

The Meaning and Use of *Otherwise*

175-016 Semantics

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1 Introduction

Discourse connectives play an important part in every day communication. They are used to relate individual clauses and sentences. This in turn allows us to build a coherent understanding out of these discourse units. This also means that their semantics often cannot be determined purely within the confines of a single sentence. To further complicate matters connectives may or may not relate adjacent discourse units so the arguments of a connective may be hard to find.

This essay discusses the semantics of the discourse connective *otherwise*. A corpus study was performed to cast an empirical light on its meaning and use. Understanding a connective is about understanding what it relates. As such, the focus of this study was on placed on characterising the connective's arguments and suggesting how they might be identified. This was done with the broad goal of developing techniques for automated argument identification. Before this, however, it is necessary to have an understanding of its the different senses and previous work on the meaning of *otherwise*.

2 The Arguments of Discourse Connectives

Discourse connectives can be lexicalized as subordinate/co-ordinate conjunctions or as adverbial phrases. Consider the following examples:

1. *John failed the exam because he was lazy.*
2. *Sally did not take Jill to do pilates. She considers exercise an unnecessary evil. Instead, they went to the movies.*

Webber et al. (2003) argue extensively that this difference arises from the nature of the connective's arguments. In example 1, the arguments of *because* are built up syntactically and as such join structurally to the conjunction. This means its semantics can be built compositionally from syntactic structure. Hence, it is called a *structural connectives*.

Deriving a structural connection between the arguments of a discourse adverbial is not so easy. In example 2 the position of the left argument of *instead*

results in crossing dependencies. This non-tree structure makes compositional semantics difficult to define. Adverbial connectives derive one argument structurally and the other anaphorically. This means any interpretation of the connective requires some notion of anaphora resolution. Adverbial connectives are thus called *anaphoric connectives*.

3 Senses of *otherwise*

There are also other senses of *otherwise* that do not have these discourse relational properties. It is important to be able to distinguish these. Consider the following examples:

3. The company said the restructuring isn't expected to have any impact, adverse or otherwise, on its financial results.
4. All of this may be understandable enough: it is, however, in fact difficult to see how diocesan authorities could have acted otherwise.
5. For an otherwise silent moment, Jim's keys jingled nervously in his pocket.
6. In 1610, Hudson was probably in his early forties, a good navigator, a stubborn voyager, but otherwise fatally unsuited to his chosen profession.
7. If Joe doesn't show up, we'll all be back here at 0600 hours. Otherwise, we hold a reception.

In example 3, *otherwise* is preceded by the conjunction *or*. In general, *otherwise* can be used in conjunction with a noun or adjective to signify opposites or alternatives. This can also be seen as describing a set by exemplar. The general statement *X or otherwise* can be replaced with *X or not X*. Similarly *otherwise* in example 4 is roughly substitutable with *differently* or *by other means*. That is, suggesting other possible actions. Neither of these senses act as connective as they do not relate two discourse units.

Otherwise is also used to describe properties of an object. In the example 5 *otherwise* appears as a modifier in an adjective phrase. In example 6 it appears as a clausal modifier. In both of these cases, a finite number of properties that might contradict a more general property are enumerated. It can be interpreted as meaning *in other respects*. All properties are true of the object they describe at the same time.

The last point is not always true in the conditional usage. In example 7 the discourse unit following *otherwise* is only carried out if a previous condition fails, in this case if Joe does show up. It can be substituted with *if not* or (less naturally) with *else*. It is this conditionality that provides a discourse connective use. The following sections discuss interpretations of this sense in greater detail.

4 Previous work on interpreting *otherwise*

Webber et al. (1999) analyze *otherwise* as an assertion with respect to possible worlds. Let C be some condition presupposed in the discourse. *Otherwise* α has the following interpretation: α is true in the set of worlds that are consistent with our knowledge of the real world but not with C . This means α must be a feasible alternative if C is false. The anaphoric argument (antecedent) we seek is the discourse unit that contributes this presupposed condition.

Kruijff-Korbayova and Webber (2001) extended this work to consider the influence of information structure (IS) on the interpretation of *otherwise*. Information structure describes the way language is used to reflect and affect context (Kruijff-Korbayova and Steedman, 2003). Sentences are partitioned into *theme* and *rheme*. A sentence's *theme* indicates given information which the *rheme* (new information) predicates over. In English this is usually conveyed via intonation although it can also be extracted by the use of questions.

