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Because We Say So

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Abstract

In this paper, we show that contingency connectives, which mark causal and conditional relations (PDTB Group, 2008), restrict the possible interpretations of reports in their scope in a way that many other connectives, such as contrastive connectives, do not. We argue that this result has immediate implications for the semantics of causal relations and for the annotation of implicit connectives. In particular, it shows that the assumption, implicit in some work on NLP, that the semantics of explicit connectives can be translated to implicit connectives is not anodyne.

1 Introduction

In addition to their standard intensional use, many embedding verbs have a semantically *parenthetical use* (Urmson, 1952; Simons, 2007), in which the content of the embedded clause conveys the main point of the report. Semantically parenthetical uses can occur even when the report is not syntactically parenthetical, as shown in (1) and (2). In these examples, the embedded clause *he is out of town* (labeled ‘ β ’) conveys the main point because its content offers an explanation of Fred’s absence.

- (1) - [Why didn’t Fred come to my party?] $_{\alpha}$
- Jane said [he is out of town.] $_{\beta}$
- (2) [Fred didn’t come to my party.] $_{\alpha}$ Jane said
[he is out of town.] $_{\beta}$

If the matrix clause does not contribute directly to the explanation of Fred’s absence in (1) and (2), it is arguable that only the content of the β -clauses contributes to the second argument of the explanatory relations that hold in these examples. In terms of *Segmented Discourse Representation Theory* (SDRT) (Asher and Lascarides, 2003), for

example, the relation QUESTION-ANSWER-PAIR in (1) should be taken to hold only between α and β ; the content of the matrix clause should be likewise excluded from the second argument of EXPLANATION in (2) (Hunter et al., 2006). Similarly, the *Penn Discourse Treebank* (PDTB) would relate only α and β in (2) with implicit *because* (Dinesh et al., 2005; Prasad et al., 2006).

Given this analysis of (1) and (2), however, it is puzzling why the report in (3) cannot be understood parenthetically. On the surface, (2) and (3) differ only in that the two sentences in (2) have been connected with the subordinating conjunction *because* in (3). Yet this seemingly harmless change leads to a dramatic change in interpretive possibilities.

- (3) (#)¹ Fred didn’t come to my party because Jane said he is out of town.

And as we’ll see in §2, the contrast between (2) and (3), heretofore unnoticed in the literature, can be replicated for all contingency relations: all contingency connectives exhibit a distaste for semantically parenthetical reports.

The contrast between (2) and (3) is surprising for a further reason, namely that many relations and connectives that do not indicate causality *do* appear to accept the embedded clauses of semantically parenthetical reports as arguments.

- (4) Lots of people are coming to my party. Jane said (for example) that Fred is coming with his whole family.
- (5) Fred is coming to my party, although Jane told me that Bill is not.

The report in (4) is understood parenthetically; it is the content of the embedded clause, not the matrix clause, that serves as a specific example of the

¹We use the symbol ‘(#)’ to mark examples containing reports that cannot be interpreted parenthetically; ‘(#)’ does not exclude the possibility of a non-parenthetical interpretation.

claim made in the first sentence. Unlike in (3), this parenthetical reading is felicitous even when *for example* is explicit. (5) shows that semantically parenthetical reports can occur in contrastive relations, as the contrast intuitively holds between Fred’s coming to the party and Bill’s not coming. It also shows, given that *although* is a subordinating conjunction, that a parenthetical reading of (3) is not blocked simply by the fact that *because* is a subordinating conjunction.

The contrast between (2) and (3), as well as that between (3) and (4)/(5), has direct implications for the annotation of reports and the semantics of contingency relations. In §2, we argue for the following generalization:

- (C) if a contingency relation is marked by an explicit connective that has syntactic scope over the matrix clause of a report, this report cannot have a parenthetical interpretation.

With general support for (C) in place, §3 returns to the contrast, illustrated by (2) and (3), between examples of EXPLANATION with implicit and explicit connectives. We argue that this contrast raises problems for existing discourse theories and annotation practices. §4 discusses causal connectives that have a temporal sense, e.g. *after*, which appear to be counterexamples to (C). We show that this problem is only superficial.

