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The Reason Why Antecedent Negation Works

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Abstract: In the first-order logic, previous studies demonstrate that the negation of the antecedent is invalid to negate the consequent in sufficient conditionals. This paper justifies some particular cases of it with a concrete example "If I have enough money, I will buy a car." by using the semantic presupposition theory, the pragmatic presupposition theory and the Cooperative Principle. In this example, sufficient conditional can be proven sufficient and necessary so that the denial of the original condition can work effectively. Then this paper discusses that there are limitations to this method. It is demanding and can become unworkable by even only changing one verb. Only if there is a unique and biconditional relationship between the antecedent and the consequence can it be proven that the negation of the antecedent works. In addition, this paper expands on this, using the relevance theory in linguistics to try to eliminate some of the strict constraints of the biconditional relationship. Sometimes the particularly strong cause will exceed the other weak causes so that the case will be temporarily viewed as a biconditional case, which is limited to daily conversations. Therefore, it is able to be applied to the main argument.

Keywords: antecedent negation, presupposition, the cooperative principle, relevance theory, logic, linguistics

1. Introduction

In daily conversations, people are more likely to oppose the other by denying the antecedent rather than the consequence. In logic and philosophy, the negation of the antecedent is invalid to negate the consequent in sufficient conditionals. For example, there is a sentence that "If Tom is a cat, then it has fur." Then "Tom is not a cat." cannot imply that Tom does not have fur because Tom may be a dog or a lion.

This paper tries to demonstrate why the denial of the antecedent seems to work naturally and validly in daily conversations although it is an invalid reasoning method in logic. It is the presupposition that enables people to conduct a conversation which is not only logical and informative but also concise. When people talk or persuade the hearers, instead of speaking out most of the information required by smooth communications, they simply presuppose it [1]. It affects people's inner thinking and reflects in people's words as well, although people rarely utter it.

The main theories used in this paper are as follows: the semantic presupposition theory, the pragmatic presupposition theory and the Cooperative Principle. Besides, to argue against a limitation, the relevance theory will also be used. And this concrete example will be taken to show it clearly:

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α：If I have enough money, then I will buy a car.

β：No, you don't have enough money.

2. Theories Used

In this paper, semantic presupposition, pragmatic presupposition, and The Cooperative Principle will be mainly used to prove the argument.

2.1. Semantic Presupposition

Before Strawson proposed the concept of "semantic presupposition", Russell's theory had achieved the status of orthodoxy at the time [2]. One of his famous examples is that if someone says "The king of France is bald," it is possible that there is no king of France and then this sentence has no meaning. Strawson's theory of semantic presupposition argues that the use of a definite description standardly presupposes the existence of an object fitting the description even though it does not say [3]. For example, if someone says "The cat is cute," it implies that there exactly exists a cat. Otherwise, this sentence is nonsense.

In addition, some presuppositions arise by default from specific words that we used. These are called "presupposition triggers". According to Karttunen, who collected and separated triggers into 31 classes, the word "IF" can lead to counterfactual conditionals [4].

2.2. Pragmatic Presupposition

Stalnaker proposed the concept of "pragmatic presupposition" [5]. In his view, presupposition belongs to the speaker rather than the sentence itself. It's the shared knowledge or information that enables the speaker and the listener to communicate with each other. The "pragmatic presupposition" contains all the common sense related to the topic that makes the conversation make sense, such as the cultural background, the emotional base, and the linguistic knowledge.

And to be clearer, it may be necessary to differentiate the pragmatic presupposition from the entailment shortly [6]. The negation of the entailment will result in the negation of the original sentence, while the negation of the presupposition will even lead the original sentence to nonsense. So it can be said that as long as there is no further information denying the existing presupposition, the existing presupposition should always be true.

