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Abstract. This paper examines the possibility of providing a unified account of the projection properties of presuppositions, conventional and conversational implicatures. I discuss the solution offered in (Roberts et al. 2009) and show that the central notion we need to cover the spectrum of observations is that of *attachment*.

1 Introduction

The most basic observations about presuppositions concern what is called their *projection* behaviour. Roughly speaking, a presupposition can be characterised as an entailment which is able to project. A sentence S presupposes a proposition ϕ whenever S entails ϕ and certain 'suitably modified' versions of S entail ϕ (projection). The 'suitably modified' qualification encompasses negation, interrogation and a variety of embeddings. For instance, *Mary knows that Paul cheated on the exam* and its modified versions *Mary does not know / Does Mary know that Paul cheated on the exam* preserve the presupposition that Paul cheated.

Projection is not automatic. It depends on context and on the properties of embedding. A less well-known property concerns the limitations on *attachment*. Ducrot (1972) had noted that it is difficult to attach a discourse constituent to a presupposition. For instance, the only possible meaning of (1) is that Paul does not cheat (asserted content) because he was behind in his work. The probably more natural interpretation that Paul was in the habit of cheating (presupposed content) because he was always behind cannot be construed.

(1)   Paul has stopped cheating on exams because he was always behind in his work

The question naturally arises whether these two properties can be unified in some way and perhaps ultimately viewed as two sides of the same coin. In the next section, I describe in more detail the symmetry between projection and attachment constraints. In section 3, I present the approach of Roberts et al. (2009) and highlight the possibility of deriving from it attachment constraints, which are shown to have a clear experimental reflection in section 3.2. Finally, in section 4, I show that attachment is a more fundamental notion to analyse the interaction between discourse and projection.

2 Extending the Symmetry between projection and attachment

There is little doubt that presuppositions tend to project and do not provide a natural attachment site. Roberts et al. (2009) suggest that projection extends to conventional implicatures (CIs) and to certain conversational implicatures (cis). For instance, they borrow from Chierchia and McConnell-Ginet the observation that non-restrictive relative clauses project. (2) would be a case of CI projection because (i) it entails that Paul cheated on the exam and (ii) according to Potts (2005), such clauses trigger a CI.

(2)   a.   Paul, who has cheated on the exam, might be dismissed
        b.   Do you think that Paul, who has cheated on the exam, might be dismissed?

Cases of ci projection have been discussed in particular in (Simons 2005). Consider (3) (Simon's example 27). Answer B1 makes sense only if one assumes some sort of negative connection between rain and going on a picnic. This connection is preserved in B2 variants.

(3)   A – Are we going on a picnic?
        B1 –It's raining
        B2 –It's not raining / Is it raining?

Attachment limitations have also been investigated with a similar result. Ducrot's (1972) *loi d'enchaînement* ('linking law') targets presuppositions. In a nutshell, the linking law forbids any attachment to a presupposition, whether by way of a subordinating or coordinating conjunction, except for *et* ('and') and *si* ('if'), or by way of a 'logical relation'. In (Jayez 2005, Jayez and Tovena 2008), it is claimed that conventional implicatures are subject to the same limitations. For instance, in (4), the preferred interpretation is that John being unable to register for the next term is the cause of his failure. A more natural interpretation is that it is bad luck for him since he cannot register, but constructing this interpretation would involve recruiting the CI trigger *unfortunately* for the attachment (see Potts 2005 for evaluative adverbs and Jayez and Rossari 2004 for parentheticals).

(4)   Unfortunately, Paul has failed his exam, because he cannot register for the next term

Finally, it has been noted in various works that CIs cannot provide natural targets for refutation, see (Jayez and Rossari 2004, Potts 2005). E.g. the refutations in (5) target only the asserted proposition that Paul has failed his exam, leaving aside the evaluative CI trigger *unexpectedly*.

(5)   A – Paul has unexpectedly failed his exam
        B – You lie / You are wrong / Impossible / Quite the contrary

I consider that refutation cases fall into the category of attachment limitations. In a refutation, the attempt by an addressee to attach a new constituent to a presupposition or to an implicature is bound to be perceived as artificial.

It is of course tempting to hypothesize that there is a common source behind the projection and the attachment observations, and that presuppositions, CIs and cis can be grouped into a natural class, whose members differ essentially by specific lexical profiles.

