Be Articulate!: A Pragmatic Solution to the Projection Problem

The analysis of presupposition projection lead researchers to posit in the early 1980's that the meaning of a clause should be viewed as its *Context Change Potential* rather than as its *truth conditions* (Heim 1983, following Stalnaker 1974). We argue that this 'dynamic turn' was misguided, and that it leads straight into a dilemma: either one follows Stalnaker in his *pragmatic* analysis, in which case one obtains a beautiful analysis of presupposition projection in conjunctions, but not of much else; or one follows Heim in her *semantic* analysis, which yields broader empirical coverage but little explanatory depth (no predictions are made about connectives whose Context Change Potential was not stipulated to begin with). We present an alternative account, entirely developed within classical logic. We argue that in some cases a complex meaning m is conceptualized as involving a precondition $\underline{p}$, with m=$\underline{p}$p' (for present purposes this division is stipulated, just like failure conditions of atomic sentences are stipulated in Heim's system). In this case a pragmatic principle, *Be Articulate!*, requires that *if possible* m should be expressed as a conjunction *$\underline{p}$ and $\underline{p}$p'* rather than as *$\underline{p}$p'* (the intuition is that this serves to make explicit the special status of the pre-condition *$\underline{p}$*). If so, __ *$\underline{p}$p'*__ can be pronounced on its own in a given syntactic environment *only* in case independent principles make the competitor __ *p and $\underline{p}$p'* __ infelicitous. This happens when the first part (*p and*) makes no contribution to the truth conditions, and is thus ruled out by considerations of least effort. We show that this suffices to capture all the cases of presupposition projection discussed by Heim 1983, with the difference that the present system is *predictive* and thus extends to cases Heim did not consider.

1. The Stalnaker/Heim Dilemma: Both Stalnaker 1974 and Heim 1983 assumed that the projection problem should be analyzed from a dynamic perspective. For Stalnaker, this was a by-product of the *pragmatic* process by which speech act participants update the Context Set in the course of a conversation. For Heim, it was the very *meaning* of words that had to be defined dynamically. Both agreed on the following analysis of elementary clauses and of conjunctions:

(1) a. Elementary Clauses: C[$\underline{p}$p']=# unless each w in C satisfies $\underline{p}$. If ≠#, C[$\underline{p}$p']={w∈C: p'(w)=true}
b. Conjunctions: C[F and G]=# iff C[F]=# or (C[F]≠# and C[F][G]=#). If ≠#, C[F and* G]=C[F][G]

(C is a Context Set, i.e. a set of possible worlds; *$\underline{p}$p'* is an elementary clause with a presuppositional component *$\underline{p}$* and an assertive component *p'*; and C[F] is the update of C with F. # indicates an 'error signal' which is obtained when a presupposition failure occurs.)
It is immediate that these rules predict that *p and $\underline{q}$q* should presuppose nothing at all whenever *p* entails *$\underline{q}$* - apparently the correct result. Stalnaker attempted to justify the update rule of *and* by equating the assertion of a conjunction with the successive assertion of each conjunct (though it is unclear how this justification can work when, say, the conjunction is embedded under a negative quantifier, as in *It never happened that John cheated on his wife and that she learned about it).* In any event, however, it is hard to see how this approach could extend to other connectives, such as disjunction. The entire point of a disjunction is, after all, that one need not assert either conjunct. Similar problems arise when one seeks to extend Stalnaker's approach to other connectives and quantifiers. For this reason, Heim 1983 gave a purely *semantic* interpretation of Stalnaker's update rules. Thus for Heim, the meaning of *and* is specified by the rule in (1)b. But as noted in Soames 1989 and Heim 1992, this deprives the dynamic approach of its explanatory force. This is because Heim's system allows for the definition of a deviant conjunction *and** which has the *opposite* projection behavior from *and*:

(2) C[F and* G]=# iff C[G]=# or (C[G]≠# and C[G][F]=#). If ≠#, C[F and* G]=C[G][F]

