Dissatisfaction theory[*]

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Abstract

I propose a new theory of semantic presupposition, which I call *dissatisfaction theory*. I first briefly review a cluster of problems − known collectively as the *proviso problem* − for most extant theories of presupposition, arguing that the main pragmatic response to them faces a serious challenge. I avoid these problems by adopting two changes in perspective on presupposition. First, I propose a theory of projection according to which presuppositions project *unless* they are locally entailed. Second, I reject the standard assumption that presuppositions are contents which must be entailed by the input context; instead, I propose that presuppositions are contents which are marked as backgrounded. I show that, together, these commitments allow us to avoid the proviso problem altogether, and generally make plausible predictions about presupposition projection out of connectives and attitude predicates. I close by sketching a two-dimensional implementation of my theory which allows us to make further welcome predictions about attitude predicates and quantifiers.

Keywords: semantic presupposition, presupposition projection, the proviso problem, two-dimensional theories of presupposition, presuppositions under attitude predicates, presuppositions in conditionals, presuppositions under quantifiers

1 Introduction

A puzzling gap exists between the predictions of most theories of presupposition projection, versus what speakers of certain sentences are felt to take for granted. The standard response to this puzzle − known as the *proviso problem* − is a pragmatic shrug: the predicted *semantic* presupposition is the correct one, but it can be

strengthened through general pragmatic reasoning to match what speakers are felt to take for granted. In this paper I argue that this response does not suffice, and sketch a new theory of presupposition which avoids the proviso problem.

I begin in §2 by arguing that a pragmatic response to the proviso problem cannot explain certain cases in which presuppositions apparently get strengthened: namely, cases in which presuppositions appear to be strengthened even though doing so leads to pragmatic infelicity. In §3, I lay out a new theory of presupposition, which I call *dissatisfaction theory*. Dissatisfaction theory avoids the proviso problem by adopting a perspective on semantic presupposition which is new in two respects. First, dissatisfaction theory adopts a new algorithm for presupposition projection, according to which presuppositions project unless they are locally entailed. Second, unlike standard theories, which treat presuppositions as contents which must be entailed by the antecedent context, dissatisfaction theory treats them as a part of the total content of an assertion which is marked as backgrounded. I show that this approach captures much of what is attractive about standard theories, while making more plausible predictions about presuppositions under connectives and attitude predicates − avoiding, in particular, the weak predictions that lead to the proviso problem. In §§4-5, I sketch an implementation of dissatisfaction theory in a two-dimensional framework, and explore the further predictions of this approach about projection out of attitude predicates and quantifiers.

1.1 Semantic presupposition

In the rest of the introduction, I say a bit more about my subject matter, semantic presupposition. I identify semantic presuppositions as follows. If an assertion of a sentence p licenses an inference to a proposition r in a context c, then p *presupposes r* in c just in case (i) the inference is preserved when p is embedded in the 'family of sentences' (Chierchia & McConnell-Ginet 1990): i.e. in the antecedent of a conditional, in a question, or under an epistemic modal or negation; and (ii) the inference is *not* preserved when p is in an entailment-canceling environment and r is locally entailed, as in sentences like (1) or (2):[1]

(1)   If r, then p_r.

(2)   Not r or p_r.

(i) is standard; (ii) lets us distinguish presuppositions from other kinds of contents which also project through the family of sentences, like conventional implicatures.

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1 I sometimes sloppily talk about a sentence presupposing a sentence, and sometimes omit a reference to a context when convenient. I use sans serif letters as sentence variables and italic letters to stand for the corresponding proposition. I write p_r for a sentence p which presupposes r, again leaving reference to context implicit.

Paradigm cases of presupposition are change of state verbs, definite descriptions, factive constructions, and clefts.[2] Contrary to much of the literature on the topic, I will *not* assume that presuppositions are truth-value gaps, or constraints on input contexts (indeed, I will argue against the latter claim, which makes '*pre*supposition' a somewhat misleading label).

2   The proviso problem

The proviso problem is a problem for a wide range of theories, with the significant exception of DRT.[3] These theories include satisfaction theory,[4] as well as multivalent theories,[5] and a variety of others.[6] All of these theories make some or all of the problematically weak predictions which I will review in this section, and so most of the negative points I make here extend equally to all these theories. I will focus here on satisfaction theory, however, partly for concreteness, and partly because it provides a helpful foil for my own view.

2.1   Satisfaction theory

Satisfaction theory has two planks. The first is a hypothesis about the pragmatic impact of semantic presuppositions. Where c is a context, which we model as the set of worlds compatible with the common ground of the conversation:

> *Stalnaker's Bridge*: If p presupposes r in c, then p can only felicitously update c if c entails r.

Stalnaker's Bridge says that the presuppositions of a sentence must be commonly accepted before the sentence is evaluated and added to the common ground. *Stalnaker's Bridge* has obvious *prima facie* counterexamples in the form of 'informative' presuppositions, but defenders of satisfaction theory posit an unobtrusive process of *accommodation* which ensures that *Stalnaker's Bridge* is satisfied with respect to the

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2 I focus less on additive particles, which behave like these presupposition triggers in some ways but not in others.

3 van der Sandt 1989, 1992, Geurts 1996, 1999, Krahmer 1996, Kamp 2001, a.o. See the conclusion for brief discussion.

4 Following Geurts's (1996) nomenclature; satisfaction theory is spelled out in Heim 1982, 1983, 1990, 1992, based on earlier work in Stalnaker 1973, 1974, Karttunen 1974, and since developed in Beaver 2001, von Fintel 2008, and many others.

5 In turn a broad class; see Kleene 1952, Strawson 1952, van Fraassen 1969, Peters 1977, Karttunen & Peters 1979, and more recently George 2008, Fox 2012.

