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How not to Project the Satisfaction Theory of Projection (on Karttunen) *Or: Who has a Proviso Problem?**

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1.1   Introduction

The *satisfaction-based conception of presupposition*, originating in early work by Stalnaker and Karttunen, is arguably the dominant conception of presupposition in linguistic semantics. According to this conception, presuppositions are conditions imposed by linguistic expressions on contexts, such that if the conditions are not satisfied by a context, the expressions cannot, in that context, be assigned an interpretation.   In the simplest cases, where a sentence presupposes a proposition, the expression can be interpreted only in contexts that entail this proposition (for Karttunen) or in which that proposition is accepted as common ground (for Stalnaker).[1]

[1]Though both Stalnaker and Karttunen conceive of presuppositions as preconditions on contexts, they do not have exactly the same view of presupposition. For Stalnaker, presupposition is a pragmatic notion, an interlocutor attitude, whereas

This conception of presupposition has the attractive feature that it very naturally captures cases in which the presupposition of an expression is not propositional, as is the case with familiarity presuppositions (Heim 1982 and much subsequent work). It also allows us to model one of the key insights of Karttunen (1974), discussed below and often overlooked, that even in cases in which an expression is intuited to carry a propositional presupposition, it is not always possible to say what that presupposition is independently of context. This is the case, for example, with additive *too*, discussed by Heim (1990, 1992), and used by Stalnaker (2002) to illustrate his version of the same point, namely that in some cases, a speaker clearly presupposes a proposition in uttering a sentence, yet there is no proposition that must be accepted as common ground in all contexts in which the sentence is acceptable.

In an influential paper, Geurts (1996) coins the term *satisfaction theory* to name a set of dynamic semantic analyses of presupposition projection. Geurts' main argument is that the satisfaction theory suffers a detrimental, insurmountable problem, which he calls "the proviso problem". The problem is that the satisfaction theory's predictions about the projection behavior of conditionals[2] do not match their actual projection behavior:

> "In particular, the satisfaction theory often predicts presuppositions of the form $\phi \rightarrow \psi$, where the intuitively perceived presupposition is simply ψ." (p. 260)[3]

According to Geurts (p. 259), "the ideas underlying the satisfaction theory go back to Stalnaker (1973, 1974) and Karttunen (1974). They were shaped into an explicit theory by Heim (1983)". Indeed, the general conception in the subsequent literature is that satisfaction theory, as shaped by Heim, is advocated by Karttunen in Karttunen (1974). Thus, Van Rooij (2007) discusses "the satisfaction theory of presupposition, as motivated by Karttunen (1974) and Stalnaker (1974) and implemented by Heim (1983) and others", and Singh (2007) directly cites "Karttunen 1974, Stalnaker 1974, Heim 1983, Beaver 2001, von Fintel (2006)[4], among others" as instances of "satisfaction theories".

Furthermore, Geurts' paper implies that the satisfaction theory suffers the proviso problem *because* it is based on a problematic conception

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for Karttunen, it is a semantic one, having to do with semantic context change (though Karttunen describes it as pragmatic in Karttunen 1974). This difference is not discussed here.

[2]Also disjunctions, but I will be exclusively concerned with conditionals here.

[3]Here and throughout, $\rightarrow$ corresponds to material implication unless noted otherwise.

[4]von Fintel (2006) is an earlier, manuscript version of von Fintel (2008).

of presupposition. This is already implied by the very term "satisfaction theory". The implication is strengthened, on the one hand, by presenting the satisfaction theory as an explicit implementation of Stalnaker and Karttunen's ideas,[5] and on the other hand, by contrasting the satisfaction theory with one that does not employ the satisfaction-based conception of presupposition and does not suffer the proviso problem.

This paper does not aim to make a contribution to the theory of projection[6] or towards solving the proviso problem. My aim is, rather, to clarify and contextualize, largely through exegesis, the relation between the ideas about presupposition and projection expressed in Karttunen (1974), the dynamic theory of projection Geurts calls 'satisfaction theory', the satisfaction-based conception of presupposition, and the proviso problem. In particular, I make the following two points:

(i) Contrary to the impression one might get from the literature, the "satisfaction theory" as defined and criticized by Geurts, namely the theory of projection for conditionals developed in Heim (1983), does not implement the ideas presented in Karttunen (1974).

