SOME FORMAL PROPERTIES OF CAUSAL AND INFERENTIAL *BECAUSE* IN DIFFERENT EMBEDDING CONTEXTS*

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1. INTRODUCTION

The aim of this paper is to gather some elements which could help us grasp the formal side of the connective *because*. In particular, the goal is to build up a core set of formal differences between two uses of *because*: (i) the genuine causal use, which introduces the causal consequence in the main clause of *because* (as in: *Mary fell because John pushed her*) and (ii) the use which gives some sort of justification for the speaker's belief (as in: *The neighbours are at home because the lights are on*). The latter is sometimes qualified as inferential (Moeschler 1989, in progress), sometimes as epistemic (Sweetser 1990) or just as a justification (Williamson 2000). Here I adopt the term *inferential*, for reasons which will become clear below.

The main part of the paper is devoted to the analysis of the two uses of *because* mentioned above with respect to the property of factivity. In the beginning, I will review some formal properties which seem to well characterise the behaviour of *because*. In particular, the analysis will be based on the examination of different contexts embedding *because* clauses such as negation, the verb *believe* and the modal operator *probably*. In addition, I will briefly consider the problem of the conflict between the connective-like and the relational nature of *because*.

The analysis of *because* under wide scope negation will allow me (i) to demonstrate that, contrary to traditional assumptions, the propositions linked by *because* are not always factive and (ii) to postulate the existence of another kind of *because*, namely the conjectural one which is used to express an educated guess about causes of a given event. Moreover, the examination of the interaction between some modal operators and *because* will reveal the effect of switch from the causal reading to the inferential one when the main clause is modified by *probably* or *believe*.

2. BASIC FORMAL PROPERTIES OF *BECAUSE*

From the grammatical point of view *because* is a dyadic connective. The first property that seems to be indisputable is the factivity of *because*:

(1) p because q $\rightarrow$ (p & q) – (factivity)

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That is, if someone links two sentences with the connective *because*, it seems that they presuppose the truth of the two propositions expressed by these sentences.

The second property of *because* is irreflexivity i.e. the necessity to have two different propositions on each side of the connective. This can be called the property of explicit non-triviality:

(2) $\neg$ (p because p) – (irreflexivity)

Typically, sentences of the form *p because p*, out of some special marked contexts, e.g. *because* of an “exasperated parent” (cf. Mulligan 2006), are false due to the lack of explanatory flavour sentences with *because* usually exhibit.

It seems also that there is another property of *because* related to the explanatory nature of *p because q* sentences; it is in fact required that *p* and *q* are not synonymous:

(3) p because q (p should not be synonymous with q)

For instance, if a question like ‘Why is the unemployment raising?’ gets an answer like: ‘Because there are more and more unemployed’, the answer can hardly be considered as an explanation. It just gives a kind of reformulation of the content of the question and so doesn’t meet the purpose of the *why* question.

There are two additional properties which are also relevant for *because* clauses, namely asymmetry and transitivity. It seems natural to think that if *p because q* is true, then it cannot be the case that *q because p*:

(4) p because q $\rightarrow$ $\neg$ (q because p) – asymmetry

If someone states that the event described by *q* is the cause of the event described by *p*, let us say that *the barn burned because there was a short circuit*, for sure it cannot be interpreted the other way around. The sentence *there was a short circuit because the barn burned* would say that the cause of the short circuit was the burning of the barn which is strange out of a very artificial context.

Moreover, *because* sentences have, in most cases, the property of transitivity:

(5) ((p because q) & (q because r) $\rightarrow$ (p because r)) – (transitivity)

Consider the following sequence:

(6) a. The barn burned because there was a short circuit.
b. There was a short circuit because the switch was damaged.
c. The barn burned because the switch was damaged.

This causal chain seems to be acceptable: from (6a) and (6b) being true, we can easily make the step to (6c).

In this paper, I will not give equal attention to all of these properties. Since the properties of non-triviality and non-synonymy are directly related to the explanatory nature of *because*, and thus are not easily treatable in the formal framework adopted here, I will not study them here. The properties of irreflexivity, asymmetry and transitivity touch the problem of the relational aspect of *because*, which is discussed briefly in the next section.

