Presupposition Projection: Two Theories of Local Contexts
Part II[*]

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1 Reconstructing Local Contexts

The Explanatory Problem discussed in Part I is conceptually simple: dynamic semantics is strictly more powerful than classical semantics; this made it possible for Heim's system to handle presuppositional data that classical semantics did not; but the very power of the framework also makes it possible to define all sorts of lexical entries which presumably do not exist in the world's languages. We will now circumvent the problem by defining something very close to Heim's 'local contexts', but on the basis of a purely classical (bivalent and non-dynamic) semantics. Specifically, we will define a general rule to compute local contexts in great generality once the syntax and classical semantics of a sentence have been specified – a rule that does without the detour of dynamic semantics.

1.1 Transparency-based Analyses

The approach we develop is part of a broader class of 'Transparency-based theories' (Schlenker 2008a, 2009, 2010), which in essence attempt to turn a derived property of dynamic semantics into the centerpiece of a theory of presupposition projection. These theories have two components: a *substantial component*, which explains under what semantic conditions a presupposition is 'licit'; and an *incremental component*, which derives the left-right asymmetries we observed in sentences such as (1) (repeated from Part I).

(1) a. John is incompetent, and he knows that he is.
b. # John knows that he is incompetent, and he is.
a'. John used to smoke, and he has stopped smoking.
b'. #John has stopped smoking, and he used to smoke.

Since these theories are built on the basis of a classical semantics, $\underline{p}p'$ will henceforth represent a classical meaning, equivalent to the conjunction of p and p'. For instance, we treat *x stopped smoking* as roughly equivalent to *x used to smoke and x doesn't now smoke*, with the specification (encoded by underlining) that one entailment, namely *x used to smoke,* has a special status. So in this case we have p = *x used to smoke* and p' = *x doesn't now smoke*, and the notation $\underline{p}p'$ indicates that the sentence will be pragmatically deviant unless p is entailed by its local context. It is then incumbent on the theory of presupposition projection to explain why the distinguished entailment behaves in a special way.[1] Importantly, nothing prevents us

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[1] We could also ask a different question – namely why some entailments become 'underlined'. This is the 'Triggering Problem': the question is to determine how the presuppositions of elementary expressions are

from working with a classical semantics while still claiming that sentences are pragmatically deviant if a presupposition fails to be entailed by its local context; this just means that 'deviance' could be encoded in the pragmatics rather than in the semantics.

Let us turn to a description of the two components of transparency-based theories.

1. *Substantial component*: A consequence of Heim's system is that presuppositions are semantically inert, in the following sense: if a sentence is felicitous, one can 'erase' from it all the presuppositions without affecting the truth conditions. Let us consider three examples. We saw at the outset that $\underline{p}p'$ and $(not\ \underline{p}p')$ both presuppose that p, and that $(p\ and\ \underline{q}q')$ as well as $(if\ p,\ \underline{q}q')$ both presuppose that $(if\ p,\ q)$. But when these conditions hold, $(not\ \underline{p}p')$ is equivalent to $(not\ p')$; similarly, $(p\ and\ \underline{q}q')$ and $(if\ p,\ \underline{q}q')$ are equivalent to $(p\ and\ q')$ and $(if\ p,\ q')$: we can delete the underlined material without affecting the truth conditions. This is the sense in which presuppositions are 'transparent'. These simple results are summarized in (2), where $C \models p$ means that p holds in each world of C (in other words, p follows from C).

(2) Uttered in a context set C:
a. $\underline{p}p'$ and $(not\ \underline{p}p')$ both presuppose that $C \models p$
… and when $C \models p$, $C \models \underline{p}p' \Leftrightarrow p'$, and $C \models (not\ \underline{p}p') \Leftrightarrow (not\ p')$
b. $(p\ and\ \underline{q}q')$ and $(if\ p,\ \underline{q}q')$ both presuppose that $C \models p \Rightarrow q$
… and when $C \models p \Rightarrow q$, $C \models (p\ and\ \underline{q}q') \Leftrightarrow (p\ and\ q')$, and $C \models (if\ p,\ \underline{q}q') \Leftrightarrow (if\ p,\ q')$.

Transparency-based theories start from the requirement that presuppositions should be 'erasable', or 'transparent', which in turn imposes constraints on C. For all these theories, it turns out to be essential that the equivalence should hold *no matter what the assertive component is.*[2] To take a very simple example, consider $(not\ \underline{p}p')$. How can we guarantee that $C \models (not\ \underline{p}p') \Leftrightarrow (not\ p')$ no matter what p' turns out to be? The condition is equivalent to $C \models \underline{p}p' \Leftrightarrow p'$, and it will certainly hold if $C \models p$. Conversely, if $C \models \underline{p}p' \Leftrightarrow p'$ holds for all p', the equivalence holds in particular when p' is a tautology – which implies that $C \models p$ (recall that semantically $\underline{p}$ and p are the same thing). So in this very simple case, the condition that a presupposition should be 'transparent' suffices to derive the desired result, namely that $not\ \underline{p}p'$ presupposes p.

2. *Incremental component:* The substantial component on its own does not distinguish between, say, $(p\ and\ \underline{q}q')$ vs. $(\underline{q}q'\ and\ p)$, which are equivalent in classical logic. In order to regain a difference, transparency-based theories require that the equivalence imposed by the substantial component should be guaranteed to hold as soon as one processes a presupposition trigger, *no matter how the sentence ends*. When the trigger is at the end of the sentence, this changes nothing – and thus the result we obtained for $(not\ \underline{p}p')$ still holds. But we will derive different results for $(p\ and\ \underline{q}q')$ vs. $(\underline{q}q'\ and\ p)$: although the two sentences are equivalent, the second will yield a stronger presupposition because the trigger is at the beginning, and as a result one cannot 'use' information about p to satisfy the substantial condition.

Transparency-based theories come in several varieties. A purely pragmatic theory was developed in Schlenker 2008a. Here we will develop instead an analysis which reconstructs

generated in the first place. We do not consider this problem here; see for instance Abrusan, to appear for a recent discussion.

[2] To see why this is crucial, consider the sentence *It is Obama who won the election*. The cleft triggers a presupposition that *exactly one person won the election*. The assertive component seems to be that *Obama won the election*. But in this case the presupposition is entailed by the assertive component, so in all standard contexts C, $C \models \ldots \underline{p}p' \ldots \Leftrightarrow \ldots p' \ldots$. This is an undesirable result, as it implies that *It is X who won the election* never presupposes anything.

as closely as possible Heim's notion of local context (see Schlenker 2009, 2010 for further formal and conceptual details).

1.2 Local Contexts Revisited[4]

1.2.1 Motivation

We will take the local context of an expression *E* to be the minimal domain of objects that the interpreter needs to consider when he computes the contribution of *E* to the meaning of the entire sentence. This notion of 'minimal domain' can be motivated as follows. The interpreter's task is to determine which worlds of the context set are compatible with the speaker's claim; in other words, he must compute a function from worlds in the context set to truth values. To do so, he has access to the context set C, and to the meaning of the words, which we take for simplicity to be functions of various types.[5] Now we assume (i) that it is easier to perform the steps of the computation when part of the domain of a function can be disregarded, (ii) that the interpretation is performed incrementally (from left to right), and (iii) that before processing any expression, the interpreter tries to simplify his task as much as possible given what he already knows about the meaning of the sentence. From these assumptions, it follows that the interpreter will try to determine in advance of interpreting any expression *E* what is the smallest domain that he needs to consider when he assesses the meaning of *E*; this 'smallest domain' is our notion of local context.

