Scalar Implicatures and Free Choice Effects in Disjunction Structures*

Jae-Il Yeom
(Hongik University)

Yeom, Jae-Il (2013). Scalar Implicatures and Free Choice Effects in Disjunction Structures. ***Language Research*** **49.2, 251-290.**

It has been disputed whether implicatures arise globally or locally and whether free choice effects are SIs. In this paper, we consider complex sentences involving the disjunction operator and discuss those issues. It will be shown that scalar implicatures (SIs) arise globally, while Free Choice (FC) effects arise locally. Cases where SIs are seemingly calculated locally are actually cases where global inferences have the effect of local inferences due to the contexts in which the sentences are interpreted. In showing this, we will see that SIs and FC effects are not syntactic phenomena. This is an opposite position to the claim that SIs are calculated locally.

Keywords: scalar implicature, free choice, disjunction, global implicature, local implicatures

1. Introduction

Among the many operators discussed in relation to implicatures, the disjunction structure is more interesting than any other because it is related to two types of implicatures: scalar implicatures (SIs) and free choice (FC) effects. First, it is involved in scalar implicatures in the following way:

(1) John ate an apple or a pear. (= A or B)
A: John ate an apple.
B: John ate a pear.

* This was supported by 2011 Hongik University Research Fund. I thank three anonymous reviewers for their comments, which helped me clarify my points I make in the paper. All remaining errors are mine.

+> John did not eat both an apple and a pear.
(SI: NOT(A and B))
('+>' means 'implicate(s)'.)

If a speaker says John ate an apple or a pear, it is implicated that John did not eat both. This is expressed in the following pattern:

(2) For a statement ϕ(α or β), NOT(ϕ[and/or]) is a SI.
(ϕ(α or β): a sentence φ including the expression 'α or β';
ϕ[and/or]: a sentence ϕ in which *or* is replaced with *and*.)

One issue related to SIs is whether they arise globally or locally. An implicature arises by a speaker's action of uttering a sentence, following the maxim of quantity by Grice (1975). Therefore SIs should arise globally. However, there have been analyses, like Chierchia (2004), Fox (2006), etc., in which SIs are calculated locally in the process of semantic interpretation of a sentence, by applying the negation or Exhaustivity operator to a certain constituent.

Actual data do not clearly take part with any position. Example (3) supports global analyses:

(3) Some students who drank beer or wine were allowed to drive.
Some students who drank beer or wine, but NOT both, were allowed to drive.
NOT [some students who drank both were allowed to drive]
(= No students who drank both were allowed to drive.)

In (3), the globalistic account would predict that no students who drank both were allowed to drive. However, a localistic account would predict that the sentence means that some students who drank either beer or wine were allowed to drive. This is also plausible, but it does not exclude the possibility that some students who drank beer and wine were allowed to drive. In this respect the global implicature is preferred. This can be compared with (4):

(4) Some students who watched TV or played games failed math.
=+> Some students who watched TV or played games, but not did both, failed maths.

+> NOT[Some students who watched TV and played games failed maths] ("=+>" means 'conveys'. A sentence conveys its literal meaning plus its implicatures.)

In (4), if students who watched TV or played games failed math, students who did both are much more expected to have failed math. Therefore, the local calculation of a SI gives rise to a plausible one.

Another issue about implicatures from disjunction structures is whether FC effects are SIs. In addition to SIs, the disjunction operator yields FC effects too:[1)]

(5) Some boys ate an apple or a pear. (= φ(C or D))
C: ate an apple; D: ate a pear
+> Some boys ate an apple & some boys ate a pear.
(FC Effect: φ[C/(C or D)] & φ[D/(C or D)])

If a sentence has an existential quantifier that has wide scope over a disjunction structure, the FC effects are what we get by replacing the whole disjunction structure with each disjunct:

(6) For a statement ϕ(α or β) where φ includes an existential quantifier which has wide scope over the disjunction structure, the FC effects are φ[α/(α or β)] and φ[β/(α or β)].[2)]

However, the condition that ϕ should include an existential quantifier can be lifted because FC effects are more general than this. I will consider some sentences in which other quantifiers than existential quantifiers are involved. The two different patterns of SIs and FC effects imply that SIs and FC effects arise differently and should belong to two different types.

However, there have been analyses, like Fox (2006) and Klinedinst (2006), in which FC effects are treated like SIs. They think FC effects arise from different alternatives than the ones that yield standard SIs.

---

1) Kamp (1973) discussed FC effects with permission statements, but all sentences that trigger FC effects involve a existential quantifier.

2) More precisely, the FC effects are φ[(α, but not β)/(α or β)] and φ[(β but not α)/(α or β)]. The reason is that FC effects are meaning contribution exclusively of each disjunct. This will be discussed further below.

To see whether the two types of inferences are all SIs, I will look into more extensive disjunctive sentences with various operators and show that SIs are global phenomena and FC effects are different from SIs in that FC effects are local. And some examples where SIs look local can be dealt with by considering contextual factors.

The paper is organized in the following order. In Section 2, previous analyses of SIs and FC effects will be reviewed critically. In Section 3, I will claim that SIs are global while FC effects are local and seemingly local SIs are effects of contexts on global SIs. In Section 4, there are some SIs that do not correspond to syntactic structures. In Section 5, I account for the observations in Sections 3 and 4, on the basis of Discourse Representation Theory. In Section 6, I summarize the discussions in the paper.