Of course *and* vs. *and** make exactly the same predictions when *F* and *G* are presupposition-free, which goes to show that the classical truth-conditional content of a connective does not suffice to predict its Context Change Potential. But this also means that we cannot explain *why* natural language has *and* but not *and**.
2. An Alternative: We give a pragmatic solution to the problem, developed entirely within classical logic. Crucially, our approach does *not* allow for the definition of a 'deviant' conjunction *and** which has the same classical content as *and* but a different projective behavior. Rather, we *predict* the projective behavior of connectives given (i) their classical semantics, and (ii) the syntax of the sentence they occur in. As in other theories, we represent what is taken for granted by the speech act participants as a Context Set. Unlike dynamic theories, however, we do not postulate that the Context Set must be updated in the course of the interpretation of a sentence. Our theory works as follows:
(a) We argue that in some cases a complex meaning m is conceptualized as involving a precondition $\underline{p}$, with m=$\underline{p}$p' (Division). *$\underline{p}$* corresponds to what is in standard theories the presupposition, while *p'* is the assertion. For us, however, *$\underline{p}$* is simply a distinguished conjunct (we don't have any other choice since the logic we adopt is entirely classical, and thus lacks the resources of a third truth value to encode 'presupposition failure'). In the present paper Division is stipulated, though we believe that it too can be given a pragmatic derivation.

(b) When a meaning undergoes *Division*, a pragmatic principle, *Be Articulate!*, requires that *whenever possible* it should be expressed as a conjunction *p̲ and p̲p'* rather than as *p̲p'*. In other words, whenever possible one should say *It is raining and John knows it* rather than *John knows that it is raining*. However the full conjunction is unacceptable (and thus *John knows that it is raining* is acceptable on its own) if the first conjunct *it is raining* is certain to make no contribution to the truth conditions no matter what it is followed by in the sentence. This is for instance the case if the sentence *It is raining and John knows it* is uttered in a Context Set in which it is assumed that it is raining. The same situation arises if C is not so constrained, but if one asserts: *If it is raining, it is raining and John knows it.* As soon as the second occurrence of *it is raining* has been heard, one can determine that, no matter what it will be followed by, it could be eliminated without truth-conditional loss. This leads us to a Principle of Transparency, which can be stated as follows:

(3) Transparency
Given an initial segment α of a sentence uttered in a background of assumptions C, the full conjunction *p and p̲p'* is disallowed and thus *p̲p'* is allowed if for any sentence completion β,
C|= ∀X(α (p and X) β ⇔ α X β) [this can also be written as: C|= ∀X(α (p̲X) β ⇔ α X β)].

3. An Equivalence Proof: We now prove that for a simple language that contains *not*, *and* and *or* the present theory is equivalent to a version of Heim's system. Our theory's advantage, however, is that it is predictive: once the truth-conditional contribution of a connective is specified, its projective behavior follows mechanically, with the result that the overgeneration problem that plagued Heim's approach can be solved.

3.1. Syntax of the object language: F ::= p | (p̲p') | not F | [F and F'] | [F or F']
(we will informally enrich this language below)

3.2. Dynamic (Trivalent) Semantics (the rule for disjunction is taken from Beaver 2001)
C[p]={w∈C: p is true in w}
C[p̲p']=# iff for some w∈C, p̲ is # in w; if ≠#, C[p̲p']= {w∈C: p' is true in w}.
C[not F]=# iff C[F]=#; if ≠#, C[not F]=C-C[F]
C[F and G]=# iff C[F]=# or (C[F]≠# and C[F][G]=#); if ≠#, C[F and G]=C[F][G]
C[F or G]=# iff C[F]=# or (C[F]≠# and C[not F][G]=#); if ≠#, C[F or G]= C[F] ∪ C[not F][G]
Heim-Truth: If w∈C, F is # in w iff C[F]=#; F is true in w iff w∈C[F]

3.3. Static (Bivalent) Semantics
w |= p iff p is true in w
w |= p̲p' iff p̲ and p' are true in w
w |= not F iff w |≠ F
w |= F and G iff w |= F and w |= G
w |= F or G iff w |= F or w |= G

Transparency: For any initial part *α p̲p'* of a sentence uttered in a background of assumptions C, it should be the case that for any sentence completion β, **C|= ∀X(α (p and X) β ⇔ α X β)**
<u>Notation</u>: Transp(C, F) = F satisfies Transparency in C

3.4. Claim: For any Context Set C and for any w∈C, C[F]=# iff not Transp(C, F). If C[F]≠#, C[F]={w∈C: w |= F}

Consequence: F is Heim-# in w iff not Transp(C, F). F is Heim-true in w iff Transp(C, F) and w |=F

