Journal of Pragmatics 152 (2019) 46–60

Contents lists available at ScienceDirect

Journal of Pragmatics

journal homepage: www.elsevier.com/locate/pragma

Meaning-preserving contraposition of natural language conditionals

Gilberto Gomes

UENF – Northern Rio de Janeiro State University, R. Lopes Quintas 100-605-I, 22460-012, Rio de Janeiro, RJ, Brazil

ARTICLE INFO

Article history:
Received 19 April 2019
Received in revised form 25 July 2019
Accepted 1 August 2019

Keywords:
Contraposition
Conditionals
Indicative conditionals
Counterfactual conditionals
Concessive conditionals
Implicative conditionals

ABSTRACT

It is argued that contraposition is valid for a class of natural language conditionals, if some modifications are allowed to preserve the meaning of the original conditional. In many cases, implicit temporal indices must be considered, making a change in verb tense necessary. A suitable contrapositive for implicative counterfactual conditionals can also usually be found. In some cases, the addition of certain words is necessary to preserve meaning that is present in the original sentence and would be lost or changed in the contrapositive without them. A distinction is made between adding new meaning and adding new words to preserve existing meaning. For concessive conditionals and relevance conditionals, however, no valid contrapositive can be found. They do not belong to the class of contraposable conditionals, which can be independently defined. Difficult cases are also discussed in which the contradictory of the consequent semantically entails the truth of the antecedent. In such cases the content of the antecedent is implicit in the meaning of the consequent. Contraposition becomes possible if what is implicit in the original consequent is made explicit in the contrapositive antecedent.

1. Introduction

The following is an attested example of contraposition of conditionals:

(1) *If it's natural leather, it'll cost you more than one hundred dollars. (…) If it costs less than one hundred dollars, it isn't natural leather.*[1]

The inference from *If p, then q* to *If ~q, then ~p* (contraposition) is valid in traditional propositional logic. This validity is easily explained by the definition of the material conditional, according to which a conditional is false when its antecedent is true and its consequent false *(p and ~q)*, and true otherwise. Assuming a bivalent logic, the truth of the antecedent of a conditional *(p)* is the falsity of the consequent of its contrapositive, and the falsity of its consequent *(~q)* is the truth of the antecedent of its contrapositive, so that the same conjunction of conditions makes a conditional and its contrapositive false

E-mail address: ggomes@uenf.br.

[1] I heard this example from a salesperson, talking about leather jackets, in a shop in Edmonton, Alberta, Canada, where I was for a conference, in 2013, and noted it down. *It will cost you less than one hundred dollars* is approximately equivalent to the negation of *It will cost you more than one hundred dollars.*

https://doi.org/10.1016/j.pragma.2019.08.003
0378-2166/

(and the same three remaining conjunctions make them true). The material conditional, however, seems inadequate to account for conditionals as they occur in natural language or in logical thought.

In 'A theory of conditionals', Robert Stalnaker (1968) introduced a new way of explaining natural language conditionals. According to Stalnaker (1990):

> The basic idea of the analysis was very simple: a conditional statement, *if* Φ *then* Ψ, is true in a possible situation α if and only if the consequent Ψ is true in a possible situation (or class of possible situations) that is a function of α and of the antecedent Φ. […] Alternative developments of this simple idea impose different constraints on such selection functions.

This is not the place for a general discussion of this account, which is largely similar to the one developed by David Lewis (1973) for counterfactuals and has, since then, become a standard account of conditionals. Here I will focus on the problem of contraposition, as discussed in the literature on conditionals. In the logic of conditionals that was developed from such semantic theories, contraposition is invalid. The failure of contraposition is illustrated in examples that will be examined below and, according to Stalnaker (1992), "the abstract semantics helps explain the failure: that B is true in the closest A world says nothing about what must be true in the closest world in which B is false". Failure of contraposition, along with failure of transitivity (hypothetical syllogism) and of strengthening of the antecedent, has been widely accepted as characterizing the nonmonotonicity of conditionals.

However, I argue that there is still room to discuss contraposition and its failure in relation to natural language conditionals. First, we still have to consider the strong intuition that contraposition *must* somehow be valid, at least for a large class of conditionals.[2] When we say *If A, then B*, this seems to imply that if B is not the case, A cannot be the case either, because if it were, B would also be the case (according to *If A, then B*). And B cannot be and not be the case at the same time. Modus tollens and contraposition are formally distinct, and may be considered as inference schemes that are not necessarily valid at the same time. However, from an intuitive perspective, they are intimately related, because if you take *If p, then q* as a premise, then inferring *If ~q, then ~p* (contraposition) is intuitively very similar to taking *~q* as a second premise and inferring *~p* (modus tollens). The only difference is that in modus tollens *~q* is accepted as true, and in contraposition merely as possible. But the inference from *~q* to *~p* itself, when *if p, then q* is accepted as a premise, is the same in both cases. Both inferences stem from the intuitive idea that, *q* not being the case, *p* cannot be the case either, given that *If p, then q* is true — because if *p* were the case, *q* would also be the case.

Another way of expressing this idea is to say that a conditional *If p, then q* means that the truth of *p* is always accompanied by the truth of *q*, within a certain set of circumstances (to be specified by one's preferred theory of conditionals). If this is so, the falsity of *q* must also be accompanied by the falsity of *p*, in the same set of circumstances — and therefore we can say a sentence meaning *If ~q, then ~p*.

Second, we have to take into account the fact that, for many conditionals, contraposition is certainly valid. Of course, one counterexample is enough to refute that an attribute is a general property of a certain class, but we also have to consider the possibility that those conditionals for which contraposition fails either fall into different classes of sentences, or accept a differently defined sort of contraposition. Natural language is very subtle and complex. It may harbor different cognitive structures under the same grammatical form. And the meaning of sentences is not always a simple function of their constituents.

It must be recognized that attested examples of contraposition are rare. Having stated a conditional, a speaker is seldom motivated to state its contrapositive, which conveys basically the same information. More than a common phenomenon of natural language, contraposition is a logical operation that can or cannot be applied to natural language conditionals, and may help identify the properties of the class of conditionals to which it can be applied. However, the hearer/reader has usually no difficulty in assessing whether or not a given contrapositive conveys roughly the same thing as the original sentence. (Controversy arises rather in relation to what counts as contraposition, i.e., what should be considered as the suitable contrapositive of a conditional.) In addition to (1), here are some examples of conditionals for which contraposition makes very good sense:

(2) She said that she had left at 10:00 and that it was raining a lot when she left. But that's impossible, because it started raining at 10:15. If it was raining a lot when she left, she didn't leave at 10:00. If she left at 10:00, it wasn't raining a lot when she left.
(3) John's blood type is AB. According to genetics, someone whose blood type is AB cannot have a child with type O blood. If Andrew is John's biological son, his blood type is not O. If his blood type is O, he isn't John's biological son.
(4) If he is a psychiatrist, he is a medical doctor. If he is not a medical doctor, he is not a psychiatrist.

Third, a careful examination of examples in which contraposition seems to fail shows that for many of them, it is possible to find a suitable contrapositive. We are still left with examples for which any sort of contraposition is undeniably invalid, but there seem to be independently motivated reasons to consider these examples as belonging to classes of conditionals different

[2] A humorous one-page defense of the intuition that contraposition of conditionals must be valid for a class of conditionals can be found in Clark's (1976) article 'If conditionals were not contraposable…', reacting to Downing's contention that "contraposition applies to no conditionals, of whatever type" (Downing, 1975: 88).

from the class of those that accept contraposition. We should thus consider the hypothesis that natural language conditionals must be divided into two groups, contraposition (in some form) being valid for one of them and invalid for the other.