It is the property of factivity which will be discussed in details as it can be used to formally differentiate between the causal and the inferential *because*. As we will see, all uses of *because* do not conserve the factivity of the connected propositions.

3. *BECAUSE* – CONNECTIVE, RELATION OR BOTH?

In order to discuss the problem of the relational aspect of *because*, let us reconsider (6a). Grammatically, (6a) is a complex sentence composed of two simple sentences linked by the connective *because*. Normally, a connective does not denote a relation. But it is obvious that in order to correctly understand (6a), we have to understand that the short circuit was the *cause* of the barn burning. In other words, there is a causal relation looming somewhere here. If we want to keep *because* as a connective on the one hand and preserve the possibility of referring to a relation (e.g. the causal one) with *because* sentences on the other hand, we have to find a way of combining these two aspects.

One important argument for the relational character of *because* comes from Chierchia's analysis (2004:87), where on the basis of some linguistic properties of *because* he proposes the following:

(7) p because q is equivalent to p_i and CAUSE (q, x_i)

"So, *because* clauses are covert conjunctive statements where the first conjunct is the main clause (which is actually asserted) and the second conjunct is formed by the CAUSE operator[1]; the second argument of the latter [x_i in (7)] is a covert pronominal element bound by the main clause. This reflects the intuition that "p because q" does two things: asserts p and adds to it a specification of what causes it" (Chierchia, 2004:87).

The analysis of *because* sentences as covert conjunctive statements can grasp the important characteristics intuitively attached to *because* clauses. First, it supports and makes explicit our intuitions about the relational character of *because*. And since *because* hides not only its conjunctive nature but also its relational aspect, its showing of the typical relational properties is not problematic anymore. Second, this analysis can help us examine the presuppositional material of *because* more precisely.

Using this analysis, I will explore two families of *because* clauses, both of which involve a causal relation: the genuine causal *because* and the inferential one.

4. CAUSAL AND INFERENTIAL *BECAUSE*

Let us start with the genuine causal example of *because* clause, as in (8) and consider its logical form in (9):

(8) Mary fell because John pushed her.

(9) [Mary fell]$_i$ $\wedge$ CAUSE (John pushed Mary, x_i)

As it was stated before, according to Chierchia's analysis, the interpretation of (8) comes in two steps as illustrated in (9): first, the speaker asserts that Mary fell and second he asserts

[1] The operator CAUSE (Dowty 1979) is an abstract element and need not be considered identical in meaning with the English surface verb *cause*.

that what caused Mary's falling was the fact[2] that John pushed Mary. This interpretation seems to fit well our intuitive understanding of simple statements with the genuine, paradigmatic causal *because*, where the event described by the proposition *q* is the cause of the event described by the proposition *p*.

There are other uses of *because* where the causal relation shows up in a significantly different manner, as in the example below:

(10) The neighbours are at home because the lights are on.

In (10), the causal relation between the event described by *p* and the event described by *q* is not the paradigmatic causal relation for *because*. In fact, it is highly improbable that the presence of lights causes the presence of neighbours. In an ordinary context, someone who states (10) concludes that the neighbours are at home on the basis of the fact that the lights are on. In this kind of examples, *p because q* behaves as an inference where *q* serves as a premise and *p* is a conclusion drawn on the basis of the premise *q* and some general rule which is in the common background of the speaker and the hearer. Let us consider in detail the form of the argument involved by the inferential *because*. There are two premises (11a) and (11b); the former, which is not overtly uttered, is a kind of general rule, and the latter, mentioned explicitly as *q*, is an observed fact:

(11) a. If the lights are on, the neighbours are at home.
b. <u>The lights are on.</u>
c. The neighbours are at home.

As we can see, the kind of inference involved in inferential *because* corresponds to the enthymemic reasoning: we mention explicitly only the minor premise and the conclusion while the major premise is left implicit.

But it is obvious that our general rule is of probabilistic nature: when the lights are on, people are normally home. The word 'normally' already suggests that this kind of inference is defeasible. We could contest the conclusion (11c) by saying that the lights are always on in our neighbours' home because they want to simulate their presence in order to prevent an eventual burglary. The important point here is that, contrary to the canonical causal examples, in our example (10) it is not *p* which is hold to be true, but *q*. In other words, we are not sure whether the neighbours are at home or not, we can only guess it, or believe it, but what we are absolutely sure of is the fact that the lights are on. The only work done by *because* here is to build up a kind of argument which aims at justifying our belief. Metaphorically speaking, we can say that the inferential *because* corresponds to the creation of an argument *in vivo*.

