Transparency: An Incremental Account of Presupposition Projection

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We sketch a theory in which presuppositions do not directly impose conditions on the *context set,* but rather on the *contextual meaning* of a sentence. Specifically, a part of an expression's meaning which is marked as presupposed should satisfy a principle of *Transparency*, according to which *this part can be disregarded without affecting the contextual meaning of the sentence*. We argue that if *Transparency* is checked incrementally, i.e. as soon as a clause is pronounced, it yields a predictive account of presupposition projection: unlike competing theories, it *derives the projection behavior of connectives from their bivalent semantic contribution*. We speculate that *Transparency* originates from a more general pragmatic principle, *Be Articulate!*, which states that *one should not say too much at the same time*, i.e. express a meaning that is too complex with a single expression. *Transparency* is a way to satisfy *Be Articulate!* even when an expression with a complex meaning is uttered because it ensures that part of this meaning can be disregarded.

1. Programmatic Outline: *Be Articulate!* and *Transparency*

Two main questions can be asked about presuppositions: (i) How are they triggered? (ii) How are they projected? In ground-breaking work, Heim 1983 gave a *lexical* answer to both questions (similar remarks apply to the DRT accounts of van der Sandt 1993 and Geurts 1999; these raise several problems for Heim's theory, which we inherit). Heim made the following assumptions:

(i) Presuppositions are triggered lexically, in a context-insensitive fashion (though *accommodation* is context-sensitive). Thus whenever *John knows that p* is uttered, p will be triggered as a presupposition.

(ii) The projection behavior of connectives and operators is encoded in their lexical entry. For example, if C is a context set, it is stipulated that C[F and G]=(C[F])[G]. [For an atomic proposition *F*, we write *F* as *<u>p</u>p'* if F contributes a presupposition p and an assertion p'. In this case, Heim's theory specifies that the update of C with F is C[F]=C[<u>p</u>p']=# iff for some w∈C, p(w)≠1. If ≠#, C[F]=C[<u>p</u>p']={w∈C: p(w)=1}].

Assumptions (i) and (ii) both raise the same explanatory problem:

(i') Why could there not be a verb *know**, which has the same global (i.e. assertive + presuppositional) content as *know*, but a different presupposition? For instance we could imagine that *John knows* that p* has no presupposition but asserts that *p and John believes that p*. We rarely encounter words such as *know** (but see Abusch 2002 for a different opinion). Why? Heim 1983 provides no answer.

(ii') Why could there not be a word *and** which had the same logical contribution as *and* but a different projection behavior? For instance we could imagine that C[p and* q]=(C[q])[p]. But there seems to be no word such as *and**. Why? Here too Heim 1983 (criticized by Soames 1989 and Heim 1992) gives no answer.

We will sketch a purely pragmatic account of presupposition triggering and presupposition projection. Our attempt is purely programmatic with respect to the Triggering Problem. On the other hand we offer a precise algorithm for the Projection Problem, one that is *predictive*, in the sense that it can be applied to any connective as soon as its bivalent semantic contribution is known (neither Heim 1983 nor DRT are predictive in this sense). Our account is stated within a fully classical (bivalent) framework, and it has the following structure (the two parts could well be separated, but the result would be conceptually less natural):

1. A general pragmatic principle, ***Be Articulate!*,** specifies that *one should not say too much at the same time*, in the sense that one should not express a complex meaning with a single expression. For instance, in *John fell*, the single word *fell* contributes -very roughly- the information that i) John was standing up (=*u* for short), ii) he underwent an involuntary motion (=*i*), and iii) He ended up lying down (=*d*). Unless one is explicitly interested in this complex conjunction *uid*, *Be Articulate* risks being violated: it would be better practice to articulate the intended meaning in separate parts, e.g. as *John was standing but he fell*.