3   Accounting for the Symmetry: the QUD Approach

3.1   Basics

Recently, Roberts et al. (2009) have proposed that presuppositions, CIs and cis, which they group under the generic term of *not-at-issue content*, after Potts' term for CIs, share indeed a central property: they do not necessarily address the Question Under Discussion (QUD). Assuming that each discourse is organised around at least one common topic (the QUD), they offer the following principle.

(6)   **QUD principle** All and only the not-at-issue content may project.

Two important points are to be mentioned at this stage. First, if we decide to see presuppositions and implicatures as members of a common family, it is no longer possible to attribute their common behaviour to properties that do not hold for the whole class. So, anaphoric or dynamic theories of presuppositions, whatever their merits, are not plausible candidates for unifying presuppositions, CIs and cis since, for instance, they do not make room for CIs (Potts 2005). Roberts et al. make the same point for common ground theories of presuppositions.

Second, if the QUD theory is correct, it should allow one to derive the attachment properties. Roberts et al. include the refutation test among those properties that characterise the projecting elements but they do not tackle the general question of attachments. Generalising from Potts, I assume that the semantic and pragmatic contribution of a discourse constituent can be seen as a n-tuple $\langle q, a_1 \ldots a_n \rangle$, where the first element (at-issue content) addresses the QUD and the other ones are presupposed or implied material. Functions can extract the relevant material. If C is a constituent, $AI(C)$ extracts the at-issue content of C, $pres(C)$ the presuppositions, etc. Consider now a pair of adjacent constituents (C_1, C_2) in a monologue, typically two successive sentences or clauses that convey a proposition. By using C_1, the speaker signals that she contributes to the QUD with $AI(C_1)$. If the next constituent is connected to an element of C_1 different from $AI(C_1)$, the speaker abandons the QUD. In most contexts, this is an odd move because the speaker just addressed the QUD *via* $AI(C_1)$, hence the impression of a non sequitur. In dialogues, the situation is a little different since we cannot, in general, assign to participants a unique discourse strategy. It may be the case that participants disagree on certain issues. This accounts for the fact, noted by Jayez and Rossari and von Fintel (2004), that it is perfectly possible to interrupt the discourse trajectory ascribed to a participant, for instance by questioning a presupposition or a CI she endorses.

(7) A – Unfortunately, Paul has failed his exam
     B – Well, I wouldn't call that 'unfortunate' / It's not really unfortunate,
         you know, he's so lazy. He got what he deserves

In monologues, the price to pay for abandoning the QUD is higher since the
speaker is supposed to have a coherent strategy. This is not quite impossible,
however. A speaker may signal explicitly that she is abandoning the QUD with
a special discourse marker such as *by the way*. In that case, the speaker may
sound uncooperative, especially if she abruptly shifts the topic in the middle of
a serious discussion, but she is not incoherent since she makes clear that she is
not currently following a plan to tackle the QUD (8).

(8) Paul stopped smoking. By the way, Mary never took to smoking

There is also the (important) possibility that the non-at-issue content *does* ad-
dress the QUD, a point to which I will return in section 4.2. In (9), B uses
the double fact that Paul has been smoking and that he does not smoke as an
argument in favour of her conclusion that Paul has a strong will.

(9) A – Does Paul have a strong will?
     B – Generally speaking, yes. He has stopped smoking, for instance

3.2 Simple Experimental Evidence

One might argue that the QUD hypothesis, in its current stage, is only a clever
guess. However, preliminary experimental evidence is clearly consonant with the
hypothesis. If the QUD approach is right, competent speakers should process
more easily an attachment to the at-issue content than to the non-at-issue con-
tent. In order to evaluate this prediction, I carried out a simple categorisation
experiment.