6 E.g., Soames 1982, Schlenker 2008, Chemla 2008.

context relative to which we evaluate an assertion, even when it is not satisfied with respect to the context before the assertion takes place.[7]

The second plank concerns presupposition projection − how to calculate the presuppositions of a complex sentence, given the presuppositions of its constituents:

> *Local Satisfaction*: p can only update a context *c* if all of p's constituents have their presuppositions *locally* entailed in *c*. p presupposes *r* just in case any context *c* which p can update entails *r*.

Local Satisfaction is a local version of *Stalnaker's Bridge*: it says that the presuppositions of a sentence's constituents must be locally entailed (in addition to the presuppositions of the whole sentence being globally entailed). Then it defines a derivative notion of sentence presupposition, as whatever is entailed by any context which that sentence can update. (*Local Satisfaction* takes for granted a notion of local entailment, which can be spelled out in various ways − the subject of much recent discussion.[8] I will not engage with that discussion, which is orthogonal to my interests here; everything I say, both in criticizing satisfaction theory and in giving my own view, is compatible with a variety of positions on this issue. For concreteness, I assume the predictions given in Heim 1983, 1992.)

Local Satisfaction makes a number of welcome predictions. For instance − assuming that (3) presupposes (4) − *Local Satisfaction* correctly predicts that this presupposition fails to project in (5), since it is locally entailed by (5)'s antecedent.

(3)   John will pick up his sister at the airport.

(4)   John has a sister.

(5)   If John has a sister, he'll pick up his sister at the airport.

Likewise, assuming that (6) presupposes (7), *Local Satisfaction* correctly predicts that this presupposition does not project in (8) (since, again, it is locally entailed).

(6)   John believes that Susie stopped smoking.

(7)   John believes that Susie used to smoke.

(8)   If John believes that Susie used to smoke, then he believes that she stopped.

Generally speaking, satisfaction theory makes plausible predictions about cases in which presuppositions fail to project, like (5) and (8).

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7 See e.g. Karttunen 1974, Stalnaker 1974, Lewis 1979, Stalnaker 2002, von Fintel 2008.
8 See especially Schlenker 2009, Rothschild 2011/2015.

2.2 Problematic predictions

In other cases, however, satisfaction theory makes predictions which are systematically weaker than what a speaker is observed to be taking for granted. This problem arises for projection through two environments: connectives and attitude predicates. Consider first a presupposition under a connective, as in (9) (I will focus on conditionals here, but these remarks extend equally to other connectives).

(9)   If John has free time this afternoon, he'll pick up his sister at the airport.

A speaker who asserts (9) in an ordinary context will be felt to take for granted that John has a sister. But according to *Local Satisfaction*, (9) presupposes just what is required at any context to ensure that the local context for its consequent entails that John has a sister. That turns out to be the material conditional (10):

(10)   John has free time this afternoon $\supset$ John has a sister.

It is easy to reproduce cases like this, which illustrate a gap between what looks like *unconditional* projection through connectives − in this case, of the proposition that John has a sister − versus *conditional* projection predicted by satisfaction theory.[9]

The second problem concerns presuppositions under attitude predicates, as in (6), repeated here (I focus on 'believes', but, again, the problem is quite broad):

(6)   John believes that Susie stopped smoking.

Local Satisfaction predicts that the strongest presupposition of (6) is that John believes that Susie used to smoke. Following Sudo 2014b, I will call this an *i-inference*. This prediction looks correct: (6) does indeed license this inference, and the family of sentences tests discussed above confirm that it is a presupposition. But, out of the blue, an assertion of (6) *also* seems to license the inference that Susie used to smoke.[10] Again following Sudo 2014b, I will call this an *e-inference*. This inference, likewise, seems presuppositional: it is preserved through the family of sentences, as in (11) and (12), and disappears when locally entailed, as in (13):

(11)   John doesn't believe that Susie stopped smoking.

(12)   If John believes that Susie stopped smoking, he'll get her a present.

(13)   If Susie used to smoke and John believes that she stopped smoking, he'll get her a present.

While satisfaction theory correctly predicts i-inferences as presuppositions, it fails to predict e-inferences as presuppositions.

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9 This problem has been known since Karttunen & Peters 1979; see Geurts 1996 for discussion.
10 See Karttunen 1974, Heim 1992.

2.3 A pragmatic response

The mismatch between what satisfaction theory (and theories like it) predict about projection out of connectives and attitude predicates, versus what speakers are felt to take for granted, is known as the proviso problem (Geurts 1996). The main line of response acknowledges this mismatch, but rightly responds that the existence of this gap does not on its own show that satisfaction theory's predictions are wrong. According to satisfaction theory, a speaker of a sentence p will be felt to take for granted all of p's presuppositions; but she may *also* be felt to take for granted other things. Defenders of satisfaction theory argue that, in the relevant cases, systematic pragmatic considerations let us make sense of why speakers are felt to take for granted more than the sentence's semantic presuppositions.[11]

Thus, for instance, a conditional like (10) is a strange conditional, and it is hard to see why a speaker would take it for granted. It is plausible on general grounds that if a speaker is assuming that conditional, it is because she is *also* assuming something stronger which entails it − in this case, that John has a sister.

A related but slightly different pragmatic story extends to e-inferences.[12] Consider (6). Here, the thought goes, the speaker is *taking for granted* that John believes that Susie once smoked ((6)'s predicted presupposition). In general, we do not take for granted noteworthy things. False beliefs are noteworthy. Thus if the speaker is taking for granted that John believes that Susie once smoked, she must also be taking for granted that this belief is true, and thus that Susie once smoked.

2.4 Against a pragmatic response

A pragmatic response to the proviso problem along roughly these lines is widely accepted. However, it faces a substantial challenge. I argue this point in detail in Mandelkern 2016, focusing on projection out of connectives; here I briefly review that argument, and then show that it extends to projection out of attitude predicates.