Let us make the intuition clear with an example. Suppose that we are in a context C, and that we have heard the speaker say: *If John used to smoke, ...* . Having computed the meaning of the antecedent of the conditional, we set out to compute the meaning of its consequent (call it *S)*; this meaning is a function from possible worlds to truth values. As before, we analyze the conditional as a material implication. Now one strategy would be to retrieve a function that specifies the value of *S* in *all* possible worlds. But for the purposes of the conversation, only the worlds in C matter, because all other worlds are excluded by the shared assumptions of the conversation partners. So instead of computing the meaning of *S*, the interpreter may just as well retrieve a function which uniformly assigns the value 0 (for 'false') to all worlds outside of C, and which assigns the value of *S* to those worlds that lie in C. With this procedure, the interpreter can assign 0's to all the worlds that are not within C, and he can do so *before* computing the meaning of *S*. In effect, an interpreter that follows this strategy will compute the value of *(c' and S)* instead of the value of *S*, where *c'* denotes C. For simplicity, we will describe this strategy by literally replacing *S* with *(c' and S)*. We will say that the interpreter assesses *S* with a restriction to *c'*, and that this restriction is 'innocuous' because no matter what the value of *S* turns out to be, the restriction does not affect the truth conditions of the entire sentence relative to the context set. Still, the interpreter can make his life *even* easier by further restricting attention to those C-worlds in which John smoked, because all worlds in which John never smoked will make the conditional true no matter what the value of *S* turns out to be; so if *c'* denotes the set of p-worlds within C, *c'* will still be an innocuous restriction. We take the local context of *S* to be the *strongest* innocuous restriction, i.e. the one that entails all other innocuous restrictions.

At this point we already have the *substantial component* of this theory: we require that a presupposition be entailed by its local context. Thus for *if p, qq'* the requirement is that the local context at the point • in *if p,* • should entail *q*. Since the local context is the *strongest*

[4] This section shares some expository material with Sections 2.1 and 2.3 of Schlenker 2010.

[5] For perspicuity, we assimilate functions from individuals to truth values with sets of the individuals.

conjunctive restriction *c'* that we can add while still guaranteeing that *if p, •* is equivalent to *if p, (c' and •)*, we do derive the general result that *q* is entailed by its local context just in case it is transparent - that is, erasable without truth-conditional loss.[6]

The *incremental component* is hidden in the way local contexts are defined. The key is that the computation of the local context of an expression *E* is done on the basis of the information that comes *before E*. This gives rise to the desired asymmetry: information that comes before *E* is known when the local context is computed, but information that comes after *E* isn't, and the interpreter must therefore ensure that *no matter how the sentence ends* the local context will indeed be innocuous. (As we will see in Section 1.4.3, this assumption can easily be relaxed, which gives rise to different predictions.)

1.2.2 Definition

To give a formal definition, we enrich the object language (i.e. the language we study) with (a) context variables, which may be of propositional or predicative type (they will be written below as *c'*), and (ii) predicate conjunction, which receives the natural interpretation. In the meta-language (i.e. the language in which we state our theory), $\wedge$ symbolizes conjunction of propositions or properties, and we write the meaning of an expression of the object language in bold. Thus **p** is the meaning of the propositional letter *p*, and C $\wedge$ **p** is the conjunction of C with that proposition. If w is a world and *F* is a formula (which may contain the variable *c'*), we write w $\models^{c' \to x}$ F to indicate that w satisfies the formula *F* when *c'* denotes x (similarly, w $\not\models^{c' \to x}$ F indicates that w *does not* satisfy the formula *F* when *c'* denotes x); and if C is a set of worlds, C $\models^{c' \to x}$ F indicates that *each world* in C satisfies *F* when *c'* denotes x. Finally, we say that a proposition x is a stronger than a proposition x' if x entails x' but not conversely; and

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[6] This conclusion only holds when local contexts exist. This is always the case in the propositional case, but in the quantificational case there are special circumstances in which no local context can be computed (see Schlenker 2009 for discussion).

To see more rigorously why the present analysis is a transparency-based theory, consider the case of *if p, •*, where the local context of • is *c'*. In the global context C, then, we have (for any •):

(i) (if p, •) $\leftrightarrow$ (if p, (c' and •)).

We will show that 1. if a presupposition *q* follows from *c'*, it is transparent; and 2. if *q* is transparent, it follows from *c'*.

1. Suppose the presupposition *q* follows from the local context *c'*. If so, we have:

(ii) (if p, (q and c' and •)) $\leftrightarrow$ (if p, (c' and •)).

By (i), replacing • with *(q and •)*, we have:

(iii) (if p, (q and •)) $\leftrightarrow$ (if p, (c' and q and •)).

Now (iii), (ii) and (i) yield:

(iv) (if p, (q and •)) $\leftrightarrow$ (if p, •). In other words, the presupposition *q* is transparent, that is, erasable without truth-conditional loss.

2. Conversely, suppose that relative to the global context C, (iv) holds (for any •): (if p, (q and •)) $\leftrightarrow$ (if p, •). Replacing • with *(c' and •)*, we have (for any •):

(v) (if p, (c' and q and •)) $\leftrightarrow$ (if p, (c' and •));

hence also by (i):

(vi) (if p, (c' and q and •)) $\leftrightarrow$ (if p, •).

But since *c'* is the *strongest* proposition with property (i), it means this means that it is equivalent (not just within C, but absolutely) to *(c' and q)*. Which is another way of saying that *q* follows from *c'*.

similarly if x and x' are properties (i.e. predicate denotations), with a generalized notion of entailment.[7] Our definition of local contexts can now be stated as follows:

(3) The local context of an expression *d* of propositional or predicative type which occurs in a syntactic environment *a _ b* in a context C is the strongest proposition or property x which guarantees that for any expression *d'* of the same type as *d*, for all strings *b'* for which *a d' b'* is a well-formed sentence,

$C \models^{c' \rightarrow x}$ a (c' and d') b' $\leftrightarrow$ a d' b'

(If no strongest proposition or property x with the desired characteristics exists, the local context of *d* does not exist.[8])

Let us explain. Following the intuition we developed earlier, the local context of *d* in the sentence *a d b* is the strongest innocuous restriction that the interpreter can make in advance of interpreting *d* when he processes the sentence from left to right. At this point, he has access to the meaning of the expressions in the string *a*, but not to the meaning of *d* itself, nor to the string *b*. Our procedure is incremental because it requires that the local context be an innocuous restriction *no matter which expressions appear at the end of the sentence*. This is why the rule in (3) involves a quantification not only over *d'* (since the value of *d* is not known yet), but also over *b'* (since the end of the sentence has not been heard yet): for every appropriate *d'* and *b'*, *a (c' and d') b'* should be equivalent to *a d' b'* relative to the context set.

As was the case for Heim's theory in Part I, we can provide an explicit definition of Presuppositional Acceptability and Truth within this new system. Truth is trivial to define, since the underlying semantics is classical (with the proviso that expressions of the form *<u>d</u>d'* are interpreted as the conjunction of *d* and *d'*). Presuppositional Acceptability is directly defined in terms of local contexts: *S* is presuppositionally acceptable relative to C just in case for every trigger of the form *<u>d</u>d'* occurring in *S*, its local context entails *d*.