2. Previous analyses

2.1. Chierchia (2002) vs. Sauerland (2004)

The issue of whether SIs are global or local started with Chierchia's (2002) claim that SIs are calculated locally in the process of compositional interpretation. In his globalistic analysis of SIs, on the other hand, Sauerland (2004) assumes that calculating SIs involves the negation operator and the epistemic operator K(now) over the whole alternative statement.[3] First, the hearer (*hr*, hereafter; assumed to be male) makes weaker inferences, which he calls primary implicatures. I will call them '¬K' implicatures because they are prefixed with the operators ¬K. When they are strengthened into 'K¬' implicatures, they are called secondary implicatures. So-called SIs correspond to Sauerland's secondary implicatures. Following the Neo-Gricean assumption as given in Horn (1972, 1989, 2005), he assumes that SIs arise from a set of scalar alternatives. He also assumes that the alternative set of or is {and, L, R, or}, following Simons (1998). L and R are operators that select the left and right disjuncts, respectively. That is, S1 L S2 = S1 and S1 R S2 = S2. Based on these assumptions, (7)

3) Zimmerman (2000) and Geurts (2005) claim that the disjunction operator is an inherently epistemic operator. This is not a correct analysis. The epistemic operator is introduced by the epistemic nature of inferences.

can implicate K¬ (George did not eat all of the fries):

(7) George ate some of the fries or the apple pie.
  a. ¬K (George ate some of the fries)
  b. ¬K (George ate all of the fries)
  c. ¬K (George ate the apple pie)
  d. ¬K (George ate some of the fries and the apple pie)

Here only (7b) and (7d) can be strengthened into K¬ (George ate all of the fries) and K¬ (George ate some of the fries and the apple pie), respectively. (7a), on the other hand, cannot be strengthened into a 'K¬' implicature, because in such a situation the speaker (*sp* hereafter; assumed to be female) would have known that George ate the apple pie, which would contradicts (7c). We can say the same thing about (7c): if it were strengthened, it would be incompatible with (7a).

Sauerland's analysis can explain (7) well, but it can be problematic with (4). When the stronger statement with *or* replaced with *and* is negated, the predicted implicature is implausible that no students who watched TV and played games failed math. The intended meaning of the sentence is that even a student who did only one of the two activities failed math, not to mention a student who did both. To account for examples like (4), Chierchia (2002) claims that a SI is calculated as part of the process of compositionally interpreting a statement to get the strong meaning (the literal meaning plus the implicatures) of it, following Krifka (1995). When a scalar expression is interpreted, a set of scalar alternatives is introduced and a SI is calculated locally by introducing the negation operator over stronger alternative chunk.

But there are problems with Chierchia's analysis. First, his analysis does not explain examples like (3), where a global SI is preferred. Second, a more serious problem with the idea of local implicature is that a locally stronger alternative expression does not make the statement stronger if it occurs in a downward entailing (DE) context. In (8), for example, we can get an implicature (8b) locally in the relative clause in the restrictor of the quantifier *every*.[4)]

4) Larson (1985) discussed the scope of the disjunction operator in terms of syntactic structures. Simons (2005) pointed out problems with Larson (1985).

(8) a. Everyone who danced or sang went to the final.
b. NOT[danced and sang]

However, the restrictor of *every* is a DE context and we get no implicature. The sentence is not understood as meaning that everyone who danced or sang but did not do both went to the final. An SI arises from the use of *or* only when it leads to a weaker statement than *and*. This means that whether a scalar alternative expression gives rise to a SI is always determined globally.

In principle, SIs are based on the maxim of quantity by Grice (1975). When a stronger statement is also relevant in the context and a weaker statement is made in a context, it is implicated that the stronger statement is false. When we compare strengths of statements, we are supposed to do it with whole statements. Therefore global approaches are in line with the basic reasoning of SIs.

Then a natural analysis is to assume a globalistic approach and to try to explain local SIs as contextual effects on global Sis. In Section 3, I consider examples of a disjunction structure embedded in various operators and show that some contexts cause global implicatures to have the effects of local implicatures, in comparison with examples of a conditional structure.

2.2. Fox (2006)

Fox (2006) tried to analyze FC effects as part of SIs. Unfortunately, his analysis is rather complex, and only after I discuss his analysis extensively can I point out problems with the data dealt with in this paper. He assumes the original version of the maxim of quantity proposed by Grice (1975) and an opinionated speaker, following Sauerland (2004). That is, unless there is counter-evidence, a stronger alternative is negated. In addition, he assumes the anti-exhaustivity, following Kratzer and Shimoyama (2002), who basically argue that FC effects arise by comparing strong meanings (i.e., literal meanings plus SIs), not just literal meanings, of statements. To get strong meanings, he introduces the operator of exhaustivity *exh*. The meaning of that operator is defined as follows:

(9) $[\![\text{Exh}]\!](A_{<st,t>})(p_{st})(w) \Leftrightarrow p(w) \ \& \ \forall q[q \in \text{I-E}(p,A) \rightarrow \neg q(w)]$
I-E(p,A) = $\cap\{A' \subseteq A$: A' is a maximal set in A s.t. $A'^{\neg} \cup \{p\}$ is consistent$\}$
$A^{\neg} = \{\neg p : p \in A\}$ (A: alternative set)
q is innocently excludable (I-E) given A (= I-E(q,A)) if $\neg \exists q' \in$ NW(p,A)[$p \wedge \neg q \Rightarrow q'$].
NW(p,A) = $\{q \in A$: p does not entail q$\}$ (non-weaker alternatives)

Fox's way of calculating SIs is quite similar to Sauerland in that, given a set of alternatives A, a SI $\neg$q from a non-weaker alternative q to a statement p is calculated if it does not lead to the necessity of another non-weaker alternative q′. In this case, q is innocently excludable (I-E), given A. One difference is that in Fox's analysis each SI is calculated separately, but a set of SIs is calculated as a whole. This is why the SIs is expressed as universal quantification over (the negations of) the non-weaker alternatives.

