

# On Presupposition Projection

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Yeom, Jae-II. 2003. **On Presupposition Projection**. *Korean Journal of English Language and Linguistics* 3-1, 55-88. In this paper, I will review two main theories on presupposition projection and point out their problems, and suggest the directions of a better analysis. Satisfaction theory is based on the single idea that presuppositions must be satisfied in the local context for the interpretation of a sentence. Problems occur because the theory makes only a minimal requirement on the input context for interpretation. They include the problems of weak presuppositions, unmotivated local accommodation, and projection of satisfied presuppositions. Binding theory assumes that presuppositions are anaphoric elements which can be accommodated. I will show that the syntactic notion of binding is not motivated, and claim that presupposition projection is a matter of information. Finally, I suggest the directions for a better analysis.

**Key Words:** presupposition projection, binding, anaphora, satisfaction, accessibility

## 1. Introduction

Presupposition is a pragmatic inference conventionally associated with the use of an expression or a structure. Consider the following examples.

- (1) a. The King of France is wise.  
    >> There is a King of France.
- b. The King of France is not wise.  
    >> There is a King of France.
  
- (2) Billy is guilty, too. >> Someone other than Billy is guilty.

(3) Ivan has stopped beating his wife.

» Ivan has beaten his wife.

Definite descriptions, expressions like *too*, *also*, *again*, etc., and aspectual verbs like *stop*, *continue*, *begin*, etc. trigger presuppositions, as shown in (1-3). Among other expressions or structures that trigger presuppositions are factive verbs like *know*, *realize*, etc. and cleft constructions. (Levinson 1983, Soames 1989)

Projection problem is the problem of determining the presuppositions of utterances of compound sentences in terms of presuppositions associated with their clausal constituents. A simple-minded hypothesis would be that compound sentences inherit all of the presuppositions of their constituent clauses. This is called cumulative hypothesis. Consider the following examples.

(4) a. It is Lauri who has solved the projection problem.

b. If it is Lauri who has solved the projection problem, then he will probably be awarded the Nobel Prize for Linguistics. » Someone has solved the projection problem.

c. It is possible that if it is Lauri who has solved the projection problem, then he will probably be awarded the Nobel Prize for Linguistics.

These three sentences all presuppose that someone has solved the projection problem. This seems to show that the cumulative hypothesis is supported. But this is not the case. Look at the following examples.

(5) a. If the projection problem has been solved, then Lauri is

- the one who has solved it.
- b. Either the projection problem hasn't been solved, or it is Lauri who has solved it.
  - c. Someone has solved the projection problem, and it is Lauri who has solved it.

- (6) If I realize later that I haven't told the truth, I will confess it to everyone.

The sentences in (5) do not presuppose that someone has solved the projection problem, which is triggered in the embedded clauses. In (6), the factive verb *realize* triggers the presupposition that the speaker has not told the truth, but the speaker himself neutralizes the presupposition implying that the presupposition is not taken for granted. These examples show that presuppositions may not be projected. Theories of presupposition projection should tell us in what cases presuppositions are projected.

## 2. Satisfaction Theory

### 2.1. Introduction

Karttunen (1974) first proposed the basic idea of satisfaction theory. In this theory, a presupposition is a requirement which a local context must satisfy for the interpretation of the expression which triggers it. And presuppositions of a whole complex sentence are requirements for the incoming context to satisfy in order for the local context to satisfy the presupposition(s) triggered in each of the embedded clauses. This is expressed as follows:

- (7) (a) A context  $C$  admits a sentence  $S$  iff  $C$  satisfies the presupposition(s) of  $S (= P_S)$ .

- (b) A context  $C$  admits 'Not  $S$ ' iff  $C$  admits  $S$ .
- (c) A context  $C$  admits ' $S_1$  and  $S_2$ ', 'If  $S_1$ , then  $S_2$ ' iff  $C$  admits  $S_1$ , and  $C + S_1$  admits  $S_2$ .

Here  $C + S_1$  is a new context which we get by updating the context  $C$  with the information carried by  $S_1$ . As shown in (7c), the local context for a clause changes from the incoming context. Karttunen (1974) could not connect context change and the semantics of sentences. Here is what Heim's (1983) analysis contributes.<sup>1)</sup>

## 2.2. Heim's Presupposition Projection in Dynamic Semantics

### 2.2.1. Heim's Satisfaction Theory

Heim (1983) sees the meaning of a sentence  $S$  as a context change potential: a function from a set of contexts to a set of contexts. She assumes that a context is a set of possible worlds which are compatible with the information contained in the context. When a sentence  $S$  is uttered in a context  $C$ , possible worlds that are not compatible with the information conveyed by the sentence are eliminated. The new set of possible worlds  $C+S$  will be smaller than the original set  $C$ . As we get more information, the set becomes smaller. Ultimately, the set becomes the singleton set when we get complete knowledge of the actual world.

Following Stalnaker (1978), a presupposition is a requirement which must be satisfied in the local context with which the sentence with that presupposition is interpreted. Heim looks at

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<sup>1</sup>Karttunen and Peters (1979) proposed projection algorithms which result in the same presuppositions as Karttunen (1974)'s satisfaction theory predicts, but they consider presuppositions as conventional implicatures which are not cancellable. Actually presuppositions are cancelled by entailments, conversational implicatures, etc.

the requirement as a definedness condition (or admittance condition), which is interdefinable with the notion of presupposition.

(8) **Definedness condition (or Admittance condition)**

$C+S$  is defined (or  $C$  admits  $S$ ) only if  $C$  satisfies  $P_S$   
(that is,  $C \subseteq P_S$ ).

(9)  $P_S$  is a **presupposition** of  $S$  iff for all contexts  $C$ ,  $C+S$  is defined.