   46 French students were asked to classify 40 French two-sentence pairs as
either *banale* (ordinary) or *bizarre* (weird). They were all native speakers, with
an age range of 17-27 and an age mean of 20.1. The test was administered col-
lectively (all the subjects rated the pairs together). Subjects had to read and
rate pairs following the order on the test sheet and were not allowed to correct a
previous choice. They were asked to run through the pair list as fast as possible.
In each pair that was not a filler, the sentences were related by a consequence
discourse marker (*donc* or *alors* ≈ 'so', 'therefore') or by a causal/justification
subordinating conjunction (*parce que* ≈ 'because' or *puisque* ≈ 'since'). The
pairs exploited either an at-issue or a non-at-issue linking and featured a pre-
supposition or conventional implicature trigger in a 2×2 design. The following
table shows the translations of the first five pairs with the expected answer in
the last column.

filler	trigger	connection mode	text	expected answer
yes			Max had the flu, so he stayed at home	OK
yes			Luc likes jam because the weather is fine	weird
no	*almost*	at-issue	Mary is almost late, so she hurries up	OK
no	*stop*	non at-issue	Paul stopped quivering, so he was cold	weird
no	*unfortunately*	non at-issue	The weather was fine, so, unfortunately, Susan had work to do	weird

The results can be analysed in several ways. In this paper, I describe only an exploration based on the Mac Nemar test for paired samples. This test is usually applied to temporal transitions of the same sample of subjects. For instance one wants to determine whether the proportion change in the value of some variable before and after a medical treatment is significant. The test can in fact be used whenever the proportions of binary responses of the same group are to be compared in two different conditions, namely two types of sentence pairs in our case. The sentence pairs (excluding fillers) were classified into different categories, according to their connection mode (at-issue or not at-issue) and the presupposition or CI triggers they contained. They were compared pairwise and the 496 resulting tests were themselves classified into different categories according (i) which mode of connection (at-issue, not at-issue with presupposition, not at-issue with CI) each pair exhibited and (ii) whether the trigger was identical in the two pairs.

The most salient observation is that, for identical triggers, there is more often a significant difference between the at-issue and non-at-issue cases and subjects preferentially reject the non-at-issue variant. There are 10 pairs (out of 13) that show a significant difference in the at-issue vs. (non-at-issue and presuppositional) comparison, and 15 pairs (out of 16) for the at-issue vs. (non-at-issue and CI) comparison. This is in agreement with the QUD approach and also with the extended version of Ducrot's *loi d'enchaînement*. However, individual results suggest that the difference in accessibility between at-issue and non-at-issue content may vary across triggers. For instance, the *seul* ('only') and the *à peine* ('hardly') element do not fit well into this general picture. More work is needed to evaluate the import of specific properties of lexical items.

4   The attachment approach

In spite of its attractiveness, the QUD approach faces some problems and I will defend the view that the notion of attachment is a better candidate to address them.

4.1   When Contrast Steps in

The possibility of linking depends, among other things, on the discourse relation on which the linking is based. Ducrot's prohibition can be extended to conventional implicatures but concerns primarily what he called *argumentative* relations, that is, essentially, justification or explanation and consequence. The experimental findings reported above are based on those very same relations.

Contrast discourse markers do not give so clear-cut results. For instance, under at least one interpretation, B's answer in (10) means that, in contrast to Mary having smoked, Paul never smoked. Crucially, the at-issue content *must* be ignored in the contrast for it to make sense (see ??*Mary does not smoke but Paul never smoked*). Many analogous examples can be constructed: in (11) the linking associates the presupposition that Mary got three A's and the fact that she failed the French exam. In (12) the implicature that Mary is under twenty is involved (Jayez and Tovena 2008).

(10)   A – Do your friends smoke, in general?
        B – It depends. Mary has stopped smoking but Paul never smoked

(11)   A – How did Mary fare?
        B – It depends. She was the only one to get three A's but she failed the French exam

(12)   A – How old are they?
        B – Mary is almost twenty but Paul is well over twenty

Following Umbach (2005), I assume that, in such cases, *but* triggers the accommodation of a *quaestio*, that is, an overt or abductively reconstructed question with respect to which the contrastive discourse constitutes a relevant answer. *But* dually connects two alternatives by asserting one and negating the other (the *confirm+deny condition* in Umbach's terms). A typical quaestio for p *but* p' is 'are p and $\neg p'$ both true?'. Let us compare now (13), (14) and (15). B's answer in (13) is predictably odd since its at-issue content bypasses the QUD (whether Mary has been smoking in the past). In (14), the at-issue content of the first conjunct still bypasses the QUD, since the proposition that Mary does not smoke is hardly relevant to A's question. However, the combination of the presupposed part (Mary has been smoking) and the at-issue content of the second conjunct addresses the quaestio made explicit through A's question. (15) shows that the order of conjuncts matters. Why is it so?