Fox makes one more assumption: in parsing (or producing) a sentence, the operator *exh* will be used (repeatedly) if the latter generates implausible Ignorance Inferences, that is, if it is not determined yet whether a non-weaker alternative is true or false.

(10) Recursive Parsing-Strategy: If a sentence S has an undesirable Ignorance Inference, parse it as Exh(Alt(S))(S).

His analysis deals with the following example:

(11) You may eat the cake or the ice-cream.

If *exh* does not apply, *hr* gets the Ignorance Inference that *sp* does not know which one is allowed to eat. *Hr* may apply the *exh* operator to get a more plausible meaning from the statement:

(12) Exh(C)(You may eat the cake or the ice-cream)
= Exh(C)($\Diamond(p \vee q)$), where
p = you eat the cake;
q = you eat the ice-cream;
C = $\{\Diamond(p \vee q), \Diamond p, \Diamond q, \Diamond(p \wedge q)\}$

$$\text{Alt}(\Diamond(p \vee q)) = \Diamond(p \vee q) \{ \Diamond p, \Diamond q \} \Diamond(p \wedge q)$$

Here $\Diamond(p \wedge q)$ is the only alternative which can be innocently excluded, and we get the meaning that $\Diamond(p \vee q) \wedge \neg\Diamond(p \wedge q)$. Still we do not know which one is permitted to eat. Hence the *exh* operator can apply again.

(13) Exh(C′)[Exh(C)(You may eat the cake or the ice-cream)] where
$C' = \{\text{Exh}(C)(p): p \in C\}$
$C' = \{1.\ \text{Exh}(C)(\Diamond(p \vee q)),\ 2.\ \text{Exh}(C)(\Diamond p),\ 3.\ \text{Exh}(C)(\Diamond q),$
$4.\ \text{Exh}(C)(\Diamond(p \wedge q))\}$
1. $\text{Exh}(C)(\Diamond(p \vee q)) = \Diamond(p \vee q) \wedge \neg\Diamond(p \wedge q) \neq (\Diamond p \wedge \neg\Diamond q) \vee (\Diamond q \wedge \neg\Diamond p)$
2. $\text{Exh}(C)(\Diamond p) = \Diamond p \wedge \neg\Diamond q$
3. $\text{Exh}(C)(\Diamond q) = \Diamond q \wedge \neg\Diamond p$
4. $\text{Exh}(C)(\Diamond(p \wedge q)) = \Diamond(p \wedge q)$ (can be ignored since already excluded by the prejacent)

The alternatives ignoring the fourth show the following ordering:

(14) $\text{Exh}(C)(\Diamond(p \vee q)) \{ \text{Exh}(C)(\Diamond p), \text{Exh}(C)(\Diamond q) \}$

Excluding $\text{Exh}(C)(\Diamond p)$ and $\text{Exh}(C)(\Diamond q)$ will not necessarily include $\text{Exh}(C)(\Diamond q)$ and $\text{Exh}(C)(\Diamond p)$, respectively. Hence we get the following meaning:

(15) $\text{Exh}(C')[\text{Exh}(C)(\Diamond(p \vee q))]$
$= \text{(i)}\ \Diamond(p \vee q) \wedge \neg\Diamond(p \wedge q);\ \text{(ii)}\ \neg(\Diamond p \wedge \neg\Diamond q);$
$\text{(iii)}\ \neg(\Diamond q \wedge \neg\Diamond p)$
$= \Diamond(p) \wedge \Diamond(q)$ and $\neg\Diamond(p \wedge q)$

That is, it means that you may eat the cake and you may eat the ice-cream, but that you may not eat both.

Apparently it seems that Fox's analysis deals with FC effects well.

However, it does not hold up to close scrutiny. One problem is that, intuitively, if one is allowed to do A or B, then it is normally allowed to do both, Simons (2005) pointed out by discussing a sentence like the following:

(16) Jane may sing or dance. (Simons 2005)
Possible Reading:
Jane may sing, she may dance, and she may do both.

In order to correct this wrong prediction of his analysis, Fox assumes that in a permission statement, each of the disjuncts could be exhaustified separately. I do not think this is the right direction of analysis, because he assumes the basic version of the maxim of quantity originally proposed by Grice (1975), which is only concerned with whole statements. It is strange to try to apply the principle that applies to whole STATEMENTS to parts of them. And the resulting meaning is not what we want. The meaning Fox predicts by applying the *exh* operator to each disjunctis the following:

(17) $Exh(C')(Exh(C')(\Diamond(p! \vee q!)))$
$= \Diamond(p! \vee q!) \wedge \neg\Diamond(p! \wedge q!) \wedge \Diamond(p!) \wedge \Diamond(q!)$
$= \Diamond(p! \vee q!) \wedge \Diamond(p!) \wedge \Diamond(q!)$
$p!:=Exh(C1)(p) = p \wedge \neg q$
$q!:=Exh(C2)(q) = q \wedge \neg p$

This means that Jane is allowed to (i) sing and not dance or (ii)_ dance and not sing, and Jane may sing and not dance and Jane may dance and not sing. This does not mean that Jane is allowed to dance while singing. It is not the meaning Simons intended.