Let us now see how, by means of Chierchia's analysis, we can formalise our inferential *because*. By analogy with (9), we get the following formula for (10):

(12) [the neighbours are at home]$_i$ $\wedge$ CAUSE (the lights are on, x_i)

This formalisation would lead us to an incorrect interpretation: the neighbours are at home and what causes their presence is that the lights are on, which cannot be true, as we have already mentioned. It shows that we have omitted to mark a very important element for the inferential interpretation of *because*, namely the fact that the speaker has a propositional attitude of *belief* towards *p*, the attitude which is not explicitly stated. It is necessary to

[2] When I say that a fact causes something, it doesn't mean that I endorse a view according to which facts have causal power. I will be using the word *fact* in its non technical sense. It is just a convenient manner to refer to the event described by the true proposition, namely fact.

integrate this not overtly uttered element in order to keep the analysis on the right track. How can we do it, since it is not overtly pronounced? One solution might come from Chierchia's idea of *silent operators* (Chierchia 2006).

Silent operators are items which do not explicitly appear in a sentence but whose presence is tacitly assumed, often in addition to focal stress[3]. Analogically, let us assume that in the inferential *because*, there is a silent operator B for *believe*:

(13) B[the neighbours are at home]$_i$ $\wedge$ CAUSE (the lights are on, x_i)

The interpretation of our sentence is now the following: the speaker believes that the neighbours are at home and what makes him believe it is the fact that the lights are on.

The above analysis allows us to obtain the correct and precise interpretation for inferential *because*. In particular, it shows that the factivity of *p* in inferential *because* is not guaranteed: we could say that the neighbours are at home because the lights are on in a situation when in fact they are not at home, which will be discussed in more detail in the next section.

5. EMBEDDING CONTEXTS

In what follows, I will examine three different kinds of contexts which can embed *because* clauses: negation, propositional attitude expressed by the predicate *believe* and the modal operator *probably*.

5.1. Embedding *because* under negation

Assuming Chierchia's analysis (2004:87), let us consider the genuine causal *because* under wide scope negation:

(14) $\neg$ [[Mary fell]$_i$ $\wedge$ CAUSE (John pushed Mary, x_i)]

Since according to this analysis, the *because* clause is a hidden conjunctive sentence, we are getting the negation of conjunction $\neg$ (p $\wedge$ q). Logically, it is equivalent to the alternative of two negated propositions ($\neg$p $\vee$ $\neg$q). However, pragmatically, the inclusive disjunction ($\vee$) in the latter formula must be replaced by the exclusive disjunction (w) which yields the formula ($\neg$p w $\neg$q) understood as either $\neg$p or $\neg$q, but not both. Therefore, we can obtain a strong meaning of (14) by using the alternative of the two formulae:

(15) [$\neg$[Mary fell]$_i$ $\wedge$ CAUSE (John pushed Mary, x_i)]]
$\vee$ [[Mary fell]$_i$ $\wedge$ $\neg$CAUSE (John pushed Mary, x_i)]]

If we assume the factivity of CAUSE (i.e. the fact that CAUSE(q, p) entails p $\wedge$ q), we get:

(16) [[Mary fell]$_i$ $\wedge$ $\neg$CAUSE (John pushed Mary, x_i)]

[3] Consider the following example, which I borrow from Chierchia (2006). If to your question: *Did you meet the new students?*, I respond: *I met [$_F$ Joe and Sue]* (where [$_F$] indicates some focal stress); my response is understood as if the silent operator *only* were present there.

The above formula captures precisely the sense we intuitively get for causal *because* clauses under negation, namely the negation of the causal relation, but not necessarily of the occurrence of its relatum.

But is this the only reading we have under negation? Can we get more details from this type of analysis? We said we are negating the causal relation between two events but are we still assuming the occurrence of the event-cause (the occurrence of the event-effect is indisputable in this case)? In fact, we can imagine two scenarios.