In what follows, we will use the term *parenthetical* to talk only about semantically parenthetical uses, unless otherwise stated. We will also adopt the notation conventions of the PDTB (PDTB Group, 2008). Each discourse connective has two arguments, Arg1 and Arg2. The text whose interpretation is the basis for Arg1 appears in italics, while the text that serves as the basis for Arg2 appears in bold. If the connective is explicit, it is underlined. An example is given in (6):

- (6) *Fred didn’t come to the party* because **he is out of town**.

Sections 2 and 3, like the current section, will focus exclusively on data in English, though the claims made about the data in these sections hold for the French translations of the data as well. In section 4, we will discuss a point on which the data in English and French diverge in an interesting way. In all cases, the examples that we use to motivate our analysis are constructed for the sake of simplicity. Nevertheless, our claims for English

are supported by data from the PDTB and *The New York Times*, as we discuss in more detail in §5.

2 Contingency relations

In the PDTB, the class of contingency relations includes causal relations (EXPLANATION and RESULT in SDRT) and their pragmatic counterparts (EXPLANATION* and RESULT*), as well as semantic and pragmatic conditional relations. To this we add relations of purpose or GOAL, marked by connectives such as *so that* and *in order to*. For simplicity, we will adopt the vocabulary of SDRT when talking about discourse relations, e.g. using EXPLANATION when the PDTB would talk of ‘reason’, etc.

In section 2.1, we argue that EXPLANATION and RESULT support (C). Section 2.2 introduces an apparent counterexample to this claim but then shows that this example can easily be explained within the confines of (C). In section 2.3, we show that EXPLANATION* and RESULT* pattern with their semantic counterparts with regard to parenthetical reports, and section 2.4 rounds out the discussion of contingency connectives by showing that CONDITION and GOAL support (C) as well.

2.1 Semantic explanations and results

EXPLANATION is lexically marked by the conjunctions *because*, *since*, *after*, *when*, *now that*, *as* and *for*; there are no adverbials that lexicalize this relation. *Since*, like *because*, supports (C).

- (7) a. *Fred can’t come to my party* since **he’s out of town**.
 b. (#) *Fred can’t come to my party* since Jane said he’s out of town.

The remaining causal conjunctions follow suit, but due to particularities that arise from their temporal nature, we delay our discussion of them until §4.

RESULT is lexicalized only by adverbial connectives: *therefore*, *hence*, *consequently*, *as a result*, *so*, and these connectives appear to pattern with markers of EXPLANATION with regard to (C). In other words, if the matrix clause falls in the syntactic scope of the adverbial, it falls in the discourse scope of the adverbial as well.

Demonstrating that (C) holds for RESULT adverbials requires care, because adverbials, unlike conjunctions, can move around. Consider (8):

- (8) Fred didn’t go to the party. (H.)₁ Jane said (,H.)₂ that Luc (, H.)₃ did (, H.)₄.

However could be inserted in one of any of the four locations marked with ‘H’ above to make the example felicitous. Yet to test whether *however* allows parenthetical readings of reports in its syntactic scope, only position 2 matters. Even when *however* is in position 1, syntactic scope over the matrix clause is not ensured, as the placement of the adverbial could be the result of extraction from the embedded clause (Kroch and Joshi, 1987; Pollard and Sag, 1994).

Once we restrict our attention to adverbials in position 2, we can see more clearly that some allow parenthetical readings of reports in their syntactic scope while others do not. A parenthetical reading of the report in (8) is permitted with *however* in position 2. By contrast, the placement of *afterwards* in the matrix clause of (9) blocks a parenthetical reading.

- (9) *Fred went to Dax for Christmas. Jane said afterwards that he went to Pau.*

To the extent that (9) is felicitous, the second sentence cannot be rephrased as *Jane said that he went to Pau afterwards* (although this would be a possible rephrasing of the example if *afterwards* were in position 1, 3 or 4). The more natural reading is a non-parenthetical one according to which the time at which Jane made her statement was after the time at which Fred went to Dax.