In fact, I argue that Karttunen's entire project can be taken to be antithetical to the construction of a theory that predicts context invariant presuppositions for conditionals (and complex expressions more generally).

(ii) Contrary to an implication of Geurts' paper, the reason satisfaction theory suffers the proviso problem is not that it assumes a satisfaction-based conception of presupposition.

Rather, satisfaction theory suffers the proviso problem because it identifies the presuppositions of an expression, specifically those of conditionals, with the minimal definedness conditions determined by a standard dynamic semantics. A proponent of the satisfaction-based conception of presupposition,[7] such as Karttunen is in no way committed to such an identification. On the contrary, the ideas put forth in Karttunen (1974) explicitly call for maintaining the satisfaction-based conception of presupposition, while rejecting the idea that it is possible, or desirable,

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[5] Though, as noted above, Karttunen and Stalnaker's ideas differ significantly. In particular, Stalnaker, unlike Karttunen, is not adopting a dynamic approach to semantics at all. The idea they *do* share is that presuppositions should be conceived of as conditions that need to be satisfied for successful interpretation.

[6] Projection is not a property of presupposition alone, but of a variety of inferences. Recently, Simons et al. (2010) have argued that projection is a general property of all implications that are not *at issue*, i.e. do not serve to resolve an open issue of privileged relevance in the context of discourse.

[7] Here I am echoing comments already made in Beaver (2001) and van Rooij (2007).

to predict what a conditional presupposes from the presuppositions of its constituent sentences, precisely because of Karttunen's insight mentioned above, namely that what a conditional presupposes depends on context.

1.2 Satisfaction and projection

Influenced by Stalnaker's pragmatic analysis of presupposition, Karttunen articulated an influential way of modeling the satisfaction-based conception of presupposition, i.e. the (arguably Fregean) idea that a presupposition is a precondition for the interpretability of a sentence. Specifically, he proposed to model presuppositions as conditions imposed by expressions on contexts, bodies of information on which utterances of such expressions operate. Within a dynamic conception of interpretation, sentence meanings are viewed as operations on contexts, and a presupposition is a condition that a context must satisfy in order for a sentence meaning to operate on it. In the simplest case, contexts are sets of worlds and presuppositions are stated in terms of propositions. To say that a sentence S presupposes p is to say that in order for S to carry out its conventionally determined operation on a context c, c must entail p. A context c entails a proposition p iff $c \subseteq p$. The conditions imposed by expressions on contexts, however, need not be propositions. In Heim's (1982) influential familiarity theory of definiteness, a definite description imposes the requirement that the context contain a particular discourse referent.

Much literature on presupposition, however, has been concerned with a problem that arises on any conception of what presuppositions are, namely the problem of presupposition projection, the relation between the presuppositions of simple expressions and those of complex expressions that contain them. The satisfaction-based conception of presupposition, obviously, does not in itself provide an account of projection. It is no more a full fledged grammatical account of presupposition than the conception of meaning as contribution to truth conditions is a full fledged grammatical account of denotational semantics.

1.3 Karttunen's insight

Karttunen (1974) proposed to link the satisfaction-based conception of presupposition to the projection problem in an interesting and surprising way. A crucial empirical observation of Karttunen's, exemplified in (1) (example 3 in Karttunen 1974), is that what at least some compound sentences presuppose is not fixed, but depends on the properties of the context in which they are uttered.

(1)   a. If Dean told the truth, Nixon is guilty too.
      b. If Haldeman is guilty, Nixon is guilty too.
      c. If Miss Woods destroyed the missing tapes, Nixon is guilty too.

(1a) presupposes the guilt of someone other than Nixon. (1b) does not. (1c) does in a context in which destroying tapes is not considered a crime, but does not in a context in which it is. In light of these examples, Karttunen suggests (already in Karttunen 1973) the descriptive generalization in (2) about the presuppositions of conditionals.

(2)   **Karttunen's generalization**:
      The presuppositions of *if A, B* (with respect to a context X) consist of:
      a. all the presuppositions of A (with respect to X) and
      b. all the presuppositions of B (with respect to $X \cup A$) except those that are entailed by $X \cup A$ and are not entailed by X alone.