(4) Let a sentence *S* be uttered relative to a context set C.

a. Presuppositional Acceptability
S is presuppositionally acceptable relative to C if and only if for each (propositional or predicative) presupposition trigger of the form *<u>d</u>d'* which appears in *S*, its local context computed relative to C entails *d*.

b. Truth
If w ∈ C and if *S* is presuppositionaly acceptable in C, *S* is true in w if and only if *S* is true in w according to the classical evaluation rules (given in the Appendix in (37)).

Importantly, since the definition in (3) makes it possible to compute the local contexts not just of propositional but also of predicative expressions, Presuppositional Acceptability handles in the same way both cases – which will prove essential to obtain an account of presupposition projection in quantified structures.

Before we turn to some examples, let us briefly mention some general results. It is shown in Schlenker 2009 that for a simplified fragment this theory derives *exactly* Heim's results in the propositional case (as discussed below, for disjunction we derive the predictions

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[7] Writing as x^w the value of a property x at w, x entails a property x' just in case for every possible world w and for every individual d, if d ∈ x^w, then d ∈ x'^w.
[8] See Schlenker 2009 for a discussion of the case in which local contexts do not exist.

made in Beaver 2001). With some technical assumptions, we also obtain Heim's predictions for all generalized quantifiers – a point to which we return below.

1.3 Examples

We will illustrate the theory by considering four important examples. We will see that we obtain in each case Heim's results: *(p and* $\underline{q}q'$*)* and *(if p,* $\underline{q}q'$*)* both presuppose that *(if p, q)*; *(p or* $\underline{q}q'$*)* presupposes that *(if not p, q)*; and *(No P .* $\underline{Q}Q'$*)* presupposes *(Every P. Q)* (as does *(Every P .* $\underline{Q}Q'$*))*. While we keep the presentation relatively informal, these examples should be read slowly to follow each step of the argument. The reader may skip some examples, but is advised to work through one or two of them to get a feel for how the system works (see Schlenker 2009, 2010 for a more rigorous presentation).

Example 1. ***(p and*** $\underline{q}q'$***)***: the local context of $\underline{q}q'$ is C ∧ **p**, which must thus entail *q*.

Suppose the addressee has heard a sentence that starts with *(p and* • - for instance *(John used to smoke and* • .

We apply the definition in (3) to the formula *(p and* $\underline{q}q'$*)*. The local context of $\underline{q}q'$ is the strongest x which satisfies (5). Note that when we apply (3), *a* is the string *(p and* , while *b* is just the right bracket *)*, so that we do have *a* $\underline{q}q'$ *b = (p and* $\underline{q}q'$*)*, as is desired. We will assume to simplify the discussion that the addressee knows that the sentence must end with the second conjunct – he knows, in other words, that the only *b'* that can turn the string *(p and d'* into a well-formed sentence is the right bracket *)*. (In more rigorous presentations, this fact can be established by considering the formal syntax of the fragment, which is defined in the Appendix.)

(5) for all *d'*, $C \models^{c' \rightarrow x}$ (p and (c' and d')) ↔ (p and d')

We prove in two steps that the desired denotation for *c'* is C ∧ **p**. First, we show that this is indeed an innocuous restriction (*Step 1*). Second, we show that no stronger innocuous restriction can be found (*Step 2*).

Step 1: Clearly, the addressee can exclude from consideration all worlds that are not compatible with C. But he can do more: any world w in which *p* is false will make the entire conjunction false irrespective of the value of the second conjunct. Hence it won't hurt to compute the meaning of *(c' and d')* rather than *d'*, where *c'* denotes those C-worlds that satisfy *p*. So we obtain the first half of our result:

(6) If x = C ∧ **p**,
for all *d'*, $C \models^{c' \rightarrow x}$ (p and (c' and d')) ↔ (p and d')

Step 2: On the other hand, *all* of these worlds must be considered. For suppose that the denotation of *c'* excludes some world w of C in which *p* is true, and suppose that *d'* is true in w; by computing *(p and (c' and S))* rather than *(p and S)*, the interpreter will wrongly conclude that the sentence is false in w (since *c'* excludes w). This situation is summarized in (7).

(7) Why *all* worlds of C ∧ **p** can matter
Hypothetical situation
w is in C and in **p**, but w is *not* in x, the denotation of *c'*. We further assume that *d'* is true in w:
$w \models^{c' \rightarrow x} d'$

We have:
w $\models^{c' \to x}$ (p and d')
w $\not\models^{c' \to x}$ (p and (c' and d'))   since w $\not\models^{c' \to x}$ c'
Conclusion: *c'* is not an innocuous restriction on the meaning of the second conjunct, since w is in C but
w $\not\models^{c' \to x}$ (p and (c' and d')) $\leftrightarrow$ (p and d')

So we obtain the second half of our result:

(8) If for some w $\in$ C $\wedge$ **p**, w $\notin$ x, then for for some *d'* (as defined in (7)),
C $\not\models^{c' \to x}$ (p and (c' and d')) $\leftrightarrow$ (p and d')

Thus we have shown that the condition in (5) is satisfied for x = C $\wedge$ **p**, and that no proper subset of C $\wedge$ **p** satisfies it. Thus the local context of *qq'* in *(p and qq')* is C $\wedge$ **p**. We can now conclude our reasoning: (i) the local context of *qq'* must entail *q*, hence: C $\wedge$ **p** $\models$ q. But (ii) this condition is equivalent to: C $\models$ p $\Rightarrow$ q; this is the very same conditional presupposition that was predicted by Heim's analysis. This result correctly predicts that *John used to smoke and he has stopped smoking* does not presuppose anything: by construction, the local context of the second conjunct already entails its presupposition, and so no special demands are made on the global context C.

Example 2. ***(if p, qq')***: the local context of *qq'* is C $\wedge$ **p**, which must thus entail *q*.

We follow the same logic, somewhat more briefly, in this second example.

Step 1: As was noted in Section 1.2.1, when we assess the consequent after processing the meaning of the antecedent, it is innocuous to restrict attention to those C-worlds that satisfy *p*: if *c'* denotes C $\wedge$ **p**, we can be certain that throughout C *(if p. (c' and d'))* has the same value as *(if p. d')*. This result is the same as the one we obtained for the conjunction *(p and qq')*. In the latter case, we could ignore the *(not p)*-worlds because they made the sentence trivially false (i.e. false no matter what the second conjunct was). Here we can ignore the *(not p)*-worlds because they make the conditional trivially *true*.

Step 2: On the other hand, any world w in C $\wedge$ **p** could turn out to matter. For suppose that *p* is true in some w of C, and that *c'* excludes w. If *d'* is true in w, by computing *(if p . (c' and d'))* instead of *(if p . d')*, we will reach the erroneous conclusion that the entire conditional is false in w. This situation is summarized in (9), which is very similar to (7).

(9) Why *all* worlds of C $\wedge$ **p** can matter
Hypothetical situation
w is in C and in **p**, but w is *not* in x, the denotation of *c'*). We further assume that *d'* is true in w:
w $\models^{c' \to x}$ d'
We have:
w $\models^{c' \to x}$ (if p, d')
w $\not\models^{c' \to x}$ (if p, (c' and d'))   since w $\not\models^{c' \to x}$ c'
Conclusion: *c'* is not an innocuous restriction on the meaning of the consequent of the conditional, since w is in C but
w $\not\models^{c' \to x}$ (if p, (c' and d')) $\leftrightarrow$ (if p, d')

So any innocuous restriction must include all of C $\wedge$ **p**, which is thus the strongest innocuous restriction one can find. C $\wedge$ **p** is, in other words, the local context of *qq'*. As was the case in our discussion of Example 1, we complete the reasoning by noticing that the local context of *qq'* must entail *q*, hence (i) C $\wedge$ **p** $\models$ q, which is equivalent to: (ii) C $\models$ p $\Rightarrow$ q.