Thus we can distinguish two groups of adverbials: (i) adverbs that when they have syntactic scope over the matrix clause of a report do not allow parenthetical readings of that report, e.g. *afterwards*, and (ii) adverbs that, given the same syntactic configuration, *do* allow a parenthetical reading of the report, e.g. *however*. We can then extend these groups to discourse connectives in general, including conjunctions. In these terms, *because* falls in group (i), because it conforms to (C), and *although*, in group (ii).

With the foregoing discussion of adverbials in mind, we return now to RESULT and the question of whether RESULT adverbials fall in group (i) or group (ii). Consider (10):

- (10) a. *Fred drank too much last night. Therefore, he has a hangover today.*
 b. *Fred drank too much last night, Jane said/thinks, therefore, that he has a hangover today.*

A parenthetical reading of the report in (10b) would be one in which the content of the matrix

clause does not contribute to the second argument of RESULT. In the case of (2), we said that the act of Jane’s *saying* that Fred is out of town in no way explains Fred’s absence—only the content of what she said matters. Yet a parallel analysis is not obviously correct for (10b) (which is why we have included the matrix clause of the report in Arg2 above). While if Jane is right, it is true that Fred’s hangover is the result of his over zealous drinking, it is also reasonable to say that Jane’s conclusions are the result of Fred’s drinking too much: it was his drinking that prompted her to say or think what she does. We conclude that *therefore* falls in group (i) and, more generally, that RESULT supports (C).

2.2 A clarification

Before moving on to pragmatic causal relations, let’s take a closer look at examples of EXPLANATION in which the source of an indirect speech report in the scope of *because* is also the agent of the eventuality described in Arg1. At first glance, such cases might appear to be counterexamples to (C), because the report in the syntactic scope of *because* does not provide a literal explanation of the eventuality described in Arg1.

- (11) *Jane didn’t hire Bill because she said he didn’t give a good interview.*

It is presumably not the case that Jane did not hire Bill because she *said* he didn’t interview well, but rather because she *thought* that he didn’t do well.

Yet in (11), the author is not even weakly committed to the claim that Bill’s interview performance is responsible for his not being hired, so the report cannot have a parenthetical interpretation (thus we have placed the matrix clause in bold-face above). And if the report is non-parenthetical, then (11) is not problematic; *because* readily allows non-parenthetical readings of reports in its syntactic scope, as illustrated in (12a) and (12b).

- (12) a. *Jane didn’t hire Bill because she thought he didn’t give a good interview.*
 b. *Jane didn’t hire Bill because her secretary said/thought that Bill didn’t give a good interview.*

The only feature that sets (11) off from the mundane examples in (12) is the fact that Jane’s act of saying what she did does not provide a literal explanation for her hiring decision. We think that the use of an indirect speech report is permitted despite this fact only because Jane is both the agent

of Arg1 and the source of the report in Arg2. The assumed close tie between an agent's thoughts and actions, together with the semantics of *because*, allow us to conclude in (11) that Jane *thought* Bill didn't do well—the real explanation proffered for her hiring decision.

Interestingly, despite the non-parenthetical reading of the report in (11), this example can be reformulated with a syntactic parenthetical:

- (13) *Jane didn't hire Bill* because, **she said, he didn't give a good interview.**

This is interesting because normally a syntactic parenthetical construction would be taken to entail a semantically parenthetical construction. Yet we do not think that the speaker is required to accept the content of Jane's report in (13) any more than she is in (11). The use of the syntactic parenthetical appears rather to distance the speaker's point of view from Jane's. But as we argued for the phenomenon illustrated in (11), we think that the non-parenthetical interpretation of the syntactically parenthetical report in (13) is made possible only by the fact that the agent of Arg1 is the source of the report in Arg2 of EXPLANATION.

2.3 Pragmatic explanations and results

Pragmatic result, or RESULT* in SDRT, holds between two clauses α and β when α provides justification for the author's affirmation of β . In other words, RESULT*(Arg1, Arg2) if and only if RESULT(Arg1, affirm(author, Arg2)). In examples (14a-c), Arg1 does not provide an explanation of the conclusion drawn in Arg2 (the accumulation of newspapers did not cause the neighbors to be out of town), but rather of why the speaker or Jane formed the belief that the conclusion holds. (14b) and (14c) are examples of RESULT because they make this causal relation explicit with *I think* or *Jane said/thinks*. (14a), an example of RESULT*, leaves this connection implicit. (In order to visually signal the presence of a pragmatic relation in the examples in this section, we mark the corresponding connectives with a '*'.)

