figure 6) is harder to see, combinations of BUT, OR and AND predominate throughout participants' top choice, with a few tokens of BECAUSE and SO, but too few to analyse as anything but noise.

Conjunction choice for enumeration 'otherwise'

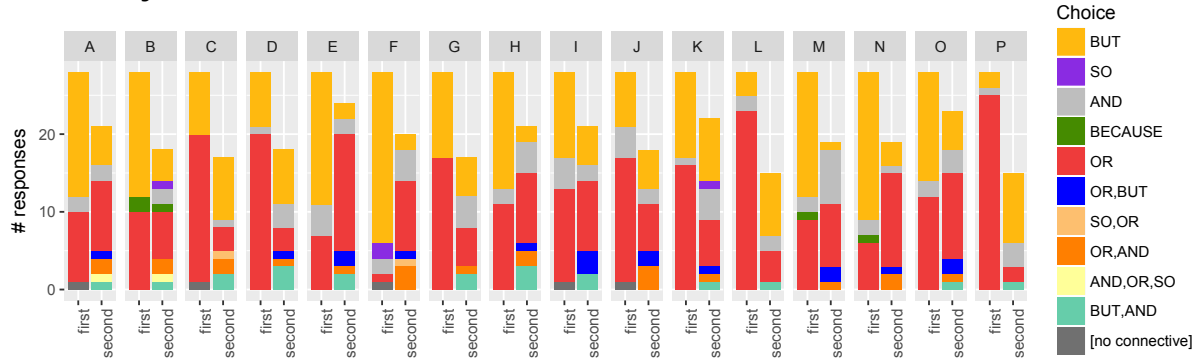


Figure 6: Distribution of first and second choice conjunctions for 'enumeration' *otherwise*. Labels in the legend such as "SO,OR" are for multiple second choices.

We conclude from the part of our experiment involving *otherwise* that our hypothesis is correct, that variability in participants' choice of conjunctions follows from both the lexical semantics of *otherwise* itself and the relation that participants infer between the segments in the passage.

3 *Instead*: Inference from a single manipulated property

Figure 7 shows participant choices in the conjunction-completion passages involving *instead* from (Rohde et al., 2017a). They range from passages on the left in which participants uniformly chose BUT, to one on the right where they uniformly chose SO. In the middle are many more in which some participants chose BUT and some chose SO. Even more surprising were passages like (10) from a subsequent experiment (Rohde et al., 2017b) where some participants selected both BUT and SO as equally expressing how the segments in the passage were related.

(10) There may not be a flight scheduled to Loja today _____ instead we can go to Cuenca. [BUT~SO]

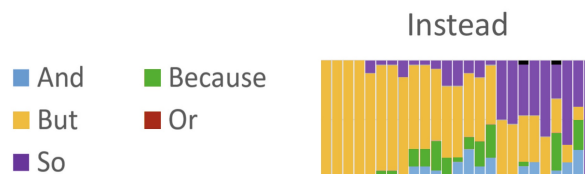


Figure 7: Stacked bar chart for participants' (N=28) conjunction completions in passages with *instead* (Rohde et al., 2017a)

These various BUT~SO splits cannot follow from *instead* itself, which simply conveys that what follows is an alternative to an unrealised situation in the context (Prasad et al., 2008; Webber, 2013). So the current experiment tested the hypothesis that the BUT~SO split is a consequence (as with *otherwise*) of inference from properties of the segments themselves.

Here we took 16 passages with *instead* and created one variant that emphasized the information structural parallelism between the clauses as in (11) and another variant as in (12) that de-emphasized that parallelism in favor of a causal link implied by a downward-entailing construction such as *too X* (Webber, 2013). We used the same conjunction-completion task as above. However, we report results for only 15 passages due to an error in how the 16th was presented to the participants.

(11) There was no flight scheduled to Loja yesterday _____ instead there were several to Cuenca.

(12) There were too few flights scheduled to Loja yesterday _____ instead we went to Cuenca.

Results On aggregate, participants responded very differently to the parallel and causal variants.

participant top choice	parallel	causal
BUT	169	6
SO	12	205
AND	19	13
BECAUSE	6	–
OR	1	–

Considering the individual passages, Figure 8 shows that in all cases, the parallel variant yielded more BUT responses, whereas the causal variant yields more causal SO.

Primary conjunction choice with 'instead', by passage

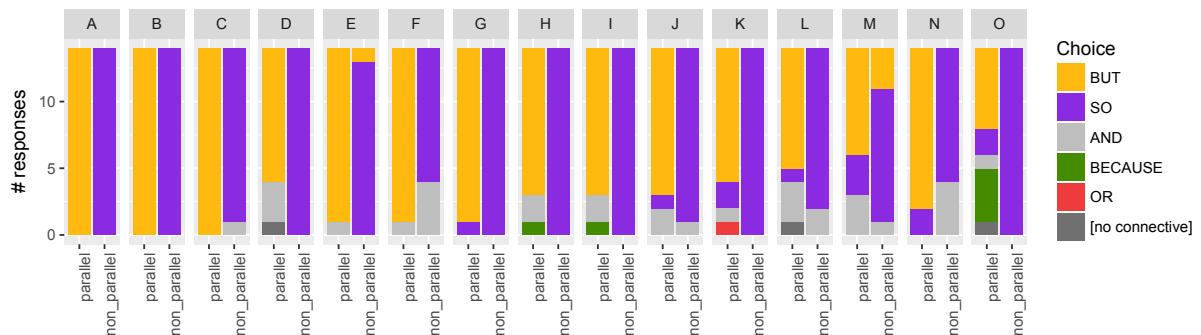


Figure 8: *Instead* passages, pairing a parallel variant and a causal variant. Each column shows the distribution of participants' first choice in the conjunction-completion task. Each participant saw only one variant.

There is a question though as to why inference yields such clean results for both parallel and causal variants of (13), corresponding to Passage A, while yielding much noisier results for the parallel variant of (14a), corresponding to Passage O.

- (13) a. Despite the change in government, Miss Bohley could have kept her seat in the German Parliament _____ instead she decided to retire from public view.
- b. With the change in government, Miss Bohley would have had a difficult battle for her seat in the German parliament _____ instead she decided to retire from public view.
- (14) a. Smugglers nowadays don't use overland passages _____ instead they use the seas to transport their goods.
- b. Smugglers' overland passages nowadays are too visible _____ instead they use the seas to transport their goods.

The answer simply seems to be that the negative claim in the first segment of (14a) could be explained by the positive claim in the second segment (BECAUSE), or contrasted with it (BUT), or a result of it (SO). That is, parallel constructions don't guarantee contrast, by virtue of their parallelism alone.

4 Conclusion

The analysis presented here explains conjunction substitutability in terms of both the lexical semantics of discourse adverbials and properties of the passages that contain them. This conjunction substitutability is additional evidence for believing in the simultaneous availability of multiple coherence relations and for believing that they arise from both explicit and implicit signals.

Acknowledgments

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