Here ‘+’ is an interpretation function which takes a context-sentence pair and gives rise to a new pair of the same type.  $S$  may be a complex sentence. The projection of presuppositions is determined by interpretation rules for complex sentences. Definedness conditions can be defined with respect to interpretations of the constituents of a sentence, but presupposition is defined with respect to a whole sentence. Heim (1983) assumes the following interpretation rules:

- (10) (a)  $C+' \text{ Not } A' = C-(C+A)$   
 (b)  $C+'A \text{ and } B' = (C+A)+B$   
 (c)  $C+' \text{ If } A, \text{ then } B' = C-((C+A)-(C+A+B))$

In (10a), the definedness condition requires that the context  $C$  satisfy the presupposition of  $A$  ( $= P_A$ ). This is the same result as the interpretation of  $A$ . For this reason, the negation is a hole, in terms of Karttunen (1973). In the interpretation of a conjunction structure,  $C+A$  is defined if  $C$  satisfies the presupposition of  $A$ , and  $C+A+B$  is defined if  $C+A$  satisfies the presupposition of  $B$ . With respect to definedness

conditions, we can say the same thing about the conditional. The definedness conditions from (10) are summarized below:

(11)  $C + ' \text{Not } A '$  is defined iff  $C$  satisfies  $P_A$  (that is,  $C \subseteq P_A$ ).

(12)  $C + 'A \text{ and } B'$  &  $C + ' \text{If } A, \text{ then } B'$  are defined iff

(a)  $C \subseteq P_A$ ;

(b)  $(C + A) \subseteq P_B$  (, which is equivalent to  $C \subseteq (A \rightarrow P_B)$ ).

From (11), '*Not A*' presupposes  $P_A$ , and from (12), '*A and B*' and '*If A, then B*' presupposes  $P_A$  and  $(A \rightarrow P_B)$ . This is exactly what Karttunen and Peters (1979) specified with respect to these constructions. A crucial difference is that while Karttunen and Peters's (1979) projection algorithms are pure specifications for compositional calculation of the presuppositions of a complex sentence from the presuppositions of embedded sentences, presuppositions in Heim's analysis just follow from the definedness conditions on semantic interpretations of sentences.

Definedness conditions on semantic interpretation are often not satisfied in actual discourses. Even in these cases, we do not stop processing the discourse, but we simply modify the context so that it can satisfy the presuppositions. This is called **accommodation**. When the context is revised, there are various options we can take. Take a conditional sentence '*If A, then B*' in which the consequent clause  $B$  triggers a presupposition  $P_B$ , and suppose that the incoming context is  $C$ . When the local context  $C + A$  does not satisfy the presupposition, there are various possible revisions of the context:

(13) Various ways to satisfy a definedness condition

- (a)  $C+P_B$ + If  $A$ , then  $B$
- (b)  $C$ + If  $A+P_B$ , then  $B$
- (c)  $C+(A\rightarrow P_B)$ + If  $A$ , then  $B$
- (d)  $C$ + If  $A+(A\rightarrow P_B)$ , then  $B$

Heim (1983), Karttunen (1974) and Karttunen and Peters (1979) take (13c) as the accommodation option. It is a minimal revision in that it revises the incoming context with the weakest proposition. (Note that ' $A\rightarrow P_B$ ' is weaker than  $P_B$ .) It is a global accommodation because it changes the incoming context for the whole sentence, rather than the local context for the consequent clause, as in (13d).

Heim (1983), however, proposes that local accommodation is also necessary for cases where global accommodation leads to inconsistency. Consider the following two examples.

- (14) a. The King of France didn't come.  
 b. (France has a king.) The King of France didn't come.  
 c.  $(C+P_B)-((C+P_A)+A)$
  
- (15) a. The King of France didn't come, because France doesn't have a king.  
 b. (France has a king.) It is not the case that the King of France came, because France doesn't have a king.  
 c. It is not the case that (France has a king and) the King of France came, because France doesn't have a king.  
 d.  $C-((C+P_A)+A)$

Sentence (14a) seems to presuppose that France has a king. When it is not satisfied by the incoming context, it is expected

to change the context, as in (14b). The process is formally expressed in (14c). In (15a), the same presupposition is triggered. Even when it is not satisfied in the local context, it cannot change the incoming context because it leads to inconsistency, as shown in (15b). A more natural interpretation of the sentence is (15c), where the triggered presupposition is incorporated within the scope of the negation. This is expressed in a formal way in (15d). In most cases, global accommodations are preferred, and local accommodations are used only when global accommodations are not admissible. But Heim (1983) does not give explicit conditions for local accommodation.

Now let's see how satisfaction theory works in predicting presupposition projection. As I said, in satisfaction theory, presupposition projection is just the result of imposing some *informational conditions on local contexts*. A *direct motivation* for imposing local satisfaction can be seen in examples like the following.

- (16) a. If the projection problem has been solved, then Lauri is the one who has solved it.  
 b. If the projection problem has been solved, someone has solved the projection problem. (tautology)
- (17) a. John is married, and his wife is happy.  
 b. If John is married, he has a wife. (tautology)

In (16a), the consequent clause triggers a presupposition that someone has solved the projection problem. So the whole sentence presupposes (16b). But it is a tautology. It conveys no substantial information, so presupposes nothing. (17) is an example of conjunction structure. (17a) presupposes a tautological presupposition of (17b), so the triggered presupposition is blocked from being projected. When presupposition projection is



determined by local satisfaction, it works well when a presupposition is blocked from projection simply by being satisfied in the local context.

Now look at a case where a presupposition is projected. Consider the following example.

- (18) a. If the problem was difficult, then Morton isn't the one who solved it.
- b. If the problem was difficult, someone solved it.