Finally, if the abstract semantics predicts failure of contraposition, as Stalnaker (1992) states, and contraposition (in some form) does not fail for a significant class of conditionals, then this would be sufficient reason to question whether this abstract semantics is strong enough to adequately describe this class of conditionals. The same question may be raised in relation to other theories of conditionals for which contraposition is invalid.

It must be emphasized that I am arguing that meaning-preserving contraposition is valid only for a class of conditional propositions, in which the truth of the antecedent is presented as sufficient for the truth of the consequent, within a certain set of circumstances.[3] It is assumed here that there are such things as conditional propositions, which can be conceived in different ways but are distinct from the sentences that express them. An empirical test for this class of conditionals is given by the possibility of paraphrasing the sentence with (i) *then as a consequence*, (ii) *we can infer from this that*, or (iii) *it's because*.

Conditionals of the class that accepts one of the above-mentioned paraphrases may be called *implicative conditionals*, since they convey that the truth of their antecedent in some sense *implies* that their consequent is also true.[4] They have been termed *strong conditionals* by Davis (1983) and *robust conditionals* by Lycan (2001). These authors have mentioned that contraposition may be valid for these conditionals, but they have not explored the problem systematically, neither have they examined all the different kinds of counterexamples to contraposition that are discussed here. Admittedly, for other classes of conditionals, contraposition is invalid. These include concessive conditionals and relevance conditionals.

The rest of this paper is organized as follows. Section 2 presents a detailed investigation of many alleged counterexamples to contraposition, showing that meaning-preserving contraposition is possible for them, mainly by way of adjustments in the verb forms used in the contrapositive. In some cases, the adjustments to be made involve the addition of certain words in the contrapositive. Many will certainly have difficulty in accepting this maneuver, since it may seem as adding new meaning to the sentence. However, I argue that these added words do not introduce additional meaning, but rather preserve meaning that was already implicitly present in the original sentence and would be lost in the contrapositive without them. Section 3 is a brief discussion of the empirical distinction between contraposable and non-contraposable conditionals on the basis of their accepting or not at least one of the above-mentioned paraphrases.

Section 4 discusses the difference between simple contraposition and meaning-preserving contraposition, and the question of the formalization of meaning-preserving contraposition, highlighting the contrast between formal language and natural language. Section 5 discusses concessive conditionals. Conditionals that are evidently concessive are not counterexamples to my thesis, as noted above. However, I will show that there are conditionals that do not seem to be concessive but actually are, and which thus do not accept contraposition. Conditionals that seem to be concessive but which are not, according to the proposed criteria, will be discussed in Section 6. Meaning-preserving contraposition is possible for the latter. Section 7 covers relevance conditionals, showing that contraposition is invalid for them. Section 8 examines some difficult cases, in which the contradictory of the consequent of an implicative conditional semantically entails the antecedent, and investigates how a valid contrapositive can be built for them. Section 9 presents my conclusions.

2. Finding the meaning-preserving contrapositive of a conditional

2.1. Necessary changes in tense

Finding an adequate contrapositive for a conditional is often difficult. The easy way out is simply to exchange the content of antecedent and consequent, changing both to the negative but keeping (almost) the same words, and pronounce that contraposition failed. For example:

(5) If he comes, I leave. If I don't leave, he doesn't come.

Note that keeping exactly the same verb forms may even lead to ungrammatical results:

(6) If he comes, I'll leave. If I won't leave, he doesn't come.

In such cases, a change in the verb forms used is usually accepted:

(7) If he comes, I'll leave. If I don't leave, he won't come.

[3] This idea of sufficiency can be formulated in different ways. Gillies (2004: 587), for example, states that "φ is sufficient to commit an agent to ψ if that agent is committed outright to the epistemic conditional $\varphi \Rightarrow \psi$". See also Gomes (2009).

[4] My use of the term *implicative conditionals* corresponds in part to Declerck and Reed's (2001).

Now the contrapositive is grammatical, but has a different meaning from the original conditional, since it involves the opposite temporal sequence. Thus, not only does syntax have to be taken into account, but also semantics and pragmatics. The meaning of the first conditional in (7) clearly involves a temporal sequence, which can be made explicit as: *If he comes at* t_i*, I'll leave at* t_j, where t is time and $j>i$. Contraposition, if it is to preserve the meaning of the original sentence, should not exchange the temporal indices, so it should run as: *If I don't leave at* t_j*, he won't come at* t_i, where again $j>i$. However, the natural way to express this temporal relation in English (and other languages) is to use the future perfect in the consequent:

(8) If he comes, I'll leave. If I don't leave, he won't have come.

With the use of the adequate verb tense, we arrive at a valid contrapositive. We may then say that contraposition is valid for the conditional proposition expressed by the first conditional sentence in (8), and that the contrapositive proposition is expressed by the second conditional sentence. A change in tense is also necessary in the following example:

(9) If butter is heated [*at* t_i], it melts [*at* t_j]. If butter does not melt [*at* t_j], it was not heated [*at* t_i].

McCawley (1993: 82–3) finds that contraposition fails for (10), since (11) has a different meaning:

(10) If I don't do heavy exercise, my pulse doesn't go above 100.
(11) If my pulse goes above 100, I do heavy exercise.

However, a consideration of implicit time indices makes it clear that a suitable contrapositive is easily obtained with a change in tense, showing that the exercise precedes pulse increase in both sentences:

(12) If my pulse goes above 100, I have done heavy exercise.

2.2. Contraposition of counterfactuals

Counterfactuals are also cited as showing the failure of contraposition. Let me make clear that I call *counterfactual* only those conditionals in which the antecedent is *contrary-to-fact*. If the antecedent is not contrary-to-fact, but the conditional has *would* in the consequent and subjunctive/past/past perfect morphology in the antecedent, I call it a *subjunctive conditional*, not a *counterfactual*. (Most subjunctive conditionals are counterfactuals, and most counterfactuals are subjunctive conditionals, but there are exceptions.) Consider the following example, uttered in a situation in which you did not burn your finger:

(13) If you had touched the pan, you would have burned your finger.

The following contrapositive is clearly inadequate:

(14) If you hadn't burned your finger, you wouldn't have touched the pan.

(14) implies that you did burn your finger, but this is not implied by (13). Therefore, (14) cannot be inferred from (13). However, let us consider Goodman's (1947: 114) suggestion that the contrapositive of a counterfactual must be a conditional with a true antecedent and consequent. This old wisdom was lost in subsequent theories of conditionals, which tend to separate indicative and counterfactual conditionals and favor a more literal rendering of contraposition. This is Goodman's example:

(15) If that piece of butter had been heated to 150 °F, it would have melted. Since that piece of butter did not melt, it wasn't heated to 150 °F. (Goodman, 1947: 113–114)

Goodman uses *since* in the contrapositive, but *if* could have been used as well. Note that Goodman gives an indicative conditional as the contrapositive of a counterfactual.

Many authors think that the contrapositive of a counterfactual should be a counterfactual as well. This seems to come from a tendency to treat natural language as if it were a formal language, or from the idea that *if* has different meanings in indicative and in counterfactual conditionals. However, if a conditional is used in a situation in which the speaker believes that its component clauses describe what is *not* the case (as is most often the case with subjunctive conditionals), it is only natural that the negation of these component clauses should describe what the speaker believes *is* the case. Consequently, indicative verb forms are usually adequate in the contrapositive, instead of the past-for-present or past-perfect-for-past forms (also called subjunctive forms) of the antecedent and the *would*-forms of the consequent used in the counterfactual. Thus, a meaning-preserving contrapositive for (13), in the assumed context, would be:

(16) If you didn't burn your finger, you didn't touch the pan.