(13)   A – Did Mary smoke?
        B – ??Mary has stopped smoking

(14)   A – Did both Mary and Paul smoke?
        B – Mary has stopped smoking, but Paul never smoked

(15)   A – Did both Mary and Paul smoke?
        B – ??Paul never smoked, but Mary still smokes

If the two conjuncts were conceived of as independent, as in an update sequence, the (14)-(15) contrast would be mysterious. I propose to represent the structures studied by Umbach as complex propositions, where the second conjunct 'maximally settles' the issue, from the speaker's point of view, that is, expresses the ultimate piece of information the speaker delivers on this particular issue at this stage. The asymmetry between the two conjuncts is captured by saying that (i) the second conjunct is attached to a *new* quaestio by a Question-Answer discourse relation in the most explicit cases or by a more abstract relation of

Resolution and (ii) the new quaestio takes into account the partial resolution of the initial quaestio by the first conjunct.

(16)   Given a quaestio Q, an Umbach-structure p *but* p' results in a Resolution type attachment of p' to the quaestio Q' obtained by eliminating the alternatives compatible with Q but incompatible with p.

(16) captures the idea that the second conjunct is the salient resolver. If we accept that, whenever the quaestio remains implicit it is nonetheless a particular form of QUD, possibly one only the speaker is initially privy to (see Ginzburg 2009 for the epistemic treatment of QUDs), we see that the QUD intuition can be preserved in the above cases but that one has to introduce some additional attachment structure. The proposition that the speaker communicates to settle the issue raised by the QUD must depend on the at-issue content of the attached resolver. This requirement is violated in (15) because the second conjunct, that maximally settles the quaestio by selecting the alternative 'Mary smoked', does not address the new quaestio 'Granted that Paul did not smoke, did Mary smoke?' through its at-issue content.

4.2   The QUD Principle Revised

The problem discussed in this section is more serious. Consider (17).

(17)   A – Is Paul a good partner?
        B – He does not answer to mails very quickly

The preferred interpretation of B's answer is that Paul answers to mails, but not very quickly. Thus, the proposition that Paul answers to mails survives the negation and projects. However, it is difficult to say that it does not address the QUD, at least not if we consider what is relevant to the topic made salient by A's question. Similar observations hold for standard presuppositional cases. B's answer in (18) clearly presupposes that John has been smoking and this fact is strongly relevant to the main topic of John's temperament. It suggests for instance that John was unable to put a term to his addiction.

(18)   A – Does Paul have a strong will?
        B – Generally speaking, no. He didn't stop smoking, for instance

Note that neither with (17) nor with (18) do we base our understanding *only* on a general or circumstantial rule like [addiction $\rightsquigarrow$ no strong will]. It is necessary to make the *fact* that Paul answers to mails or that he has smoked enter the picture, in order to draw from B's answers various inferences relevant to the QUD. So, the situation cannot be reduced to the Simon's type of example we mentioned in section 2.

(17) and (18) illustrate the possibility that information pieces which address the QUD project. Crucially, in both cases, one observes attachment limitations. E.g. it is impossible to interpret (19a) and (19b) as meaning that Paul answers to mails because he is professional and that he smoked because he liked smoking.

(19) a. . . . He does not answer to mails very quickly, because he is very
          professional
      b. . . . He didn't stop smoking, for instance, because he liked that

Such observations have two consequences. First, they show that material usually
considered as implied or presupposed can address the QUD *and* be projected.
Second, if attachment limitations were a reflection of not addressing the QUD,
as I have proposed, they should disappear. In view of these problems, I propose
to modify principle (6) as follows.

(20) **Revised QUD principle** In linguistic communication, whenever some
      content is conventionally marked as obligatorily interpretable with re-
      spect to the QUD, all and only the content that is not marked in this
      way projects.

(20) postulates that every piece of linguistic communication can come with con-
ventionally QUD-relative content. The linguistic marking of at-issue content vs.
presuppositions or CIs provides a typical case. I leave open the possibility that a
linguistic item contains no conventionally QUD-relative content, as might be the
case for interjections (Wharton 2003). Conventional QUD-relative content does
not necessarily address the QUD, but is conventionally marked as obligatorily
interpretable with respect to it. Thus, an uncooperative conventionally QUD-
relative discourse constituent which abruptly 'drops' the current topic cannot be
projected.