Problems with Fox's (2006) analysis start from the assumption that FC effects are SIs. I will show that FC effects are different from Sis in Section 3. In addition, an additional serious problem arises from the assumption that implicatures are syntactic phenomena. In this respect, Fox (2006) shares the same problem with Chierchia (2002). This will be discussed in detail in Section 4.

3. Local FC Effects vs. Global SIs

We get global and local Sis, but we have to consider a whole statement anyway even in getting local implicatures. In calculating implicatures, one crucial factor we have to check is that a scalar expression has to make the *WHOLE* statement stronger. This indicates that SIs are basically global. If SIs are inherently global, we can claim that FC effects are not Sis by showing that FC effects are inherently local. One remaining problem is how we can explain cases where local SIs are preferred. In this section I will discuss these issues.

3.1. Contexts Where Only FC Effects Arise

First, FC effects arise even in non-monotonic contexts:

(18) a. If Gordon sometimes drinks beer or wine, then we can offer him a good bottle of Bordeaux as a present. (Eckardt 2007)
b. ??If Gordon sometimes drinks beer or wine but does not drink both, then we can offer him a good bottle of Bordeaux as a present.
c. If Gordon sometimes drinks beer AND sometimes drinks wine, then we can offer him a good bottle of Bordeaux as a present.

The antecedent clause of a conditional is now non-monotonic, but FC effects arise in it, as in (18.c), while SIs do not, as in (18.b).

Even when the disjunction operator yields the strongest meaning in a DE context, we can get FC effects:

(19) All students who sang or danced went to the final.
+> Some students sang.
+> Some students danced.

In this example, the expressions that possibly introduce scalar alternatives are *all* and *or*. But their alternatives only yield weaker statements, and there is no reason for applying the *exh* operator. Still we get the inferences of the existence of some students who sang and of some students who danced. This is the same inference as a FC effect

we get from a sentence with an existential quantifier. This cannot be explained by Fox's (2006) analysis.

Second, even when a standard SI is canceled, we can get FC effects arise. From (5), we can also get the SI that no boys ate an apple and a pear. But the standard SI can be canceled overtly in a sentence like (20), while we still get the same FC effects:

(20) Some boys ate an apple or a pear or both.
+⊁ No boys ate both. (SI)
+> Some boys ate an apple. *(FC)*
+> Some boys ate a pear.

From this we can claim that SIs and FC effects are independent of each other.

3.2. Local FC Effects

If an implicature is global, it means that for a deeply embedded scalar expression we get an implicature by applying a necessary operator to the root sentence. Consider the following example:

(21) Some students must eat an apple or a pear. (some > must > or)
+> No students must eat both. (SI)

The meaning of the sentence is that there are some students each of whom is required to eat an apple or a pear.[5] In this linguistic configuration, we can get a SI from the use of the disjunction operator by applying the negation operator to the root sentence: the operator *must* does not block the calculation of the SI that no students must eat both fruits. On the other hand, the obligation operator does block FC effects from the disjunction operator to the existential quantifier *some*:

---

5) The sentence has another meaning in which *some* has narrower scope than *must*:

i. There must be some students who eat an apple or a pear.

In this case we can get the following two implicatures as FC effects:

ii. a. There must be some students who eat an apple.
b. There must be some students who eat a pear.

It is also possible that *or* has wide scope over *must*, and this reading is obtained when it is designated who eats what.

(22) +⊁ Some students must eat an apple. *(FC)*
+⊁ Some students must eat a pear.

The FC effects I intended in (21) is that there are some students each of whom must eat an apple but nothing else and there are some students each of whom must eat a pear but nothing else. This is not an available inference from the statement. FC effects from the disjunction operator need an existential operator that does not have wide scope over a universal operator like *must*.

Consider another example. In (23), the disjunction operator is embedded in the complement of the verb *believe*, which is in the scope of *some*. In this example, we can get the SI that no students believe that Mary ate both fruits. On the other hand, we cannot get the expected FC effects from the disjunction operator to the existential quantifier *some*.

(23) Some students believe that Mary ate an apple or a pear.
+> No students believe that Mary ate both fruits. (SI)
+⊁ Some students believe that Mary ate an apple. *(FC)*
+⊁ Some students believe that Mary ate a pear.

We do not get the inference that some students believe Mary ate an apple and that some students believe Mary ate a pear. This shows that FC effects arise locally.

When an existential quantifier occurs in the complement clause of *believe*, we can get the expected FC effects:

(24) John believes that some people ate an apple or a pear.
+> John does not believe that any people ate an apple and a pear.
+> John believes that some people ate an apple.
+> John believes that some people ate a pear.

Here we can get the global SI that John does not believe that some people ate an apple and a pear. We can get FC effects within the local context in which an existential quantifier is located.