When a presupposition is triggered in the consequent clause of a conditional or conjunction structure, the satisfaction theory predicts that the presupposition of the whole sentence has the form of a conditional, as in (18b). But from (18a), we normally assume that someone solved the problem.

This problem was noticed by semanticists who work within the satisfaction theory. So they propose the following strategy, following Karttunen and Peters (1979)

- (19) (a) Since there is no relation between the antecedent and the consequent of the conditional form of presupposition, the speaker's ground for the assertion and presupposition may be truth-functional: that is, to the speaker, the presupposition is true because the antecedent is false or the consequent is true.
- (b) The utterance shows that the speaker does not know if the antecedent is true or false.
- (c) Therefore the presupposition is taken to be true because the consequent is true.

In (18b), the difficulty of the problem and its solution have no due relation, and the hearer comes to think that (18b) is truth-functional. The antecedent clause is part of the assertion

that implies the speaker does not know if the problem was difficult. So the hearer concludes that the consequent clause is true. In this way, the predicted presupposition is strengthened to what is normally expected.

### 2.2.1. Problems with Satisfaction Theory

In satisfaction theory, presupposition projection is determined by the ways sentences are interpreted. So the theory can make different predictions with different interpretation rules. Soams (1989) claims that the interpretation rules Heim assumes are not independently motivated. Take a conditional sentence for example.

- (20)  $C+$  'If  $A$ , then  $B$ ' =  
 (a)  $C-((C+A)-(C+A+B))$       or  
 (b)  $C-((C+A)-(C+B))$

When a conditional is assumed to be a material implication, it can be interpreted as in (20a) or (20b) without difference. Heim assumes (20a), but when (20b) is taken, it predicts that presuppositions in both  $A$  and  $B$  are projected directly to the incoming context. Then it cannot explain why presuppositions are blocked in (16) and (17). Soames takes a conjunction structure, and says that  $C+$  ' $A$  and  $B$ ' can be interpreted as  $C+A+B$  or  $C+B+A$ .

This criticism is not fair enough. Interpretation rules are formulated so that accessibility for anaphora can be captured. An expression conveys two kinds of information. One is world information which tells us what world we live in. The other is linguistic information which tells us what antecedents are available in using anaphoric expressions like reflexives, pronouns, etc. When anaphora is considered, ordering of interpretation is definitely necessary. Consider the following examples.

- (21) a. If a child beats his cat, he will be punished.  
 b. \*If he beats his cat, a child will be punished.
- (22) a. A child beat his cat, and he was punished by his mother.  
 b. \*He beat his cat, and a child was punished by his mother.

Assume that the underlined expressions co-refer. These examples show that conditionals and conjunction structures do have a required ordering of interpretation. In a conditional sentence, the antecedent clause must be interpreted first so that the resulting context contains the discourse marker introduced by the indefinite and provides it for the pronoun in the consequent clause. In a conjunction structure, the first conjunct must be interpreted first and the expanded context allows the pronoun to be used in the second conjunct.

Accessibility relations, however, are not sufficient for explaining how presupposition projection is determined. Heim (1983) doesn't give an explicit rule for disjunction, but, as Soames (1989) claims, when we consider various possible interpretation rules, we can conclude that presupposition projection in disjunction structures cannot be explained based on the definedness condition alone. Let's consider a first possibility.

$$(23) (a) C + 'A \text{ or } B' = (C+A) \cup (C+B)$$

If we use this rule, we are predicting that the presuppositions in *A* and *B* are all projected. However, this is not empirically supported.

- (24) (a) Either no one at the conference solved the problem, or it was Susan who solved it.

In the second disjunct, the presupposition is triggered that someone solved the problem, and it is predicted to be projected. In (24a) no presupposition is actually projected. For examples like this, the first rule could be revised as follows:

$$(23) (b) C+ 'A \text{ or } B' = (C+A) \cup (C+ 'Not A'+B)$$

Since  $C+A$  includes possible worlds in which  $A$  holds, we do not have to consider them when  $B$  is interpreted. So (23a) equivalent to (23b). But this does not help when the order of the two disjuncts is reversed. In relation to presupposition projection, disjunction structures show symmetry; the order does not make any difference.

$$(24) (b) \text{ Either it was Susan who solved the problem, or no one at the conference did.}$$

Here the presupposition triggered in the first disjunct is not projected, either. But from  $C+A$  and  $C+ 'Not A'$ , the rule in (23b) makes the prediction that presuppositions in the first disjunct are projected. Finally we could revise the rule as follows:

$$(23) (c) C+ 'A \text{ or } B' \\ = (C+ 'Not B'+A) \cup (C+ 'Not A'+B)$$

But this does not help either, because  $C+ 'Not A'$  ( $=C-(C+A)$ ) and  $C+ 'Not B'$  ( $=C-(C+B)$ ) predicts that presuppositions in  $A$  and  $B$  are all projected, just like (23a). The discussion so far shows that presupposition projection cannot be explained by the definedness condition, at least in the

case of disjunction structures. We have to resort to local accommodation even in the case where inconsistency does not arise along the accessibility path. Note that the presupposition is contradictory with the information in the other when the two disjuncts have no accessibility relation. This shows that presupposition projection is not uniquely determined by the condition of satisfaction. So we tentatively project a triggered presupposition, and then see if it violates a certain condition. If it does, we search for a local accommodation as an appropriate interpretation of the sentence. Otherwise, we take it as the intended reading of the sentence.

Another problem caused by the satisfaction theory is that it predicts too weak presuppositions. Satisfaction theorists already knew this problem, and attempted to correct this problem by attempting to strengthen weak presuppositions based on the reasoning given in (19). Geurts (1996), however, opposed to this idea. Let's look at the following examples:

- (25) a. If the problem was easy, then Morton isn't the one who solved it.
- b. If the problem was easy, then someone has solved the problem.
- c. Someone has solved the problem.