Example 3. ***(p or qq')*****:** the local context of *qq'* is C ∧ **(not p)**, which must thus entail *q*.

We can follow the same logic to show that the local context of *qq'* in *(p or qq')* is C ∧ **(not p)**.

Step 1: When we assess the consequent after processing the meaning of the antecedent, it is innocuous to restrict attention to those C-worlds that satisfy *(not p)*: if *c'* denotes C ∧ **(not p)**, we can be certain that throughout C *(p or (c' and S))* has the same value as *(p or S)*.

Step 2: On the other hand, any world w in C ∧ **(not p)** could turn out to matter. For suppose that *(not p)* is true in some world w of C, and that *c'* excludes w. If *d'* is true in w, by computing *(p or (c' and d'))* instead of *(p or d')*, we will reach the erroneous conclusion that the entire disjunction is false in w (since *p* is false in w, and *c'* is false as well). This situation is summarized in (9).

(10) Why *all* worlds of C ∧ **(not p)** can matter
Hypothetical situation
w is in C and in **(not p)**, but w is *not* in x, the denotation of *c'*. We further assume that *d'* is true in w:
$w \models^{c' \to x} d'$
We have:
$w \models^{c' \to x}$ (p or d')
$w \not\models^{c' \to x}$ (p or (c' and d'))   since $w \not\models^{c' \to x}$ p, and $w \not\models^{c' \to x}$ c'
Conclusion: *c'* is not an innocuous restriction on the meaning of the second disjunction, since w is in C but $w \not\models^{c' \to x}$ (p or (c' and d')) ⇔ (p or d')

So any innocuous restriction must include all of C ∧ **(not p)**, which is thus the strongest innocuous restriction one can find. C ∧ **(not p)** is, in other words, the local context of *qq'*. We complete the reasoning by noticing that the local context of *qq'* must entail *q*, hence (i) C ∧ **(not p)** ⊨ q, which is equivalent to: (ii) C ⊨ not p ⇒ qd.

In computing the local context of the second disjunct, we did everything 'from scratch'. Alternatively, we could also have used a shortcut. Remember that we treat conditionals as material implications; as a result, *(p or qq')* is equivalent to *(if (not p), qq')*. But we already know from Example 2 that in the latter case the local context of *qq'* is C ∧ **(not p)**. This result extends to the case of the disjunction *(p or qq')* because (i) it is logically equivalent to *(if (not p), qq'),* and (ii) the propositional letters appear in the same order in the two formulas. We won't give a formal proof, but we note that the substantial component of our theory is only sensitive to logical equivalences, while the incremental component considers the order in which the lexical material appears. In both respects, *(p or qq')* is similar to *(if (not p), qq'),* which is why the local context of *qq'* is the same in both cases.

It is interesting to note that we have derived the predictions of the dynamic entry for *or* due to Beaver 2001, as discussed in Part I. The overgeneration problem we discussed there has been solved: nothing in the present theory corresponds to the 'deviant' entries *or** and *or***. This is so because we did not allow ourselves the extra-power afforded by dynamic semantics, but used a general rule for computing local contexts that works on top of a lean (classical, non-dynamic) semantics. We come back in Section 1.4.3 to the (complex) data that are relevant to assess these predictions.

Example 4. *(No P . QQ'):* the local context of *QQ'* is the property **P** restricted to C (written as ^{C}**P**), which must thus entail *Q*. (The same result extends to *(Every P. QQ')*.

Importantly, nothing needs to be added to our theory to account for these simple quantificational examples (recall that these were difficult to handle for Stalnaker's pragmatic theory, which took local contexts to be belief states).

As before, the reasoning is in two steps. In this discussion, $^{C}\mathbf{P}$ is the property of being an individual that has property **P** in C.[9]

Step 1: First, we must show that the restriction to $^{C}\mathbf{P}$ is innocuous, in the sense that when *c'* denotes $^{C}\mathbf{P}$ one may without risk compute *(No P. (c' and V))* rather than *(No P. V)*. The exclusion of non-C-worlds is unproblematic; and because of the meaning of *No*, *(No P . V)* is always equivalent to *(No P . (P and V))*, which means that one can safely restrict attention to P-individuals. (This is in fact a consequence of the property of 'conservativity', which holds of all generalized quantifiers: *No student smokes* is equivalent to *No student [is a student and smokes]*, *Every student smokes* is equivalent to *Every student [is a student and smokes]*, etc.)

Step 2: Second, we must show that any further restriction *would* carry a risk. So suppose that there is a pair <w, e> such that individual d has property $^{C}\mathbf{P}$ in world w, and that *c'* is false of <w, e>. If *V* is true of <w, e> and false of all other pairs, by computing *(No P. (c' and V))* instead of *(No P. V)* we will get the erroneous impression that the sentence is true in w, whereas it is in fact false (because of e, which satisfies *P* and *V* in w). So we cannot exclude <w, e> from consideration. This scenario is described in (11).

(11) Why *all* of $^{C}\mathbf{P}$ can matter
Hypothetical situation
<w, e> satisfies $^{C}\mathbf{P}$ (i.e. e has property **P** in w and w is in C), but <w, e> does not satisfy *c'*, i.e. the denotation x of *c'* guarantees that x(w)(e) ≠ 1. We further assume that <w, e> satisfies *V,* and no other pair does:
<w, e> satisfies **V** (i.e. x has property **V** in w) and if <w', e'> ≠ <w, e>, <w', e'> does not satisfy **V**.
We have:
w $\not\models^{c' \to x}$ (No P . V) because e has property **V** in w
w $\not\models^{c' \to x}$ (No P . (c' and V)) because in w **V** in only true of e, which does not have property *c'*.
Conclusion: *c'* is not an innocuous restriction on the meaning of the verb phrase, since w is in C but
w $\not\models^{c' \to x}$ (No P . (c' and V)) $\leftrightarrow$ (No P . V)

We see, then, $^{C}\mathbf{P}$ is the local context of the verb phrase, and that it must thus entail its presupposition *Q*.[10] What does it mean for a property to entail another property? It means in this case that for every world w and every individual x, if x has property $^{C}\mathbf{P}$ in w, x has property **Q** in w. For the sentence *No student stopped smoking*, we correctly predict a presupposition that *every individual who is a student in a world w of C used to smoke in w*.

[9] $^{C}\mathbf{P}$ can be defined more precisely using the λ-notation: $^{C}\mathbf{P} = \lambda w_s\ \lambda x_e\ .\ w \in C$ and $\mathbf{P}(w)(x) = 1$ (where *P* is of type <s, <e, t>>).

[10] The reasoning is similar for *(Each P . QQ')*. When *c'* denotes $^{C}\mathbf{P}$, *(Each P. (c' and V))* is equivalent to *(Each P. V)*: the restriction to $^{C}\mathbf{P}$ is innocuous. To show that this is the strongest innocuous restriction, let us assume that there is a pair <w, e> for which x has property $^{C}\mathbf{P}$ in w, and that *c'* is false of <w, e>. If *V* is a tautological predicate, by computing *(Each P. (c' and V))* instead of *(Each P. V)* we will get the erroneous impression that the sentence is false in w (because in w x satisfies *P* but not *c'*) - although it is in fact true. So this restriction is not innocuous. This shows that $^{C}\mathbf{P}$ is the local context of *QQ'*.