- (14) a. *The newspapers are piling up on the neighbors' stoop.* Therefore*, **they must be out of town.**
 b. *The newspapers are piling up on the neighbors' stoop.* **I think**, therefore, **that they must be out of town.**

- c. *The newspapers are piling up on the neighbors' stoop.* **Jane said/thinks**, therefore, **that they must be out of town.**

Reports in examples like (14b) and (14c) cannot be read parenthetically, and the nature of RESULT* prevents its second argument from ever being a clause embedded by a parenthetically used verb.

EXPLANATION* reverses the order of explanation from RESULT*, i.e. EXPLANATION*(Arg1, Arg2) = EXPLANATION(affirm(author, Arg1), Arg2). EXPLANATION* is marked by connectives such as *since*, *because*, and *for*, which need not be explicit, hence the parentheses in (15). (15a) and (15c) are examples of EXPLANATION*, while (15b) and (15d), which explicitly evoke the speaker's belief state for Arg1, are examples of EXPLANATION.²

- (15) a. *The neighbors must be out of town* (because*) **newspapers are piling up on their stoop.**
 b. *I think that the neighbors must be out of town* because **newspapers are piling up on their stoop.**
 c. *The neighbors must be out of town* (because*) **Jane said that newspapers are piling up on their stoop.**
 d. *I think that the neighbors must be out of town* because **Jane said that newspapers are piling up on their stoop.**

In both (15c) and (15d), the matrix clause *Jane said* contributes to Arg2, i.e. the reports are not parenthetical. These examples are not like (2) because the fact that the evidence comes from Jane is crucial in the formation of the speaker's belief that the neighbors are out of town in (15c,d) in a way that it is not crucial to Fred's absence in (2). In all three examples, there is a reasoning process involved in which Jane figures, but the reasoning process is not the main point of (2) in the way that it is for (15c) and (15d).

In §3 we will provide a further reason why (15c) should not be considered parenthetical. This argument, together with those given in this section, in turn supports our claim that connectives that mark causal relations are members of group (i) of discourse connectives, regardless of whether they

²We assume that for Jane to sincerely say that P, Jane must believe P; it might be more accurate to talk about Jane's commitments rather than her beliefs, but that detail is not important here.

mark semantic or pragmatic relations. That is, these connectives conform to (C).

2.4 Other contingency relations

A quick review of the remaining contingency relations shows that principle (C) is obeyed throughout this class. GOAL can be lexically marked by the subordinating conjunctions *in order that* and *so that*; semantic conditional relations are generally marked by the conjunction *if*. In all cases, principle (C) is respected because the reports in examples like (16b) and (17b) cannot be understood parenthetically.

- (16) a. *Fred made a pizza last night so that Mary would be happy.*
b. * Fred made a pizza last night so that Jane said/thinks that Mary would be happy.
- (17) a. *Fred will play tennis if Mary doesn't show up.*
b. (#) Fred will play tennis if Jane said/thinks that Mary won't show up.

3 Commitment and veridicality

Now that we have shown that contingency relations support (C), we return to the contrast between (2) and (3) and discuss the problems that this contrast raises for existing theories of discourse and annotation.

In (15c) note that while the verb *say* could be replaced by, for example, *noticed* or *told me*, it cannot be replaced by *believe* or *thinks*.

- (18) # The neighbors must be out of town because Jane thinks that newspapers are piling up on their stoop.
- (18) can be repaired, however, by weakening the modal in Arg1 from *must* to *might*:
- (19) *The neighbors might be out of town (because) Jane thinks that newspapers are piling up on their stoop.*

This follows from the semantics of EXPLANATION*, which holds when Arg2 is presented as *the* reason for drawing the conclusion given in Arg1. The speaker is not entitled to draw a stronger conclusion than her evidence allows. The use of *thinks* in (18) implies that Jane is not fully committed to the claim that newspapers are piling up on the

neighbor's doorstep, so the speaker is only entitled to affirm a possibility claim like that in Arg1 of (19). Thus (18) is infelicitous for the same reason that (20) is not an example of EXPLANATION*: Jane's saying what she did does not justify the conclusion that the neighbors are out of town (Danlos and Rambow, 2011).