One interesting fact is that an existential quantifier does not block FC effects from going over it:

(25) It may be the case that Mary sometimes eats an apple or a pear. (may > sometimes > or)
+> It may be the case that Mary sometimes eats an apple. *(FC)*
+> It may be the case that Mary sometimes eats a pear.

(26) Some students may eat an apple or a pear. (some > may > or)
+> Some students may eat an apple. *(FC)*
+> Some students may eat a pear.

Here the intermediate existential quantifiers *sometimes* and *may* do not block FC effects from going over them to the existential quantifier *may* and *some*, respectively. This does not mean that the intermediate existential quantifiers do not play any role. I suppose that FC effects primarily arise from the first existential quantifier over the disjunction structure and that the rest of the process is a separate one. Once FC effects arise through an existential quantifier that has immediately wide scope over the disjunction operator, the FC effects can be projected to whatever operators have wide scope over the existential quantifier, unless it leads to a contradiction:

(27) It must be the case that Mary sometimes eats an apple or a pear.
+> It must be the case that Mary sometimes eats an apple. (FC)
+> It must be the case that Mary sometimes eats a pear.
+> It may be the case that Mary sometimes eats an apple. (FC effects entail these)
+> It may be the case that Mary sometimes eats a pear.

(28) All students may eat an apple or a pear. (all > may > or)
+> All students may eat an apple. (FC)
+> All students may eat a pear.
+> Some students may eat an apple. (FC effects entail these)
+> Some students may eat a pear.

This shows that FC effects are blocked from being projected by the first non-existential operator over a disjunction structure, preferably combining with the meanings of the rest of sentences.

From the comparisons of SIs and FC effects in relation to non-existential operators over a disjunction structure, we can see that SIs behave globally, while FC effects behave locally. This indicates that the two types of inferences are different.

3.3. Projection of Local Implicatures

Sauerland (2004) assumes that an alternative set of *or* is {and, L, R, or}. This has the effect that the disjunction operator does not introduce a local context. The operators L and R make each disjunct treated as if they were not embedded in a disjunction structure. This makes the disjunction operator transparent for the projection of SIs. Consider a more complex case where a disjunction structure or_e is embedded in another disjunction structure or_m:

(29) a. John sang or_edanced, or_m Mary bought a pen or_e a book, for their brother.
+> John did not sing and dance.
+> Mary did not buy a pen and a book.

b. Every boy sang or_e danced, or_m every girl bought a pen or_e a book, for their brother.
+> Not every boy did both.
+> Not every girl bought both.

Here again each disjunction operator or_e yields SIs and they can be considered to be SIs of the whole statement. In this respect a disjunction structure behaves like a conjunction structure in the projection of SIs:

(30) a. John sang or_e danced, and Mary bought a pen or_e a book, for their brother.
+> John did not sing and dance.
+> Mary did not buy a pen and a book.

b. Every boy sang or_e danced, and every girl bought a pen or_e a book, for their brother.
+> Not every boy did both.
+> Not every girl bought both.

From the two conjunction structures including smaller disjunction structures, we get the same SIs as (29.a-b). This shows that if an expression is embedded in a disjunct, the disjunction operator does not have any blocking effect on SIs in their projection out of the disjuncts at all.

SIs are clearly contrasted with FC effects in this respect. When two disjunction operators are embedded in another disjunction operator, the FC effects from each of the embedded disjunction structures do not become the inferences of the whole sentence:

(31) Some boys sang or_e danced, or_m some girls bought a pen or_e a book, for their teacher.
+⊁ Some boys sang.
+⊁ Some boys danced.
+⊁ Some girls bought a pen.
+⊁ Some girls bought a book.
+> Some boys sang and some boys danced, or some girls bought a pen and some girls bought a book.

(31) shows that the FC effects from each embedded disjunction structure are just embedded in the larger disjunction structure. In (31), the last implicature is the one in which the FC effects from each of the disjunction structures stay within the scope of or_m. This is contrasted with the case where two disjunction structures are conjoined:

(32) Some boys sang or danced, and some girls bought a pen or a book, for their teacher.
+> Some boys sang.
+> Some boys danced.
+> Some girls bought a pen.
+> Some girls bought a book.

In this case all FC effects from the embedded disjunction structures are projected. Then we need to be able to account for why the disjunction operator is transparent for SIs, but not for FC effects.

To get an answer to this question, we need to compare the disjunction operator with another truth-functional structure like a conditional. A SI from an expression embedded in a conditional structure is not

generally projected to the main context. In principle, the antecedent clause is a condition for the consequent clause to hold. Therefore it does not have to be a condition for the stronger alternative of the consequent clause. However, in most cases the stronger alternative is closely related to the original consequent clause. Moreover, we get a SI only when the original consequent clause holds. This makes the antecedent clause also related to the stronger alternative, which has the effect of blocking a SI from the consequent clause from being projected. In (33), the consequent clause may yield the SI that you may not eat both fruits. But this cannot be a SI of the whole statement:

(33) If your father brings fruits, you may eat an apple or a pear.
+$\not>$ You may not eat both.
+> If your father brings fruits, you may not eat both.

The permission (or prohibition) is valid only when fruits are brought. This yields a local SI.