In (25b), the antecedent and consequent clauses are related, but (25c) seems to be presupposed. Furthermore, not all presuppositions of a conditional form are not strengthened.

- (26) Walter knows that if the problem was difficult, then someone solved it.

(26) presupposes that if the problem was difficult, then someone solved it, rather than that someone solved the problem. This

shows that there must be a distinction between a conditional presupposition which is itself a triggered one and a presupposition which has a conditional form due to the structure of the sentence.

This is not what is intended by satisfaction theory. Presuppositions are background information in the local context, so they must be distinguished in the projected presupposition too. One solution can be the use of some operator @ which is attached only to background information. Then the presuppositions from (25a) and (26) can be expressed as follows:

- (27) a. (25a) » If the problem was easy, @(someone solved the problem)  
 b. (26) » @(if the problem was difficult, then someone solved it).

One candidate for @ is 'it is taken for granted that ...' or 'it is assumed that ....' Under this assumption, the antecedent and consequent clauses in (27a) are not related, unlike (25b). And (27a) and (27b) are not the same, nor are expected to undergo the same strengthening process. This also gives the correct result in cases where presuppositions are satisfied. In this revised analysis, (16a) and (17a) are taken to presuppose the following:

- (28) a. (16a) » If the projection problem was solved, it is assumed that someone solved it.  
 b. (17a) » If John is married, it is taken for granted that he has a wife.

The new presuppositions also convey no significant information, so they are trivially satisfied.<sup>2)</sup> If this is on the right track, satisfaction theory can be improved, and we must not reject it

as a failure yet.

A third problem is with local accommodation. For cases where projected presuppositions lead to inconsistency, Heim (1983) proposes local accommodation. But the notion of local accommodation does not seem compatible with the definedness condition. Let's look at the example for local accommodation again.

(15) a. The King of France did not come, because there was  
no King of France.

d.  $C-(C+P_A+A)$

Here  $P_A$  is accommodated to the second  $C$  without changing the first  $C$  for the interpretation of  $A$ . But the distinction of two  $C$ s is not compatible with the definedness condition. According to this condition, the presupposition triggered in  $A$  must be satisfied by the context  $C$ . When this condition is not met, we are supposed to repair  $C$ , which is a semantic entity, and  $C$  is always the incoming context. Here there is no distinction between the "first" and "second" contexts. Local accommodation requires such a syntactic distinction of the "first" and "second"  $C$ .

Cases like this happen in other constructions. In the antecedent

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<sup>2</sup>The notion of tautology is semantic. It has been claimed that tautologous presuppositions convey no significant presuppositions. Here the notion of 'being assumed' or 'being taken for granted' is rather a pragmatic notion. So presuppositions we get are not tautology, but they pragmatically convey no significant presuppositions. Presupposition projection is a pragmatic phenomenon, so we could expect that the pragmatic notion will be appropriate in dealing with the pragmatic phenomena. Furthermore, we need to distinguish what is taken to be background information and part of what is asserted. I do not go into the different implications of using the notion of 'being assumed' or 'being taken for granted'.

clause of a conditional, the presupposition must be satisfied by the incoming context. But if this is not possible, then local accommodation requires a similar distinction.

(29) If you meet his wife at the party, John is married.

In this sentence, the presupposition from the definite description *his wife* cannot be projected. In this case we have to abandon the requirement that the incoming context, which is the local context for the antecedent clause, satisfy the presupposition even with revision. So local accommodation applies. We have already seen that a disjunction structure also needs local accommodation in cases like (24a,b). This indicates that local accommodation is a rule rather than an exception.

If local accommodation is sufficient for the definedness condition, then all presuppositions that satisfaction theory predicts in other cases are meaningless. Take a presupposition in a negative sentence for example. Satisfaction theory is based on the definedness condition, and a presupposition is assumed to be projected due to the definedness condition in a negative sentence. But if the definedness condition can be satisfied by local accommodation, then a presupposition does not need to be projected.<sup>3)</sup> We can say the same thing about other structures.

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<sup>3</sup>Another problem, which is mentioned in Geurts (1996), is that local satisfaction leads to an empty set of possible worlds, which is generally taken to be an absurd state.

- (i) a. There is no king of France. Therefore, The King of France did not come.  
 b.  $(C + \text{'Not } P_A') - (C + \text{'Not } P_A' + P_A + A)$

The triggered presupposition is that there is a King of France. Because of the first sentence, the presupposition cannot be projected. So it is locally accommodated. In this case the local context contains the information that there is no king of France. When this is updated with



Then global accommodation is not motivated by the definedness condition any longer.

Finally, a more serious problem, which is pointed out by van der Sandt (1992), is that presuppositions can be projected even when they can be locally satisfied.

- (30) a. If John has grandchildren, his children are happy.  
 b. If all countries have presidents, then the president of France probably regards himself as their cultural leader.  
 (He is such a pompous person.)

In (30a), the presupposition from *his children* is locally satisfied under the condition that John has grandchildren. In (30b), the presupposition from *the president of France* is satisfied if all countries have presidents. Notice, however, that both of them can be projected. This shows that local satisfaction may be a requirement for interpreting a sentence with a presupposition, but it does not determine whether the presupposition is projected or not.