This is a perfectly meaningful sentence and it seems undeniable that it can be inferred from (13). It might find its place, for example, in the following piece of conversation:

(17) X: *You must be more careful. If you had touched the pan, you would have burned your finger.*
Y: *How do you know I didn't touch the pan?*
X: *Is your finger burned? Certainly not. If you didn't burn your finger, you didn't touch the pan.*

Certainly the two conditionals stated by X can be inferred one from the other. And certainly the propositional contents of the antecedent and of the consequent of one of them are the negation of the propositional contents of the consequent and of the antecedent of the other, respectively. It may be objected that they are still not contrapositives of one another. I propose that, although they are not *literal* contrapositives, they are nevertheless *meaning-preserving* contrapositives. I will return to this point later on.

These proposed indicative contrapositives of counterfactuals pertain to a class of conditionals which van der Auwera (1986), Comrie (1986) and Bhatt and Pancheva (2006) termed *factual conditionals*. I have discussed them in Gomes (2008), where I proposed to call them *accepted-fact conditionals*.[5] Though they are not characterized by a particular linguistic form, their content or the context in which they appear show that they involve the belief that both the antecedent and the consequent are true. The fact that an indicative conditional is used as the contrapositive of a counterfactual is in itself a context that characterizes it as factual. This factual character may also be conveyed by the use of *since* instead of *if*, as in Goodman's example.

In some rare cases, only the antecedent of a subjunctive implicative conditional is understood as being false. These conditionals are counterfactual only in relation to the antecedent. For example:

(18) Christine didn't come to the party and I know that neither Paul nor Mary invited her. If she had been invited by Paul, she would have come. But if she had been invited only by Mary, she wouldn't have come.

The speaker states that Christine did not come to the party, and that neither Paul nor Mary invited her; therefore, both the antecedent and the consequent of the first conditional are treated as false, while the antecedent of the second is treated as false, but the consequent as true (even though expressed with *would*).[6] In such a case, the contrapositive would have to be subjunctive, since the negation of the true consequent would have to be false:

(19) If she had come, she wouldn't have been invited only by Mary.

Exceptionally, neither the antecedent nor the consequent of a subjunctive conditional is understood as false or improbable. Pragmatically, such a subjunctive conditional should not be considered a counterfactual. An example:[7]

(20) His eyes are red and, if he had smoked marijuana, his eyes would be red. So he has probably smoked marijuana.

Here it is understood that the speaker believes the consequent to be true and the antecedent to be probably true. In this context, the conditional is not contrary-to-fact; therefore, its contrapositive should be counterfactual, since it involves the negation of the antecedent and of the consequent: *If his eyes weren't red, he wouldn't have smoked marijuana.*[8] In other contexts, however, or if presented in isolation, the same conditional could be interpreted as contrary-to-fact, and the suitable contrapositive for it would be factual: *If his eyes aren't red, he hasn't smoked marijuana.*

Most frequently, the contrapositive of a subjunctive conditional should be a factual conditional. The following pair, for example, would be adequate assuming that Bob is not here:

(21) If Bob had been invited, he'd be here. If Bob isn't here, he wasn't invited.

[5] See also Gomes and Monken (2011).

[6] Such a conditional might, therefore, be called an *implicative semifactual* and, in this case, what is usually simply called a *semifactual*, after Goodman, should be called a *concessive semifactual.*

[7] Modelled on examples provided by Anderson (1951) and Edgington (1995: 240).

[8] Or: *If his eyes weren't red, it wouldn't be the case that he has smoked marijuana.*

A counterfactual contrapositive (If Bob weren't here, …), by contrast, would only be adequate for a different situation, in which he is in fact here. What the contrapositive of a counterfactual should preserve, at least from a pragmatical point of view, is not the verbal forms used in it, but the context for which it is adequate. The empirical fact that the natural contrapositive of a counterfactual is usually a factual conditional seems to favor a unified theory of indicative and subjunctive conditionals, although those who believe that these two types must be explained by different theories will probably not be inclined to recognize it.

One might think that the temporal sequence in Goodman's and similar examples is a confounding factor, without which the contrapositive of a counterfactual could adequately be a counterfactual as well:

(22) If Alice were in Boston, she would be in New England.
(23) If Alice were not in New England, she would not be in Boston.

However, (22) would most likely be used when Alice is neither in Boston nor somewhere else in New England, whereas (23) would most likely be used when Alice is in New England, and specifically in Boston. It is difficult to see how we could infer from a proposition that implies that Alice is *not* in New England another that implies that she *is* in New England and, more precisely, in Boston. However, this is what (22) and (23) imply, respectively: that Alice is outside New England, and that she is in Boston. A better contrapositive for (22), in this context, seems to me to be (24), which preserves the same implication that Alice is outside New England that is usually conveyed by (22):

(24) If Alice is not in New England, she is not in Boston.

Counterfactually, her condition of being in Boston would imply that she was in New England. Therefore, in the actual world, her condition of not being in New England implies that she is not in Boston.

2.3. *Contrapositives in which the consequent expresses a cause for the antecedent*

Hunter (1993: 287) discusses what the contrapositive of the following counterfactual would be:

(25) If my grandmother had not already been dead, he would
have killed her.

To my mind, the following would be the adequate contrapositive:

(26) If he did not kill my grandmother, it's because she was already dead.

What (25) conveys is that conditions were present (call them X) that, added to my grandmother's being alive, would have been sufficient to cause his killing her. I am not saying that a cause-effect relation between antecedent and consequent is part of the meaning of the conditional construction itself. One might rather say that the grounds for believing the sentence to be true include such a causal relation (Sanford, 2003: 231–239). However, if we consider the sentence as a whole, including the semantics of its lexical items and the pragmatics of their interaction, we must recognize that a causal relation between the contents of the antecedent and of the consequent is part of the meaning of this specific sentence. In providing a contrapositive, we need to take this causal relation into account. If contraposition is viewed as an inference involving propositions, rather than sentences, it may be easier to accept that these new words express something that was already present in the original proposition (namely, the cause-effect relation), and would not be apparent without them.

We can imagine different stories that would justify someone saying (25) – that is, different contents for X. However, I cannot figure out any interpretation of it in which the grounds for accepting the conditional are not such that the condition described in the antecedent, in conjunction with other conditions (X), is treated as a sufficient counterfactual cause for the counterfactual consequent. Since antecedent and consequent are switched in the contrapositive, it must be made clear that the antecedent now describes the effect, and the consequent the cause. The contrapositive must somehow preserve the original causal relation, and not reverse it. This is the reason for the addition of *it's because* in the contrapositive of (25): the causal status of the consequent would not be apparent without it.

This addition should not be considered problematic, however, because we are changing neither the meaning of the antecedent and the consequent (beyond the addition of negation), nor the relation between them that the entire sentence conveys. On the contrary, words are being added to preserve the original causal relation between them, which would otherwise be lost. In the original counterfactual, Grandmother's not being already dead (plus X) would be the cause and his killing her would be the effect, just as in the factual contrapositive, his not killing her is the effect and Grandmother's being already dead (plus X) is the cause. In analyzing natural language conditionals, the meaning of the sentence as a whole should have precedence over its syntactical structure.

Iacona, 2018 argues that logical form, when the theoretical role of formalization is to explain logical properties and inferences, should be based on the contents expressed by sentences, since the latter are, in large measure, context-sensitive. In

agreement with this view, I claim that the contents of the antecedent and of the consequent must be taken into account, as well as the relations between these contents, as for example, a cause-effect relation. In particular, the inference of contraposition must be formulated taking the necessary measures to preserve such relations existing between the antecedent and the consequent, which switch their roles in the contrapositive, in negative form.