The basic architecture of the pragmatic response just sketched is as follows. In some contexts in which a sentence p presupposes r, a speaker of p is, for pragmatic reasons, felt to take for granted some r^+ strictly stronger than r. We can test this proposal by constructing contexts in which there are strong pragmatic reasons *not* to 'strengthen' r to r^+, and see whether strengthening nonetheless happens. In particular, we can construct contexts in which, if we take the speaker to be assuming

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11 Stories of this kind have been sketched e.g. in Karttunen & Peters 1979, Soames 1982, Heim 1990, 1992, Beaver 1992, 1999, 2001, Heim 2006, van Rooij 2007, Singh 2007, 2008, von Fintel 2008, Fox 2011, Schlenker 2011, Lauer 2014, Sudo 2014b; see also Pérez Carballo 2009, Lassiter 2012 for related but slightly different proposals, which also run into trouble with the kinds of cases I give here.

12 See especially Heim 1992, Sudo 2014b.

r^+, her assertion is felt to be peculiar, but not so if we take her to be assuming r alone. The pragmatic approach just sketched predicts that strengthening must be justified on general pragmatic grounds. In these contexts, such considerations clearly tell against strengthening, since we can only preserve the coherence of the speaker's assertion if we do not strengthen the presupposition.

This prediction, however, does not seem to be borne out, either for connectives or attitude predicates. Consider first the exchange involving conditionals in (14):

(14) a. Why was John limping earlier? Is he an athlete?

   b. ?? I'm not sure why he was limping. Maybe he has a stress fracture? I don't know if he plays any sports, but if he has a stress fracture, then he'll stop running cross-country now.

(14b) is strange: intuitively, because the speaker first says that she doesn't know whether John plays any sports, and then asserts a conditional which seems to commit her to the proposition that John runs cross-country. But why would an assertion of the conditional in (14b) be felt to commit her to this? According to satisfaction theory − assuming the consequent of the conditional presupposes that John once ran cross-country − the conditional has the semantic presupposition in (15):

(15) John has a stress fracture $\supset$ John once ran cross-country.

By contrast with a conditional like (10), there is nothing particularly strange about a conditional like (15); after all, having a stress fracture makes it much more likely that you used to run cross-country. And yet this conditional seems to get 'strengthened' to the unconditional proposition that John once ran cross-country. This runs counter to the predictions of the pragmatic response to the proviso problem, however, since it is only because of this strengthening that (14b) strikes us as infelicitous. If strengthening were indeed a pragmatic process, then we would expect it to be blocked in cases like this, where there is strong pragmatic pressure against strengthening. Instead, we would expect to interpret (14b) as communicating just what (16) does:

(16) I'm not sure why he was limping. Maybe he has a stress fracture? I don't know if he plays any sports, but if he has a stress fracture then he used to run cross-country, but he'll stop now.

And, unlike the speaker of (14b), the speaker of (16) sounds coherent (if overconfident − after all, it's possible to get stress fractures from something other than cross-country). A pragmatic strengthening story, therefore, seems to undergenerate in cases like this: it cannot explain why conditional presuppositions like (15) are strengthened to unconditionals even in the face of strong pragmatic pressure not to.

Similar cases to (14b) can be constructed with other kinds of triggers (see Mandelkern 2016 for more cases). And a similar point can be extended to presuppositions under attitude predicates. Consider (17):

(17)   a.   What's become of the vase that used to be on the table?

        b. ?? I don't know. Lucy believes that it was Susie who broke it.

(17b) is odd: intuitively, because the speaker first says that she doesn't know what happened to the vase, then says something which commits her to the proposition that it was broken. According to satisfaction theory, however, (17b) presupposes (18):

(18)   Lucy believes that someone broke the vase.

A pragmatic strengthening story says that (18) can get strengthened to the proposition that someone broke the vase, on the basis of general pragmatic considerations. But those considerations should be blocked in this case, since strengthening (18) leads to infelicity. By contrast, leaving it unstrengthened should render the sequence perfectly felicitous, so that it communicates essentially what the felicitous variant in (19) communicates:

(19)   I don't know. Lucy believes that someone broke the vase, and that it was Susie who broke it.

Similar cases, again, can be generated with different triggers, as in (20):

(20)   ?? I don't know much about Bugandan politics, for instance whether it's a monarchy or a republic. But Bernhard believes that Buganda's monarchy is hereditary.

Once again, satisfaction theory predicts that (20) presupposes just that Bernhard believes that Buganda is a monarchy. But the speaker is felt, with her second sentence, to be assuming that Buganda *is* a monarchy. This strengthened reading, however, is not predicted by the pragmatic approach, since it clashes with the speaker's avowal of ignorance in the first sentence, rendering the sequence marked.

As with connectives, then, the pragmatic strengthening story undergenerates for attitude predicates: it cannot explain why presuppositions get strengthened even when there is strong pragmatic pressure not to strengthen them.

3   Dissatisfaction theory

The pragmatic response to the proviso problem thus faces a substantial challenge. Rather than propose a different solution to the proviso problem here, I will propose a new theory, *dissatisfaction theory*, which avoids the weak predictions that lead to the proviso problem in the first place, while capturing much of what is attractive about satisfaction theory.

3.1 Core commitments

As we saw above, satisfaction theory seems to make the right predictions about when a presupposition fails entirely to project. In other words, satisfaction theory seems to be correct in predicting that presuppositions fail to project when locally entailed. Satisfaction theory captures this fact by adopting *Local Satisfaction*, which stipulates that presuppositions *must be locally entailed*, and then defining a derivative notion of sentence presupposition. But we can also capture this fact more directly by stipulating that presuppositions project *unless they're locally entailed*:[13]

> *Local Dissatisfaction*: If p presupposes r in c and q embeds p, then q presupposes r in c unless r is locally entailed at any node in q which dominates p.

To get a feel for *Local Dissatisfaction*, consider its predictions about (21):

(21)   If p, then q_r.