2.3. The Cooperative Principle

Grice raised a series of conversational principles called The Cooperative Principle, abbreviated to "the CP" [7]. It describes how people achieve effective conversational communication in a common social situation, that is, how listeners and speakers act cooperatively and mutually accept one another to be understood in a particular way. The principle is divided into four maxims of conversation as quantity, quality, relation, and manner. In order to achieve effective, meaningful and smooth conversations, these four maxims should be observed [8].

Briefly speaking, to have a smooth and meaningful talk, good speakers should give as moderate information in quantity as is required for the current purposes of the exchange, say truth sincerely instead of anything that lacks adequate evidence in quality, omit any information irrelevant to the utterance, and describe precisely without ambiguity.

Applying the Gricean maxims is a method to explain the link between utterances and what is understood from them. Hence, to analyze an utterance in a standard and plain way without too much noise, such as some emotional points, this principle is introduced in.

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3. Analysis Process

The utterance can be justified by being broken down and reorganized according to the theories mentioned above.

3.1 Break Down with Semantic Presupposition and the CP

To be standard, it should be supposed that both speakers obey the Cooperative Principle. They don't tend to say anything ridiculous or opposite to what they are really thinking about so that it is reliable to understand and symbolize the words they speak out.

Since α says "IF I have enough money," he/she doesn't have enough money at the time of the conversation, according to the semantic presupposition arising out of the presupposition trigger "IF".

Since α says "will buy," it shows α's intention of buying a car.

Since β says "No," β sincerely intends to say something opposite to what α said. In a particular case, it can be supposed that β wants to say "α won't/can't buy a car."

3.2 Break Down with Pragmatic Presupposition

In this example, it is clear that some mutual knowledge between α and β has been activated:

1. If someone wants to buy something, then he/she should have enough money.
2. α is a person.
3. The car is something people can buy.

Originating from the common sense above, the following statement can be known:

If α wants to buy a car, then α must have enough money.

To test whether it can be regarded as presupposition, we can create a sentence embedded under a negation operator [9]:

α: If I don't have enough money, I won't buy a car.

It is clear that in the absence of special factors, someone who sincerely uttered this sentence might be expected to believe the presuppositions. Actually, the verb "buy" is closely associated with the word "have money" in our society as common sense.

3.3 Elements Collection

Thus, the presuppositions in this conversation comprise all the above, including α's financial status (without money), α's intention to buy a car, and the basic knowledge that to buy a car, money is a must.

Now in the utterance, there are 3 atomic sentences and 2 arguments given by α and β respectively:

Atomic sentence 1: α has enough money----A

Atomic sentence 2: α will buy a car----B

Atomic sentence 3: α doesn't have enough money now---- ¬A

Argument 1(said by α): (B→A, A) l= B

Argument 2(said by β): (B→A, A→B, ¬ A) l= ¬B

Note: "¬A" means the negation of "A" and "¬B" means the negation of "B".

3.4 Reorganization and Argument

Obviously, the second argument said by β is valid, and it can be proven in the following ways quite easily:

The first method is the truth table, which is a formal method in logic to calculate the truth value of complex sentences on each possible valuation [10]. In this case, the main logical connective of the whole sentence is the last conditional mark. According to the truth table below (table 1), the column

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of "T"s under the main connective shows that regardless of the truth values of "A" and "B", the compound sentence is true. Therefore, it can be confirmed that argument 2 "(B→A∧A→B∧¬ A) →¬B" is true on every possible valuation and proves to be logically permanently valid.

Table 1: A truth table in first-order logic.

A	B	(B→A	∧	A→B	∧	¬A)	→	¬B
T	T	T	T	T	F	F	T	F
T	F	T	F	F	F	F	T	T
F	T	F	F	T	F	T	T	F
F	F	T	T	T	T	T	T	T

Note: "T" means "True" and "F" means "False".

The second way is as follows. Since A if and only if B, this biconditional relationship can be simplified into A=B. And then, the negation of A will negate B simultaneously.

The third way is as follows. Since in the (B→A), (¬A) is the negation of the consequence, which is a valid reasoning method.