Consider a further example:

(27) If I were 10 inches taller than I am, I'd be a good basketball player. If I'm not a good basketball player, it's because I'm not 10 inches taller than I am.

In conditionals such as (25) and (27), the causal relation from antecedent to consequent is part of the meaning of the sentence (though not of the conditional construction *If A, then B* itself). When we add *it's because* in the contrapositive, we are not adding extra meaning, because this meaning was already implicitly, but unmistakably, present in the original sentence. The need for the added *words* is given by the fact that the conditions or events denoted by *A* and *B* must preserve their roles as cause and effect, respectively, while the form *If not-B, not-A* might lead to an interpretation that has *B* as indicating the cause and *A* the effect. In such cases, *If not-B, it's because not-A* preserves *A* as representing the cause and *B* the effect. Words were added, but the global meaning was merely preserved.

The two examples above are counterfactuals, but indicative conditionals may also require *it's because* to preserve the original cause-effect relation. In some cases, this is optional:

(28) If he left early, he arrived on time. If he didn't arrive on time, [it's because] he didn't leave early.

Here the use of *arrive* and *leave* without any indication of the place of arrival or the destination of the departure suggests that both refer to the same journey, so that the departure must have preceded the arrival. The causal status of the consequent of the contrapositive is thus quite clear without *it's because*, although the sentence could also mean that if he did not arrive *at X* on time, he did not leave early *from X to Y.*

The use of *it's because* is also unnecessary when the different tenses used in the antecedent and the consequent clearly indicate a backward temporal sequence in the contrapositive, which establishes the direction of causality:

(29) If it hadn't rained, the road wouldn't be wet. If the road is wet, it has rained.

3. Paraphrases that can or cannot be accepted

Many authors have noted that the word *then*, when it is present in conditionals, can usually be removed from the sentence without appreciable change in meaning. Conversely, many conditionals that do not have *then* may be paraphrased with *then*. More important, however, is that some conditionals do not seem to accept a paraphrase with *then*. The contrast between conditionals that have or admit *then* and those that do not has been stressed by John Barker (1973), Davis (1983) and Lycan (2001). Iatridou (1994) has devoted an entire article to this subject, wherein she makes the important observation that conditionals that have, or accept the addition of, *then* carry the presupposition that it is possible that their antecedent and consequent are conjointly false (Iatridou, 1994: 172).

There are some native speakers of English, however, who feel that *then* is acceptable at least in some conditionals that are not implicative, but rather concessive conditionals. In section 5, we will discuss an example by Stalnaker, which, according to the interpretation he provides, is pragmatically a concessive conditional, although it does not have *even*, and has *then*. For this reason, in order to make the paraphrase completely unambiguous, I have strengthened *then* to *then as a consequence* in my paraphrase (i).

The other two paraphrases I propose are also useful in identifying implicative conditionals. The important point in relation to these paraphrases is not so much that at least one of them can always be used for implicative conditionals, but rather that they are unacceptable for the other kinds of conditionals, for which contraposition is invalid.

It can be ascertained that all the examples in section 2, in their most natural interpretation, can be paraphrased using at least one of the three phrases I have proposed: (i) *then as a consequence*, (ii) *we can infer from this that*, or (iii) *it's because.* (For counterfactuals, (ii) and (iii) become *we'd be able to infer from this that*, and *it'd be because*, respectively.) For example:

(30) If he comes, *then as a consequence* I'll leave.
(31 If I don't leave, *it's because* he won't have come.
(32) If she left at 10:00, *we can infer from this that* it wasn't raining a lot when she left.
(33) If he is a psychiatrist, *we can infer from this that* he is a medical doctor.
(34) If it costs less than one hundred dollars, *it's because* it isn't natural leather.
(35) If Bob had been invited, *then as a consequence* he'd be here.

By contrast, none of them, in their most likely interpretation, accepts a paraphrase with *whether or not*:

(36) *_Whether or not_ Bob had been invited, he'd be here.

It is certain that a paraphrase may mean more than, less than, or something somewhat different from the original expression. However, I am not saying that the suggested paraphrases provide the meaning, or the alternative meanings, of the *if … then …* form, but rather that their acceptability for a class of conditionals, contrasted to their non-acceptability for another class, may be used as a test to distinguish these two classes.

4. Simple contraposition and meaning-preserving contraposition

If we understand contraposition as the inference from *If A, then B* to *If ~B, then ~A*, without any changes in the form of *A* and *B*, then contraposition as a general form of inference is clearly invalid for natural language conditionals, as shown by the examples considered above, and many others. However, this is an extremely limited view of contraposition as an inference that has its place in conditional thought. As von Fintel (1997: 39) writes:

> Contraposition is not a recipe for constructing paraphrases by switching antecedent and consequent and inserting negation into both. (…) since there can be a number of implicit semantic ingredients in these structures we are not guaranteed that simple syntactic operations concluded at the surface will give us the proper contraposed form of a conditional statement. If part of the original structure was an implicit dependency between [antecedent and consequent], that dependency has to be maintained.[9]

If changes in the sentence are allowed to preserve either its grammaticality or the temporal or causal relation present in the natural interpretation of it, then we see that, in many cases in which simple contraposition fails, a meaning-preserving form of contraposition is valid. Unlike simple contraposition, this sort of contraposition is not exclusively based on the form of the conditional, regardless of the meaning of its constituents and of the relation between them. Certainly, it has to do with the overall form of the conditional, and may also be represented as an inference from *If p, then q* to *If ~q, then ~p*. However, the meaning of the sentence as a whole must be considered, in order that the necessary adaptations be made to the contrapositive to preserve the meaning of the original sentence, as shown by the examples in section 2.

It may be questioned, however, whether what I am calling a meaning-preserving contrapositive should really count as a contrapositive. Formalization is at issue here. Is it adequate to represent a meaning-preserving contrapositive sentence by means of a formula that is the contrapositive of the formula that represents the original conditional sentence? If we represent the first conditional in (29) (*If it hadn't rained, the road wouldn't be wet*), for example, as ~R→~W, can we represent the second (*If the road is wet, it has rained*) as W→R? A first point to consider is whether R and W represent the same thing in both formulae, and a second point is whether the symbol → represents the same logical operator.

Here we should decide whether contraposition should be treated as applying to sentences or to propositions and whether formal symbolization should be considered as a mere abbreviation of sentences or as a representation of the logical form of a proposition. As to the first point mentioned above, R and W do not represent *literally* identical sequences of words in both formulae, respectively. However, their propositional content is arguably the same.

It may be objected that the verb forms are different in a counterfactual from what they are in an indicative conditional, and that this gives a different aspect, or contributes a different element, to the propositional content. I argue, however, that most often this contribution is to show that both the antecedent and the consequent *of the counterfactual* are false, and this is precisely what is preserved in a factual contrapositive, since its consequent and antecedent are, respectively, the *negation* of the antecedent and of the consequent of the original sentence. In other words, the indicative verbal forms of the factual contrapositive also indicate that the antecedent and the consequent *of the counterfactual* are false (since they indicate that their negation is true).

From a logical point of view, to imply that a proposition is false is to imply that its negation is true. If a sentence implies that *p* and *q* are false, another sentence validly inferred from it that denotes *~p* and *~q* should imply that the latter are true (i.e., that the former are still false).