Proof (by induction on the construction of formulas; we assume throughout that w∈C)
a. F =p
C[F]≠# and Transp(C, F)
If ≠#, C[F]={w∈C: p is true in w}={w∈C: w |=F}
b. F =(p̲p')
C[F]=# iff for some w∈C, p̲ is false in w,
iff C |≠ ∀X(p̲X ⇔ X), iff not Transp(C, F)
If C[F]≠#, C[F]={w∈C: p is true in w}={w∈C: p and p̲ are true in w}={w∈C: w |=F}.
c. F = not G
C[F]=# iff C[G]=#, iff not Transp(C, G), iff not Transp(C, not G), iff not Transp(C, F). If C[F]≠#, C[F]=C-

$C[G]=C-\{w\in C: w \models G\}=\{w\in C: w \models \text{not } G\}$

d. F =[G and H]

$C[F]=\#$ iff $C[G]=\#$ or ($C[G]\neq\#$ and $C[G][H]=\#$), iff not Transp(C, G) or (Transp(C, G) and $\{w\in C: w \models G\}[H]=\#$), iff not Transp(C, G) or (Transp(C, G) and not Transp($\{w\in C: w \models G\}$, H)).

-Suppose Transp(C, G) and not Transp($\{w\in C: w \models G\}$, H). Let $w^*\in C$ satisfy: (i) $w^* \models G$ and (ii) $w^* \not\models \forall X(\alpha\ (\underline{p}X)\ \beta \Leftrightarrow \alpha\ X\ \beta)$, where α ($\underline{p}p'$) is an initial segment of H. Then $w^* \models \forall X([G \text{ and } \alpha\ (\underline{p}X)\ \beta] \Leftrightarrow [G \text{ and } \alpha\ X\ \beta])$, and since $w^*\in C$ and [G and α ($\underline{p}X$) is an initial segment of [G and H], not Transp(C, [G and H]). Thus Transp(C, G) and not Transp(C, [G and H])

-Conversely, suppose that Transp(C, G) and not Transp(C, [G and H]). Then for some $w^*\in C$, $w^* \not\models \forall X([G \text{ and } \alpha\ (\underline{p}X)\ \beta] \Leftrightarrow [G \text{ and } \alpha\ X\ \beta])$ for some initial segment α ($\underline{p}p'$) of H. It must be the case that $w^* \models G$ (or else both sides would be false in w^*), and thus $w^* \not\models \forall X(\alpha\ (\underline{p}X)\ \beta \Leftrightarrow \alpha\ X\ \beta)$, hence not Transp($\{w\in C: w \models G\}$, H).

-In sum, $C[F]=\#$ iff not Transp(C, G) or (Transp(C, G) and not Transp(C, [G and H])), iff not Transp(C, [G and H]). If $\neq\#$, $C[F]=C[G][H]= \{w\in C: w \models G \text{ and } w \models H\} = \{w\in C: w \models [G \text{ and } H]\}$.

e. F=[G or H]

$C[F]=\#$ iff $C[G]=\#$ or ($C[G]\neq\#$ and $C[\text{not } G][H]=\#$), iff not Transp(C, G) or (**Transp(C, G) and not Transp($\{w\in C: w\models \text{not } G\}$, H)**).

-Suppose **Transp(C, G) and not Transp($\{w\in C: w\models \text{not } G\}$, H)**. Then for some $w^*\in C$ for which $w^* \models$ not G and some initial segment α ($\underline{p}p'$) of H, $w^* \not\models \forall X(\alpha\ (\underline{p}X)\ \beta \Leftrightarrow \alpha\ X\ \beta)$, where α ($\underline{p}p'$) is an initial segment of H. We also have: $w^* \not\models \forall X([G \text{ or } \alpha\ (\underline{p}X)\ \beta] \Leftrightarrow [G \text{ or } \alpha\ X\ \beta])$, and thus not Transp(C, [G or H]). Hence **Transp(C, G) and not (Transp(C, [G or H])**.

-Conversely, suppose **Transp(C, G) and not Transp(C, [G or H])**. Then for some $w^*\in C$, $w^* \not\models \forall X([G \text{ or } \alpha\ (\underline{p}X)\ \beta] \Leftrightarrow [G \text{ or } \alpha\ X\ \beta])$ for some initial segment α ($\underline{p}p'$) of H. It must be the case that $w^* \models$ not G (or else both sides would be true in w^*), and thus $w^* \not\models \forall X(\alpha\ (\underline{p}X)\ \beta \Leftrightarrow \alpha\ X\ \beta)$, hence not Transp($\{w\in C: w \models \text{not } G\}$, H). Thus **Transp(C, G) and not Transp($\{w\in C: w \models \text{not } G\}$, H)**.