2. In case *Be Articulate!* might seem to be violated, there is a way to salvage the principle by assuming that part of the meaning of the offending term is *transparent*, in the sense that one can *disregard it without changing the contextual meaning of what is said.* Specifically, ***Transparency*** states that one can *erase* one of the conjuncts that make up the meaning of the offending term, and still obtain a sentence which, given the assumptions of the conversation, is equivalent to the original one. *Transparency* is checked in two steps:

a. *Selection* (=Triggering Problem)*:* First, one divides up the meaning of the offending term into two parts, and chooses (on pragmatic grounds to be determined) which one should be transparent; we write this part as underlined. How this selection process is performed may depend on the context. For instance, *He didn't fall* typically presupposes that the agent was standing up; we have in this case an analysis of the sentence as *not f* = *not*($\underline{u}$*id*). But one may utter the sentence felicitously to reassure a concerned mother who just saw that her son is lying on the floor crying (*Don't worry, he didn't fall*); here one seems to be presupposing that the little boy is lying on the floor, not that he was standing up right before [*not f* = *not*(*ui*$\underline{d}$)]. To see a third kind of situation, suppose that we saw someone come off a cliff. If I say that *he didn't fall*, I am probably presupposing that he was standing up and is now lying down, and denying that the motion was involuntary. Thus depending on the context, *John didn't fall* may be variably analyzed as *not* $\underline{u}$*id, not ui*$\underline{d}$*, not* $\underline{u}$*i*$\underline{d}$ (or as *uid* if one is explicitly interested in the conjunction).

b. *Incremental Verification* (=Projection Problem)*:* Second, as soon as the offending clause is pronounced, one checks that, no matter what the end of the sentence will be, and no matter what the semantic content of the non-underlined part of the clause might be, *Transparency* will be satisfied. Suppose that *John didn't fall* is analyzed as *not* $\underline{u}$*id*. In a context set C, we want to ensure that no matter what the end β of the sentence is:

(1) $C \models \forall X\ [\text{not}(\underline{u}X)\beta \leftrightarrow \text{not}(X)\beta)$

This will turn out to require that C |= u, as is desired. By contrast, if the sentence uttered is *John was standing and he didn't fall*, it can be understood with no presupposition whatsoever, because *Transparency* is automatically satisfied - no matter what C is, we know that:

(2) $C \models \forall X\ [(u \text{ and not}(\underline{u}X))e \leftrightarrow (u \text{ and not}(X)\ e)]$

We now develop in greater detail our account of the Projection Problem. Programmatic remarks on the Triggering Problem are included in the last section.

2. The Projection Problem I: Principles

A) The Stalnaker/Heim Dilemma: Unlike the standard Stalnaker/Heim account of presupposition projection, the present analysis does not take presuppositions to be constraints on the *context*, but rather on the *contextual meaning* of a sentence (specifically: a presupposition is a part of the meaning of a clause that one should be allowed to disregard without changing the truth conditions of the sentence). We take the Stalnaker/Heim analysis to have the following logic, which leads straight into a dilemma.

1. *Assumption:* When a clause $\underline{p}$*p'* with presupposition p is uttered, it requires that p be taken for granted in the context (i.e. context set) of utterance .

2. *Observation:* In some cases, the *Assumption* seems to be violated, e.g. in *It is raining and John knows that it is*, which does not presuppose anything.

3. *Conclusion*: The notion of 'context' must be ramified. In the course of the evaluation of a sentence, there are a variety of *local contexts*, which are obtained as modifications of the initial context. In *It is raining and John knows that it is*, the local context obtained after the first conjunct is evaluated is one in which the presupposition that it is raining is indeed satisfied.