As I pointed out, a presupposition can be satisfied in various ways, by the incoming context or by the local context. Satisfaction theory insists on local satisfaction, and when a presupposition is not actually satisfied by the local context, the incoming context is repaired only as much as the repair allows the local context to satisfy the presupposition. This predicts too weak presuppositions in most cases. But it also predicts too strong presuppositions in some cases. That is, when local accommodation is required, there is no way of repairing the incoming context, even with the weakest presupposition

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the triggered presupposition within the scope of the negation, it becomes the empty set since 'Not  $P_A$ ' and  $P_A$  are contradictory. When a new presupposition is triggered in  $A$  later, it is trivially satisfied because the empty set remains the same whatever updates it.

predicted. In satisfaction theory, presupposition projection is based on the definedness condition, but we know that the condition is often not satisfied. These facts imply that presuppositions are not minimal requirements for a context to satisfy.

### 3. Binding Theory of Presupposition Projection

Now we will look at a second theory of presupposition projection, which I call binding theory. In this theory the basic assumption is that presuppositions are anaphors. A crucial difference of presuppositions from pronouns is that they contain rich descriptive content which enables them to be accommodated as an antecedent in the event that the discourse does not provide one. And they have an internal structure of their own which can have the same semantic representation as the rest of an utterance. Parallelism between pronouns and presuppositions is observed in (31-32).

- (31) a. John has children, and they are intelligent.  
 b. John has children, and all of John's children are intelligent.
- (32) a. If John owns a donkey, he beats it.  
 b. If John owns a donkey, he beats his donkey.

Anaphoric nature of presupposition can be observed even in non-nominal structures. This is illustrated in (33).

- (33) a. If someone solved the problem, it was Julius who solved it.  
 b. If John is ill, Mary regrets that he is ill.

In this view presupposition projection is a repair strategy of accommodation which enables us to establish an anaphoric link even if the current discourse does not provide a suitable antecedent. Neutralization or presuppositional satisfaction is a process of anaphoric binding at some level of representation. Binding is a syntactic notion, so this theory uses the syntactic nature of Discourse Representation Theory.

### 3.1. Anaphora Resolution in DRT

In order to deal with the resolution of anaphoric elements with internal structures, this theory assumes the following Discourse Representation Structure:

A DRS  $K = \langle U(K), Con(K), A(K) \rangle$ , where  $A(K)$  is the A-structure of  $K$ , collection of the anaphoric elements of  $K$ .

In the following example, the sentences in (34a) and (34b) are translated into the DRSs in (34a') and (34b').

(34) a. John has a cat.

a'.  $K_0 = \langle \{x, y\}, \{John(x), cat(y), poss(x, y)\}, \emptyset \rangle$

b. His cat purrs.

b'.  $K_1 = \langle \emptyset, \{purr(z)\},$

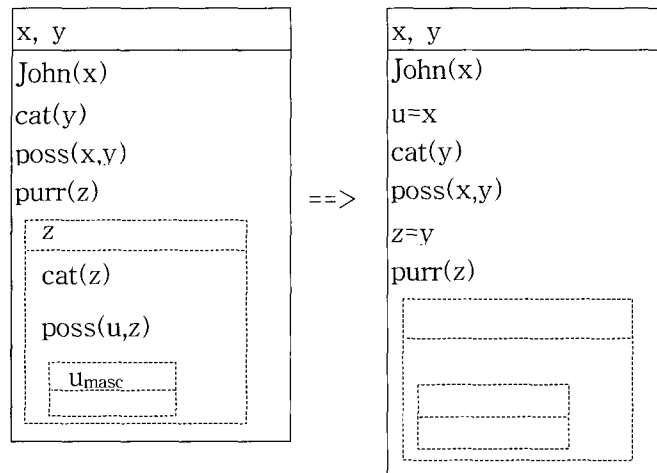
$\{ \langle \{z\}, \{cat(z), poss(u, z)\}, \{ \langle \{u\}, \emptyset, \emptyset \rangle \} \rangle \} \rangle$

c.  $K_0 + K_1 = \langle \{x, y\}, \{John(x), cat(y), poss(x, y), purr(z)\},$

$\{ \langle \{z\}, \{cat(z), poss(u, z)\}, \{ \langle \{u\}, \emptyset, \emptyset \rangle \} \rangle \} \rangle$

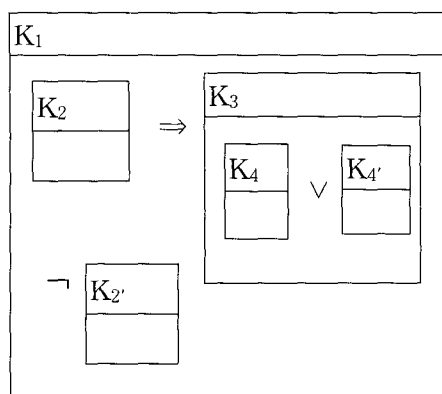
$K_1$  is added into  $K_0$ , as in (34c). This representation is hard to read, so it is expressed using boxes as in (34'), where dotted lines enclose A-structures, which must be resolved. For a structural reason, the most embedded element is resolved first. The discourse marker  $u_{masc}$  is resolved first.

(34')



The discourse marker  $u$  is masculine and there is one male person in the DRS, assuming that John is a name for a male person. The person is introduced as  $x$  in the DRS. So  $u$  takes  $x$  in the main DRS as its antecedent. So  $u=x$  is added in the main DRS. Then  $z$  must find its antecedent. It is equated with  $y$  because both are cats and are possessed by  $x(=u)$ . So the equation  $z=y$  and the conditions on  $z$  is added into the box in which the antecedent  $y$  is introduced, that is, into the main DRS. Now all anaphoric elements are resolved and the A-structure is empty.

So far we have seen a simple illustration of anaphora resolution. When the structure is more complex, we have to specify how an anaphoric element is resolved. This is where accessibility comes in. In satisfaction theory, accessibility is reflected in the interpretation rules for various structures. In DRT, a structure is translated into a DRS in a specific way, and accessibility is defined in terms of subordination relation between DRSs. I will simply show it graphically.