1.4 Assessment

1.4.1 Dynamic Reinterpretation

The foregoing reconstruction solves the Explanatory Problem. But isn't the latter overblown? There was certainly a feeling in some corners of dynamic semantics that some dynamic lexical entries are *clearly* more natural than others, and that a simple recipe could rule out the 'deviant' ones. In particular, one idea was that one should prefer lexical entries that make 'optimal use' of information and follow the order in which the arguments of an operator are processed – though as far as I know this intuition was never fully formalized.[11]

While this is not the interpretation we have offered, one could view our reconstruction of local contexts as a way of constraining the space of lexical entries *within* Heim's dynamic system. To illustrate this idea, let us start from a classical connective – say *or*. Heim's system can define a variety of dynamic entries for *or*, as we showed in Part I. But we can solve the overgeneration problem by requiring that *C[(F or G)]* be derived from our new rule for computing local contexts:

-First, the presupposition of *F* should be satisfied in its local context *as reconstructed in this section*. Now for any sentence that starts with *(•* ... in a context set C, the local context of • is C itself (any further restriction would not be innocuous).

-Second, the presupposition of *G* should be satisfied in its local context. But we saw in Example 3 of Section 1.3 that the local context of the second disjunct is C ∧ **(not F)**. So the appropriate lexical entry should require that the presupposition of *G* be entailed by C ∧ **(not F)**.

-Third, when all the presuppositions are satisfied, we want *C[(F or G)]* to be the set of C-worlds that satisfy *F* or *G* or both (which is the same thing as the set of C-worlds that satisfy *F* or *((not F) and G)*, thanks to the logical equivalence between *(F or G)* and *(F or ((not F) and G))*).

In this way, we obtain a dynamic lexical entry which is equivalent to the one used in Beaver 2001:

(12) C[F or G] = # unless C[F] ≠ # and C[not F][G] ≠ #. If C[F or G] ≠ #, C[F or G] = C[F] ∪ C[not F][G]

So we *can* use our reconstruction of local contexts to constrain Heim's dynamic semantics. But in the cases we considered it makes it unnecessary, since the same results can be obtained without the intermediary of the dynamic framework.[12] It should be noted that a different way to constrain Heim's dynamic semantics has recently been proposed by Daniel Rothschild (2008a, b); his method might be closer to the spirit of Heim's approach than the present one. And unlike the present approach, it does not make the *dynamic* nature of Heim's system dispensable.

[11] A version of this intuition was expressed in particular by Henk Zeevat at the workshop 'New Directions in the Theory of Presupposition' (ESSLLI, Bordeaux, July 2009). Zeevat's impression was that it was shared early on by several researchers.

[12] Two cautionary notes should be added.

(i) In the quantificational case, it is only with some auxiliary assumptions that Heim's universal presuppositions can be derived (see Schlenker 2009 for discussion).

(ii) Our equivalence results hold for a specific syntactic fragment. When more complex languages are considered, the results may fail to hold. Thus it should in principle be possible to distinguish empirically between the dynamic and the non-dynamic implementations of our reconstruction of local contexts.

1.4.2 Empirical Problems I: Quantified Statements

Modulo some technical assumptions, our reconstruction of local contexts matches Heim's predictions. But are these always good? We already discussed the 'Proviso Problem', which neither approach currently has a good solution to (unlike DRT, which we discuss in Section 2). We wish to add here that experimental results suggest that in quantified sentences the presuppositional data are quite complex. This poses a problem for both approaches discussed here, since they uniformly predict universal presuppositions from the nominal and from the verbal argument.

Chemla 2009a applied an inferential paradigm to test these predictions. He relied on two experimental methodologies: one was to ask subjects, in a binary task, whether they did or did not obtain a particular inference; another one was to ask them to evaluate the strength of the inference. Both methodologies established two major results.

1. When a trigger appears in the verbal argument of a quantifier (i.e. in the nuclear scope), the inference obtained depends on the particular quantifier under study. *Each of these ten students takes care of his computer* and *None of these ten students takes care of his computer* both yield a strong inference that *each of these ten students has a computer*; but with other quantifiers (*at least five*, *exactly five*, *less than five*), subjects have much lower rates of endorsement of the universal inference.

2. When a trigger appears within the nominal argument of a quantifier (i.e. in the restrictor), patterns of universal projection are not found, or only in very weak form.[13]

These results are summarized in (13), which plots the robustness of universal inferences obtained depending on the quantifier and on the position of the trigger (restrictor vs. nuclear scope).

(13) Chemla's experimental results (from Chemla 2009a)

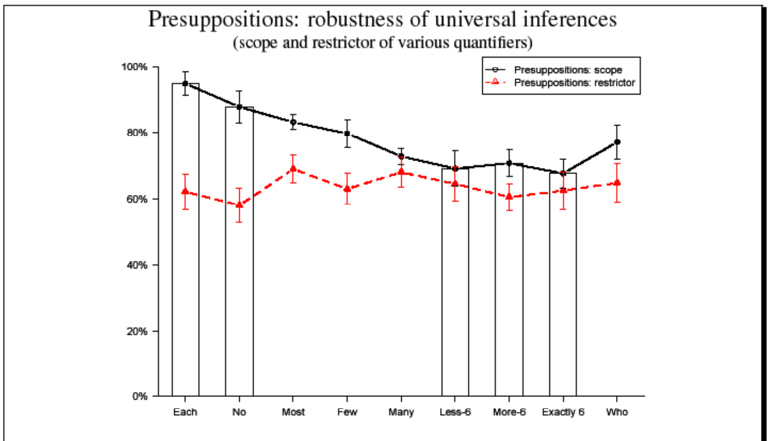

Figure 9: This figure presents the mean (normalized) robustness of universal inferences when presuppositional items are embedded in the scope or restrictor of different quantifiers: Each, No, Most, Few, Many, Less than 6, More than 6, Exactly 6 and Who. The bars on this graph highlight the replication of the results from experiment 1 (see figure 5).

These results are problematic for both theories discussed here, since they make the same predictions (*modulo* some technical assumptions). By contrast, two recent theories that are not based on any notion of 'local context' offer more fine-grained (though not fully unproblematic) predictions; these are the trivalent theories of Fox 2008 and George 2008a, b

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[13] As E. Chemla notes, further controls would be needed: cases in which the trigger was in the restrictor were syntactically more complex than the other cases, and thus the lower endorsement for of universal presuppositions might reflect comprehension difficulties.

(who both develop ideas of Peters 1975); and Chemla's 'Similarity theory' (Chemla 2009b), possibly the most successful analysis to date in accounting of these data. Importantly, these theories do not suffer from the explanatory problem faced by Heim's analysis; in fact, they also share the general architecture of transparency-based theories, with a 'substantive component' and an 'incremental component'. As we will see below, the DRT analysis of presuppositions also encounters problems with some of these experimental results, notably with patterns of projection out of the verbal argument of the determiner *no*.

1.4.3 Empirical Problems II: Symmetric Readings

At this point, both theories of local contexts incorrectly predict that there should be a clear contrast between the following sentences:

(14) a. There is no bathroom or the bathroom is well hidden (after Partee).
b. The bathroom is well hidden or there is no bathroom.
a'. If there is a bathroom, the bathroom is well hidden.
b'. If the bathroom is not hidden, there is no bathroom.