Stalnaker and Heim differ in the way in which they set up the theory of local contexts. 1) In the case of conjunction, Stalnaker 1974 argues that presupposition projection can be explained in pragmatic terms: in *p and q*, *q* is evaluated in the initial context set *as modified by the assertion of p*. This is a plausible analysis, but only because a conjunction can be seen as a succession of two assertions. The account does not extend to other connectives, such as disjunction (*p or q* can certainly not be analyzed as a succession of assertions). 2) Heim 1983 abandons Stalnaker's pragmatic explanation, and posits that the way in which a connective modifies the context set is stipulated in its lexical entry. This account can extended to any connective, but it fails to be explanatory: it does not explain why the conjunction we find in natural language is *and* rather than *and**. The dilemma is thus between a pragmatic - and explanatory - analysis that works for conjunction but not for all other connectives; and a lexical account that works for all connectives but is not explanatory. We conclude that a different course should be taken: the *Observation* should be seen as *refuting the Assumption*. Presuppositions do not directly impose something on the *context*, but rather on the (contextual) *meaning* of a sentence.

B) Transparency: Let us assume that Selection has been performed, and that we are given a Logical Form that includes elements of the form $\underline{p}p'$, where $\underline{p}$ is underlined to indicate that it must be transparent. The principle to be satisfied is stated in (3).

(3) *Transparency:* For any initial part $\alpha\ \underline{p}p'$ of a sentence uttered in a background of assumptions C, where $\underline{p}p'$ is the semantic composition of an IP (=a clause), it should be the case that for any sentence completion β, $C \models \forall X(\alpha\ (\underline{p}X)\ \beta \Leftrightarrow \alpha\ X\ \beta)$, where *X* is a propositional variable[1].

We will assume that *Transparency* is checked incrementally with respect to *linear order*. There are variants of theory, however, in which *Transparency* is checked following (a) order of processing (whatever this turns out to be), or (b) order c-command (scope) in a top-down system. We do not explore these alternatives here[2]. Instead, we immediately turn to examples and show that in simple cases the *Transparency* theory can emulate the results of Heim 1983.

3. The Projection Problem II: Examples

A) Connectives I - Standard Cases (*not, and, if*): We start with an extremely simple syntax for the object language[3]:

(4) *Syntax:* F ::= p | ($\underline{p}$p') | not F | [F and F'] | [F or F'] | [if F]F'

Boolean connectives have their standard semantics, and *if F, G* is taken to be a strict implication: with background assumptions C, *if F, G* evaluated in any C-world is true iff every C-world that satisfies *F* also satisfies *G*. As before, $\underline{p}p'$ is interpreted as a simple conjunction (the syntax is intended to indicate that the conjuncts correspond to a single lexical item). We go through some representative examples, stating in each case what *Transparency* requires and how it derives the correct projection behavior.

Example 1. Sentences starting with *($\underline{p}$p')* [e.g. *($\underline{p}$p') and ..., ($\underline{p}$p') or ...*]

Transparency requires that for any sentence completion β, $C \models \forall X\ ((\underline{p}X)\beta \Leftrightarrow X\ \beta)$

Claim: Transparency is satisfied iff $C \models \underline{p}$.

i. If $C \models \underline{p}$, $C \models \forall X\ ((\underline{p}X) \Leftrightarrow p')$, and the result follows. **ii.** Taking β to be the null string, *Transparency* requires that $C \models \forall X\ ((\underline{p}X) \Leftrightarrow X)$. Taking X to be a tautology, we obtain that $C \models \underline{p}$.

Example 2. Sentences starting with *[not ($\underline{p}$p')]*

Transparency requires that for any sentence completion β, $C \models \forall X\ ([\text{not}(\underline{p}X)]\beta \Leftrightarrow [\text{not}\ X]\beta)$.

Claim: Transparency is satisfied iff $C \models \underline{p}$.

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[1]The quantification over X will have to be eliminated or justified in future work. It is an unpleasant feature of the present analysis. A more natural condition would be: $C \models (\alpha\ (\underline{p}p')\ \beta \Leftrightarrow \alpha\ p'\ \beta)$, but this is not quite strong enough to derive the desired results.