We can see a similar result in FC effects. The FC effects from the consequent clause unless the antecedent clauses are satisfied beforehand:

(33′) If your father brings fruits, you may eat an apple or a pear.
+$\not>$ You may eat an apple.
+$\not>$ You may eat a pear.
+> If your father brings fruits, you may eat an apple.
+> If your father brings fruits, you may eat a pear.

From the discussions, we should say disjunction structures are opaque only for FC effects, while conditionals are opaque for both SIs and FC effects. More close scrutiny, however, reveals that the disjunction operator is not inherently transparent for SIs, either. There are cases where a SI from one disjunct should be accepted only when the other disjunct does not hold. In such cases, even SIs must remain within the scope of the disjuncts where they arise. Here are such examples.

(34) a. John will get a free pass for all movies or see some blockbusters.
b. The weather is cold in this area, but the weather is warm

or (even) hot in South-East Asia.

In (34.a), the use of *some* generates the implicature that John will not see all movies. But it cannot be a SI of the whole statement because it would contradict the first disjunct and it would make the use of a disjunction structure unnecessary. Thus, in Sauerland's analysis, the implicature would have to be canceled. However, we still think that the implicature from the use of *some* holds within the second disjunct: the disjunctive sentence is understood as meaning that John will get a free pass for all movies or see some, *but not all*, blockbusters. A similar observation can be made in (34.b). By the use of *warm, sp* might implicate that the weather is not hot, but it should stay within the scope of the first disjunct.

However, a global approach like Sauerland (2004) assumes the operators L and R, and if primary implicatures from them are not strengthened, he assumes they are simply canceled.

(35) a. ¯¬K (John will get a free pass for all movies)
b. ¯¬K (John will see some blockbusters)
c. ¯¬K (John will get a free pass for all movies and see some blockbusters)

(35.a) is not strengthened because if strengthened into a 'K¬' implicature, *sp* simply should have uttered the sentence with only the second disjunct. (35.c) is not strengthened either, because it can be taken to have the same strength as (35.a). (35.b) is not either, because then it would contradict the whole statement itself. Hence no implicatures should arise. However, we have to assume that if John sees only some blockbusters, he will not be able to see all blockbusters.

This shows that the general projection of SIs from a disjunction structure we have observed in (29) does not come from the inherent properties of the disjunction operator, but from the pragmatic tendency that in a disjunction structure, disjuncts tend to be independent of each other. When two disjuncts are related to each other, one disjunct can play a role in blocking a global SI from arising from the other disjunct.

Conditionals are normally opaque for SIs because in conditionals, antecedent clauses and consequent clauses are not supposed to be in-

dependent of each other. Nevertheless, there are cases where SIs from consequent clauses can be projected. Suppose that some apples are going to be given to John if he finishes his work by 2 o'clock:

(36) i. If John finishes his work by 2 o'clock, he will get some of the apples.

ii. a. John will not get all of the apples
b. If John finishes his work by 2 o'clock, he will get some, but not all, of the apples.

(37) If you want to eat some fruits, you may eat an apple or a pear.
+> You may not eat both.

Here some of the apples are the maximum reward anyway. Then he will not be given all apples, regardless of whether he finishes the work by 2 o'clock. For this reason, (36.iib) can be strengthened into (36.iia). In (37), *sp* tries to allow *hr* to eat some fruit. In this case, the antecedent clause conveys a trivial condition because the permission itself is based on the assumption of *hr*'s desire to eat some fruit. Thus it does not block a SI from being projected out of the consequent clause.

FC effects can also be projected from the consequent clause of a conditional structure, if the antecedent clause conveys a trivial condition. In (37′), *sp* gives *hr* the permission to eat some fruit, assuming the antecedent clause is trivially satisfied. In this case, the FC effects from the consequent clause are projected:

(37′) a. You may eat an apple.
b. You may eat a pear.

So far I have shown that disjunction structures and conditionals are not quite different. Apparent differences are just general tendencies. In the two constructions, it is a contextual matter whether an implicature is projected out of a local linguistic context, or whether or not we get a global or local implicature.

4. No Syntactic Phenomenon

We have discussed local and global calculation of implicatures and projection of implicatures with respect to operators in sentences. It sounds as if an implicature were treated like a scope phenomenon. In fact, Chierchia (2002) and Fox (2006), SIs are calculated locally by applying the negation operator or the *exh* operator to a syntactic constituent. However, there are cases that show that calculating implicatures is not a matter of syntactic scope. A relative clause is a syntactic island and a scalar expression in it cannot have wide scope. Still we can get a global implicature from the use of an expression in a relative clause. In (38), suppose that *or* gives rise to an alternative set {and, L, R, or}, as Fox (2006) assumes, and we get the four alternatives {φ(m ∨ p), φ(m), φ(p), φ(m ∧ p)}, where m is *math* and p is *physics*.

(38) A teacher who talked with some students who flunked math or physics went home late.
+≯ No teacher who talked with some students who flunked both went home late.
+> No students flunked both.

They show the following ordering:

(39) $Alt(\varphi(m \vee p)) = \varphi(m \vee p) \dashv \begin{cases} \varphi(m) \\ \varphi(p) \end{cases} \vdash \varphi(m \wedge p)$

In this example, the strongest alternative φ(m ∧ p) is innocently excludable, while φ(m) and φ(p) are not. However, the negation of the strongest alternative does not lead to the right SI. There is no reason that a teacher who talked with a student who failed both subjects went home early, when a teacher who talked with a student who failed only one of them.