In the first scenario, it is true that Mary fell and it is true that John pushed her but in fact Mary fell for another reason, for example, she slipped on a banana skin. But there is still another possibility. In this case, it is also true that Mary fell but it did not happen because John pushed her, because as a matter of fact he didn't. It seems that the wide scope negation is ambiguous between these two scenarios.

In the first reading, the described events have both occurred but there is no causal relation between them. Consider (17):

(17) a. ¬ [p because q]
b. p & q
c. ¬CAUSE (q, p)
d. (17b) & (17c)

In the second scenario, something else is going on. There are two things that are negated: the existence of the causal relation between the two described events and the very occurrence of the event given as the cause. We can say even more: the causal relation does not hold because one of its relata does not exist, as it is shown below:

(18) a. ¬ [p because q]
b. p & ¬q
c. ¬CAUSE (q, p)
d. (18c) because (18b)

The particular use of this last *because* can be found in situations when the speaker is guessing or speculating about causes. It is widely used in natural science, history, medicine and last but not least in criminal investigations. Typical examples can be found in most "who-done-it" stories. We can easily imagine the following dialogue between various characters taken from one of the classic Sir Conan Doyle's stories: "What could possibly cause the sudden death of Sam?" asked Maria. "He died because he had a heart attack" said Dr Watson. "I'm afraid you are wrong my dear Watson. He didn't die because he had a heart attack but because he was poisoned by curare[4]", said Sherlock Holmes.

Summing up, the reading of *because* under wide scope negation leads to an ambiguity. One can negate the existence of the causal relation between two events either because one of the events (event-effect) did not occur (18) or because the causal relation itself is wrongly asserted to hold between two events that really occurred (17).

If the above is correct, it means that I have identified a third kind of causal *because*, one which is factive only with respect to *p*. I propose to call it the conjectural *because*. In the positive uses of this *because*, some explicit linguistic elements may modify the sentence containing *because*: Mary fell *perhaps* because John pushed her. In this case, the speaker explicitly signals his distance with the event announced as the cause. In every day practice, the explicit marking can be used or not.

[4] Which can simulate the heart attack symptoms, as is well known to every reader of detective stories.

Let us now see what happens when we put the inferential *because* under wide scope negation:

(19) The neighbours are not at home because the lights are on.

and apply the silent *believe* operator. By analogy to (15), we get (20):

(20) $[\neg B[\text{the neighbours are at home}]_i \wedge \text{CAUSE (the lights are on, } x_i)]$
$\vee\ [B[\text{the neighbours are at home}]_i \wedge \neg\text{CAUSE (the lights are on, } x_i)]$

By the same reasoning as in (16), we achieve the following analysis for (19):

(21) $B[\text{the neighbours are at home}]_i \wedge \neg\text{CAUSE (the lights are on, } x_i)$

Given the inferential nature of this kind of *because*, the interpretation of (21) is the following: on the basis of the fact that *q* (presence of lights) the speaker is not allowed to believe that *p* (presence of neighbours). Or, step by step: (i) the speaker believes that *p* (the first conjunct is not negated), but (ii) the speaker is not allowed to maintain his belief (the negation of the causal relation in the second conjunct conveys the impossibility of doing the correct inference because the tacitly invoked rule: “when the lights are on, people are at home” doesn’t hold or cannot apply here).

What the inferential *because* does under wide scope negation is confirming our intuitions that are sketched below:

(22) a. p because$_{\text{inferential}}$ q
b. (22a) -/-> p
c. (22a) $\rightarrow$ q

In other words, by the fact that the rule the speaker is using to infer his belief that *p* is incorrect or inappropriate to the case at hand, the conclusion of his inference, namely his belief that *p*, is not correct, and therefore the content of his belief (p) is not true. That is also the reason why the causal relation itself cannot hold. This is schematically illustrated below for the negative inferential *because*:

(23) a. $\neg$[p because$_{\text{inferential}}$ q]
b. $\neg$p & q
c. $\neg$ CAUSE (q, p)
d. (23b) because (23c)

We can see in (23) a similarity with the scheme describing the conjectural *because* identified in this section (recall 18), with the significant asymmetry of factivity: $\neg$ *p & q* (23b) in the former versus *p &* $\neg$ *q* in the latter (18b).