This generalization correctly describes the facts. That what a conditional presupposes depends on context is captured by clause (2b), which states that which presuppositions of the consequent B are presupposed by the conditional depends on what is entailed by $X \cup A$, and this, of course, depends on what X is like. In Karttunen's example, adding the information that Miss Woods destroyed the tapes will lead to the contextual entailment that she is guilty in a context which entails that destroying tapes is a crime, but not in a context that does not entail this. There is, however, also something clearly wrong with the way (2b) is stated, since whether an expression conventionally imposes a condition on contexts or not must be determinable independently of whether any given context satisfies that condition or not. For example, the sentence *God stopped hiding* presupposes that God was hiding, regardless of whether any given context satisfies the presupposition or not. The clause in (2b), however, states that whether or not a conditional *if A then B* imposes the conditions conventionally associated with B on a context depends on whether the context satisfies them or not.

What Karttunen sets out to demonstrate is that the satisfaction-based conception of presupposition makes it possible to state when a context satisfies the presuppositions of a conditional without committing to what those presuppositions are. In other words, it makes it possible to account for the empirical generalizations without stating a theory of projection, without making the theoretical commitment that the presupposition of a complex expression are predictable solely from

those of its constituent parts, and, crucially, without making the empirically problematic assumption that one can state what an expression presupposes independently of context. The statement he offers is in (3), which forms the basis for his more general statement of when a context satisfies the presuppositions of a complex expression.

(3) Context X satisfies-the-presuppositions-of *If A then B* just in case (i) X satisfies-the-presuppositions-of A, and (ii) $X \cup A$ satisfies-the-presuppositions-of B.

(3) shifts the theoretical burden from predicting what a complex expression presupposes to predicting what it takes for a context to satisfy a complex expression's presuppositions.

This shift is of great consequence. Its importance lies not only in the fact that it allows Karttunen to better express the descriptive generalization in (2), but also because it enables an account of the context dependence of presupposition, of those cases in which it is not possible to point to a general condition that an expression imposes on all contexts, but it is possible to say, in a general way, what it takes for a context to satisfy whatever condition that is. An example is the case, mentioned earlier, of expressions with anaphoric presuppositions, such as additive *too* and definite descriptions. A particularly revealing example of the explanatory potential of distinguishing presuppositions from the different ways in which contexts can satisfy them is Condoravdi and Gawron's (1996) analysis of definite implicit arguments, where different ways of satisfying a familiarity presupposition account for distinct interpretations. Having explicated Karttunen's observation and theoretical move, I turn to what Geurts calls the satisfaction theory of presupposition and the proviso problem.

1.4   Satisfaction theory and the proviso problem

The target of Geurts' paper, what he calls "the satisfaction theory", is a particular theory of presupposition projection developed within dynamic semantics, which assumes a particular definition of presupposition, a definition that, in turn, utilizes a satisfaction-based conception of presupposition. The theory, first articulated formally in Heim (1983), is very familiar and I do not reproduce it here in detail. Informally put, the idea behind it is that sentence meanings are operations on contexts, and stating the presuppositions of a simple expression is stating the conditions under which the conventional meaning of the sentence, the operation on contexts it conventionally performs, is defined. For example, the linguistic intuition that an expression S presupposes a proposition p is captured by making the operation that S convention-

ally performs on contexts defined only for contexts that entail p. Heim's theory of projection is simply that the presupposition of any complex expression are that expression's minimal definedness conditions as determined by the minimal definedness conditions of its parts and the dynamic semantics of the operators or connectives that put the parts together. As Geurts points out, this is a highly attractive theory, since it makes the projection properties of any expression a direct side effect of its dynamic semantics.

Unfortunately, argues Geurts, the predictions this theory makes do not match the empirical facts. He points out that, according to Heim's theory, the presupposition of an expression is defined as in (4) (where $c[\phi]$ is the context resulting from the operation ϕ performs on c). The equivalent definition found in Heim (1983) is given in (5).

(4) ϕ presupposes χ iff for all c, $c[\phi]$ is not defined unless c satisfies χ.

(5) S presupposes p iff all contexts that admit S entail p.