With regard to the second point, many theorists of conditionals believe that *if* has a different meaning in counterfactuals and in indicative conditionals, and that it should thus be represented by different symbols (for example, the 'corner' > for counterfactuals and the arrow → for indicative conditionals). Whatever the symbol employed, it may be argued that it stands for *If it were the case that … then it would be the case that …* in the case of counterfactuals, but not in the case of indicative conditionals. However, in this paraphrase, the words *If* and *then* are themselves present, so that it may be replied that the meaning of *If … then …*, in itself, is independent of what comes after these words. In other words, the symbol employed for the conditional operator in counterfactuals may be taken to only represent *if … then …*, and not also *it were the case that … it would be the case that … .*[10] From this perspective, counterfactuality is to be considered as a part of the meaning of the antecedent and of the consequent (corresponding to the factuality of their negations), not as a part of the meaning of the conditional operator.

[9] However, von Fintel's (2011) chapter on conditionals only discusses contraposition within the context of Stalnaker-Lewis analysis, where it is invalid.

[10] New symbols, in addition to the symbol for *if … then …*, might perhaps be proposed for indicating the counterfactuality of the antecedent and of the consequent, and the factuality of their negations, but this is not the place to explore such a possibility.

Although I do not have space here to discuss the question adequately, I must say that I do not favor the view that *if … then …* has different truth conditions in counterfactuals and in indicatives. With regard to the famous example involving the difference between the truth conditions of *If Oswald hadn't killed Kennedy …* and *If Oswald didn't kill Kennedy …*, I will just mention Fogelin's (1998) compelling argument against the conclusion usually drawn from it.[11]

What is it that makes an inference such as contraposition valid? In a logic system, using a formal language, the answer is easy: the logic system itself establishes what inferences are valid. Natural language, however, is very different from a formal language. Natural language sentences express thoughts, and are understood to express thoughts. The relation between thoughts and sentences, however, is not a one-to-one relation. Different thoughts may be expressed by the same verbal expression, and different verbal expressions may express the same thought. Utterances are highly dependent on context, and there are various levels of context. A distinction is usually made between semantics, concerned with sentence meaning, and pragmatics, concerned with speaker meaning. There is no little disagreement between the authors, however, concerning the frontier between semantics and pragmatics, and recent developments seem to indicate that, instead of a sharp boundary line, one should rather think of a transition zone between the two fields (Korta and Perry, 2015).

How to establish, then, whether an inference such as contraposition is valid or not in natural language and natural thought? I believe the only way to do this is to attempt to establish as clearly as possible to what class of sentences (independently defined) it is applicable and to show that alleged counterexamples fail. That is what the present paper endeavors to do. If it can be shown that validity can be attributed to a certain sort of contraposition for a certain class of natural language conditionals, a theory of conditionals will then be needed to explain this validity within a general explanation of conditionals. It is outside the scope of this paper to present a theory of conditionals, but I believe such a theory must be able to explain the data gathered here and the relation that was established between a conditional being implicative and the possibility of meaning-preserving contraposition.

5. Concessive conditionals (with or without *even if*)

There are conditionals, however, for which no valid contrapositive can be found. Salient among them are concessive conditionals, which usually have *even* before *if* or a non-temporal *still* in the consequent. For example:

(37) If Boris had gone to the party, Olga would still have gone. (Lewis, 1973: 35)
(38) Even if the Bible is divinely inspired, it is not literally true. (Bennett, 2003: 32)
(39) Even if she goes, I won't.

Concerning the latter example, it is uncertain whether she will go, but it is certain that I will not (at least within a certain set of circumstances). Of course, the following attempt at contraposition would describe a totally different situation:

(40) Even if I go, she won't.

Now it is uncertain whether *I* will go, and certain that *she* will not. If concessive conditionals are semantically or pragmatically different from implicative ones, failure of contraposition in the former does not exclude contraposition as a valid inference for the latter. This is the hypothesis that will be explored in the following discussion.

Concessive conditionals typically have *even* before *if*. They may also have a non-temporal *still* in their consequent, as in (37). Sometimes they have both. However, some concessive conditionals do not have either. Concessive conditionals without either *even if* or *still* can, in general, be paraphrased with *even if* or *still.* A decisive additional test for establishing that a conditional is concessive, however, as discussed in section 3, is the impossibility of paraphrasing it with any of the implicative conditional paraphrases: (i) *then as a consequence*; (ii) *we can infer from this that*; or (iii) *it's because* (see also Gomes, 2019). If this is the case, we have a concessive conditional that cannot be used as a counterexample against the validity of contraposition in implicative conditionals. This is what happens with some conditionals that are used to deny a previous conditional, as in the following dialogue:

(41) X: If it rains, the match will be cancelled.
Y: No. If it rains, the match will not be cancelled.

In order to emphasize the contrast between their respective predictions, Y repeats X's conditional just as it is, only changing the consequent to the negative. It is clear, however, that Y's conditional can be paraphrased with *even if* or *still* and

[11] The following remark by Edgington (1995: 236) is also worth quoting: "[W]e are arguing about whether, if you eat this apple, you will be ill. You throw it away in disgust. Our argument continues unabated – about whether you would have been ill if you had eaten it. We do not appear to have changed the topic of debate."

cannot be paraphrased with any of the phrases (i)-(iii) mentioned above. X's conditional, by contrast, accepts a paraphrase with *then as a consequence*, or with *we can infer from this that*, but not one with *even if* or *still*.

What Y means is not that the rain will be a sufficient reason for the match not to be cancelled, but that it will be an insufficient reason for it to be cancelled. This is another way of characterizing the difference between concessive and implicative conditionals. In implicative conditionals, the truth of the antecedent is presented as sufficient for establishing the truth of the consequent.[12] In concessive conditionals, the truth of the antecedent is presented as insufficient for preventing the truth of the consequent.

Many proposed counterexamples against contraposition of conditionals really involve concessive conditionals without *even*. This observation is not new (see for example, Lycan, 2001: 35). Here is one such counterexample to contraposition:

(42) If Gore is not happy, he will be permitted to go on residing in the United States. (Lycan, 2001: 32)

A paraphrase with *Even if* is clearly possible, but not one with any of the implicative paraphrases, showing that the sentence is indeed a concessive conditional. The same applies to Lewis's counterexample to contraposition (37).

The following is Stalnaker's (1968: 49) example of failure of contraposition:

(43) If the U.S. halts the bombing, then North Vietnam will not agree to negotiate.

He presents the sentence in a context in which the speaker believes "that halt in the bombing, and much more, is required to bring the North Vietnamese to the negotiating table" (1968: 174). In this context, the sentence may be considered equivalent to an *even if … still* conditional, as remarked by John Barker (1973: 336), Hunter (1993: 285–286) and Horn (2000: 318):

(44) Even if the U.S. halts the bombing, North Vietnam will (still) not agree to negotiate.

It may be noticed that *then* is somewhat out of place in (43), according to this interpretation. And if we paraphrase it with *then as a consequence*, the sentence acquires a meaning that is clearly different from the one intended by Stalnaker.

Another way of understanding this example is to consider that it means:

(45) If the U.S. simply halts the bombing and does nothing more, then North Vietnam will not agree to negotiate.

Now we have an implicative conditional (which accepts paraphrases with *then as a consequence* and with *we can infer from this that*) and its contrapositive is valid:

(46) If North Vietnam agrees to negotiate, the U.S. will not have simply halted the bombing and done nothing more.

This would be in accordance with Stalnaker's mentioned assumption that the speaker thinks "that halt in the bombing, and much more, is required to bring the North Vietnamese to the negotiating table" (1968: 174).