According to *Local Dissatisfaction*, (21) presupposes r in c unless $c \cap p \subseteq r$. We thus preserve satisfaction theory's correct predictions about when presuppositions fail to project; e.g., like satisfaction theory, we predict that r does not project out of a sentence with the form of (22), like (5).

(22)   If r, then q_r.

(5)   If John has a sister, he'll pick his sister up at the airport.

Local Dissatisfaction is also a first step towards avoiding the proviso problem. Suppose $c \cap p \nsubseteq r$; then *Local Dissatisfaction* predicts that (21) presupposes r — rather than just the conditional $p \supset r$ predicted by satisfaction theory. But to truly avoid the proviso problem, *Local Dissatisfaction* must be coupled with a new theory of the pragmatic impact of semantic presuppositions. Suppose that we couple *Local Dissatisfaction* with *Stalnaker's Bridge*, and someone asserts a sentence with the form of (21). Assume that the antecedent context entails neither r nor $p \supset r$. Then *Stalnaker's Bridge* says that the interlocutors will have to accommodate something to

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13 I move freely between talking about sentences and LFs here, and continue to take for granted a notion of local entailment. *Local Dissatisfaction* builds on and generalizes Karttunen 1973, which stipulates projection properties for the logical connectives which make the same predictions as *Local Dissatisfaction* (but otherwise differs in important ways from dissatisfaction theory). This is somewhat surprising, since Karttunen (1974), in one of the first expositions of satisfaction theory, claims to make the same predictions as Karttunen 1973: 'The new way of doing things and the old way are equivalent.' But this equivalence, importantly, is not an equivalence in predictions about presuppositions, but rather an equivalence of predictions of what sentence can be used felicitously in a context. And that equivalence holds only *modulo Stalnaker's Bridge*, which I reject.

ensure that (21)'s presuppositions are common ground (which, in this case, happens to be equivalent to ensuring that (21) has no presuppositions). The weakest thing that they can accommodate to achieve this will be $p \supset r$. Thus the proviso problem will arise again: we will not be able to explain the infelicity of cases like (14b), since we will predict that a weak, felicity-preserving accommodation is available.

To avoid this problem, I propose to reject *Stalnaker's Bridge* in favor of a new principle about the pragmatic impact of presuppositions:

> *Backgrounded Contents*: Presuppositions are backgrounded entail-ments, not constraints on input contexts.

Backgrounded Contents has a negative and a positive element. First, it rejects *Stalnaker's Bridge*: we no longer think of presuppositions as contents that must be entailed by an input context. Instead, we treat them as contents that are felt to be backgrounded. I will not say much here about what this amounts to, but the basic idea is that presuppositions should be treated in roughly the way that recent work has proposed we should treat conventional implicatures.[14] Borrowing from that work, we can say, somewhat impressionistically, that an assertion will be felt to *propose* to update the common ground with its main (non-presupposed) content, but to *impose* its presupposed content on the common ground in a way that is difficult to challenge without derailing the conversation.

3.2 Connectives

More needs to be said to precisely spell out *Local Dissatisfaction* and *Backgrounded Contents*. But we're now in a position to see how dissatisfaction theory avoids the proviso problem. Consider first presuppositions under connectives, as in (23):

(23)   If p, then q$_r$.

According to *Local Dissatisfaction*, (23) presupposes r in c unless $c \cap p \subseteq r$. And according to *Backgrounded Contents*, the presupposition of (23) will be calculated relative to the context prior to assertion, and then imposed on the common ground (not accommodated). Thus whether (23) presupposes r just depends on whether the context *prior to assertion*, together with p, entails r. So, for instance, we rightly predict that, in an ordinary context, (9), repeated here, presupposes that John has a sister, by contrast with satisfaction theory's prediction that (9) presupposes the conditional (10).

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14 See Karttunen & Peters 1979, Potts 2005, AnderBois, Brasoveanu & Henderson 2010, Murray 2014 for similar ideas regarding other kinds of backgrounded content. Others who have suggested rejecting *Stalnaker's Bridge* have been largely motivated by theoretical skepticism about presupposition accommodation (e.g. Gauker 2008). By contrast, I have no theoretical qualms about accommodation.

(9)   If John has free time this afternoon, he'll pick up his sister at the airport.

(10)   John has free time this afternoon ⊃ John has a sister.

Moreover, we predict that (14b), repeated here, presupposes that John once ran cross-country (assuming it is not already contextually entailed that John used to run cross-country if he has a stress fracture):

(14b)   ?? I'm not sure why he was limping. Maybe he has a stress fracture? I don't know if he plays any sports, but if he has a stress fracture, then he'll stop running cross-country now.

Unlike satisfaction theory, we therefore immediately predict the infelicity of (14b). And we avoid the proviso problem for other connectives in a similar way.

    Before turning to dissatisfaction theory's predictions about attitude predicates, I note a potential issue for the present approach. Dissatisfaction theory predicts that complex sentences *never* have conditional presuppositions (apart from factives which embed conditionals). But defenders of satisfaction theory have rightly pointed out that in some cases, like (24), a speaker is indeed felt to take for granted a conditional.

(24)   If Buganda is a monarchy, then its king is little-known.

Being a monarchy doesn't entail having a king, and so dissatisfaction theory predicts that, in a null context, (24) presupposes that Buganda has a king. But this is wrong. The prediction of satisfaction theory in (25) seems more plausible here.

(25)   Buganda is a monarchy ⊃ Buganda has a king.