Geurts then observes that, given the definition in (4) and the standard assumptions about semantics and definedness for conditionals in (6), conditionals are predicted to have conditional presuppositions. A conditional $\phi \rightarrow \psi_r$ (where ψ_r means ψ presupposes r) is predicted to be defined in a context c whenever ψ_r is defined in $c[\phi]$, which is whenever c entails $\phi \rightarrow r$.

(6) $c[\phi \rightarrow \psi]$ is defined iff $c[\phi]$ is defined and $c[\phi][\psi]$ is defined.

As an example, consider (7).

(7) If it's raining, then it's stopped snowing.

As a matter of descriptive fact (where what is being described are native speaker intuitions), (7) presupposes that it was snowing. But if (4) is the definition of presupposition, then, given (6), (7) is wrongly predicted to presuppose that if it is raining, then it was snowing. This is because, according to (6), (7) is defined in all and only those contexts c such that $c[it's\ raining]$ satisfies the presupposition of *it stopped snowing*, and this is the case exactly when c entails *if it's raining, it was snowing*. This is the proviso problem, and much work has been dedicated to reacting to it (Heim 1983, Beaver 1999, van Rooij 2007, Singh 2007, Schlenker 2011, Lassiter 2012, Lauer 2015 among others).

As discussed above, the general conception in the literature is that the satisfaction theory is a formal explication of the ideas of Stalnaker and Karttunen. The theory clearly employs their satisfaction-based conception of presupposition, the view that presuppositions are con-

ditions on contexts. This, together with Geurts' discussion, also mentioned above, of van der Sandt's (1989) DRT based "binding" theory, which is *not* rooted in the satisfaction-based conception of presupposition and does not suffer the proviso problem, invites the inference that the proviso problem arises for satisfaction theory because of the conception of presupposition it employs. For example, Geurts ends his paper with the following statement: "The binding theory views a presupposition as an agile creature that sets itself off to either find its antecedent or become accommodated. The satisfaction theory, on the other hand, pictures presuppositions as lethargic beings that keep hanging around in the neighborhood, content to get local satisfaction. The main purpose of this paper was to show that presuppositions are more demanding than that."

1.5 How not to project the satisfaction theory of projection (on Karttunen)

Neither the diagnosis of the proviso problem as rooted in the satisfaction-based conception of presupposition[8] nor the claim that satisfaction theory embodies Karttunen's ideas are warranted. First, as the discussion in section (1.3) should make very clear, Karttunen, working within a satisfaction conception of presupposition, goes to great pains to *not* predict conditional presuppositions for conditionals. On the contrary, the entire point of his move, as elaborated above, is to be able to deal with his descriptive generalization (2), that conditionals presuppose different things in different contexts, and therefore to avoid making context independent predictions about what they presuppose, predicting instead what the set of contexts that can satisfy their presuppositions is. So, not only is the satisfaction theory not an implementation of Karttunen's ideas, its premises are practically antithetical to his.

Second, the proviso problem arises for the satisfaction theory not because it is rooted in a satisfaction-based conception of presupposition, but because it employs the definition of presupposition in (4) and (5). These definitions of presupposition obliterate Karttunen's distinction between the presuppositions of an expression and what it takes for a context to satisfy them.

On Karttunen's theory of contextual satisfaction, a context c satisfies the presuppositions of conditional $\phi \rightarrow \psi_r$ in exactly the following kinds

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[8]A diagnosis which Geurts himself changes elsewhere (p. 292), where he attributes the proviso problem not to the conception of presupposition on which the satisfaction theory is based, but rather to what the theory says about projection: "presuppositional requirements are inevitably weakened because of the way they are transmitted to the global context."

of context:

(i) c entails r

(ii) c does not entail r, but $c[\phi]$ does.

For any context c of the type in (i) or (ii), it is also true that $c[\phi]$ entails r, and therefore any such context is of the type in (iii) (contexts of type (i) are trivially of type (iii)).

(iii) c entails $\phi \to r$

(iii) is therefore the minimal condition for a context to satisfy the presuppositions of a conditional.

The definition of presupposition in (4), and hence what Geurts calls the satisfaction theory, identifies the presupposition of a conditional with this minimal condition, and hence makes the prediction that conditionals with presuppositional consequents have conditional presuppositions. As already pointed out above, however, the satisfaction-based conception of presupposition in no way requires us to make this identification.[9] In fact, Geurts himself provides a different characterization of presupposition, the one in (8), immediately before proposing (4).