[2]Other variants of the system would be obtained if instead of requiring that the 'stripped' version of the sentence is equivalent to the original one, one simply stipulated that there should be no asymmetric entailment between the two. In monotonic environments, this will make the same predictions as the present theory. But for non-monotonic environments, the results will be different (the prediction is that non-monotonic operators should 'filter out' presuppositions, which sometimes appears to be the case).

[3]When we discuss the effects of Transparency, we enrich this language with propositional variables, quantifiers, material implication (⇒), and material equivalence (⇔); and we allow $\underline{p}$ to be an atom.

i. If C |=p, the result follows immediately. **ii.** Taking β to be the null string, we have C |= ∀X (not(pX) ⇔ not X), hence C |= ∀X ((pX) ⇔ X), and thus from Example 1, ii: C |= p.

Example 3. Sentences starting with *[p and (qq')]*.

Transparency requires that for any sentence completion β, C |= ∀X ([p and (qX)] β ⇔ [p and X] β)

Claim: Transparency is satisfied iff C |= p ⇒ q.

i. If C |= p ⇒ q, C |= ∀X ([p and (qX)] ⇔ [p and X]) and hence for any sentence completion β, C |= ∀q' ([p and (qq')]β ⇔ [p and q'] β) **ii.** By taking β to be the null string and X to be a tautology, *Transparency* entails that C |= p ⇒ [p and q], and hence that C |= p ⇒ q.

Example 4. Sentences starting with *[if (pp')]*

We start by observing that, given our semantics, if w is a C-world, w |= [if F] F' if and only if C |= F ⇒ F'.

Transparency requires that for all sentence completions β, C |= ∀X ([if (pX)]β ⇔ [if X] β)

Claim: Transparency is satisfied iff C |= p.

i. Clearly, if C |= p, C |= ∀X ((pX) ⇔ X), from which it follows that C |= ∀X ([if (pX)]β ⇔ [if X]β). **ii.** Taking β to be p and X to be a tautology, *Transparency* entails in particular that C |= ([if (pX)]p ⇔ [if X]p). The left-hand side is tautology, and thus C |= p.

Example 5. Sentences starting with *[if p](qq')*

Transparency requires that for all sentence completions β, C |= ∀X ([if p](qX) β ⇔ [if p]X β)

Claim: Transparency is satisfied iff C |= p ⇒ q

i. If C |= p ⇒ q, C |= ∀X ([if p](qX) ⇔ [if p]X), from which it follows that for any sentence completion β, C |= ∀X ([if p](qX)] β ⇔ [if p] X β)[4]. **ii.** Taking β to be empty and X to be a tautology, *Transparency* entails that C |= [if p] q ⇔ [if p]X. The right-hand side is a tautology, and thus C |= p ⇒ q.[5]

B) Connectives II - Other Cases (*or, unless, while):* Heim 1983 does not discuss the projection behavior of disjunctions. There are a variety of positions in the literature (see Krahmer 1998, Beaver 2001). Following Beaver 2001, we take the correct result to be that *pp' or q* presupposes that *p*, and *p or qq'* presupposes that *if not p, q*. Whatever their stand on this issue, competing theories must stipulate the projection behavior of *or,* which does not follow from anything else. By contrast, our algorithm makes precise predictions: as shown in Example 1, *pp' or q* presupposes *p*; and *p or qq'* presupposes *if not p, q:*

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[4]The result follows because our very simple syntax guarantees that any sentence starting with *[if F]G* has *[if F]G* as a syntactic unit (otherwise *G* should be preceded by: *[*).