    I propose to account for facts like this by appealing, in a limited way, to accommodation. Dissatisfaction theory, in contrast to satisfaction theory, holds that new semantic presuppositions are not generally accommodated in the technical sense of being added to the common ground *before* the main assertion is processed. But, as Stalnaker (2002) and others have argued, accommodation is a perfectly ordinary part of communication in general. Accommodation, then, may well nonetheless play a role in calculating presuppositions in dissatisfaction theory, even if it does not play the same central role as in satisfaction theory. In particular, I hypothesize that when an assertion of p in c would be felt to be infelicitous if its presuppositions were calculated relative to c, then interlocutors will cast around for hypotheses which the speaker might be implicitly assuming, which would preserve the coherence of the speaker's utterance if they were added to the common ground. Thus, in (24), since the predicted presupposition − that Buganda has a king − conflicts with the ignorance implicature licensed by (24)'s antecedent, interlocutors will wonder if the speaker is assuming something she has not made explicit. Since it is commonly

assumed that monarchies have kings, interlocutors will (if they are willing) assume that the speaker is mistakenly taking this to be common ground, and quietly add it to the common ground relative to which (24) is evaluated. (24) will then end up having no presupposition (though in the course of this reasoning, the speaker will be felt to take for granted that monarchies generally have kings).

It is crucial to spell out this proposal in a way which doesn't reintroduce the proviso problem: we do not want conditional hypotheses of *any* kind to be available for accommodation in this way, lest we lose our explanation of the infelicity of assertions like (14b). The key is to maintain a perspective on accommodation *not* as a quotidian form of information transfer − as in satisfaction theory − but rather as a way of adding propositions to the common ground which the speaker wrongly assumed were *already* common ground. In satisfaction theory, accommodation is modeled as follows: a speaker recognizes that p is not common ground before her assertion, but makes manifest that she believes that p is common ground at the time at which her assertion is evaluated − thus bringing it about that p really is common ground at that time, if her interlocutors commonly accept it in virtue of recognizing her assumption. By contrast, accommodation in dissatisfaction theory comes into play when a speaker *mistakenly believes* that p is common ground before her utterance. Thus in considering whether an accommodation is available to preserve the felicity of some sentence, the space of possible accommodations for dissatisfaction theory will be much smaller than on satisfaction theory: while in satisfaction theory, nearly anything can be accommodated,[15] in dissatisfaction theory, only those hypotheses which a speaker might have wrongly assumed were already common ground will be available for accommodation. Call hypotheses like this − e.g. that monarchies have kings − *defaults* (cf. Kálmán 1990). The kind of assumption needed to rescue a sequence like (14b) − namely, that people with stress fractures are cross-country runners − is intuitively not a default of this kind, and thus will not be available to rescue (14b), leaving intact our explanation of its infelicity.

More must be said about what defaults amount to, but this discussion shows how dissatisfaction theory can make sense of the fact that some assertions merit genuinely conditional inferences, without thereby reintroducing the proviso problem.

3.3 Attitude predicates

So much for connectives; we turn now to the predictions of dissatisfaction theory about attitude predicates. First, note that we replicate satisfaction theory's prediction that a sentence with the form of (26), like (8), repeated here, does not presuppose

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15 As we can see by embedding nearly any proposition under a factive, and then finding contexts in which the resulting sentence can be asserted which don't antecedently entail that proposition. See Geurts 1996 for related discussion.

r, since r is locally entailed by S's beliefs (since the local context for an attitude ascription is the set of worlds accessible under that attitude):

(26)   If S believes r, then S believes p_r.

(8)   If John believes that Susie used to smoke, then he believes that she stopped.

Consider now an attitude ascription with the form of (27). Suppose c doesn't entail that S believes r; then dissatisfaction theory predicts (27) presupposes r in c.

(27)   S believes p_r.

We therefore solve the proviso problem for attitudes. For instance, we predict that (17b), repeated here, presupposes that someone broke the vase, and thus, unlike satisfaction theory, we immediately explain its infelicity (and likewise for (20)).

(17b)   ?? I don't know [what's become of the vase]. Lucy believes that it was Susie
        who broke it.

It will be noted that, although we solve this problem, we have lost the i-inference (that Lucy thinks someone broke the vase) which satisfaction theory correctly predicts as a presupposition. I return to this issue in a moment. First I briefly explore three other predictions of dissatisfaction theory about attitude predicates, in particular 'wants'. First, as with 'believes', presuppositions under 'wants' tend to project: sentences with the form of (28), like (29), presuppose r (provided r is not contextually entailed in S's desire worlds). This is just what dissatisfaction theory predicts.

(28)   S wants p_r.

(29)   Susie wants it to stop raining.

By contrast, satisfaction theory predicts that (28) presupposes only that S believes r (again, both look correct − more on this in a moment).

Second: if we assume that the desire worlds are always a subset of the belief worlds,[16] then we match the correct prediction of satisfaction theory that sentences with the form of (30), e.g. (31), do not presuppose r (since r will be locally entailed):

(30)   S believes r and S wants p_r.

(31)   Susie believes that it is raining and wants it to stop.

Finally, dissatisfaction theory avoids a substantial problem for satisfaction theory: want-want sequences. According to satisfaction theory, a sentence with the form of (32) presupposes the conditional in (33); thus (34) presupposes (35):

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16 Roughly following Heim 1992, von Fintel 1999. This is no doubt a simplifying assumption.

(32) S wants r and S wants p_r.

(33) S wants r $\supset$ S believes r

(34) Leo wants a cello, and he wants his cello to be a Stradivarius.

(35) Leo wants a cello $\supset$ Leo believes that he has a cello.

This is obviously wrong.[17] By contrast, dissatisfaction theory rightly predicts that (32) has no presupposition, since *r* will be locally entailed by S's desire worlds.

4 Implementation and i-inferences

I return now to the question of how to recapture the i-inferences which we miss at present: i.e. how to predict that $\ulcorner$S believes/wants $p_r$$\urcorner$ presupposes $\ulcorner$S believes r$\urcorner$. To answer this question, I will first say more about how to formally implement dissatisfaction theory. (Note that the details of this implementation are largely independent of the core commitments of the theory laid out in the last section.)