In the DRS, a conditional is translated as  $K_2 \rightarrow K_3$ , where  $K_2$  is the DRS for the antecedent clause and  $K_3$  that for the consequent. In this configuration,  $K_2$  is subordinate to the main DRS  $K_1$ , and  $K_3$  is subordinate to  $K_2$  and to whatever  $K_2$  is subordinate to. A disjunctive sentence is translated as  $K_4 \vee K_4'$ , where each DRS corresponds to one disjunct. The two DRSs do not have any subordination relation between each other, but both are subordinate to the DRS in which they are embedded, say,  $K_3$  and whatever  $K_3$  is subordinate to. A negative sentence is translated as  $\neg K_2'$ , where  $K_2'$  corresponds to its affirmative counterpart.  $K_2'$  is subordinate to whatever  $\neg K_2'$  is embedded in, that is,  $K_1$ . Based on subordination relations, accessibility is defined as follows:

Accessibility :

Let  $u \in U(K_j)$  be a discourse marker in an A-structure and  $v \in U(K_i)$  an established marker.  $v$  is accessible to  $u$  just in case  $K_i$  subordinates  $K_j$ .

A discourse marker introduced in a DRS  $K_i$  is accessible to a discourse marker introduced in a DRS  $K_j$  which is subordinate to  $K_i$ .

A projection line of an anaphoric element in  $K_n$  is defined as a sequence of DRSs  $(K_1, \dots, K_n)$ , where for any two adjacent DRSs  $K_i$  and  $K_j$  such that  $i < j$ ,  $K_i$  immediately subordinates  $K_j$ .<sup>4)</sup> In the DRS  $K_1$  above, the projection line for a discourse marker in  $K_4$  is  $(K_1, K_2, K_3, K_4)$ , and the projection line for a discourse marker in  $K_2$  is  $(K_1, K_2)$ . A presupposition introduces a DRS as an A-structure, and a discourse marker in the DRS searches its antecedent from the DRS itself to the main DRS along the projection line. When it finds its antecedent, the discourse marker and the antecedent are equated. This equation and the descriptive content for the discourse marker are added to the DRS in which the antecedent discourse marker is introduced. If it cannot find an antecedent, it searches for the accommodation site from the top down, along the projection line again. The accommodation must not violate any semantic and pragmatic constraints. These will be discussed below.<sup>5)</sup>

When presuppositions are all resolved by being bound by antecedents or by being accommodated, the resulting DRSs must satisfy some conditions. First, resolved DRSs may not contain

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<sup>4</sup>Immediate subordination is defined as below:

- (i) A is immediately subordinate to B iff A is subordinate to B and there is no C such that A is subordinate to C which is subordinate to B.

<sup>5</sup>Presupposition projection can be understood as a procedure like this, but van der Sandt (1992) opts for sorting out all possible interpretations in parallel with respect to semantic and pragmatic conditions. He does so in order to avoid the complexity of procedures of anaphora resolution and backtracking. But he seems to want to look at it as a procedure, because it will follow from the procedure that binding has priority over accommodation.

free variables (= discourse markers). Consider the following examples.

- (35) a. If *a man* loves *his wife*, she is happy.  
 b. If John is rich, his wife is happy.

In (35) the presupposition from *his wife* cannot be accommodated in the main DRS. If it were, the variable for *his* would have to be bound in the main DRS. But the variable for *his* cannot be bound by the only potential antecedent discourse marker which is introduced by *a man* in the antecedent DRS for the conditional. So such an interpretation violates the condition of the ban on free variables. On the other hand, the presupposition in (35b) can be projected to the main DRS because the variable for *his* is bound there. Although the proper name *John* occurs in the antecedent clause of the conditional, it introduces the discourse marker in the main DRS, just as all other proper names do. This should be specified in the interpretation rule for a proper name. The discourse marker from *John* is equated with the variable for *his* in the main DRS. So no free variable occurs. 'Ban on free variables' is a well-formedness condition. If it is violated, the reading is an impossible one.

A second condition is a pragmatic one: lower DRSs not be entailed by higher DRSs.

- (36) a. If John is married, his wife is happy.  
 b. ??(John has a wife) If he is married, she is happy.

The presupposition that John has a wife could be tentatively projected to the main DRS, but if it were, it would entail the DRS for the antecedent clause of the conditional (36a), as in (36b). So the presupposition is not accommodated to the main DRS. This condition is necessary to deal with some cases where

presuppositions are locally satisfied in the sense of satisfaction theory, but it does not block presuppositions from being projected in cases in (30): the presupposition does not entail the potential antecedents.

A third condition is that all DRSs be consistent. Consider the following example, which is problematic in satisfaction theory.

- (37) a. Either John has no donkey or his donkey is eating quietly in the stable.  
 b. ??(John has a donkey.) Either John has no donkey or the donkey is eating quietly in the stable.

The presupposition from *his donkey* is not projected to the main DRS. Suppose that the presupposition were projected to the main DRS. Then the DRS would be like the one we would get from the discourse in (37b). As shown in (37b) the DRS for the first disjunct has the information that John has no donkey. It is inconsistent with the information in the main DRS that John has a donkey. The condition on inconsistency prohibits such cases. So the presupposition must stay in the DRS for the second disjunct. Note that in evaluating a DRS with respect to this condition, we have to consider only the DRSs on the projection line. Otherwise, it would exclude disjunctive sentences in which two disjuncts are incompatible.

### 3.2. Characteristics of the Binding Theory

The binding theory of presupposition projection is characterized as a theory in which a presupposition is directly manipulated as a syntactic object. When a triggered presupposition is projected, it moves up along the projection line as a syntactic object. When it arrives at the main DRS, it is the same as the triggered presupposition. This allows us to avoid the problem of weak presupposition which occurs in satisfaction theory.