Many sentences with the clause *if it kills me* are examples of concessive conditionals without *even if* or *still*, which do not need a context to be interpreted as concessive conditionals – the idiom *if it kills me* guarantees this interpretation by itself. Here are some attested examples:

(47) I am going to Paradise Falls, if it kills me.
(48) I am gonna make it through this year if it kills me.
(49) I will find a way to you, if it kills me.

6. Nonconcessive conditionals with *even if* or *still*

Several authors have discussed '*even if* conditionals'. However, this is a misleading concept that should not replace the concept of concessive conditionals. We have seen that many concessive conditionals do not include *even if*. The previous section should make it clear that I do not define concessive conditionals descriptively, by the presence of *even if* or of a non-temporal *still*, but by the meaning they convey. A thorough characterization of concessive conditionals is beyond the scope of this paper, but the possibility of including *even* before *if*, when it is not already present, and the impossibility of paraphrasing them with *then as a consequence*, *we can infer from this that*, or *it's because* is sufficient for our purposes. Concessive

[12] An example of the utility of this classical concept of the truth of the antecedent as sufficient for the truth of the consequent (and, conversely, of the truth of the consequent as necessary for the truth of the antecedent) can be found in Gomes (2006), where it is used to establish the logical form of a sentence with two conditionals, having the surface syntax *If A, then B too, but only if C*.

conditionals, *as defined here*, always involve the impossibility of these paraphrases and the presence of, or the possibility of inserting, *even* before *if*. Admittedly, other definitions are possible (notably those involving scalarity),[13] but I claim that they will not be useful in distinguishing the classes of contraposable and non-contraposable conditionals.

According to this definition, there are conditionals with *even if* or *still* that are not concessive (Gomes, 2019). The semantics of *even* and of *still* in these and other cases is a complex matter that need not be addressed here. Some examples will suffice, along with the practical rule that any conditional paraphrasable with (i) *then as a consequence*, (ii) *we can infer from this that*, or (iii) *it's because* before the consequent is not a concessive conditional, even if it has *even if* or a non-temporal *still*.

(50) Even if he drinks just a little, he'll be fired.

This might be called an *'even if'* conditional, since it has the sequence of words *even if*, but it is not a concessive conditional, as can be shown by the paraphrase:

(51) Even if he drinks just a little, *then as a consequence* he'll be fired.

This conclusion applies to the usual interpretation of (50), which is equivalent to:

(52) If he drinks even just a little, he'll be fired.

According to this interpretation, it is not certain that he will be fired. If he does not drink at all, he may not be fired.

In accordance with its classification as an implicative conditional, meaning-preserving contraposition is possible for (50):

(53) If he isn't fired, he won't have drunk even just a little.

According to the criteria adopted here, the following conditional with *even if* and *still* is also nonconcessive:

(54) Even if he drives at a speed only 10% above the limit, he will still be fined.
(55) Even if he drives at a speed only 10% above the limit, *we can infer from this that* he will still be fined.

It has been noted that in examples such as (50) and (54) *even* focus on just a part of the antecedent and can thus be displaced to a position just before that part, as in (52) and (56).

(56) If he drives at a speed even only 10% above the limit, he will still be fined.

However, a conditional containing *Even if* may be an implicative rather than a concessive conditional, even when the word *Even* focus on the entire antecedent and cannot be displaced to another position, as in the following example by Iten (2002: 120):

(57) Even if Neville's hair is untidy [in the interview], he won't get the job.

We thus see that the presence of *even if* or *still* is not sufficient to characterize a concessive conditional. I argue, however, that this is no reason to question the distinction between concessive and implicative conditionals, since there are other ways of characterizing the two classes. Concerning contraposition, conditionals interpreted as concessive, either with or without *even if* or *still*, are never contraposable, and conditionals interpreted as implicative, even if they have *even if* or *still*, are always contraposable. Here are meaning-preserving contrapositives for (54) and (57):

(58) If he isn't fined, he won't have driven at a speed even only 10% above the limit.
(59) If Neville gets the job, his hair won't have been untidy [in the interview].

I claim, therefore, that the relevant distinction is between concessive and implicative conditionals, according to the proposed criteria, and that the fact that contraposition is invalid for concessive conditionals should not be a reason for rejecting contraposition for implicative conditional propositions.

[13] See Sweetser (1990), Stephen Barker (1991), Lycan (2001), Declerck and Reed (2001), Bennett (2003), Iten (2002) and Vidal (2017).

7. Relevance (speech-act) conditionals

Relevance conditionals also do not accept contraposition. The following is an example of a relevance conditional, and it can readily be seen that it is not contraposable.

(60) If you are hungry, there are biscuits on the sideboard.

Conditionals such as this, first discussed by Austin (1970: 210), have been called relevance conditionals (Johnson-Laird, 1986) or speech-act conditionals (van der Auwera, 1986; Sweetser, 1990), since their antecedent expresses a condition which is relevant for the felicity of the speech-act performed by uttering the consequent. They belong to the class that Horn (2001: 380) calls metalinguistic conditionals. The thought behind (60) may be seen as involving metalinguistic commentary that might be expressed as: *There are biscuits on the sideboard and I'm saying this so that you may use this information if you are hungry.*

Contraposition is also obviously not applicable to conditionals whose consequents are questions, orders or requests.

8. When the contradictory of the consequent implies the antecedent

A difficult problem concerning contraposition involves conditionals for which the contradictory of the consequent semantically entails the truth of the antecedent. In such cases, simple contraposition is evidently impossible, since to obtain a valid contrapositive, the contradictory of the consequent would have to permit us to infer the falsity of the antecedent. This occurs in conditionals in which the content of the antecedent is implicit in the meaning of the consequent. I will call these conditionals '*AIC* conditionals', *AIC* standing for *'antecedent-implicit-in-consequent'*. I have found AIC conditionals of two types: (i) those in which the consequent presupposes the antecedent; and (ii) those in which the consequent is in itself an imprecise way of expression, which, in the context of the whole sentence, includes in its meaning the content of the antecedent.

An example of type (i) is:

(61) If Jack has a wife, she's miserable. (Horn, 2000: 318.)

In the context of the conditional, *she* refers to Jack's wife, and *Jack's wife is miserable* presupposes that Jack has a wife. If it is true that Jack's wife is miserable, then Jack has a wife, and if it is true that Jack's wife is *not* miserable, then Jack has a wife as well. A simple contraposition of (61) would be:

(62) If Jack's wife isn't miserable, Jack has no wife.

Literally interpreted, this sentence is absurd, and shows the failure of contraposition. In order to shape a meaning-preserving contrapositive, we must recognize that the presupposition that Jack has a wife is an integral part of the consequent, so the latter must be interpreted as cognitively equivalent to a conjunction of the presupposition and the specific content of the clause. The sentence may thus be paraphrased as 'If Jack has a wife, then Jack has a wife who is miserable'. The contrapositive would then be:

(63) If Jack doesn't have a wife who is miserable, then he doesn't have a wife.

It is remarkable that external negation of the consequent of (61) can be used to form a valid contrapositive with no further transformation of its content:

(64) If it's not the case that Jack's wife is miserable, Jack has no wife.

The reason why it is not the case that Jack's wife is miserable may indeed be the fact that no such woman exists. With external negation, it is naturally understood that what is being negated may also be the presupposition present in the clause *Jack's wife is miserable* – namely, that there is a woman who is Jack's wife. External negation of a consequent that presupposes the antecedent may render contraposition possible even when this consequent is negative:

(65) If he has children, then they won't inherit his fortune. If it's not the case that his children won't inherit his fortune, he has no children.

Again, it may not be the case that his children will not inherit his fortune simply because there are no such children.