The presupposed condition C may be supplied from the theme or the rheme of a discourse unit. If the antecedent occurs in an *if-then* construction, C could arise from the *if*-clause (theme) or purely the main *then*-clause (rheme). Moreover, C might arise from only part of the theme or rheme. Thus, α may or may not be consistent with the theme of the antecedent. This effects what we can assume as our real-world knowledge as it derives from context updates.

This has implications if we wish to identify such presuppositions. The empirical study by Cresswell et al. (2002) found that the antecedent of *otherwise* generally occurs close to the connective. That is, in the same or previous sentence. However, the possibility of partial theme and rheme conditions means that greater precision is required to correctly identify the presupposed condition.

This also makes it all the more important to determine which the features that trigger the condition. Besides the *if*-clause, the possibility of alternative possible worlds may be contributed by a number of other devices. These include modal, infinitival clauses and possibly certain classes of verbs.

Webber et al. (1999) also notes that *otherwise* can be used with other discourse relations, sometimes implicitly. For example, inferential *because*. These causal relations may also indicate alternative possibilities. However, the attributes and relationships governing the interpretation have not been yet been mapped out in detail.

5 A corpus study of *otherwise*

This study attempts to understand the meaning and use of *otherwise* via its anaphoric and structural arguments. This is done in the context of a three corpora. The *Wall Street Journal* corpus contains 1 million words from that editions of that newspaper published in 1989. The *Brown* corpus contains 1 million words from American English texts printed in 1961. These texts are gathered from fifteen categories ranging from press reportage to romantic fiction. The *Switchboard* corpus (Godfrey et al., 1992) comprises of approximately

	Sense	Wall Street Journal	Brown	Switchboard	Total
1.	‘or otherwise’	6 (16%)	12 (15%)	8 (13%)	26 (15%)
2.	‘By other means’	8 (21%)	26 (33%)	3 (5%)	36 (20%)
3a.	‘In other respects’ (clausal)	2 (5%)	6 (8%)	14 (23%)	23 (13%)
3b.	‘In other respects’ (Adj)	5 (13%)	6 (8%)	0 (0%)	11 (6%)
4.	Conditional	17(45%)	29 (37%)	35 (59%)	81 (46%)
	Total	38	78	61	177

Figure 1: Frequency of senses of otherwise: NB percentages may not add to 100 due to rounding

3 million words of conversational speech (2500 conversations from 500 speakers). These corpora are part of the Penn Treebank (Marcus et al., 1994) and are annotated with syntactic structure.

The main emphasis here is placed on the anaphoric argument. That is, what can provide the condition that *otherwise* is evaluated over and how can it be identified. The goal here is to determine characteristics that could be used in algorithms for resolution of the anaphoric argument. This study follows a similar methodology to the study by Miltakaki et al. (2003) of the discourse adverbial *instead*. Each corpus has been manually annotated to identify different sense occurrences and both anaphoric and structural arguments of the conditional sense. After examining subsets of the data, a number of lexico-syntactic features of the anaphoric argument were also identified and annotated. Frequencies of annotations were extracted using the Unix tool `grep`. The results are discussed in the following sections.

6 Triage: identifying senses of otherwise

A total of 177 occurrences of *otherwise* were found in the three combined corpora. However, Section 3 identified four general senses of *otherwise*, not all of which admit an anaphoric argument. On the other hand, being able to identify lexico-syntactic properties of non-connective senses contributes to understanding the semantics of *otherwise* as discourse adverbial. The frequency counts of the various senses are given in figure 1.

The *or otherwise* sense is the simplest to identify. All occurrences of *or otherwise* and all except one of *and otherwise* are of the same sense. Thus instances of *otherwise* that appear directly after *and* or *or* do not require an anaphoric argument.

The key factor in identifying the *differently/by other means* sense is *otherwise* modifies a verb in close proximity (often immediately previous). Also, occurrences within one or two words of the conjunction *than* should be identified with this sense. Note this sense is less frequent in conversation (Switchboard) than it is in the text corpora. The opposite is true in the next sense.