5.2. Embedding *because* under *believe*

In this section, I turn to *because* clauses explicitly embedded under *believe*, starting with the inferential *because*. Let us consider the following sentence:

(24) I believe the neighbours are at home because the lights are on.

The question is what kind of interpretation we can get out of it – can the operator *believe* have a narrow scope interpretation only or can it have wide scope or even both? We can certainly have the narrow scope interpretation – it is just stating explicitly what was implicit in the basic inferential reading: the speaker believes that the neighbours are at home and what causes his belief is the fact that the lights are on (Section 2).

But what interpretation do we get if we place *believe* in wide scope in the formal way? In order to use Chierchia's type of analysis, as in the previous section (19-21), I introduce the operator BEL to signal the overtly asserted belief in contrast with the silent B. The wide scope reading of (24) is then (25):

(25) BEL [the neighbours are at home because the lights are on]

If we now assume, what seems to be intuitively correct, that BEL(p $\wedge$ q) implies BEL(p) $\wedge$ BEL(q), we are getting (26):

(26) [BEL[the neighbours are at home]]$_i$ $\wedge$ BEL[CAUSE (the lights are on, x_i)]

(26) seems to be the interpretation we would like to have: the speaker believes the neighbours are at home and he believes it because the lights are on and not for another reason. In other words, the speaker believes two things: (i) he believes that *p* and (ii) he believes that it is just *q* that causes his belief that *p*. This suggests that we are tacitly admitting the existence of other possible reasons for the conclusion *the neighbours are at home*. What we have in mind is a set *R* of such alternative reasons, for example R = {the neighbour's car is in the parking, the neighbours are always home after 8 p.m., their fireplace is burning…}. The inferential *because* serves here to contrast our own reason with other members of the set of possible reasons in order to underline or confirm our belief of the correctness of our own choice.

Summing up, the inferential *because* embedded under *believe* may receive two interpretations: wide scope and narrow scope. The latter is equivalent to the basic inferential reading where the *believe* clause does not appear explicitly, and the former consists in taking into account the set of possible alternative reasons in addition to the reason given as the speaker's own reason.

Let us now consider what happens in the genuine causal *because* clauses when embedded under *believe*. Our example (8) becomes (27):

(27) I believe Mary fell because John pushed her.

Let us start, as before, with the narrow scope reading of *believe.* In the notation we adopted, it is expressed by the following formula:

(28) [BEL[Mary fell]]$_i$ $\wedge$ CAUSE (John pushed Mary, x_i)

(28) has the following interpretation: the speaker believes that Mary fell and what causes his belief is the fact that John pushed Mary. The causal consequence is not really asserted. What seems to be sure here is the occurrence of the event-cause *John pushed Mary*. In addition, there is some high level of certitude that the event-consequence *Mary fell* has occurred. But, in fact, what we get here is just the inferential reading of *because*. It seems that the modification of the first proposition in the *because* clause switches the genuine causal reading into the inferential one.

But one could legitimately ask whether the main clause could be put under the scope of *believe* as illustrated below:

(29) BEL [Mary fell because John pushed her]

Formal arguments, as in (26), yield the following formula:

(30) $[\text{BEL}[\text{Mary fell}]]_i \wedge \text{BEL}[\text{CAUSE (John pushed Mary, } x_i)]$

But does (30) correspond to our intuitive interpretation? The answer seems to be: no, it does not. First, we loose the factivity of *p* which is not acceptable in the case of causal *because*. Second, the interpretation itself would also be very strange for a genuine causal reading: the speaker believes that Mary fell and he believes that the causal relation is between the fact that John pushed Mary and his belief that Mary fell. In another words, the speaker believes that Mary fell and what causes his belief is the fact that it was John who pushed her (and not for instance Paul who is smaller and does not have enough strength). As before, what we get here is the inferential reading of *because*. The speaker makes some kind of inference: he knows that John pushed Mary. Since John is very tall and strong, this might have been the cause for Mary to fall. Additionally, it seems that once again the speaker constructs a set of possible alternatives: {Paul pushed Mary, Max pushed Mary, Sue pushed Mary…}. What activates the alternatives in the case at hand is probably the focal stress the speaker intuitively puts on 'John'. As a result, the factivity of *p* is no longer guaranteed. But we do not need to be bothered by this fact, since we have changed the realm; we are not in the causal world any more but in the inferential one.