[5]An *Amsterdam Colloquium* reviewer observes that post-posed *if-clauses* might well have the same projection behavior as pre-posed ones: *Ok If there is a reviewer, the reviewer is mad, Ok The reviewer is mad, if there is a reviewer.* Is this a problem? Given our statement of *Transparency*, it all depends what the syntactic position of the post-posed *if*-clause is. If it is not possible to have a complete IP without including it, then we predict that the projection behavior of post-posed *if*-clauses should indeed be identical to that of pre-posed *if*-clauses. Now Bhatt & Pancheva 2001 argue that post-posed are attached quite low, as suggested by the Condition C effect that obtains in #*She$_i$ yells at Bill if Mary$_i$ is angry*[5]. The results are arguably similar in #*He$_i$ is mad, if [the reviewer]$_i$ exists* (which contrasts with *If he$_i$ exists, [the reviewer]$_i$ is mad*). This suggests that the post-posed *if*-clause is in the scope of the matrix subject, and hence belongs to the smallest IP that includes the matrix verb. As a result, only after the post-posed *if*-clause is processed can *Transparency* be checked, which predicts that *The reviewer is mad, if there is a reviewer* should indeed be acceptable...

[7]Are these predictions correct? *This house has no bathroom or the bathroom is in a funny place* (after Partee) suggests that the analysis of Example 6 might be right. But arguably *The bathroom is in a funny place or this house has no bathroom* is also acceptable, which does not square well with the claim that *(pp' or q)* presupposes that p. But as pointed out by B. Spector (p.c.), there are other cases that suggest that there is a systematic asymmetry in the projection behavior of disjunctions, as illustrated by the following contrast:

Example 6. Sentences starting with *[p or (qq')]*.
Transparency requires that for any sentence completion β, C |= ∀X ([p or (qX)] β ⇔ [p or X] β).
Claim: Transparency is satisfied iff C |= (not p) ⇒ q
i. If C |= (not p) ⇒ q, C |= ∀X ([p or (qX)] ⇔ [p or X]) [this follows from the propositional logic equivalence between *p or r* and *p or ((not p) and r)*]. Thus for any sentence completion β, C |= ∀X ([p and (qX)]β ⇔ [p and X] β) **ii.** By taking β to be the null string and X to be a tautology, *Transparency* entails that C |= [p or q] ⇔ [p or X]. The right-hand side is tautology, thus C|= [p or q], i.e. C|= (not p) ⇒ q[7].

Heim 1983 makes no predictions about other connectives that she does not consider, such as *unless* or *while*. But the present analysis is more constrained. From the equivalence between *Unless F, G* and *Unless F, (not F) and G*, we predict that any presupposition of G entailed by *not F* should automatically be transparent. This prediction is borne out in (5), which presupposes nothing at all:
(5) Unless John didn't come, Mary will know that he is here (*presupposes nothing)*
(5) has the form *unless F, qq'*, where *not F* entails *q* (specifically: *not (John didn't come)* entails: *John is here*). This accounts for the data. Turning now to *while*, the equivalence between *While F, G* and *While F, F and G* explains the facts in (6):
(6) While John was working for the KGB, Mary knew that he wasn't truthful about his professional situation.
(6) is of the form *While F, qq'*, where *F* contextually entails *q* (because a spy isn't truthful about his professional situation). *Transparency* is automatically satisfied.
C) Extension - Quantifiers (Simple Cases): Presupposition projection in quantified structures is a notoriously hairy topic, which we only treat superficially by considering *[every P](QQ')*, *[at least one P](QQ')* and *[no P](QQ')* (we extend out notation from propositional letters to predicates: the underlined part is the presuppositional one, and concatenation is interpreted as generalized conjunction). In all three cases Heim 1983 predicts the same presupposition, namely that *every P-individual satisfies Q*. For better or worse, we match this result.
Example 7. Sentences starting with *[Every P] (QQ')*
Transparency requires that for any sentence completion β, C |= ∀Y ([Every P] QY β ⇔ [Every P]Y β), where Y is a predicate variable.
Claim: Transparency is satisfied iff C |= [Every P] Q
i. Clearly, *Transparency* is satisfied if every P-individual is a Q-individual. **ii.** If some P-individual, say i, is not a Q-individual, *Transparency* fails: take β to be the null string, and take Y to hold of every individual. Then the right-hand side holds, but the left-hand side doesn't.
Example 8. Sentences starting with *[At least one P] (QQ')*
Transparency requires that for any sentence completion β, C |= ∀Y([At least one P] *(QY)* β ⇔ [At least one P] Y β)
Claim: Transparency is satisfied iff C |= [Every P]Q
i. Clearly, *Transparency* is satisfied if every P-individual is a Q-individual. **ii.** If some P-individual, say i, is not a Q-individual, *Transparency* fails: take β to be the null string, and take Y to hold only of i. Then the right-hand side holds, but the left-hand side doesn't. [These predictions are notoriously too strong for indefinites, as in *A fat man was pushing his bicycle*. We leave this for the future...]
Example 9. Sentences starting with *[No P] (QQ')*
Transparency requires that for any sentence completion β, C |= ∀Y([No P] (QY) β ⇔ [No P] Y β)
Claim: Transparency is satisfied iff C |= [Every P]Q
i. Clearly, *Transparency* is satisfied if every P-individual is a Q-individual. **ii.** If some P-individual, say i, is not a Q-individual, *Transparency* fails: take β to be the null string, and take Y to hold only of i. The left-hand side is true (since i is not a Q-individual, QY has an empty extension), but the right-hand side is false (it is refuted by i itself).