The sense *otherwise* corresponding to example 5 (*in other respects*) can be identified syntactically as part of an adjective phrase. It can be preceded

Construction	WSJ	Brown	Switchboard	Total
If-then (explicit)	1 (6%)	7 (24%)	13 (37%)	21 (26%)
If-then (implicit)	2 (2%)	4 (14%)	4 (11%)	10 (12%)
Relative clause	8 (47%)	5 (17%)	3 (9%)	16 (20%)
Other	6 (35%)	13 (45%)	15 (43%)	34 (42%)

Figure 2: Antecedent constructions

by a determiner or a preposition (eg. ‘in otherwise dreary conditions’). The clausal modifier version of this harder to categorize. This sense often seems to be triggered by the conjunction *but*. This accounts for *but otherwise* occurrences in the Wall Street Journal and Brown corpora. However, examples in Switchboard have this combination appearing in the conditional sense. The main difference appears to be that noted before; the clausal modifier is part of an enumeration of properties. As such, (*but otherwise*) may refer to large sections of discourse on a certain topic instead of a presupposed condition. This is particularly evident in the Switchboard data. An example there ¹ included several minutes discussion on recent viewing of the Turner Broadcasting Network concluding with a reaffirmation of preference for PBS ².

7 Otherwise and the making of an antecedent

Adverbial connectives act as relational anaphora as such require two units to relate. Knott (1996) suggests a simple test for connectiveness: if a sentence containing the adverbial cannot be understood when it is isolated, then it is probably a connective. However, this does not help identify the antecedent.

The following section attempts to uncover more objective and computable features of the conditional discourse connective sense of *otherwise*. In the following all references to *otherwise* will be to the conditional sense unless otherwise marked.

7.1 Antecedent and *if*

The anaphoric antecedent of *otherwise* was found in variety of constructions. The frequency distributions can be found in figure 2. The following provides further description of these constructions.

Approximately 26% of antecedents (anaphoric arguments) of *otherwise* were found in explicit *if-then* constructions preceding the connective. These comprised 70% of the *if*-clauses in a sentence immediately preceding *otherwise*. So, this is a good indicator of the antecedent’s location.

A further 12% of antecedents could be paraphrased as an *if-then* construction. This seems to arise primarily from a causal relationship indicated by another discourse connective. For example:

¹This was discussion number 2039.

²The exact words were *But, uh, but otherwise you know we, uh, with PBS and so forth.*

8. Since there is a continual loss of micrometeoritic material in space because of the radiation effects, there must be a continual replenishment: otherwise, micrometeorites would have disappeared from interplanetary space.

Here the *since*-subordinate clause is evidence that ‘there must be continual replenishment’. This example could be paraphrased into a conditional statement

9. If there is continual loss of micrometeoritic material in space because of the radiation effects, then there must be continual replenishment,

which leads to an interpretation of the *otherwise* statement:

10. If there is continual loss of micrometeoritic material in space and there isn’t continual replenishment then the micrometeorites would have disappeared from interplanetary space.

The presupposed condition derives from the whole of example 8. Note, however, for the structural argument of *otherwise* to be true, the *then*-clause of example 9 must be negated. That is, the rheme of examples 8 and 9.

In this sense, *since* is substitutable with the subordinate conjunction *because*. Other subordinate conjunctions that provided a similar paraphrase were *where*, *when* and the adverbial *so*. Here, the casual nature of these connectives admits alternatives. As such, other similar discourse connectives (for example, *thus*, *consequently*, *as a result*) may trigger an *otherwise*-condition. However, it is still not clear whether the cause or the consequence acts as the presupposed condition. However, in *if-then* constructions (explicit or not) it appears that the *if*-clause is much more likely to contribute the *otherwise* condition than the main clause (71%).

7.2 Relative clauses

Approximately a quarter of *otherwise*’s appearances occurred in relative clauses. For example:

11. Market-based pollution control may consume some capital that would otherwise purchase state industries

This can be paraphrased into two sentences using the discourse deictic *that*:

12. Market-based pollution control may consume some capital. Otherwise that capital would purchase state industries.

That is, ‘if market-based pollution control does not consume some capital, that capital would purchase state industries’. In general we can consider the form: *if* $\neg V_1(X, Y)$ *then* $V_2(Y, Z)$, where the V_i are predicates. In this case, *otherwise* signals an alternative action for the object of the antecedent.