(14)a-a' are correctly predicted to carry no presupposition: *(p or qq')* presuppositions *(if not p, q)*, and this condition is always satisfied here. By contrast, theories with a left-right asymmetry (be it dynamic semantics or the alternative we have offered) predict that (14)b-b' should presuppose that there is a bathroom.[14] The issue is complex and would require a longer discussion (see Schlenker 2008a,b, 2009, and Geurts 1999). But it is plausible that in these examples the presupposition of the first element is justified on the basis of information that appears at the end of the sentence; in fact, when the entire sentence is taken into account, (14)b becomes informationally indistinguishable from (14)a. And similarly for (14)b' and (14)a': trading on the near-equivalence between *If not F, not G* and *If G, F*, when the entire sentence is taken into account, (14)b' becomes informationally similar to (14)a' - which makes it unsurprising that they should transmit presuppositions in the same way.

One can interpret these observations as showing that the 'incremental component' of transparency-based theories is just a bias, possibly due to processing limitations: the local context of an expression *E* in a sentence *S* is preferably computed on the basis of the information that comes before *E*; but it can to also be computed by taking into account *all* of *S* except *E*. This option is presumably costly, since (14)b-b' are somewhat less felicitous than (14)a-a'. It must be granted, however, that the empirical status of these 'symmetric readings' is currently unclear; experimental evidence would be needed to establish the facts (see Chemla and Schlenker 2011 for an initial attempt).

The availability of symmetric readings is easily explained by transparency-based theories – and more generally by all analyses that distinguish between a 'substantial component' and an 'incremental component'. In essence, they can posit that presuppositions are preferably computed in accordance with the 'incremental component', but that at some cost the left-right bias can be over-ridden (see Schlenker 2009 for a discussion of how local contexts can be computed 'symmetrically', i.e. without the incremental component). Things

[14] Post-posed *if*-clauses also make the same point: *The bathroom is well-hidden, if there is a bathroom* is much more acceptable than is predicted by the incremental version of our analysis; on the other hand, the symmetric version makes appropriate predictions (for this particular example, Heim's dynamic semantics makes correct predictions, which differ from those of the incremental version of our theory; this is because Heim's analysis is not sensitive to displacement operations that may take place in the syntax – the same asymmetric lexical entry is involved no matter what happens in the syntax. By contrast, in (14)b' the basic version of Heim's theory and our incremental theory both make incorrect predictions).

are different in standard dynamic semantics, where the left-right bias is incorporated into the lexical entries of the connectives.[15]

2 Local Contexts vs. DRT: a Comparison

We turn to a brief comparison between satisfaction theories, which are based on local contexts, and DRT, a representational alternative which treats presupposition projection as a species of anaphora resolution.

2.1 DRT

The analysis of presupposition projection offered by DRT seeks to offer a viable alternative to Heim's dynamic semantics, one that does not suffer from the Proviso Problem (van der Sandt 1992, Geurts 1999). The basic idea is that presuppositions are parts of a Logical Form that want to 'percolate up' as far as possible in a Logical Form. Whenever possible, they are given matrix scope, though other – and less preferred – options are also open.

To illustrate, we start from a sentence such as (15)a, which is given the initial representation in (15)b (here too the presupposition is underlined). Following Kamp's analysis of anaphora (Kamp 1981), the formal representation contains two components, separated by a semi-column: a list of discourse referents (here: the variable *x*); and a list of conditions on these discourse referents. Van der Sandt's innovation is to underline certain conditions – the presuppositional ones – and to require that they be accommodated by being moved upwards.

(15) a. If John is realistic, he knows that he is incompetent.
b. $[_1$ x: John x, $[_2$: realistic x$]$ ⇒ $[_3$: <u>x is incompetent</u>, x believes that x is incompetent$]]$

There are various 'projection sites' that the underlined material could land to. We obtain three possible readings depending on the landing site: in (16)a the presupposition appears at the matrix level, and we obtain an unconditional inference that John is incompetent – which is the preferred reading; in (16)b, the presupposition lands in the antecedent of the *if*-clause ('intermediate accommodation'), while in (16)c it stays in its original position ('local accommodation'). In this case these readings are not plausible, but they have been claimed to be instantiated in other examples (this is not debated for local accommodation; intermediate accommodation is far more controversial, as is for instance discussed in Beaver 2001[16]).

(16) a. **Reading 1 [preferred]: Global Accommodation**
$[_1$ x: John x, **x is incompetent** $[_2$: realistic x$]$ ⇒ $[_3$: x believes that x is incompetent$]]$
b. **Reading 2: Intermediate Accommodation**
$[_1$ x: John x $[_2$: realistic x, **x is incompetent**$]$ ⇒ $[_3$: x believes that x is incompetent$]]$
c. **Reading 3: Local Accommodation**
$[_1$ x: John x $[_2$: realistic x$]$ ⇒ $[_3$: **x is incompetent**, x believes that x is incompetent$]]$

Since DRT offers a variety of landing sites for presuppositions, it generates many more readings than satisfaction theories do. But it cuts down on these readings by adding constraints on interpretation (see Geurts 1999 p. 59 for a more detailed discussion). For

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[15] See also Rothschild 2008 for a reconstruction of Heim's semantics which has a natural place for symmetric readings.

[16] The issue of intermediate accommodation is further discussed in Schlenker, to appear; dubious cases of intermediate accommodation (into the restrictor of an operator) are contrasted with more robust cases, due to Bart Geurts (they involve intermediate accommodation within the scope of attitude operators).

instance, it posits a constraint of 'informativeness' which prohibits a clause from being replaceable with a tautology or a contradiction in the environment in which it appears. This explains why, *despite* the general preference for matrix accommodation, the latter is not an option in (17)a-b:

(17) a. If John is incompetent, he knows that he is.
b. **Matrix accommodation** *(violates local informativity)*
$[_1$ x: John x, **x is incompetent** $[_2$: incompetent x] ⇒ $[_3$: x believes that x is incompetent]]
c. **Local Accommodation** *(does not violate local informativity)*
$[_1$ x: John x $[_2$: incompetent x] ⇒ $[_3$: **x is incompetent**, x believes that x is incompetent]]

With matrix accommodation as in (17)b, the antecedent of the conditional becomes replaceable with a tautology – it is, in other words, locally uninformative. Local accommodation can solve the problem: when it is applied, as in (17)c, no other expression is made uninformative (though the presupposition is – but this is of course entirely in order).

DRT has great appeal, for at least two reasons. First, it offers a compelling solution to the Proviso Problem, which the satisfaction theories we considered earlier cannot handle without further additions. Second, it handles presupposition projection and anaphora resolution within a unified framework. Without discussing anaphora resolution proper, let us give an idea of the parallels that motivated the analysis (see Geurts 1999 p. 46 for a more detailed discussion of some of the same examples). In each case, the (a) example involves a pronoun (underlined) and its antecedent (in bold), while the (b) example displays a trigger (underlined) and what intuitively justifies the presupposition (in bold).[17]

(18) Conditionals
a. If Smith owns **a donkey**, he beats <u>it</u>. (Geach 1962)
b. Maybe **Mary proved the theorem** and John proved it, <u>too</u>.

(19) Disjunction
a. Either Morrill Hall doesn't have **a bathroom** or <u>it</u> is in a funny place. (attributed to Partee)
b. Either Morrill Hall doesn't have **a bathroom** or <u>the bathroom</u> is in a funny place.