- (20) The neighbors must be out of town. Jane said that newspapers are piling up on their stoop, but that's not why I think they're gone.

In contrast to (18), (2) is felicitous with *thinks*:

- (21) *Fred didn't come to my party.* Jane thinks **he's out of town.**

In (21), the author's commitment to Fred's absence is allowed to be higher than Jane's commitment to his being out of town. This is because Jane's saying what she did is not presented as the justification of the author's belief that Fred wasn't at the party. The author has other reasons for thinking and saying that Fred was not at his party; now he's exploring reasons for Fred's absence. Thus the contrast between (18) and (21) provides further support for our claim in §2.3 that the report in (15c) is not parenthetical; the semantics of the report in (15c) affect the acceptability of the example.

The foregoing discussion of parenthetical reports has implications for the *veridicality* of discourse relations. In SDRT, which provides a theory not only of discourse structure but also of the interpretation of that structure, EXPLANATION and RESULT, along with their pragmatic counterparts, are *veridical* relations, where a relation R is veridical just in case if $R(\alpha, \beta)$ is true at a world w , then α and β are true at w as well. In the case of causal relations, for it to be true that one eventuality caused another, it must be the case that both eventualities truly occurred. In this paper, we have limited our study of parenthetical reports to the right argument (Arg2) of discourse relations. Accordingly, we will limit our discussion of veridicality to *right-veridicality*.

From the data that we have so far, it is clear that EXPLANATION* is right veridical: if Arg2 isn't true, it cannot justify Arg1. Even in the case of (15c), while what Jane said can be false, it must be true that Jane said what she said. Likewise, the data that we have discussed for RESULT, RESULT*, GOAL and conditional relations indicate that these relations are also right-veridical.

The question is more complicated for EXPLANATION. A speaker who asserts (2) or (21) and offers Jane’s comment as an explanation is not fully committed to Fred’s being out of town. This is clear in (21), where the verb *think* indicates a hedged commitment. Thus, if we analyze the reports in (2) and (21) as parentheticals, then right veridicality is not ensured for EXPLANATION, at least when unmarked by an explicit connective.

When EXPLANATION is explicitly marked with *because*, *since*, or *for*, right veridicality appears to be ensured by the fact that these conjunctions block parenthetical readings of reports in their syntactic scope. Yet (3), repeated as (22a), is greatly improved if we use a syntactic parenthetical, which suggests that its infelicity has more to do with syntax than with veridicality:

- (22) a. (#) Fred didn’t come to my party because Jane said he is out of town.
b. *Fred didn’t come to my party* because, Jane said, **he is out of town**.

However, note that *said* in (22b) cannot be replaced with a weaker embedding verb like *thinks*:

- (23) # Fred didn’t come to my party because, Jane thinks, he is out of town.

This shows that even though a syntactic parenthetical is used in (22b), the speaker must be fully committed to the content of Arg2, i.e. right veridicality is ensured for EXPLANATION when it is explicitly marked with *because*.

We have seen that EXPLANATION is right veridical when explicitly marked, but that (2) does not require the veridicality of the clause labeled ‘ β ’. This difference forces us to make a choice. We can maintain the claim that (2) is nevertheless an example of EXPLANATION; in this case, we must adjust the semantics of EXPLANATION accordingly and conclude that veridicality is a requirement imposed by connectives, not relations. Alternatively, we can maintain that EXPLANATION is always (right) veridical; in this case, we must give up the claim that (2) is an example of EXPLANATION.

We suspect that the second choice is better. There is, after all, no connective that can be inserted between the sentences in (2) in such a way that the meaning is preserved, which suggests that a deep semantic difference is at play between (2) and examples of EXPLANATION. Either way, however, existing theories of discourse structure will

need to be adjusted to account for our observations on contingency relations and parenthetical reports. For example, if (2) is not a genuine example of EXPLANATION, SDRT needs to offer a viable alternative relation. On the other hand, if (2) is a genuine example of EXPLANATION, SDRT needs to adjust the notion of veridicality in the semantics of this relation and indeed, of any other supposedly veridical discourse relations that allow their Arg2 to be the embedded clause of a parenthetical report.