-In sum, $C[F]=\#$ iff not Transp(C, G) or (**Transp(C, G) and not Transp(C, [G or H])**), iff not Transp(C, [G and H]). If $\neq\#$, $C[F]=C[G] \cup C[\text{not } G][H]=\{w\in C: w \models G \text{ or } w\models[\text{not } G \text{ and } H]\}=\{w\in C: w \models[G \text{ or } H]\}$.

4. Other Cases: Without giving a general proof of equivalence, let us show that Heim's results can also be matched in other cases.

4.1. Conditionals: We take the expression *if F, G* to be a strict indicative conditional: with background assumptions C, *if F, G* evaluated in any C-world is true if and only if every C-world that satisfies *F* also satisfies *G*. We then show that Heim's predictions for *if* $\underline{p}p'$, *q* and *if p,* $\underline{q}q'$ can be matched: the former sentences presupposes that p, and the second that if p, q. We start by observing that for any Context Set C and any world $w\in C$, we have: $w \models [\text{if } F]F'$ if and only if $C \models (F \Rightarrow F')$. We call I the interpretation function, and we write $I[\pi\rightarrow p]$ an interpretation which is identical to I except that it assigns p to the constant π.

a. Sentences starting with *If* $\underline{p}p'$***, q***: *Transparency* requires that for all sentence completions β, $C \models \forall X\ ([\text{if } (\underline{p}X)]\beta \Leftrightarrow [\text{if } X]\beta)$

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

i. Clearly, if $C \models \underline{p}$, for any $p\subseteq C$, $C \models^{I[\pi\rightarrow p]} ((\underline{p}\pi) \Leftrightarrow \pi)$, hence for any sentence completion β $C \models^{I[\pi\rightarrow p]} ((\underline{p}\pi)\beta \Leftrightarrow \pi\beta)$. It follows by universal quantification that $C \models \forall X\ ([\text{if } (\underline{p}X)]\beta \Leftrightarrow [\text{if } X]\beta)$.

ii. Taking β to be $\underline{p}$, *Transparency* entails in particular that $C \models^{I[\pi\rightarrow C]} ([\text{if } (\underline{p}\pi)]\underline{p} \Leftrightarrow [\text{if } \pi]\underline{p})$. The left-hand side is true in every C-world, and thus $C \models^{I[\pi\rightarrow C]} [\text{if } \pi]\underline{p}$, whence (given the value of π), $C \models^{I[\pi\rightarrow C]} \underline{p}$. But since π does not occur in $\underline{p}$, this yields: $C \models \underline{p}$.

b. if p, $\underline{q}q'$: *Transparency* requires that for all β, $C \models \forall X\ ([\text{if } p](\underline{q}X)\ \beta \Leftrightarrow [\text{if } p]X\ \beta)$.

Claim: Transparency is satisfied iff $C \models (p \Rightarrow \underline{q})$.

i. If $C \models p \Rightarrow \underline{q}$, for any $d\subseteq C$, $C \models^{I[\pi\rightarrow d]} ([\text{if } p](\underline{q}\pi) \Leftrightarrow [\text{if } p]\pi)$, hence for any sentence completion β, $C \models^{I[\pi\rightarrow d]} ([\text{if } p](\underline{q}\pi)\beta \Leftrightarrow [\text{if } p]\pi\beta)$. Applying universal quantification, we obtain: $C \models \forall X\ ([\text{if } p](\underline{q}X)\beta \Leftrightarrow [\text{if } p]X\beta)$[1].

ii. Taking β to be empty, *Transparency* entails that $C \models^{I[\pi\rightarrow C]}([\text{if } p]\ (\underline{q}\pi) \Leftrightarrow [\text{if } p]\pi)$. The right-hand side is true in every C-world, and thus $C \models^{I[\pi\rightarrow C]} [\text{if } p]\ (\underline{q}\pi)$. But π is true in every C-world, and thus $C \models^{I[\pi\rightarrow C]} [\text{if } p]\ \underline{q}$, i.e. $C \models^{I[\pi\rightarrow C]} (p \Rightarrow \underline{q})$. Since π does not occur in $(p \Rightarrow \underline{q})$, $C \models (p \Rightarrow \underline{q})$.