(38′) A teacher who talked with some students who flunked math or physics went home late.
+≯ ¬(A teacher who talked with some students who flunked

math went home late) (¬φ(m))
+≯ ¬(A teacher who talked with some students who flunked physics went home late) (¬φ(p))
+≯ ¬(A teacher who talked with some students who flunked math and physics went home late) (¬φ(m ∧ p))
= No teacher who talked with any students who flunked math and physics went home late.

Instead, we seem to be able to get the inference that no students flunked both, if we get any. Even if *sp* believes it, she does not have to utter a sentence that the inference arises globally. This inference does not arise even if we introduce the *exh* operator locally. The operator is supposed to apply to a sentence of semantic type <s,t>. The only plausible local position for the operator is the smaller relative clause:

(38′) A teacher who talked with some students who Exh (x flunked math or physics) went home late.
= A teacher who talked with some students who flunked math or physics, but did not fail both, went home late.

This does not yield the inference that no students flunked both. Moreover, we can get the inference that some students flunked math and some flunked physics too, as FC effects, and these come from the NP *some students who flunked math or physics*, not from a clause.

The inference we get in (38) shows that some implicatures do not come from syntactic structures and syntactic operators. The only sources we get such implicatures from are some chunks of sentences, but not chunks that localists use nor in the way localists use them. Structures should be more fine-grained than syntactic structures and the negation operator has to be able to apply to a non-clausal constituent.

Consider another example in which a disjunction structure is embedded in a syntactic island:

(40) Some students who picked a blue ribbon or a yellow one got another chance for an overseas trip.
+> No students picked a blue ribbon and a yellow one.
+> The students who got another chance for an overseas trip did not pick both ribbons.

+≯ No students who picked both a blue ribbon and a yellow ribbon got any chance for an overseas trip.

We can get a couple of plausible inferences from the use of the disjunction operator. A first one is that no students picked both a blue ribbon and a yellow ribbon, and the other is that the students who got another chance for an overseas trip did not pick both ribbons.

(41) a. No students picked both a blue ribbon and a yellow ribbon.
b. The students who got another chance for an overseas trip did not pick both ribbons.

In neither a global analysis nor a local analysis do we get the two inferences. In a global approach, we get the SI that no students who picked both a blue ribbon and a yellow ribbon got any chance for an overseas trip. In a local analysis, we get the meaning that some students who picked a blue ribbon or a yellow one, but not both, got another chance for an overseas trip. The second one, in particular, is almost impossible to calculate, if you resort to the syntactic structure. This shows that a SI is not a matter of syntactic structure.

When a disjunction structure is embedded deeply, it is not clear how SIs are calculated. On the other hand, it is clear how FC effects are calculated. As we have seen above, they arise through the first existential quantifier over the disjunction structure. Thus it does not matter how deeply a disjunction structure is embedded. In (25), the expression *some students who flunked math or physics* implicates that some students flunked math and some students flunked physics. Similarly, in (40), the sentence implicates that some students picked a blue ribbon and some picked a yellow ribbon. Even though the FC effects arise from within the relative clause, they can be projected to the main context in these examples. This shows that FC effects cannot be explained syntactically. As a matter of information, something in a relative clause can change the context just like anything in the main clause, unless they are embedded in a semantic operator that introduces an opaque context.

So far I have discussed SIs and FC effects with respect to the global vs. local issue. We can summarize the observations:

A. SIs are basically global, while FC effects are local.
B. In this respect, Sis and FC effects belong to different types of inferences.
C. Local implicatures, whether Sis or FC effects, can be projected from disjunction structures or conditionals if contexts allow them to.
D. Implicatures cannot be calculated based on syntactic structures.

Contexts are one of the main factors in determining implicatures, but we are interested in principles in calculating implicatures. Since context is an independent factor, it should be excluded in deciding what principles we need to calculate implicatures. In the next section, I will propose a new analysis that can account for these observations.

5. Structured Contexts and Implicatures

5.1. DRSs as Semantic Representations for Alternative Meanings

I have shown that implicatures cannot be accounted for in any syntactic analysis. This is in line with the standard view of implicatures. We make pragmatic inferences from meanings of statements. And implicatures from a statement are based on inferences on *sp*'s information state when she makes that statement. One word in caution is that by "*sp*'s information state"' I mean *sp*'s information state in the common ground. A hearer has *sp*'s information state only in the common ground, but he has to make inferences on *sp*'s information state from her statements, not knowing what her personal information state is like. But in the common ground, *sp*'s information state is normally the same as *hr*'s, unless they overtly disagree on something.

When a speaker makes a statement p in an information state s as a common ground, p is supposed not to be supported in s so that it can be informative in s. Thus it changes the input information state non-trivially into a new one s′:

(42) p is felicitously uttered in an information s if s is updated into s′ s.t. p is supported in s′ and $s \neq s'$.
(p is supported in s iff s+p = s.)

Unless the statement is a lie, it must be supported in *sp*'s personal information state. But all we have is *sp*'s information state in the common ground, and with the new statement, *hr* updates *sp*'s information state in the common ground and if there is no problem with it, he also updates his own too.