I adopt a two-dimensional framework,[18] treating the denotation function as a function from linguistic items to sets of (i) a set of presupposed contents; and (ii) an ordinary, 'main' content.[19] Our composition rule works roughly as follows (formal details are in an appendix). Main contents combine with main contents by functional application slightly modified to incorporate variable assignments. Each element of the set of presupposed contents combines with either (i) the main content of its sister; or (ii) the set of presupposed contents of its sister, according to its type requirement. Presupposed contents compose like this until they are of propositional type, at which point they move freely up the composition tree − with the caveat that no presupposed content ever moves past a node where it is locally entailed (thus encoding *Local Dissatisfaction*).

Crucially for present purposes, if we admit a type Σ of sets, then presupposed contents can compose with the *set* of presupposed contents of their sister, by selecting for an argument of type Σ. This allows lexical items to 'see' presupposed contents in the composition process. We can thus recapture the i-inference of attitude predicates by encoding these inferences as lexical presuppositions. We write $[\![\alpha]\!]_{\pi}^c$ for the set of

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17 Defenders of satisfaction theory appeal to modal subordination here; see Heim 1992, Sudo 2014b.

18 Pioneered by Herzberger (1973, 1975) (crediting Buridan); adopted by Karttunen & Peters (1979); mostly (though not entirely; see e.g. Bergmann 1981) neglected for many years, because of the 'binding problem' which I discuss below; then revived in the recent literature on conventional implicature (e.g. Potts 2005) and presupposition (e.g. Dekker 2008; Sudo 2012).

19 Ordinary contents in a standard compositional framework are themselves often (non-empty) functions, which in turn are standardly represented as sets. I will therefore use 'set' throughout to mean 'set which is not also a function'; this restriction is unproblematic, since the set of presupposed contents will never itself be a non-empty function.

Dissatisfaction theory

α's presupposed contents; $[\![\alpha]\!]_\mu^c$ for α's main content;[20] and $Dox_x(w)$ and $Bul_x(w)$ for the set of x's belief and desire worlds in w, respectively:[21]

(36) a. $[\![\text{believes}]\!]_\pi^c = \{\lambda\sigma_\Sigma.\lambda x_e.\lambda w.\forall p_{st} \in \sigma : \forall w' \in Dox_x(w): p(w') = 1\}$

b. $[\![\text{believes}]\!]_\mu^c = \lambda p_{st}.\lambda x_e.\lambda w.\forall w' \in Dox_x(w): p(w') = 1$

(37) a. $[\![\text{wants}]\!]_\pi^c = \{\lambda\sigma_\Sigma.\lambda x_e.\lambda w.\forall p_{st} \in \sigma : \forall w' \in Dox_x(w): p(w') = 1\}$

b. $[\![\text{wants}]\!]_\mu^c = \lambda p_{st}.\lambda x_e.\lambda w.\forall w' \in Bul_x(w): p(w') = 1$

The main contents here are standard. But we now treat 'believes' and 'wants' as carrying lexical presuppositions to the effect that the agent of the attitude ascription believes everything presupposed by prejacent of the attitude ascription. Sentences with the form of (38) are thus predicted to presuppose (39):

(38) S believes/wants p_r.

(39) S believes r.

The present implementation of dissatisfaction theory thus has the expressive power to predict not only e-inferences, but also i-inferences.

5 Quantifiers

Before concluding, I will make some brief remarks about the predictions of the present account about projection out of quantified contexts. This is a particularly important topic for present purposes because quantified environments make a special problem for multi-dimensional approaches to presupposition: Karttunen & Peters's (1979) 'binding problem'. The issue is that if quantifiers operate just on main contents, then − assuming that ⌜Someone(q_r)⌝ presupposes ⌜Someone(r)⌝ − a sentence like (40) will be taken to presuppose (41) and assert (42).

(40) Someone broke his cello.

(41) Someone has a unique cello.

(42) Someone broke a cello.

This clearly misses something: we need a way to knit together the individuals who witness (41) and (42). I propose to do this by ensuring that presupposed content is added to the main content at each step of composition.[22] Technically this is easy to accomplish; see the appendix for formal details. The result is that a sentence like (40) is still predicted to presuppose (41), but has as its main content (43), not (42):

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20 'π' for 'presupposed', 'μ' for 'main'. These are just left and right projection functions.

21 In the appendix I will treat indices as pairs of variable assignments and worlds; here I assume for simplicity they are just worlds (type s).

22 See Dekker 2008, Sudo 2014a for different, dynamic solutions to this problem.

(43)   Someone has a unique cello and broke it.

It may be objected that this approach undermines the separation of the two dimensions of content which my account countenances, since presupposed content will be repeated as main content. But this isn't right. If p presupposes r, then an assertion of p will indeed be felt to put up for discussion a content p which entails r. But since it will also be felt to impose r on the common ground, then of course r itself will not be felt to be up for discussion; what will be felt to be up for discussion is the part of p's content which does not entail r.[23]

So much for the binding problem; what do we predict about presupposition projection out of quantifiers? Consider first projection out of the nuclear scope of a quantified sentence with the form $\ulcorner Q(p)(r_s)\urcorner$. If we assume categorematic predicate abstraction − details in appendix − we predict that a sentence with this form presupposes $\ulcorner Q(p)(s)\urcorner$, since according to our composition rule, the presupposed content s will compose with the content of $\ulcorner Q(p)\urcorner$. This new generalization makes interesting and plausible predictions. We predict, for instance, that (44), (46), and (48) presuppose (45), (47), and (49), respectively (assuming 'won' presupposes 'participated'):

(44)   Every student won.

(45)   Every student participated.

(46)   Some student won.

(47)   Some student participated.

(48)   Most students won.

(49)   Most students participated.

These predictions look plausible: it is natural to think that the strength of the presupposition varies with the strength of the quantifier.

Things are more complicated when we turn our attention to negative quantifiers. E.g. the standard generalized quantifier semantics for 'no' predicts that (50) presupposes (51):

(50)   No student won.

(51)   No student participated.