The fourth way is as follows. (B→A) can be replaced with (¬A → ¬B), which shares the same truth value on the ground of the relationship of inverse negation propositions. And then "not A" is the modus pones (affirmation of the antecedent), which is also a valid reasoning method.

Among the 4 explanations above, I prefer the fourth one because it is not only logically correct as the other three, but it may also show how it works in our daily conversation. People are more likely to talk about the conditions in their daily life.

For example, people usually say "If I can pass this exam, then I will get an exam-passed reward from mom." with believing that "If I cannot pass this exam, then I won't get any exam-passed reward from mom." in their inner mind. It is the closest negation expression in people's mind. Then if the second speaker wants to oppose the first speaker, it is just simple and convenient to pick this sentence out. Then, according to the Principle of Least Effort, I suppose that if people need to negate the whole sentence, they tend to just deny the antecedent [11]. And it can also correspond with the daily needs that people hope for a true and acceptable premise.

4. Limitations and Extension

However, it has to be admitted that this method cannot always work validly. There are two limitations to the argument above.

4.1 Failure in Finding Out the Biconditional Relationship

In the car's example, the reason why the condition of "B→A" can be added logically correctly is based on the biconditional relationship between "buy" and "money". If the verb "buy" is replaced with the verb "possess", it depends. "no money" is not equal to "cannot possess a car" as there are various ways to possess a car, such as using a great coupon or getting a gift from others.

4.2 Chronological Orders

In the example of rewards above, it should also be noticed that there's a lure that it seems like the sentence "If I cannot pass this exam, then I won't get any exam-passed reward from mom" can be turned into "If I get an exam-passed reward from mom, then I can pass this exam" like the car's example. Even though it can be assumed that the exam-passed reward is particularly related to the

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result of the exam and vice versa, there's something beyond the first-order logic, and that is the chronological order. It would be some other cases.

4.3 Extension

Finally, to expand the scope of the application, I try to add another case that usually happens in our daily life resembling the car's example.

In the car's example, the particular verb "buy" was emphasized as necessary, while the verb "possess" will lead to controversy. The reason is that besides purchasing a car, a car from parents as a gift or some other methods are also common in our society. If a university graduate says it, the gift method sounds more possible.

But how about one result with one strong reason and a few weak reasons? Or they can be called as correlation factors.

For example, if there is some fresh fur without tangles, it's more likely and direct that there was an animal passing by rather than the wind blew the fur here from some other places, although the latter is also possible. In the documentaries, it can be found that scientists track animals through the fur left on the ground and trees.

Sperber and Wilson's relevance theory argues that the best solution in daily conversation is to abandon truthfulness and treat whatever expectations of truthfulness emerge in conversation interpretation as by-products of the more basic expectation of relevance. Neither Hyperbole nor loose talk is the opposite of truthfulness. Instead, they are alternative routes to achieve optimal relevance [12].

Based on this theory, at last, this paper tries to argue that people tend to not only give little consideration to causes in any other possible worlds in logic but also ignore the causes with particularly low possibility. If people know there are several causes and one of them is much more possible than the others, people will take the strong one as it's a daily conversation, not a rigorous experiment.

Then it will come back to the argument in the main paragraph.

5. Conclusions

To sum up, a limited but ordinary and reasonable case has been assumed according to the definition and functions of presuppositions and cooperative principles. In this case, another condition "to buy a car, money is a must" and some other backgrounds are inserted into the premise of β's argument. So that the original premise "A implies B" can be turned into "A if and only if B". And the new argument can be proven valid in more than one way.

But it should also be recognized that there are limitations of this method. Only if there's a unique and biconditional relationship between the antecedent and the consequence can it be proven that the negation of the antecedent works in some cases. And sometimes, the particularly strong cause will exceed the other weak causes so that the case will be temporarily viewed as a biconditional case, limited to daily conversations, being able to be applied to the argument above.

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