Conventionally QUD-relative content contains those elements which con-
tribute to 'what is said' in the Gricean sense, that is, all the non-presupposed and
non-conventionally implied formulae resulting from exploiting the linguistic code
and assigning values to those indexical arguments that occur in the predicates
of such formulae. This amounts to saying that the conventionally QUD-relative
content comprises entailments and certain *explicatures*[1] (Sperber and Wilson
1986). For instance, in (21a) the QUD relative content includes all the entail-
ments of the proposition that it is raining at t, where t is the value assigned
to the time indexical associated with the sentence tense. In contrast, whereas
the existence of a consequence relation between the rain and staying at home in
(21b) is also considered as an explicature in some recent approaches (see Ariel
2008 for a survey), it is not integrated into the QUD-relative content under the
present analysis. This choice is motivated in the next section, which considers
the attachment problem.

(21) a. It is raining
      b. It is raining, so I prefer to stay at home

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[1] Standard explicatures result from interpreting pronouns and providing spatio-
temporal coordinates.

4.3 Attachment Revisited

The reviewed data suggest that attachment is not uniquely context-sensitive. In fact, for at least certain discourse relations, including Explanation, Justification and Contrast, attachment may not target non QUD-relative content, even when this content happens to address the QUD, see (17), (18) and (19). This is not to be confused with a prohibition on *binding*. Lexical material such as pronouns or additive discourse markers (see Winterstein 2009 for *too*) can be bounded to non QUD-relative content. I propose that attachment limitations are related to the *independence* of QUD-relative and non QUD-relative content. Consider the well-known 'sister' example discussed by Stalnaker.

(22)   I have to pick up my sister at the airport

In a DRT-based treatment (Geurts 1999), (22) asserts that the speaker S has to pick up x at the airport and presupposes that x is a sister of the speaker. The net result is a set of literals $\{L_1 = pick\text{-}up(x), L_2 = sister(x)\}$, whose elements sound unrelated. For instance, there is no obvious 'proposition' (literal) that would be a common consequence of L_1 and L_2 or would entail jointly L_1 and L_2. More generally, given the contribution of a discourse constituent, $\langle L_1, \ldots, L_n \rangle$, there is no guarantee that $L_1 \ldots L_n$ can be jointly connected to a common literal through some discourse relation. If attachment was unconstrained, the general independence of the contribution members would make the construction of an interpretation in discourse even more difficult than it is. For instance, given simple two sentence dialogues of the form (A:S1=$\langle L_1, L_2 \rangle$–B:S2=$\langle L'_1, L'_2 \rangle$), A would have to eliminate one of L'_1, L'_2 since *both* would be a priori equivalent candidates for providing a continuation to S1. Symmetrically, B would have to eliminate one of L_1, L_2 to determine which part of the contribution is intended by A to require a continuation. This would lead to massive ambiguity in the worst cases. A plausible conjecture is that languages have developed conventionalised preferences for attachment in order to streamline discourse management. We are now in a better position to understand the relation between the QUD and attachment. Only those elements that are marked for attachment are obligatorily interpreted as addressing the QUD because the constraints on attachment help keeping the thread in discourse evolution. Accordingly, when an element is marked for attachment, it is also marked as contributing to the discourse topic at the current point. Elements that are not so marked can project, since they are subtracted from the current discussion thread. As we saw in the previous section, this does not prevent something from addressing the QUD and projecting, if this element is not conventionally marked as attachable (and addressing the QUD).

5   Conclusion

The upshot of the previous discussion is that an element can address the QUD and nonetheless project. This is so because projection is (negatively) associated with conventionalised attachment preferences, that do not vary with the

context. Several important issues are still pending. I will mention two of them. First, additional experimental work is necessary to construct models of cognitive processing for non-at-issue content. In particular, recent work on anticipatory effects (Chambers and San Juan 2008) might complicate the debate over the role of common ground and, more generally, the dynamic character of presuppositions, questioned in various approaches (Abbott, Schlenker). Second, the status of non-conventional elements, so called 'conversational implicatures', is unclear. Since they do not necessarily correspond to a segment of linguistic code, their integration into a layered conventional system, as is proposed here, has to be reconsidered.

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