Sentence in (18a) presupposes that someone solved the problem, not that if the problem was difficult, someone solved the problem.

A second characteristic is that this analysis allows various readings of a sentence depending on whether a presupposition is bound or accommodated and, if accommodated, where it is accommodated. This implies that it deals with bound readings and accommodation readings together as alternative interpretations of the same sentence. Consider the following examples.

- (38) a. If John has sons, his children are happy.  
 b. If John has grandchildren, his children must be happy.

The A-structure for the presupposition that John has children can be bound by John's sons in (38a) and by the grandchildren John has in (38b). But it is also possible that the presupposition is projected to the main DRS because it violates no semantic or pragmatic condition. A similar observation can be made in the following example, too.<sup>6)</sup>

- (39) a. If John has an oriental girlfriend, his girlfriend won't be happy, but if he has one from France, ....  
 b. If John has an oriental girlfriend, his girlfriend won't be

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<sup>6)</sup>In the following sentence, it does not seem possible that the presupposition is projected, despite the syntactic and semantic similarity.

(i) If France has an intelligent king, then the King of France is the only monarch in Europe.

The reason is that if the presupposition is to be projected, there must be a possibility that France has more than one king. But we generally assume that there is a unique king in a country. This assumption blocks the projection reading.

happy. She has always been rather jealous.

The A-structure from *his girlfriend* can be bound by John's oriental girlfriend, as in (39a), but it is also possible that the definite description can refer to a different girlfriend than the oriental one, as in (39b). So it can be referred back to by a pronoun. Both readings are taken to be the interpretations of the same sentence.

We get only a bound reading when the global accommodation reading violates some pragmatic condition. This is illustrated in the following:

(40) If John has a girlfriend, his girlfriend won't be happy.

If the presupposition triggered by the definite description is accommodated to the main DRS, it will entail the DRS for the antecedent clause of the conditional, violating a pragmatic condition on DRSs. So we only get the bound reading.

A third characteristic is that this analysis allows tentative accommodation. This is required for cases where disjunctive sentences are involved. This has been discussed in (37). A similar example is given below.

- (41) a. Either it was Susan who solved the problem, or no one at the conference did.  
 b. ??(Someone solved the problem.) Either it was Susan who solved the problem, or no one at the conference did.

Here the presupposition from the cleft sentence in the first disjunct is tentatively projected to the main DRS, but it violates the condition on inconsistency in the DRS for the second disjunct.

However, this is not a strong point of this theory over the satisfaction theory. Satisfaction theory exploits the notion of global and local accommodations. Heim (1983) does not provide conditions for local accommodation, but she could incorporate the pragmatic conditions which van der Sandt (1992) adopts. The conditions are completely compatible with Heim's analysis. So for the disjunction structure, as in (24), we can use just the simplest interpretation rule (23a), which reflects only the accessibility relations of the structure. When it leads to the violation of a pragmatic condition, we get only readings in which local accommodation applies.

### **3.3. Problems with the Binding Theory**

The binding theory of presupposition projection can solve several problems that arise with satisfaction theory. First, no problem of weak presuppositions arises. Second, it allows for the possibility that even when a presupposition is satisfied, it is projected. Despite these strong points, the binding theory is not sufficiently motivated as a presupposition projection theory. In this section, I will discuss some problems with the binding theory.

First, if a presupposition is an anaphoric element, there is no motivation for preferring global accommodation. Anaphora resolution is affected by various factors. But anaphors tend to have its antecedents as close as possible, as far as distance is concerned. Then why do presuppositions tend to have their antecedents as far as possible? There should be some explanation about this. If presuppositions are just like other anaphoric expressions, the tendency of global accommodation is unexpected, and seems to show that presuppositions are different from other anaphoric expressions. This weakens the motivation for assuming that presuppositions are anaphoric elements.

Second, presuppositions in conditionals and quantification

structures do not behave as the theory predicts. In conditional, the antecedent clause is preferred to the consequent clause as an accommodation site, since the former subordinates the latter. Empirically, however, presuppositions do not seem to be accommodated into the restrictor of a quantificational operator.

- (42) a. If Central Africa becomes a monarchy, its king/?queen will represent the country.  
 b. If Central Africa becomes a monarchy, it has a king/?queen and (s)he will represent the country.  
 c. If Central Africa becomes a monarchy and it has a king/queen, (s)he will represent the country.

In (42a) the presupposition from the definite description is not projected to the main DRS because it would entail the antecedent clause somehow, or because it would be inconsistent with the implicature that Central Africa is not a monarchy. So the accommodation site is the antecedent or consequent clause. In (42a), the use of *queen* is surprising since a monarchy generally has a king. If the presupposition triggered by the description is accommodated in the antecedent clause, it becomes (42b), but this reading is not surprising at all. If the presupposition is accommodated in the consequent clause, we can get the same surprising effect. This implies that the natural reading of the sentence should be the one in which the presupposition is accommodated in the consequent clause.

Similarly, in a quantification sentence a presupposition triggered in the nucleus scope tends to be accommodated in the nucleus scope rather than in the restrictor.

- (43) a. Every girl brings her boyfriend to the party.  
 b. Every girl who has a boyfriend brings him to the party.  
 c. Every girl has a boyfriend and brings him to the party.

Sentence (43a) is construed as (43c) rather than as (43b). The plausible reading is the one where the presupposition is accommodated into the nucleus scope. The binding theory predicts rather that the restrictor is preferred to the nucleus scope as an accommodation site, and the prediction is not supported empirically.

Third, the binding theory deals with similar phenomena in two different ways. Consider the following two sentences:

- (44) a. If John has a wife, his wife is happy.  
 b. If John is married, his wife is happy.