(20) Modal subordination
a. It is possible that John has **children** and it is possible that <u>they</u> are away.
b. It is possible that John has **children** and it is possible that <u>his children</u> are away. (Gazdar 1979)

It is quite easy to construct systematic examples displaying the parallel between anaphora resolution and presupposition projection: start from an anaphoric sentence such as (19) and (20), and replace the pronoun with a definite description that is appropriate for the antecedent. For proponents of DRT, the similarity between pronouns and presuppositions holds because presupposition projection is a species of anaphora resolution. For some proponents of satisfaction theories, the similarity may well hold, but for the opposite reason: pronouns are a species of presupposition triggers. This analysis has some plausibility because an entire class of theories of anaphora, called 'E-type theories', treat pronouns as concealed definite descriptions (see for instance Elbourne 2005 for a detailed analysis and a survey); since definite descriptions are presupposition triggers, pronouns should be too – and they should behave like other triggers with respect to presupposition projection. Thus the similarity between presupposition projection and anaphora resolution need not favor one camp over the other, at least not without much more detailed argumentation.

[17] We write '*intuitively* justifies the presupposition' because the actual implementation in DRT is more complex, and does not just involve coindexation between a trigger and its antecedent.

2.2 Problems

❑ *Conditional Presuppositions*

One of DRT's advantages over satisfaction theories is that it can generate unconditional presuppositions. Still, it has been argued that in *some* cases *bona fide* conditional presuppositions do arise (e.g. Beaver 2001). By '*bona fide* conditional presuppositions', I mean conditional inferences that project like presuppositions, and thus cannot be explained away as mere entailments. I believe the examples in (21) have this property:

(21) a. If you accept this job, will you let your family know that you're going to be working for a thug?
=> If you accept this job, you're going to be working for a thug.
≠> You're going to be working for a thug.
b. If you accept this job and let your family know that you are going to work for a thug, they won't be happy.
=> If you accept this job, you're going to be working for a thug.
≠> You're going to be working for a thug.

(21)a has the form *if p, $\underline{q}$q' ?* with *p = you accept this job* and *q = you will work for a thug*. If the conditional did not appear in a question, the inference we obtain (= *If you accept this job, you are going to be working for a thug*) could be treated as a mere entailment. But the fact that the conditional inference survives in a question suggests that we are dealing with a *bona fide* conditional presupposition. The same argument applies to (21)b, which is of the form *if p and $\underline{q}$q', r*. Here we obtain the conditional inference predicted by Heim 1983: *p and $\underline{q}$q'* presupposes *if p, q*, and this presupposition projects out of the antecedent of the conditional. Standard DRT does not account for these cases. Take for instance the case of (21)b, with the simplified representation in (22). The various accommodation possibilities are represented in (23):

(22) $[_1$ x: you x, $[_2$: x accepts this job] ⇒ $[_3$: <u>x will work for a thug</u>, x tells x's family that x is working for a thug]] ?

(23) a. **Matrix accommodation**
$[_1$ x: you x, **x will work for a thug**, $[_2$: x accepts this job] ⇒ $[_3$: x tells x's family that x is working for a thug]] ?
b. **Intermediate accommodation**
$[_1$ x: you x, $[_2$: **x will work for a thug**, x accepts this job] ⇒ $[_3$: x tells x's family that x is working for a thug]] ?
c. **Local accommodation**
$[_1$ x: you x, $[_2$: x accepts this job] ⇒ $[_3$: **x will work for a thug**, x tells x's family that x is working for a thug]] ?

None of these representations gives rise to the conditional inference *If you accept this job, you're going to be working for a thug*; in particular, (23)b does *not* predict this inference because the entire sentence is embedded under a question operator.

❑ *Quantified Statements*

Due to the architecture of DRT, a presupposition that contains a bound variable cannot be accommodated outside the scope of its binder, as this would 'unbind' the variable (this is sometimes called the 'trapping constraint'). In simple cases, we can still obtain the correct results through local or intermediate accommodation. For instance, (24)a gives rise to an inference that *each of these ten students is incompetent*, and this inference is captured by the reading with local accommodation in (25)a.

(24) a. Each of these ten students knows that he is incompetent
b. [[each x: student x] **x is incompetent**, x believes that x is incompetent]

(25) **Local Accommodation**
[[each x: student x] **x is incompetent**, x believes that x is incompetent]

As soon as we consider non-assertive uses of (24)a, however, the predictions are far more problematic.

(26) a. Does each of these ten students know that he is incompetent?
b. If each of these ten students knows that he is incompetent, they must be depressed.

In each case we find, as before, an inference that each of these ten students is incompetent. But this is not predicted by either local or intermediate accommodation; in particular, local accommodation fails to make the right predictions because in these cases the Logical Form in (25)a appears in a non-assertive environment.

The problems get worse when the quantifier *no* is considered. As mentioned, Chemla 2009a shows with experimental means that French sentences of the form *[No P] QQ'* yield the universal inference *[Every P] Q* (here capital letters stand for predicative elements). For instance, (27)a triggers an inference that *each of these ten students is incompetent*. But neither Logical Form in (28) derives the correct inference.

(27) a. None of these ten students knows that he is incompetent
b. [[no x: student x] **x is incompetent**, x believes that x is incompetent]

(28) a. **Local Accommodation**
[[no x: student x] **x is incompetent**, x believes that x is incompetent]
b. **Intermediate Accommodation**
[[no x: student x, **x is incompetent**] x believes that x is incompetent]

(It should be added that when a trigger with a variable finds itself in the restrictor of the quantifier that binds it, only local accommodation is available, because accommodating the presupposition in a higher position would unbind that variable. This predicts extremely weak inferences, which might be a good thing – Chemla's results in (13) suggest that no universal inferences are obtained in this case.)

- *Proviso Redux*

Even when DRT predicts appropriate inferences in simple quantified statements, further embeddings can lead to the re-appearance of the Proviso Problem.

(29) If I grade their homeworks, each of my students will know that he is {a genius | incompetent}.
=> Each of my students is {a genius | incompetent}

Due to the prohibition against 'unbinding', the presupposition triggered by *know* must be accommodated within the scope of *each of my students*. As a consequence, it must remain within the consequent of the conditional – and we just cannot obtain an unconditional presupposition in this case.

2.3 DRT with Local Contexts?

Could we adopt DRT's view of presupposition projection as anaphora resolution, while still preserving some of the advantages of satisfaction theories – notably, their treatment of *some* instances of conditional presuppositions, and their treatment of presupposition projection under some quantifiers? Zeevat 1992 explored such a unification within a dynamic framework. Schlenker, to appear a builds on the non-dynamic reconstruction of local contexts we discussed in Section 1. Thus it is assumed that (i) sentences can be decorated with variables that denote the local contexts of all predicative and propositional expressions. The crucial addition is to postulate that (ii) a presupposition trigger must be indexed with a context variable, which in many cases will be the highest available one.

The main hypotheses are given in (30)-(31): they state that each presupposition must be entailed by some accessible local context – if possible, the highest one (the details of the accessibility rules could easily be tweaked). Importantly, whenever a trigger is indexed with the *closest* context variable, we just obtain a variant of the theory we discussed in Section 1: we will have a requirement that a presupposition should be entailed by its local context; and this, of course, will emulate the main predictions of Heim's theory. Thus it is only to the extent that we allow *non*-local indexing that we will gain different predictions.

(30) a. Each presupposition trigger is coindexed with a context variable.
b. A context variable is accessible to a trigger *T* if and only if it appears on a constituent that dominates *T*.
c. The context of speech shoud guarantee that the presupposition of each trigger is entailed by each context variable it is coindexed with.