This is obviously wrong. Similar points go for other negative and non-monotone quantifiers. To avoid this problem, we must assume that negative quantifiers decompose into positive quantifiers under negation.[24] Since presuppositions project

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23 On partial content see Yablo 2014. This move commits us to the principle that all sentences entail their presuppositions; but not to the assumption, challenged in Klinedinst 2010, Sudo 2012; Sudo & Spathas 2016, Zehr & Schwarz 2016, that all *triggers* entail their presuppositions.

24 Decomposition along these lines has been defended on independent grounds; see e.g. Sauerland 2000.

through negation, negative quantifiers will have the presupposition of the relevant positive quantifier. Thus if e.g. we treat 'no' as 'not some', then we predict that (50) presupposes that some student participated. It is controversial whether this prediction is strong enough.[25] The prediction depends on the details of the decomposition we adopt, which leaves the present account some room for maneuver; we could, for instance, hypothesize that 'no' decomposes into negation, existential quantification, and a homogeneity requirement of some kind, which would result in effectively universal projection out of the scope of 'no'. I leave exploration of these options, and discussion of other negative and non-monotone quantifiers, for future work.

Our predictions about projection out of the restrictor of quantifiers are *prima facie* more problematic. We predict that a sentence with the form $\ulcorner Q(p_s)(r) \urcorner$ will presuppose $\ulcorner Q(s)(r) \urcorner$, since the presupposition of the restrictor will compose with the main content of 'Q' and then of 'r'. This is wrong, however; e.g., (52) does not presuppose (53).

(52)   Every student who won a race was thrilled.

(53)   Every student who participated in a race was thrilled.

We can avoid this prediction by assuming that quantifiers come with a (usually) tacit domain argument, selected so that every element in the domain satisfies the presupposition of the restrictor.[26] Then the restrictor's presupposition will be locally entailed, and thus inert, given *Local Dissatisfaction*. Presuppositions in the restrictor will thus end up licensing the assumption that every element of the domain satisfies the presupposition of the restrictor. As far as I can tell, this is a plausible prediction.

These predictions about projection out of quantifiers thus strike me as promising, though further exploration, experimental as well as theoretical, is required.

6   Conclusion

I began by formulating a challenge for the pragmatic response to the proviso problem. I then sketched a new theory, dissatisfaction theory, which avoids the proviso problem by taking a new perspective on presupposition, in two respects. First, dissatisfaction theory views presuppositions as contents which project *unless* locally entailed, rather than (as on satisfaction theory) contents which *must be* locally entailed. Second, dissatisfaction theory views presuppositions as backgrounded contents, rather than contents which must be antecedently accepted. Dissatisfaction theory avoids the proviso problem, and, given the two-dimensional implementation which I sketched, makes generally plausible predictions about projection out of connectives, attitude predicates, and quantifiers.

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25 See e.g. Sudo, Romoli, Hackl & Fox 2011; Zehr, Bill, Tieu, Romoli & Schwarz 2015.
26 For independent evidence for such a parameter see e.g. Stanley & Szabó 2000.

I flagged throughout a number of areas which require further exploration. In closing I will add to that list. The biggest unpaid theoretical debt of my theory is an account of local entailment. I have assumed the predictions of Heim 1983, 1992 throughout, but it is not clear whether those predictions are correct (in particular with respect to their asymmetry) or theoretically satisfying;[27] nor is it entirely clear how to marry them with the theory of projection which I have given here.

A closely related issue is 'local accommodation' (Heim 1983). Like most theories of presupposition, dissatisfaction theory must incorporate a device to account for the fact that a sentence like (54) does not presuppose there is a king of France.

(54)   The King of France isn't here; there is no king of France!

The most natural route to explore, following Heim 1983, is to incorporate into our theory of local entailment a device which allows us to locally 'add' a content, preventing a presupposition from filtering.

A third issue involves the nature of presupposition triggers. I have assumed here that presuppositions are given in the lexicon. But it is compatible with dissatisfaction theory that triggers have a pragmatic source, either on an *ad hoc* or generalized basis.[28]

A fourth issue is how dissatisfaction theory compares with competitor views. In most cases the contrasts are stark. An exception is DRT, whose predictions are closest to those of dissatisfaction theory. I note here three points of contrast. One is in the theoretical frameworks used by the two views, which are obviously quite different. The second is in predictions about attitude predicates: dissatisfaction theory predicts both e- and i-inferences as presuppositions, whereas DRT approaches capture one or the other as a presupposition (see Geurts 1998). The third is in predictions about quantifiers. DRT theories, unlike dissatisfaction theory, predict no projection out of quantifiers, thanks to van der Sandt's (1992) 'trapping constraint'. There is some room for maneuver here on behalf of DRT, but it is not clear whether there is enough, especially when it comes to intermediate quantifiers like 'most'.[29]

A final issue concerns the relation of presuppositions to other kinds of backgrounded contents, like conventional implicatures. Presuppositions and conventional implicatures have been widely taken to differ insofar as presuppositions, but not conventional implicatures, are required to be commonly accepted before a sentence can be evaluated. I have argued that this is wrong.[30] Presuppositions and conventional implicatures are more similar in this respect than they have been taken to be, which raises the important question whether a unified treatment of them can be given.[31]

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27 See again Schlenker 2009, Rothschild 2011/2015.

28 See Stalnaker 1974, Simons 2001 for approaches in this direction.

29 Thanks to Hans Kamp for discussion. See Beaver 2001 for critical discussion of DRT.

30 Indeed, it follows from my account that semantic presuppositions are *never* globally old.

31 See Simons, Tonhauser, Beaver & Roberts 2010; Tonhauser, Beaver, Roberts & Simons 2013

A Appendix: Formal implementation

Assumptions and Shorthands:

- For any sets S, R: let $S^{R \nvDash}$ be $\{s \in S : R \nvDash s\}$, with $\vDash$ generalized entailment.

- We assume each node α is tagged with that node's local context, κ_α.