Both sentences have the same structure of meaning, and in neither of them is the presupposition from *his wife* accommodated in the main DRS. According to the binding theory, however, the presupposition in the first sentence is not projected because it is bound by John's wife while that in the second sentence is not projected because the accommodation in the main DRS would give rise to the DRS which entails the DRS for the antecedent clause. Intuitively, they both should be excluded by the same mechanism, probably the one that applied to (44b).

This theory implies that if there is no binder and a tentative projected presupposition does not entail a lower DRS, then the presupposition is sure to be projected. But this is not supported empirically. Consider the following example, which is a slightly modified version of (44b).

- (45) If John has been married long, his wife is happy.

There is no discourse marker introduced in the antecedent clause that could bind John's wife. Then the binding theory excludes the possibility that the presupposition is bound. However, the

presupposition that John has a wife may, or may not, be projected, just like the examples in (39), where there is a potential binder but the triggered presupposition does not entail the potential binder. Whether a presupposition has a potential (syntactic) binder or not does not determine presupposition projection.

This type of examples can be observed in other types of presuppositions. Consider the following sentences:

- (46) a. If John is a heavy smoker, he will stop smoking for a better record in the marathon.  
 b. ??If John is a heavy smoker, he will stop it for a better record in the marathon.  
 c. If John smokes heavily, he will stop it for a better record in the marathon.

From (46a) we may, or may not, assume that John has been smoking. The verb *stop* triggers the presupposition that John has been smoking, but this is entailed by the proposition that John is a heavy smoker. However, the presupposition is not bound. If it were, we could use a pronoun like *it*, as in (46b). The indefinite *a heavy smoker* does not introduce a discourse marker for the event of smoking. This again shows that if the presupposition is not projected, it is because the presupposition is entailed, not because it is bound. This is contrasted with (46c), in which the antecedent clause introduces a discourse marker for the event of smoking and the pronoun is used felicitously. This shows that what is involved in presupposition projection is not a syntactic notion of binding.

Finally, the binding theory deals with binding readings and accommodation readings together as possible readings of the same sentence or utterance. However, the two types of readings should not be taken to be readings of the same

sentence/utterance. Consider the following sentences.

- (47) a. If John has an oriental girlfriend, his girlfriend won't be happy.  
b. If John murdered his father, then he probably regrets killing him, but if he killed him accidentally, then he probably doesn't regret having killed him. (Gazdar 1979: 114)

(47a) can have the bound reading and the projection reading. But the two readings are associated with different focus assignments. With the bound reading, the focus is more likely to be placed on the whole VP has an oriental girlfriend. But with the projection reading, the focus goes to oriental. In (47b) the bound reading is associated with the focus on the whole VP murdered his father, but the projection reading is with the focus on murdered. In (47b), the context indicates that the focus is on murdered, and we are more likely to get the projection reading.

This implies that we should not talk about preference between bound readings and accommodation readings. We rather have to compare between bound readings and between accommodation readings. Among bound readings, a closer antecedent is preferred to a farther one. Among accommodation readings, a global accommodation reading is preferred to a local accommodation reading. These two comparisons are independent, and so it is not plausible to explain them with the same notion of anaphora.

#### 4. New Directions

From the discussion of both theories we can see several characteristics a new analysis must consider. First, presupposition projection must be based on information relation, rather than a syntactic apparatus. In this respect entailment is

too narrow to explain presupposition projection. Consider the following example.

- (48) If John is a golfer, he may use his golf club when he pushes the button.

Being a golfer does not entail the possession of a golf club. But the presupposition that John has a golf club may not be projected. In calculating presupposition projection, we consider both semantic and pragmatic information.

Second, a presupposition is canceled by some information in a preceding context along the accessibility path, but when a presupposition is accommodated, it does not seem to follow the same path. Note that a presupposition in the consequent clause of a conditional can be satisfied or bound by something in the antecedent clause, but when it is accommodated, it is not accommodated there. This observation also supports the claim that bound readings and accommodation readings should be dealt with separately.

Thirdly, presuppositions can be accommodated in various contexts, which gives rise to various readings. Satisfaction theory only tries to capture this observation by strengthening a single weak presupposition. This strategy is necessary even for cases where presuppositions are satisfied. But we have seen that it makes wrong predictions which cannot be corrected easily. If bound readings and accommodation readings are dealt with separately, and if the preference of global accommodation is to be captured, the direction must be reversed. That is, the strongest reading must be checked first. Disjunction structures are cases where this is required. This shows that, as Geurts (1995, 1996) mentioned, we have to be able to manipulate a triggered presupposition directly. And the manipulation have to involve various accommodations so that various readings can be



allowed from the beginning. This is the strategy that the binding theory takes.<sup>7)</sup>

Finally, presupposition accommodation is always possible with only several exceptions. As Heim (1992) noted, a presupposition triggered by *too*, *also*, etc. must be definitely satisfied. The reason is that they involve variables in the triggered presuppositions that are necessarily bound. Asher and Lascarides (1996) also discuss cases where accommodation is not readily acceptable. Except such cases, accommodation is generally admitted. This shows that presuppositions should not be constrained by something like the definedness condition which is necessarily loosened quite often, as observed in satisfaction theory. This is related to the fundamental question of what presuppositions are. A proposal can be that presupposing is a way of conveying "background" information, new or old, for a context. This is the position that Gazdar (1979) takes. But a problem with Gazdar is that for him the context is always the incoming/main context. We need a more refined version, where the context can be the incoming context or a local context.

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<sup>7)</sup>This shows that at least in this respect the binding theory is in the right direction, but it finds its motivation from the assumption that presuppositions are anaphoric elements. In Yeom (1998, 2001), I take a similar strategy. But I take presuppositions as semantic entities. This allows us to avoid some problems with the binding theory.

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