Therefore, we can conclude that the scope of *believe* over the first proposition switches the genuine causal meaning of the *because* clause to the inferential one. The wide scope *believe* corroborates the results of the narrow scope *believe*. This confirms the very general intuition we have for the causal *because*: the first proposition is asserted as such and it is impossible to modify it without taking the risk to leave the real causal world.

But is this the only analysis for the wide scope interpretation of *believe*? One question remains: how can we preserve the factivity of *p* and the action of the BEL operator on the second conjunct?

We can do it but only if we supplement our formalism with an extra pragmatic argument. The point is that if someone knows that *p* then they will not apply the operator *believe* to it. Maybe our initial assumption that $\text{BEL}(p \wedge q)$ implies $\text{BEL}(p) \wedge \text{BEL}(q)$, based on the analysis of the modal operator *possible*, is not complete. One way to save this formalism would be to treat the BEL operator like the negation operator. This would mean that $\text{BEL}(p \wedge q)$ is equivalent to $\text{BEL}(p) \vee \text{BEL}(q)$. With the alternative, this time inclusive, it would imply two other possibilities, namely $(p \wedge \text{BEL}(q))$ or $(\text{BEL}(p) \wedge q)$, in addition to $(\text{BEL}(p) \wedge \text{BEL}(q))$.

The first of these three possibilities would apply to the case at hand. In other words, the interpretation of wide scope would be the following: what the speaker's belief is about is the existence of a causal relation between the two described events but he treats the first clause as known. This is demonstrated below:

(31) $[\text{Mary fell}]_i \wedge \text{BEL}[\text{CAUSE (John pushed Mary, } x_i)]$

This interpretation has two advantages: (i) it conserves the factivity of *p* and *q*, as expected in genuine causal *because*, and (ii) it preserves our intuition about the scope of *believe*, namely: what is put under the scope of *believe* is the causal relation itself between the event described by *p* and the event described by *q*.

5.3. Embedding *because* under *probably*

The last part of our analysis consists in verifying the behaviour of *because* clauses under the modal operator *probably*.

Let us start by embedding the genuine causal example under *probably*:

(32) Probably [Mary fell because John pushed her].

The translation into Chierchia's analysis takes the wide scope reading form in (33), where PROB stands for *probably*. (33) is analogous to (31) which involves the BEL operator.

(33) $[\text{Mary fell}]_i \wedge \text{PROB}[\text{CAUSE (John pushed Mary, } x_i)]$

The intuitive interpretation is that Mary fell and what probably caused Mary's falling is the fact that John pushed her. Once again, we can see here that the wide scope reading of *probably* may describe two slightly different scenarios. In the first one, it is sure that Mary fell and that John pushed her, but it is not sure (but only probable) that the latter event caused the former one, as shown below:

(34) a. probably [p because q]
b. p & q
c. PROB [CAUSE (q, p)]
d. (34b) & (34c)

The second scenario is somewhat different: it is sure that Mary fell but it is not sure that John pushed her and that is why it is not sure that there is a causal relation between the two events:

(35) a. probably [p because q]
b. p & PROB(q)
c. PROB [CAUSE (q, p)]
d. (35c) because (35b)

(35d) says that the existence of the causal relation is only probable because it is not sure that the event-cause occurred.

Interestingly, if we force the operator *probably* to take scope over the main clause of *because*, either in the wide scope reading (36) or in the narrow scope reading (37), the causal interpretation of *because* is replaced by the inferential one:

(36) $[\text{PROB}[\text{Mary fell}]]_i \wedge \text{PROB}[\text{CAUSE (John pushed Mary, } x_i)]$

(37) $[\text{PROB}[\text{Mary fell}]]_i \wedge [\text{CAUSE (John pushed Mary, } x_i)]$

(36) roughly says that on the basis of the fact that John pushed Mary, the speaker can probably draw the conclusion that Mary probably fell. The translation of (37) is easier and probably more frequent in natural language. It states that on the basis of the fact that John pushed Mary, the speaker can draw the conclusion that Mary probably fell. After all, it seems that (36) makes explicit what is implicitly assumed in (37), since in both cases the occurrence of one of the events (namely the event described by *p*) is not sure.