Our observations also raise questions about the semantic implications of the choice made in the PDTB to insert an implicit connective in the absence of an explicit one. While this choice was a practical one meant to facilitate the annotation task for the PDTB, it has been taken to further levels in other work on NLP, and we think this is dangerous from a semantic point of view. While NLP systems designed to identify discourse relations in the presence of explicit connectors have yielded very positive results (f-scores over 90% for guessing one of the four major PDTB sense classes, i.e. Temporal, Contingency, Comparison and Expansion (Pitler and Nenkova, 2009)), the task of identifying discourse relations that hold between spans of text has proven very difficult in the absence of explicit connectives. To handle the latter type of case, systems have been designed that use the deletion of explicit connectives, whose semantics are known, to obtain examples with implicit connectives that inherit the semantics of their explicit counterparts in an effort to create new data that can be exploited in the identification of implicit relations (Marcu and Echihiabi, 2002). In the other direction, systems have been built to predict implicit discourse connectives between two textual units with the use of a language model (Zhou et al., 2010).

In both kinds of systems, deleting an explicit connective or adding an implicit connective is considered a harmless move, though this practice has been questioned by (Sporleder and Lascarides, 2008). The data presented in this paper show that the presence or absence of a discourse connective may drastically change the data when reports of saying or attitudes occur in the second argument of a discourse relation — positing an implicit *because* in (2) is not an anodyne move from a semantic point of view.

4 Temporal relations

While *afterwards* falls in group (i) of discourse connectives, because it does not allow parenthetical readings of reports in its scope, as shown in (9), other temporal markers appear to fall in group (ii). Consider, for example, *after* and *before* in (24a) and (24b), respectively.

- (24) a. *Fred arrived at the scene* $_{\alpha}$ after [police say] $_{\beta}$ [the crime occurred.] $_{\gamma}$
b. *Fred had tried to improve his life* $_{\alpha}$ before [police say] $_{\beta}$ [he robbed a bank.] $_{\gamma}$

Both (24a) and (24b) have a reading according to which the temporal relation indicated by the underlined conjunction holds between the clauses α and γ rather than α and β , which suggests that the reports are parenthetical. The fact that the relation between α and β can be independent of the temporal constraints of the connective is clearest in (24a) in which the time of β can actually be after the time of α .

The possibility that temporal connectives allow parenthetical readings of reports in their scope is potentially problematic for our arguments in §2 because some temporal connectives, such as *after*, *now that*, *as* and *when*, can have a causal sense in addition to their temporal sense. And when they do, parenthetical reports still appear to be possible, as shown in (25):

- (25) *Fred was arrested* $_{\alpha}$ after [police say] $_{\beta}$ [he pulled a gun on an officer.] $_{\gamma}$

In (25), we understand the arrest as a result of Fred's pulling a gun on an officer, so *after* has a causal sense. Nevertheless, the time of β can come after the time of α , thus suggesting a parenthetical report.

Interestingly, the data on *after* and *before* in English are not supported cross-linguistically. Up to example (24), all of the data that we have discussed are felicitous in French if and only if they are felicitous in English,³ but this is not so for (24) and (25), whose French counterparts are syntactically ill-formed.

- (26) a. * Fred est arrivé sur les lieux après que la police dit/dise que le crime a eu lieu.
b. * Fred a essayé d'améliorer sa vie avant que la police dise qu'il a cambriolé une banque.

³Some of the data presented in this paper are discussed for French in (Danlos, 2013).

- c. * Fred a été arrêté après que la police dit/dise qu'il a pointé un pistolet sur un policier.

The parenthetical reading of the report in (25) is greatly aided by the use of the present tense on *say*, which excludes the possibility that the matrix clause introduces an eventuality that held before Fred was arrested. For whatever reason, the use of the present and/or present subjunctive in similar environments is not allowed in French, as shown in (26). This difference could be taken two ways. Perhaps *after* does violate (C) after all and the only reason that parenthetical readings are blocked in (26) is because French syntax does not allow this reading to be brought out. On the other hand, it could be that *after* does support (C), but that *police say* in (25) is not functioning as a standard matrix clause.