In this construction, the antecedent occurs in the same sentence as the consequent. If we can resolve the relative pronoun, we can infer the presupposed condition. This should be the closest clause that involves that resolvent as an object.

Argument	WSJ	Brown	Switchboard	Total
antecedent	3 (18%)	13 (45%)	19 (54%)	35 (43%)
consequent	10 (59%)	21 (72%)	18 (51%)	49 (60%)

Figure 3: Occurrences of modal auxiliaries: percentages are calculated with respect to the number of occurrence of *otherwise* as discourse connective

7.3 Modal auxiliaries

The majority of antecedents are not constrained by relative clause structure. Nor can they be paraphrased as an *if-then* construction. What we can say is that antecedents are generally statements that form a conditional relationship with the consequent when negated.

It was suggested earlier that occurrences of modals could signal the anaphoric argument of *otherwise*. It is in this seemingly constraintless situation that they become prominent. Modals occurred in 43% of the antecedents (cf. figure 3). These made up 88% (30 out of 34) of the antecedents categorized as *other* in figure 2.

In this data, the modals occurring in antecedents of *otherwise* expressed an opinion of actions to be performed in the future³. They are often used in this sense to make a recommendation or to make an action obligatory. The consequent of the *otherwise*-clause (structural argument) then expresses a evidence for that opinion. This is done through the explication of undesirable alternatives. For example:

13. For both economic and political reasons *all segments of the population must be able to share in the growth of a country*. Otherwise, development will not lead to long run stability.

Modals in antecedents can be used to demonstrate possibility. The consequent of *otherwise* may also contain a modal. However, it now expresses other viable (perhaps desirable) alternatives. The consequent does not effect the desirability of antecedent. Consider the following non-corpus example⁴.

14. Jill might be in the study. Otherwise she might be in the kitchen.

In general, a major of use of *otherwise* is to predict alternatives. The fact that they are predictions can be gleaned from the corpus data. Approximately 60% of consequents contain a modal.

The difference between these two uses appears to be whether there is a causal relationship between antecedent and consequent. This can be demonstrated by making the implicit connective *because* explicit. That is, we can insert *because* before *otherwise* in example 13 but not in example 14. In second use, the

³In this data *would* only occurs in in the form *would have to*

⁴In fact there were no examples of this kind in the corpora, yet it is clearly a reasonable thing to say. This is a major disadvantage of corpus linguistics

Clause position	Wall Street Journal	Brown	Switchboard	Total
That-complement	4 (23%)	2 (7%)	7 (20%)	13 (16%)
conjunction	4 (23%)	2 (7%)	7 (20%)	13 (16%)
relative clauses	2 (12%)	0 (0%)	0 (0%)	2 (2%)

Figure 4: Distributions of antecedent as embedded clause. Note, in all of these cases the antecedent occurred last in the sentence previous to the occurrence of *otherwise*

conjunction *but* can inserted in example 14 but not in example 13. This gives *otherwise* an *exclusive or* interpretation.

Finally, The *exclusive or* use of *otherwise* can also suggest a repetitive alternation of states or actions. Consider the following:

15. We are already committed to establishing man’s supremacy over nature and everywhere on earth, not merely in the limited social-political-economical context we are fond of today. Otherwise, we go on endlessly trying to draw the line, colour and other, as to which kind of man we wish to see dominate

Here there are two types of actions have occurred repeatedly: (1) establishing man’s supremacy and (2) deciding which man will dominate.

7.4 Verbs in the antecedent

The main verb of the antecedent may also shed some light onto the interpretation of *otherwise*. However, the distribution of these verbs appears uniform. This is likely to be due to the sparsity of the data. However, there were noticeable clusterings that a larger study may be able to confirm.

Any verb can participate in the antecedent of *otherwise*. However, it appears some are more likely than others to generate the necessary presupposition. From the data examined, there are verbs that do indicate alternatives. For example, *need*, *want* and *demand* all express a desire that may or may not be fulfilled. To *urge* is to recommend a course of action, excluding other possibilities. Similarly, to *choose* or *decide* is to reject alternatives.

Furthermore, 17% of antecedents also occurred as that-complement clauses (cf. figure 4). In the majority cases the matrix verb was a version of *to say*. The other matrix verbs were of a similar feel: *think*, *decided*, *suggest*, *note*. That is, verbs of reported speech or thought. These too, alongside verbs of desire or choice, need to be considered along with modals when determining if a clause is an antecedent of *otherwise*.