(31) Preference rules
Index a presupposition trigger with the highest accessible context variable, subject to the following constraints:
(i) No constituent should be made trivial (i.e. contradictory or tautologous) relative to its most local context.
(ii) Subject to (i), a trigger should in general be coindexed with the highest accessible context variable

Three simple examples are given in (32).

(32) a. ^{c_0}[It has [stopped raining]$_0$]
b. ^{c_0}[If ^{c_2}[John is outside], ^{c_1}[it has stopped raining]$_0$]
c. ^{c_0}[If ^{c_2}[it rained], ^{c_1}[it has stopped raining]$_1$]

-In (32)a, *[stopped raining]* is coindexed with the only available context variable, c_0, which denotes the global context C – hence a presupposition that it rained.
-In (32)b, there are two accessible context variables, c_0 and c_1. Coindexation with the higher variable c_0 also yields a presupposition that it rained (by contrast, satisfaction theories predict a conditional presupposition that *if John is outside, it rained*).
-In (32)c, coindexation with c_0 would force the global context to entail that it rained – which would make the antecedent of the conditional trivial relative to its most local context. Hence coindexation with c_1 is forced. In both satisfaction theories we considered, the local context of the consequent is the global context updated with the information that it rained – hence no matter what the global context is, c_1 will entail the presupposition of the consequent; thus the entire sentence presupposes nothing.

As shown by (30)b, this system makes it possible to emulate DRT's main result, namely the derivation of unconditional presuppositions. But it has two advantages: it can also generate conditional presuppositions; and it provides more adequate results for presupposition projection under quantifiers of the form *[No NP]*.

❑ *Conditional presuppositions*

Let us tweak the indexing rules in (31) so as to allow for local indexing in (33):

(33) ^{c_0}[You will accept this job and ^{c_1}[your family will know that you will work for a thug]$_1$]

Here the presupposition trigger in the second conjunct is coindexed with its local context c_1; we obtain a requirement that c_1 should entail *you will work for a thug*, hence a conditional presupposition that *if you accept this job, you will work for a thug* – exactly as we did in satisfaction theories.

❑ *Quantified Statements*

We can also provide a more adequate treatment of some quantified statements. In (34), we index the trigger with its most local context, and we emulate in this way the predictions of satisfaction theories.

(34) ^{c_0}[[No ^{c_2}student] ^{c_1}[stopped smoking]$_1$]

The only accessible context variables are c_0 and c_1. c_0 is propositional, while c_1 is predicative – as is the presupposition of *stopped smoking*. The latter must be indexed with c_1, and we thus predict that the property of being a student in C must entail the property of smoking – hence the universal inference that *every student used to smoke*.
(The present system also has disadvantages over DRT. When the trigger is in the restrictor, only local indexing is possible, and for this reason we replicate the universal predictions of satisfaction theories – which as we saw is *not* a good thing given the results of Chemla 2009a. DRT seems to do better in this case.)

❑ *Proviso Redux*

While the present system has some advantages over classical DRT, it fully inherits one of its problems, which we dubbed 'Proviso Redux'. In examples such as (35), the presupposition trigger is in the scope of a quantifier, which is itself in the consequent of a conditional.

(35) a. If I don't give an exam, none of my students will know that he is incompetent.
b. ^{c_0}[If I don't give an exam, none of my students ^{c_1}[will [know that he is incompetent]$_1$]]

The intuitive presupposition of (35)a is that *each of my students is incompetent*. But because the presupposition trigger is predicative, only local indexing is possible, as illustrated in (35)b. This means that we replicate the conditional presupposition of satisfaction theories – here: *if I don't give an exam, each of my students is incompetent*. While this problem is shared by DRT, some non-DRT based frameworks (Singh 2007, 2009, Schlenker, to appear b) can arguably solve it.

3 Conclusion

Three main conclusions can be drawn from this discussion.

• On a methodological level, we now have theories that solve the Explanatory Problem faced by Heim's semantics. Specifically, we have been able to predict the projection behavior of any operator on the basis of its syntax and classical (bivalent, non-dynamic) semantics. Our analysis was crucially modular: instead of lumping together truth conditions and presuppositions, as in dynamic semantics, we started from a 'lean' (bivalent, non-dynamic) semantics and added on top of it an algorithm to compute local contexts in great generality. This is just one example of an analysis that solves the Explanatory Problem: theories developed in Fox 2008, George 2008a,b, Rothschild 2008a, b and Chemla 2009b also offer explanatory accounts.

• On an empirical level, three issues are likely to be crucial to future debates. First, modular theories that distinguish between a 'substantial component' and an 'incremental component' could in principle explain the availability of 'symmetric readings', which are rather puzzling for standard dynamic semantics. Second, Chemla's experimental work has shown that there are complex data to account for in quantified statements; none of the theories discussed here is in a very good position to do so. Finally, the Proviso Problem remains, as before, an open problem for non-representational theories based on local contexts.

• The debate between DRT and satisfaction theories is still a live one. DRT is at an advantage to solve the Proviso Problem (although it encounters another version of the same problem when a presupposition trigger is in the scope of the quantifier which is itself in the consequent of a conditional). However, it might be possible to combine advantages of DRT and of satisfaction theories, and in particular to allow both for conditional and for unconditional presuppositions depending on the example (importantly, other problems are left open by the proposed unification).

Appendix. Definition of the Classical Fragment

Our reconstruction of local contexts assumes the following syntax and classical semantics. A deeper discussion and general results can be found in Schlenker 2009.

(36) Syntax
a. Predicates: $P ::= P_i \mid \underline{P_i}P_k$
b. Propositions: $p ::= p_i \mid \underline{p_i}p_k$
c. Formulas: F ::= p | (not F) | (F and F) | (F or F) | (if F. F) | (Each P . P) | (No P . P) | (Most P . P)

(37) Semantics
We take as given a domain D of individuals and a domain W of possible worlds.
The initial valuation assigns to each elementary predicate P_i a value $\mathbf{P_i}^w \subseteq D$ and to each elementary proposition p_i a value $\mathbf{p_i}^w \in \{0, 1\}$. For any world w of W:
a. $(\underline{\mathbf{p_i}}\mathbf{p_k})^w = 1$ iff $\mathbf{p_i}^w = \mathbf{p_k}^w = 1$; $(\underline{\mathbf{P_i}}\mathbf{P_k})^w = \mathbf{P_i}^w \cap \mathbf{P_k}^w$;
b. **(not F)**$^w = 1$ iff $\mathbf{F}^w = 0$; **(F and F')**$^w = 1$ iff $\mathbf{F}^w = \mathbf{F'}^w = 1$; **(F or F')**$^w = 1$ iff $\mathbf{F}^w = 1$ or $\mathbf{F'}^w = 1$; **(if F . F')**$^w = 1$ iff $\mathbf{F}^w = 0$ or $\mathbf{F'}^w = 1$; **(Each P . P')**$^w = 1$ iff each object $d \in D$ such that $d \in \mathbf{P}^w$ satisfies $d \in \mathbf{P'}^w$; **(No P . P')**$^w = 1$ iff no object $d \in D$ such that $d \in \mathbf{P}^w$ satisfies $d \in \mathbf{P'}^w$; **(Most P . P')**$^w = 1$ iff more than half of the objects $d \in D$ such that $d \in \mathbf{P}^w$ satisfy $d \in \mathbf{P'}$

It should be noted that the *semantics* treats the presuppositional component *d* of an elementary expression *<u>d</u>d'* as if *d* were just part of its assertive component. But the *pragmatics* will give *d* a distinguished status through the requirement that the presupposition of an elementary expression be entailed by its local context.

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