Evidence for the second option, which is consistent with (C), comes from the fact that all of the examples that we have found like (25) come from newspapers and involve a matrix clause like *police say* (*parents say*, *teachers say*, ...) and can be paraphrased using *allegedly* instead of *police say*:

- (27) *Fred was arrested* after **he allegedly pulled a gun on an officer.**

Parenthetical readings do not appear to be possible for reports in which the matrix clause cannot be paraphrased with *allegedly*, as shown in (28):

- (28) (?) Fred revised his negative opinion of Paris after Jane says/said he had a wonderful visit there last summer.

If the result in (25) does not generalize to standard reports like that in (28), it is unlikely that the interpretation of the report in (25) should be explained in terms of the causal nature of *after*; it is far more likely to be due to an idiosyncrasy of the matrix clause *police say*.

In any case, a full discussion of examples like (25) is not directly relevant to the discussion of causality in this paper. For the temporal connectives that can have a causal sense (*after*, *now that*, *when*, *as*, and their French counterparts), it is the case in both French and English that when they have a causal + temporal sense, their interpretative possibilities match those in which these connectives have a purely temporal sense. This fact, combined with the fact that these connectives rarely if ever have a purely causal sense, tells us that their

temporal nature is more fundamental. So (25) is not a direct challenge to the arguments that we have made in this paper about causal relations and parenthetical reports.

Let's return to (C):

- (C) if a contingency relation is marked by an explicit connective that has syntactic scope over the matrix clause of a report, this report cannot have a parenthetical interpretation.

We conclude that this generalization holds for all contingency relations and markers with a purely causal or otherwise contingent sense. We furthermore predict that if there are examples in which either *after*, *now that*, *when* or *as* has a purely causal interpretation, in none of these examples will we find a parenthetical reading of a report in the connective's syntactic scope.

5 Conclusion

In this paper, we have examined the interaction between contingency connectives and the interpretation of reports that fall in their syntactic scope. We have shown that contrary to certain other types of connectives, such as contrastive connectives like *although* and *however*, contingency connectives restrict the interpretations of reports in their scope so that these reports must be interpreted non-parenthetically. That is, contingency connectives support (C). We argued that this result has immediate implications for theories of discourse structure and annotation. In particular, SDRT must either adjust the semantics of EXPLANATION to include examples like (2), which are not right-veridical, or introduce a new relation to handle (2). And the assumption that one can move between implicit and explicit connectors—an assumption made for practical reasons in the PDTB but taken to further extremes in other work on NLP described in §3—is not semantically innocent.

Throughout this paper, we have used constructed examples to simplify the discussion. However, data from the PDTB provide support for our claims in the sense that it provides no counterexamples to (C) with *because* or *since*. We found only 6 results for a search of the PDTB with the following criteria: explicit relation + (connector = *because*) + (Arg2 Source = Other). Our aim was to find examples in which a report is in the syntactic scope of *because*. Of the 6 examples that we found, two involved continuations of di-

rect quotations and so did not have an explicit matrix clause, while the 4 remaining examples were of the sort discussed in §2.2, where the agent of Arg1 is the source of the report in Arg2. Nor did we find any counterexamples with an equivalent search for *since* (0 results for an equivalent search with explicit *since*).

A separate search of the PDTB revealed no violations of (C) for examples in which *now that*, *as*, and *when* have purely causal interpretations. That is, for all examples in the PDTB in which *now that*, *as*, and *when* are explicit and have a causal sense, and in which 'Arg2 Source = Other' holds, these connectors have a temporal sense as well. (There are no examples in the PDTB in which *after* has a purely causal sense). While a thorough study of temporal connectives is needed to fully understand the behavior of these conjunctions, as explained in §4, these data provide strong prima facie support for the claims made in §4.

In future work we would like to extend our study of contingency connectives, starting with temporal connectives, to see how far (C) can be generalized to other kinds of relations. We also hope to back up our results for English and French with more cross-linguistic research. In the meantime, data on contingency connectives in French and English offer clear support for (C).

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