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[1]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: *[*).

4.2. Quantified Statements: Heim's predictions can also be matched for simple quantified statements (we write QQ' for a predicate with a presuppositional component Q and an assertive component Q'; the domain of individuals is D).

a. Sentences starting with *[Every P] (QQ'):* *Transparency* requires that for any sentence completion β, C |= ∀Y ([Every P](QY)β ⇔ [Every P]Yβ), where Y is a predicate variable (we assume that the syntax requires that [Every P](QY) and [Every P]Y be constituents in this configuration).

Claim: Transparency is satisfied iff C |= [Every P] Q

i. If C |= [Every P] Q, for any d⊆D, C $\models^{I[\partial\to D]}$ ([Every P](Q∂)⇔ [Every P]∂). Thus for any sentence completion β, C $\models^{I[\partial\to D]}$ ([Every P](Q∂)β ⇔ [Every P]∂β). By universal quantification, we obtain C |=∀Y ([Every P](QY)β⇔ [Every P]Yβ).

ii. If some P-individual, say i, is not a Q-individual in a C-world w, *Transparency* fails. Let us take β to be the null string. Then w, C $\models^{I[\partial\to D]}$ [Every P]∂, but w, C $\not\models^{I[\partial\to D]}$ [Every P](Q∂) (because i satisfies P but not Q in w).

b. 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. If C |= [Every P] Q, for any d⊆D, C $\models^{I[\partial\to D]}$ ([At least one P](Q∂)⇔ [At least one P]∂). Thus for any sentence completion β, C $\models^{I[\partial\to D]}$ ([At least one P](Q∂)β⇔ [At least one P]∂β) (by Substitutivity). By universal quantification, we obtain C |=∀Y ([At least one P](QY)β⇔ [At least one P]Yβ).

ii. If some P-individual, say i, is not a Q-individual in a C-world w, *Transparency* fails. Let us take β to be the null string. Then: C $\models^{I[\partial\to\{i\}]}$[At least one P]∂, but C $\not\models^{I[\partial\to\{i\}]}$ [At least one P](Q∂) (because i, the only individual that satisfies ∂ in w, satisfies P but not Q).

c. 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. If C |= [Every P] Q, *Transparency* is satisfied (the argument is the same as in the preceding examples).

ii. If some P-individual, say i, is not a Q-individual in a C-world w, *Transparency* fails. Let us take β to be the null string. Then: w, C $\models^{I[\partial\to\{i\}]}$[No P](Q∂) (because i does not satisfy Q in w, which entails that no individual can satisfy both ∂ and Q in w). But w, C $\not\models^{I[\partial\to\{i\}]}$[No P]∂ since i satisfies both P and ∂ in w.

4.3. Further Predictions: Our theory makes predictions in cases in which Heim's doesn't, for instance *unless*:

(4) Unless John didn't come, Mary will know that he is here

Intuitively (4) presupposes nothing additional if it is assumed that *if John came, he is here*. This follows because the example has the form *unless F, qq'*, where *not F* entails *q* (specifically: *not (John didn't come)* entails *John is here*). Turning now to *while*, the equivalence between *While F, G* and *While F, F and G* explains the facts in (5):

(5) While John was working for the KGB, Mary knew that he wasn't entirely truthful about his professional situation.

This sentence has the form *While F, qq'*, where *F* contextually entails *q* (because we take for granted that a spy isn't truthful about his profession). For this reason, *Transparency* is automatically satisfied. Similar examples can be constructed *ad libitum*. In (6) we consider the contrast between *Before F, G* and *After F, G* [we are only concerned with the projective behavior of the main clause; the pre-posed clauses trigger presuppositions of their own, a fact we disregard here]:

(6) a. Before John became a politician, his mother was glad that he had a normal job.
b. After John became a politician, his mother was worried that he didn't have a normal job.

If in a context C the speech act participants assume that *John is a politician* is true if and only if *John does not have a normal job*, we predict that in C both sentences should be acceptable, thanks to the following intuitive equivalences:

(7) a. Before John became a politician, G ⇔ Before John became a politician, John wasn't a politician and G
b. After John became a politician, G ⇔ After John became a politician, John was a politician and G

Partial References

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