The very last step is to embed the inferential *because* under the operator *probably*. If it takes narrow scope, as in (38):

(38) $[\text{PROB}[\text{the neighbours are at home}]]_i \wedge [\text{CAUSE (the lights are on, } x_i)]$

we get the basic interpretation of inferential *because* where the modification of *p* is made by the modal operator *probably*: the speaker concludes, on the basis of the fact that the lights are on, that the neighbours are probably at home. As this example shows, the inferential reading of *because* can be obtained by embedding its main clause under any modifier which signals the speaker's distance to the content of the expressed proposition (*believe*, *think*, *probably*, *perhaps*, etc.).

The reading we get when *probably* has wide scope, as in (39) below:

(39) $[\text{PROB}[\text{the neighbours are at home}]]_i \wedge \text{PROB}[\text{CAUSE (the lights are on, } x_i)]$

is similar to the previous one, although more prudent. This cautious basic reading goes roughly as follows: on the basis of the fact that the lights are on, the speaker can probably draw a conclusion that the neighbours are probably at home.

If we do not put an explicit operator marking the speaker's distance to *p*, we have to assume the presence of a silent operator (for instance *believe*) as in (40) below. Otherwise, the interpretation would be completely incorrect (namely that the speaker probably draws the conclusion that certainly *p*):

(40) $[\text{B}[\text{the neighbours are at home}]]_i \wedge \text{PROB}[\text{CAUSE (the lights are on, } x_i)]$

(40) gives us the following interpretation: on the basis of the fact that the lights are on, the speaker can probably draw the conclusion (which has the form of a belief) that the neighbours are at home.

The behaviour of both, causal and inferential *because*, under the modal operator *probably* corroborates the conclusions we reached from their behaviour under the operator *believe*. In genuine causal readings, the main clause of *because* cannot be modified, otherwise we observe a switch from the causal reading to the inferential one.

6. CONCLUSIONS

Using Chierchia's type of analysis, we have revealed the mechanisms responsible for the different behaviours of *because* in the causal use and in the inferential use. In particular, we have examined these two uses of *because* embedded under operators like negation, *believe* and *probably* with respect to the property of factivity.

With the basic reading (without any explicit modifier like negation, *believe* or *probably*), the causal and the inferential *because* intuitively have different constraints on factivity: the causal *because* implies the factivity of *p* and *q* while the inferential one implies only the factivity of *q*. These intuitions are for most part confirmed by the analysis of the non basic readings of these two types of *because*. However, some adjustments had to be made with respect to factivity in the causal reading of *because*. In particular, the fact that *because* is ambiguous under wide scope negation as I showed in (17)-(18), has allowed me to postulate another kind of *because* – the conjectural one.

The conjectural *because* arises when the speaker makes an educated guess about causes on the basis of established effects. More precisely, the speaker reckons that there must be an event described by *q* which causes the event described by *p* without necessarily explicitly announcing the fact that he is just speculating about the causes of the given event described by *p*. Crucially, in this case, *q* is not factive anymore. The difference between the conjectural *because* and the genuine causal *because* can be plainly grasped in one particular reading of wide scope negation. This is the reading where the causal relation cannot hold because the *q* relatum does not exist (cf. 18). This differs from the other interpretation of *because* under wide scope negation, namely the one when the relata *q* and *p* both exist but without a causal relation between them (cf. 17).

Summing up, what follows from these analyses concerning the property of factivity is that in causal uses of *because* the only element which always remains factive is the main clause *p* whereas in inferential use of *because* it is only the factivity of *q* which is guaranteed.

Finally, the study of the interaction between *because* clauses and the operators *believe* and *probably* has revealed an interesting phenomenon. Any attempt to modify the main clause of the causal *because* with *believe* or *probably* inevitably switches the causal reading of the whole sentence to the inferential one. This phenomenon cannot run in the opposite direction because, in the basic inferential reading, we have to deal with a silent *believe* operator which is not removable and thus prevents the switch effect.

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