4. The Triggering Problem: Remarks

Our projection algorithm could in principle be adapted to any solution to the Triggering Problem. As long as there is a way to determine which elements are 'underlined', *Transparency* can be applied to yield the predictions we have laid out. However one would then like to know *why Transparency* should hold in the first place. In the present framework, *Transparency* can be seen as a strategy of *complexity reduction*, which guarantees that *Be Articulate!* is satisfied even when a complex meaning is expressed by a single expression, thanks to the assumption that part of this meaning is eliminable. We now present preliminary evidence in favor of this pragmatic analysis as it applies to the Triggering Problem.

1) As was observed at the outset, in some cases, such as *fall*, the generalization appears to simply be that *some* part of the meaning should be presupposed; which one it is would seem to be context-dependent[8]. In more recalcitrant cases, similar effects can be obtained by manipulating the preceding discourse. *Do you know that Mary is pregnant* normally presupposes that Mary is pregnant. By contrast, *Do you know that Mary is pregnant or do you believe it?* presupposes that the addressee believes that Mary is pregnant.

2) As pointed out by Simons 2001, presuppositional effects can be obtained through adverbial modification: *None of my students arrived on time* typically implies that each of my students arrived. It is difficult to see how this could come from an implicature (with a scale <*arrive, arrive on time*>), as this analysis would predict a weaker inference, namely that some of my students arrived[9]. From the present perspective, the facts follow because *arrived on time* (by contrast with *arrived, and did so on time*) violates *Be Articulate!* unless part of the meaning is taken to be transparent. This triggers a presuppositional phenomenon, as desired.

3) Obviously these remarks only scratch the surface of the Triggering Problem. At best they indicate that presuppositions are triggered when an expression would otherwise violate *Be Articulate!*. But this leaves entirely open the issue of *which part of the meaning is selected to be transparent*. This we leave for future research.

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[8] The effect can be reproduced in other cases. *None of these kids is starting to smoke* typically presupposes that each of the kids was heretofore a non-smoker. But if I utter the sentence while watching some teenagers smoking, we obtain the opposite pattern: it is then presupposed that each of kids is a smoker, and it is asserted that each of them was one before.

[9] An alternative possibility, however, is that the standard theory of scalar implicatures is incorrect, as has been recently argued by Chierchia and others. It is thus important to perform a direct comparison between adverbial modification and clear instances of scalar implicatures in similar environments. Focusing on the scale <*or, and*>, we can consider *None of my students read Chomsky and Montague*. The question is whether this simply implies that some of my students read Chomsky or Montague, or that *each* of my students read Chomsky or Montague. The data are subtle. My impression is that without focus on *and* we only get the weak implication. With focus on *and*, I believe the strong implication is obtained. I leave this issue for future research.