Of course, when we spell out the presupposition present in the consequent of the original conditional, negation can only be external, since this consequent has now become a conjunction of two propositions. This is shown in the following example:

(66) If there's a king of France, then he's a Bourbon. If there's a king of France, then there's a king of France and he's a Bourbon. If it's not the case that there's a king of France and he's a Bourbon, then there's no king of France.

Simple contraposition of the original sentence fails, but using external negation of the original consequent, we get a suitable contrapositive:

(67) If the king of France isn't a Bourbon, there's no king of France.
(68) If it's not the case that the king of France is a Bourbon, then there's no king of France.

Another alleged counterexample to contraposition (Jackson, 1991):

(69) If it snows, it will not be as bad as last Thursday.

In the context given by the antecedent, the word *it* refers to the snow, so the consequent presupposes the antecedent. External negation yields a valid contrapositive:

(70) If it's not the case that the snow won't be as bad as last Thursday, then it will not snow.

The following example is of an AIC conditional of type (ii) mentioned above. This means that its consequent is, in itself, an imprecise way of expression, which in the context of the whole sentence includes in its meaning the content of the antecedent.

(71) If he doesn't live in Boston, then he lives somewhere in New England. (Jackson, 1979: 578.)

It has often been noted that the consequent of this conditional really means that he lives somewhere *else* in New England. With the inclusion of *else*, the contrapositive is all right. Bennett (2003: 143) objects that this "offers a reasonable explanation of [(71)] but does not show what is wrong with accepting [(71)] just as it stands." It is not wrong to accept (71) just as it stands. What is wrong is to try to assign to one of its constituents (the consequent) a meaning that is independent of the context given by the rest of the sentence. The reason why the word *else* may be omitted in the consequent is that the antecedent has already excluded Boston from the places in New England where the man in question may live (in the hypothetical situation under consideration). He cannot live in this city in New England called Boston if, as supposed in the antecedent, he doesn't live in Boston – so Boston is excluded. *In the context given by the antecedent*, the consequent, just as it stands, means that he lives somewhere *else* in New England.

When the consequent becomes the antecedent of the contrapositive (in negative form), however, it loses this context: there is no longer anything to show that *somewhere in New England* does not include Boston. Consequently, the implicit *else* must now be made explicit:

(72) If he doesn't live somewhere else in New England, he lives in Boston.

In this case, external negation will not do. The implicit *else* must be made explicit. However, if we add the content of the antecedent to the consequent (as a conjunct), contraposition becomes possible without *else*:

(73) If he doesn't live in Boston, then he doesn't live in Boston but lives somewhere in New England. If it's not the case that he doesn't live in Boston but lives somewhere in New England, then he lives in Boston.

Similarly in (74) and (75), in order to preserve the meaning that the consequent has in the context given by the antecedent, we would have either to add *other* before *day* and *English poet*, respectively, or to add the content of the antecedent to the consequent, as a conjunct.

(74) If it wasn't on Christmas Day, it was some day in December.
(75) If it wasn't Shakespeare who wrote it, it was some English poet.

The role of the antecedent as a context that complements the meaning of the explicit words of the consequent is also manifest in the following example:

(76) If he took arsenic, he's showing no signs. (Edgington, 1995: 240)

If the consequent had been stated as an independent sentence, one might ask: no signs of what? In the context given by the antecedent, however, it is clear that these are signs of arsenic poisoning. Still, two different answers might be given to this question: (a) No signs of having taken any arsenic. (b) No signs of the arsenic he took. If we interpret the conditional according to answer (a), it proves to be a concessive conditional, and this explains the failure of contraposition. In this case, it is paraphrasable as:

(77) Even if he took arsenic, he's showing no signs [of having taken any arsenic].

According to answer (b), by contrast, the consequent presupposes the antecedent, so in this interpretation (76) is a type (i) AIC conditional. If we explicitly incorporate the content of the antecedent to the consequent, we get:

(78) If he took arsenic, then he took arsenic but is showing no signs [of the arsenic he took].

The contrapositive of this version would be:

(79) If it's not the case that he took arsenic but is showing no signs, then he didn't take arsenic.

It may be noted that this contrapositive is a perfectly adequate sentence, one that could be used to emphatically show that the speaker has thoroughly examined the patient. If instead of *If A, then B* you say *If A, then (A & B)*, the second *A* is just redundant, because *A* entails *A*, so that if you have supposed *A*, you do not need to assert *A* again while still in the scope of this supposition. However, if you use this redundant form to form the contrapositive, you get *If ~(A & B), ~A*, which does not involve any redundancy. It should be noted that *~(A & B)* does not entail *~A* (an entailment that would make the conditional uninformative). *~(A & B)* is satisfied by three possible situations: *(~A & B)*, *(A & ~B)* and *(~A & ~B)*, only two of which include *~A*. If you say *If he took arsenic, then he took arsenic but is showing no signs*, this is redundant. However, when you use this version to form the contrapositive, you get (79), which is not redundant and makes perfect sense, in contrast with the absurd *If he is showing signs (of the arsenic he took), he didn't take arsenic.*

Still assuming interpretation (b) above, an alternative meaning-preserving contrapositive for (76) can be formed using external negation and making explicit what is implicit in this interpretation of the consequent:

(80) If it's not the case that he's showing no signs of the arsenic he took, then he didn't take arsenic.

In conclusion: (1) AIC conditionals are not contraposable by applying internal negation, or negation suppression, to their consequent, without further changes to it. (2) Some AIC conditionals are contraposable by applying external negation to their (affirmative or negative) consequent. (3) All AIC conditionals are contraposable when the content of their antecedent is included in their consequent as a conjunct (or by some other means). This suggests that, although AIC conditionals are not simply contraposable in their explicit form, they have an underlying cognitive structure that, when its full meaning is taken into account, is contraposable. This cognitive structure can be rendered by the form $p \rightarrow (p \,\&\, q)$ since the meaning of the consequent, in the context provided by the antecedent, is one that includes the content of the antecedent. Therefore, meaning-preserving contrapositives may always be formed for AIC conditionals. The cognitive structure of these contrapositives can be rendered as: $\sim(p \,\&\, q) \rightarrow \sim p$.

9. Conclusions

Meaning-preserving contraposition is a valid inference form for implicative conditional propositions expressed in natural language – that is, for conditional propositions in which the truth of the antecedent is presented as sufficient for the truth of the consequent, within a certain set of circumstances.[14] This class of conditional propositions is characterized by the possibility of paraphrasing the sentences that expresses them with (i) *then as a consequence*, (ii) *we can infer from this that*, or (iii) *it's because*. Adaptations may be necessary in contrapositive sentences in order to preserve the original meaning of the antecedent and consequent, and the original relation between them. However, simple contraposition, that is, an inference from *If A, B* to *If ~B, ~A* sentences, in which the form of *A* and *B* is kept unchanged (with merely the possible exception of exchanging verb forms between *A* and *B*) is invalid even for this class of conditionals.