(8) If ϕ presupposes χ, then $c[\phi]$ isn't defined unless c satisfies χ.

(8) says that if an expression ϕ presupposes something, then $c[\phi]$ is not defined unless c satisfies the condition that is the presupposition of ϕ.[10] The reverse is part of the definition of presupposition espoused by the satisfaction theory, but it is not part of the satisfaction-based conception of presupposition. It might very well be that $c[\phi]$ is not defined unless c satisfies some condition, but that the condition that is the presupposition of ϕ is a stronger one.[11] Given a standard dynamic semantics in which basic presuppositions induce (but are not identified with) definedness conditions, a conditional $\phi \to \psi_r$ is clearly not defined in a context c unless c satisfies $\phi \to r$. The conclusion that this is what the conditional presupposes, however, is not merited by the assumption that presuppositions are admissibility conditions. The actual presuppositions of a conditional (like those of additive *too*) are

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[9]van Rooij 2007 points to Beaver 2001 as an example of a theory couched in this conception of presupposition that does not make the identification.

[10]Recall that presuppositions need not be propositions.

[11]Turning the *if* in (8) into an *iff* is clearly wrong if the goal of defining presupposition formally is to capture the notion of presupposition employed in linguistic theory, namely the backgrounded inferences associated with linguistic expressions by virtue of grammatical convention. It would entail that every sentence presupposes any number of tautologies, an intuition that native speakers never have, essentially emptying the term presupposition of empirical content.

themselves context dependent, and one can state when they are satisfied **without** making any context independent predictions about what they are. So, the source of the proviso problem is not the satisfaction-based conception of presupposition, but the definition of presupposition employed in the analyses of projection that Geurts calls the satisfaction theory.

If the presuppositions of a conditional can be satisfied both by contexts of type (i) and contexts of type (ii) above, one obviously would like to know: when does a conditional require a context to be of type (i), and when does it require the weaker type (ii)? This is the problem raised by Karttunen's theory of presuppositions as conditions on contexts, but it is not the projection problem. It is the problem of accounting for the role of context in determining what an expression presupposes. Van Rooij's (2007) idea is that a conditional requires its input context c to be of type (i) when the information contained in the antecedent ϕ is not enough to ensure that $c[\phi]$ entails r no matter what c looks like. In other words, when ϕ and r are conditionally independent of each other. For example, in (7) above, the presupposition of the consequent is that it was snowing. Adding the information that it is raining to a context c is not generally enough to secure the inference that it was snowing. If c, for example, contained worlds in which it was snowing as well as ones in which it was not, there is no assurance that the subset of c in which it is raining does not also contain both kinds of worlds, in which case c will not be a context of type (ii). In this case, therefore, the context is required by the conditional to be of the type in (i), and so the conditional is correctly predicted to presuppose that it is snowing.[12] This explanation is not only compatible with, but is couched within, a satisfaction theory of presupposition. A related idea that brings in pragmatic considerations of plausibility can be found in Beaver (1999, 2001).

1.6 Conclusion

Geurts (1996) demonstrates that what he calls the satisfaction theory of presupposition makes systematically wrong predictions about the presuppositional behavior of conditionals, a problem which he calls the

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[12]In cases such as (i), the presupposition of the consequent is the antecedent itself. In this case, the information contained in the antecedent is necessarily enough to ensure entailment of the consequent regardless of what the original context is like. Consequently, our intuition is that no condition is imposed, and hence that nothing is presupposed:

(i) If Sara has a brother, her brother likes latkes.

proviso problem. The satisfaction theory is claimed by Geurts and others to implement the ideas of Stalnaker and Karttunen, and Geurts' discussion implies (inadvertently, see fn. 8) that the source of the problem is the satisfaction-based conception of presupposition. This note shows that the ideas put forth in Karttunen (1974) about the presuppositions of conditionals are very different from the ideas about projection embodied in the satisfaction theory, and that the satisfaction theory suffers the proviso problem not because it assumes that presuppositions are conditions on contexts but rather because it identifies presupposition with minimal definedness conditions. This is a fortunate result, because it means we do not have to throw away a perfectly satisfactory baby just because we might not yet able to explain exactly where we got the water for the bath.

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