- With τ a type that 'ends in t', $\wedge_\tau$ is a generalized conjunction operator which takes a set and returns the generalized conjunction of all type-τ elements of the set.[32]

- We assume that negation and conjunction always have the types of propositional operators and connectives, respectively $-$ we cannot have type-shifted operators and connectives in our language, or else we will make the wrong predictions about projection out of connectives.

- i is the type of indices, which for present purposes we treat as pairs of a variable assignment (type a) and world (dedicated variable w, type s). D_τ is the (relevant) set of type-τ elements.

- Where δ and ρ are semantic values, we define the *modified functional application* of δ to ρ, written $f(\langle \delta, \rho \rangle)$, as follows (following Poesio 1996, Novel & Romero 2010; as I discuss in a moment, this variant on functional application allows us to incorporate variable assignments into our language, which is crucial in turn for getting predicate abstraction right):

  i. if δ is of type $\langle a, \langle \theta, \tau \rangle \rangle$ and ρ is of type $\langle a, \theta \rangle$ for some types θ and τ, then $f(\langle \delta, \rho \rangle) = \lambda g_a.\delta(g)(\rho(g))$;

  ii. if δ is of type $\langle a, \langle \theta, \tau \rangle \rangle$ and ρ is of type θ for some types θ and τ, then $f(\langle \delta, \rho \rangle) = \lambda g_a.\delta(g)(\rho)$;

  iii. else $f(\langle \delta, \rho \rangle) = \lambda g_a.\lambda w.\top$, i.e. the necessarily true proposition.

Composition: For node α with daughters β, γ, with $[\![\beta]\!]_\mu^c$ of type $\langle a, \langle \theta, \tau \rangle \rangle$ and $[\![\gamma]\!]_\mu^c$ of type $\langle a, \theta \rangle$ or θ, for types θ and τ with τ ending in t:[33]

  i. $[\![\alpha]\!]_\mu^c = \wedge_{\langle a, \tau \rangle}([\![\alpha]\!]_\pi^c \cup \{f(\langle [\![\beta]\!]_\mu^c, [\![\gamma]\!]_\mu^c \rangle)\})$

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for recent work towards a unified approach to backgrounded contents. A careful comparison of dissatisfaction theory to that approach must await future work.

32 On generalized conjunction see e.g. Partee & Rooth 1982.

33 If we want our composition rule to be defined for meanings whose types which do not end in t, we will have to generalize this rule slightly.

ii. $[\![\alpha]\!]^c_\pi = \delta^{\kappa_\alpha \nvDash}$, with δ the smallest set such that for all ρ:

- $\rho \in ([\![\beta]\!]^c_\pi \setminus D_{it})^{\kappa_\beta \nvDash} \times [\![\gamma]\!]^c \to f(\rho) \in \delta$.
- $\rho \in \{[\![\beta]\!]^c_\mu\} \times ([\![\gamma]\!]^c_\pi \setminus D_{it})^{\kappa_\gamma \nvDash} \to f(\rho) \in \delta$.
- $\rho \in ([\![\beta]\!]^c_\pi \cup [\![\gamma]\!]^c_\pi) \cap D_{it} \to \rho \in \delta$.

In words: α's main content is the generalized conjunction of (i) the modified functional application of the main contents of β and γ, with (ii) all of α's presupposed contents which have the same type as (i) (as discussed in §5, we use generalized conjunction here to duplicate contents from the presupposed dimension into the main dimension, in order to avoid Karttunen & Peters's (1979) binding problem). α's set of presupposed contents is the set of contents which are not locally entailed at α and which result from (i) modified functional application of a presupposed content of β which is neither locally entailed nor of propositional type, with either γ's main content or its set of presupposed contents; or (ii) modified functional application of β's main content with any of γ's presupposed contents which are neither locally entailed nor of propositional type; or (iii) any proposition presupposed by either β or γ.

Quantification: We treat predicate abstraction categorematically, following Poesio 1996, Novel & Romero 2010, a.o. We assume quantified sentences have the form below, with p and q open sentences and i and j numerical indices (type n).
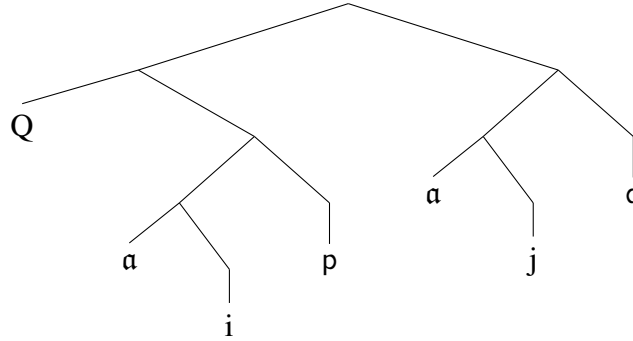
ɑ, our object language predicate abstractor, has the semantics in (55):

(55) a. $[\![ɑ]\!]^c_\pi = \{\lambda g_a.\lambda i_n.\lambda \sigma_\Sigma.\lambda x_e.\lambda w.\forall p_{it} \in \sigma : p(g^{x/i})(w) = 1\}$
      b. $[\![ɑ]\!]^c_\mu = \lambda g_a.\lambda i_n.\lambda p_{it}.\lambda x_e.\lambda w.p(g^{x/i})(w) = 1$

$g^{x/i}$ is, as usual, the variable assignment which assigns i to x but otherwise is just like g. This categorematic treatment of predicate abstraction, plus the presuppositional

component of the predicate abstractor, ensures that not only the main content but also all the elements of the set of presupposed contents are abstracted, so that they can compose with the quantifier in the appropriate way. We incorporate variable assignments into our system as follows. A trace t_i is of type $\langle a, e \rangle$, with denotation $\lambda g_a.g(i)$. Other standard entries of type τ are raised to type $\langle a, \tau \rangle$ by taking the constant function from variable assignments g to the original meaning.

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