The changes that may be necessary to preserve the meanings included in the original sentence include: (1) changing verb tenses so as to preserve a temporal relation that may be present between *p* and *q*; (2) using *it's because* before the consequent to preserve a causal relation that may be present between *p* and *q*, when verb tenses are unable to do so; (3) changing the verb forms (subjunctive/*would*) used in a counterfactual to indicative verb forms, so that the counterfactuality of *p* and *q* matches

[14] At least, for conditionals with antecedents and consequents that are simple assertoric (nonmodal) propositions. Antecedents and consequents involving subordinate clauses and modals bring additional difficulties that may prevent contraposition.

the factuality of ~*p* and ~*q* in the contrapositive; (4) using external negation (*it's not the case that*) instead of internal negation, so that negation may apply to a presupposition of the negated clause; and (5) making explicit something that is implicitly meant by the consequent in the context given by the antecedent. Concessive conditionals, according to the proposed definition, whether with or without *even if* or *still* are not contraposable. *Even if* conditionals and *still* conditionals are not contraposable when they are concessive (as they usually are), but are contraposable when they are implicative (as sometimes occurs). Relevance conditionals and conditionals with consequents expressing questions, orders or requests are not contraposable. Implicative conditionals in which the consequent presupposes the antecedent are contraposable using external negation. Implicative conditionals in which the consequent is in itself imprecise and has its meaning complemented by the antecedent are contraposable if words such as *else* or *other*, or the whole original antecedent, are added to the antecedent of the contrapositive.

References

Anderson, Alan Ross, 1951. A note on subjunctive and counterfactual conditionals. Analysis 12, 35–38.
Austin, John L., 1970. Ifs and cans. In: Philosophical Papers. Oxford University Press, Oxford, pp. 205–232.
van der Auwera, Johan, 1986. Conditionals and speech acts. In: Traugott, E.C., ter Meulen, A., Snitzer Reilly, J., Ferguson, C.A. (Eds.), On Conditionals. Cambridge University Press, Cambridge, pp. 197–214.
Barker, John A., 1973. Hypotheticals: conditionals and theticals. Philos. Q. 23 (93), 335–345.
Barker, Stephen J., 1991. Even, still and counterfactuals. Linguist. Philos. 14, 1–38.
Bennett, Jonathan, 2003. A Philosophical Guide to Conditionals. Oxford University Press, Oxford.
Bhatt, Rajesh, Pancheva, Roumyana, 2006. Conditionals. In: Everaert, M., Riemsdijk, H. C. van (Eds.), Blackwell Companion to Synthax, vol. 1. Blackwell, Oxford.
Clark, M., 1976. If conditionals were not contraposable. Analysis 36 (2), 112.
Comrie, B., 1986. Conditionals: a typology. In: Traugott, E.C., ter Meulen, A., Snitzer-Reilly, J., Ferguson, C.A. (Eds.), On Conditionals. Cambridge University Press, Cambridge, pp. 77–99.
Davis, Wayne A., 1983. Weak and strong conditionals. Pac. Philos. Q. 64, 57–71.
Declerck, Renaat, Reed, Susan, 2001. Some truths and nontruths about *even if*. Linguistics 39 (2), 203–255.
Downing, Peter, 1975. Conditionals, impossibilities and material implication. Analysis 35 (3), 84–91.
Edgington, Dorothy, 1995. On conditionals. Mind 104, 235–329.
von Fintel, Kai, 1997. Bare plurals, bare conditionals, and *only*. J. Semant. 14, 1–56.
von Fintel, Kai, 2011. Conditionals. In: Heusinger, K. von, Maienborn, C., Portner, P. (Eds.), Semantics: an International Handbook of Meaning, vol. 2. de Gruyter Mouton, Berlin, pp. 1515–1538.
Fogelin, Robert J., 1998. David Lewis on indicative and counterfactual conditionals. Analysis 58 (4), 286–289.
Gillies, Anthony S., 2004. Epistemic conditionals and conditional epistemics. Noûs 38 (4), 585–616.
Gomes, Gilberto, 2006. If *A*, then *B* too, but only if *C*: a reply to Varzi. Analysis 66 (2), 157–161.
Gomes, Gilberto, 2008. Three types of conditionals and their verb forms in English and Portuguese. Cogn. Linguist. 19 (2), 219–240.
Gomes, Gilberto, 2009. Are necessary and sufficient conditions converse relations? Australas. J. Philos. 87 (3), 375–387.
Gomes, G., 2019. Concessive conditionals without *even if* and nonconcessive conditionals with *even if*. Acta Anal. https://link.springer.com/article/10.1007/s12136-019-00396-y.
Gomes, G., Monken, P.M., 2011. Postura epistêmica e parafraseabilidade diferencial em condicionais. Rev. Estud. Ling. 19 (2), 127–140.
Goodman, Nelson, 1947. The problem of counterfactual conditionals. J. Philos. 44 (5), 113–128.
Horn, Laurence R., 2000. From *if* to *iff*: Conditional perfection as pragmatic strengthening. J. Pragmat. 32, 289–326.
Horn, Laurence R., 2001. A Natural History of Negation. CSLI Publications, Stanford (CA).
Hunter, Geoffrey, 1993. The meaning of 'if' in conditional propositions. Philos. Q. 43 (172), 279–297.
Iacona, A., 2018. Logical Form: between Logic and Natural Language. Springer. ISBN: 978-3-319-74153-6.
Iatridou, S., 1994. On the contribution of conditional *then*. Nat. Lang. Semant. 2, 171–199.
Iten, C., 2002. *Even if* and *even*: the case for an inferential scalar account. UCL Work. Pap. Linguist. 14, 119–157.
Jackson, Frank, 1979. On assertion and conditionals. Philos. Rev. 88, 565–589.
Jackson, Frank, 1991. On the logic of ordinary conditionals, by Robert N. McLaughlin (book review). Mind 100, 403–406.
Johnson-Laird, Philip N., 1986. Conditionals and mental models. In: Traugott, E.C., ter Meulen, A., Snitzer Reilly, J., Ferguson, C.A. (Eds.), On Conditionals. Cambridge University Press, Cambridge, pp. 55–75.
Korta, Kepa, Perry, John, 2015. Pragmatics. In: Zalta, E.N. (Ed.), The Stanford Encyclopedia of Philosophy. URL =. https://plato.stanford.edu/archives/win2015/entries/pragmatics/.
Lewis, David K., 1973. Counterfactuals. Harvard University Press, Cambridge, MA.
Lycan, William G., 2001. Real Conditionals. Oxford University Press, Oxford.
McCawley, James D., 1993. Everything that Linguists Have Always Wanted to Know about Logic but Were Ashamed to Ask, second ed. University of Chicago Press, Chicago.
Sanford, David H., 2003. If P, Then Q, second ed. Routledge, London.
Stalnaker, R.C., 1968. A theory of conditionals. In: Rescher, N. (Ed.), *Studies in Logical Theory*. APQ Monograph N° 2. Blackwell, Oxford, pp. 98–112. Reprinted in Harper, W.L., Stalnaker, R., Pearce, G. (Ed.) Ifs. Reidel, Dordrecht, pp. 41-45.
Stalnaker, Robert C., 1990. Semantics for conditionals. In: Parikh, R. (Ed.), Proceedings of the Third Conference on Theoretical Aspects of Reasoning about Knowledge. Morgan Kaufmann, San Mateo (CA), pp. 137–138.
Stalnaker, Robert C., 1992. Notes on conditional semantics. In: Moses, Y. (Ed.), Proceedings of the Fourth Conference on Theoretical Aspects of Reasoning about Knowledge. Morgan Kaufmann, San Mateo (CA), pp. 316–327.
Sweetser, Eve, 1990. From Etymology to Pragmatics: Metaphorical and Cultural Aspects of Semantic Structure. Cambridge University Press, Cambridge.
Vidal, Mathieu, 2017. A compositional semantics for 'even if' conditionals. Logic Log. Philos. 26, 237–276.

Gilberto Gomes has obtained his PhD in Paris, France (Université Paris 7), in 1998 and has published articles in Analysis, Australasian Journal of Philosophy, Cognitive Linguistics, Consciousness and Cognition, Journal of Consciousness Studies, and Philosophical Psychology, among others.