8 Distance data

This corpus study confirmed that the antecedent of *otherwise* is usually found close to the connective (cf. figure 5). When discourse did intervene between

Construction	Wall Street Journal	Brown	Switchboard	Total
Same sentence	9 (53%)	12 (41%)	16 (45%)	37 (46%)
Previous sentence	6 (35%)	16 (55%)	15 (43%)	37 (46%)
Previous paragraph	2 (12%)	1 (3%)	4 (11%)	7 (8%)

Figure 5: Distance data: frequencies of the location of the antecedent relative to *otherwise*

Construction	Wall Street Journal	Brown	Switchboard	Total
SS gap	0	1	0	1
PS gap	0	1	3	4
PP gap	2	1	4	7
if-then	1	6	2	9

Figure 6: Gap data: frequencies of occurrence of extra text between the antecedent and *otherwise*. SS, PS and PP gaps refers to the antecedent being in the same sentence, previous sentence and previous paragraph respectively. if-then indicates where gaps were caused by *if* or main clauses in a *if-then* construction that did not contribute to the presupposed condition

otherwise (cf. figure 8) and its arguments, the text was primarily an elaboration of condition or to provide a alternative course of action. No antecedent spanned more than one sentence. Moreover, the antecedent always appeared as the last clause in multi-clause sentences. It appears that *otherwise* places only weak selectional restrictions on its arguments. However, frequency distributions may skew towards certain types of constructions such as *if*-clauses. That is, locality is more of an issue than with other discourse connectives.

In any case, an automated method of locating the antecedent should start from the connective and concentrate on the same and previous sentence.

9 Conclusion and Further Work

The discourse connective *otherwise* can be understood as relating the negation of a presupposed condition with a further state or event. The ‘left’ argument contributes the presupposed condition and is derived anaphorically. The makes it difficult to locate that argument in previous discourse. Thus, interpretation of *otherwise* can be viewed as an anaphora resolution problem.

A corpus study of *otherwise* was performed on three subcorpora of the Penn Treebank. The study examined constructions that distinguished the conditional sense and could be used to identify the anaphoric argument (or antecedent). Existence of *if*-clauses and positioning of *otherwise* in relative clauses provide constraints on the antecedent location and interpretation. A number of antecedents could be paraphrased into *if-then* constructions. This was attributed to appearance of ‘causal’ discourse connectives in or near the antecedent. When

a conditional construction could be inferred the majority expressed the presupposition in the *if*-clause.

For the remaining majority of cases it was seen that modals and certain types of verbs had a part in triggering other possible worlds. Two uses of *otherwise* were further identified. The first evidenced a recommendation by contrasting it with an undesirable alternative. The second could be considered as a conditional *exclusive or* which could also have a habitual interpretation. Although both are require a conditional interpretation, this does seem to indicate a further, finer distinction in sense.

The Switchboard corpus was selected in order to highlight differences between written and spoken usage of the connective. There were indeed differing frequencies of usage. However, at this level of inquiry there appeared to be little difference in the characteristics of that usage. The properties described above could be found in all three corpora. The main differences appeared to be in the use of *in other respects* sense where *otherwise* could refer to large sections of previous dialogue. Nevertheless further study is warranted on these different sorts of data. Given that information structure is indicated in English by intonation further prosody data would be of great use in identifying the antecedent. A study of discourse disfluencies may play a similar indicative role.

Overall, there is still much to be learnt about *otherwise*. For example, verbs trigger other possible worlds require a deeper characterisation. Similarly, the interaction and precedence of other connectives on *otherwise* could be better formalised. This requires more work on developing representations for interpretations of *otherwise* and its relationship with its arguments.

A larger sample size and greater ease of data collection would also certainly help. The forthcoming Penn Discourse Treebank (Miltsakaki et al., 2004) should greatly facilitate this. This project builds on top of the Penn Treebank adding a layer of discourse structure annotation. This would have easily provided many of the statistics found here. Identification of arguments is somewhat subjective so some level of inter-annotator agreement would make the data also much more reliable. Until that larger sample is available, the features presented in the essay could be used develop automated annotation tools.

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