Semantic entities like possible worlds, however, are extremely fine-grained, and they can be structured independently of the statement itself, reflecting contextual information. This leads to different inferences for the same statement. But it is cumbersome to deal with semantic entities directly. And whether we get a certain implicature depends on information structures that are affected by expressions and their saliency. For this reason, we have to consider expressions and information structures they make. On the other hand, we have seen that syntactic structures are not fine-grained enough to deal with implicatures. We need devices that are more fine-grained but can be dealt with more efficiently than semantic entities. One solution is to use semantic representations.[6] In this paper, the meaning of a sentence is represented as a discourse representation structure (DRS) in the framework of Kamp (1981) and Kamp and Reyle (1993). One reason is that it is more fine-grained than predicate logic or any other classical logic. But we do not need DRSs. Any dynamic interpretations will do. One main reason I adopt the DRT is that DRSs are easy to use in visualizing the explanations I want to make.

For the discussion of implicatures, I will assume that a DRS is interpreted with respect to an information state. For an information state $s \subseteq W \times G$, a DRS is supported in an information state if the following condition is met:

(43) Given a model <W,D,F,G>, where W is a set of possible worlds, D a set of individuals, F an interpretation function of constants, and G a set of assignments,
   a. s supports a DRS <var,con> iff every <w, g∪var> in s supports every condition in con.
   b. <w,g> supports $P_v(x)$ iff $_g(v)=w$ and $g(x) \in F(P)(w)$[7]

6) One possible objection to the use of semantic formulas might be that they are not necessary in semantic interpretation. But as I said, there are semantic entities behind semantic formulas, and when we deal with semantic entities, we are actually dealing with semantic entities.

c. <w,g> supports '<var(i), con(i)> $\vee$ <var(ii), con(ii)>' iff
<w, g$\cup$var(i)> supports every condition in con(i) or
<w, g$\cup$var(ii)> supports every condition in con(ii).
d. <w,g> supports '<var(i), con(i)> $\Rightarrow$ <var(ii), con(ii)>' iff
<w, g$\cup$var(i)> does not support every condition in con(i)
or <w, g$\cup$var(i)$\cup$var(ii)> supports every condition in con(ii).

Except that I assume a DRS is interpreted with respect to an information state and a variable for possible worlds is introduced, I follow the standard interpretation rules.

One crucial reason I interpret a DRS with respect to an information state is that projection of implicatures is a matter of a composition of semantic entities like possible worlds or individuals or a matter of semantic relations, not a matter of structure. Therefore the source of an implicature from a sentence is not a syntactic structure of the sentence, but the semantic interpretation of that sentence. In this respect, my analysis is **semantic analysis**. This is the reflection of our position against the idea that implicatures are derived by assuming an operator in a syntactic structure.

I also assume the standard accessibility path for anaphoric dependency:

(44) Given a <var, con>, a variable in var(i) is accessible for a variable in var(ii), but a variable in var(ii) is not for a variable in var(iii), and not vice versa, either, in one of the following configurations:
<var(i), ...<var(ii),... >...>
<var(i),<var(ii),...>$\vee$<var(iii),...>>
<var(i), ...> $\Rightarrow$/$\forall$<var(ii),...>

A variable in the var of a DRS is accessible for any variable in the conditions in it. In a disjunction structure, a variable in one disjunct is not accessible to a variable in another disjunct. In a conditional, a variable introduced in the antecedent clause is accessible for a variable in the consequent clause, but not vice versa.

---

7) A set of variables var includes a variable v for possible worlds.
The idea that a previous statement becomes a presupposition for a statement that follows comes from Stalnaker (1978).

When a sentence is interpreted, we assume that it is done in some steps with respect to the main DRS. By this I mean that a sentence is translated into a DRS within the main DRS. A sentence is interpreted as follows:

A. A sentence is first interpreted separately with all new discourse referents, and then it is incorporated into the main DRS by equating the discourse referents of anaphoric expressions with some discourse referents already introduced in the matrix DRS.
B. Suppose that ϕ contains a scalar alternative α and $\beta \in \text{ScalSet}(\alpha)$ and $\phi[\beta/\alpha]$ is stronger than ϕ. Then the DRS from $\neg\phi[\beta/\alpha]$ is a tentative SI, and it is incorporated into the main DRS.
C. A tentative inference from a sentence is added to the main DRS and see if it is projected along the accessibility path under the condition that dynamically bound discourse referents do not become free.
D. The resulting interpretation does not violate general pragmatic conditions like Grice's maxims of conversation.
E. We do not consider contexts when we talk about how to derive SIs or FC effects because we talk about the principles we follow in calculating SIs or FC effects. However, derived implicatures can be canceled or modified by contextual factors because they are pragmatic phenomena.

Here I mention how a SI is derived. The process of projection of SIs reminds us of the presupposition projection discussed in van der Sandt (1992) and Kamp, Genabith and Reyle (2011). How FC effects are calculated in a DRS will be discussed below. Now consider actual examples to see how this way of interpretation accounts for them.

5.2. Global Approach and Contexts

I have claimed that SIs are basically global phenomena. Then the next question is how local implicatures are derived in a global analysis. Consider a case where a global implicature arises first. When (7) is uttered and interpreted, we get the DRS in (45). This should be added to the previous DRS, but I will assume that this is the first statement, and the DRS constitutes the main DRS.

(45)

v x Y k		
George(x) $fries_v$(Y) $apple_pie_v$(k)		
Z Z ⊆ Y ate_v(x,Z)	∨	 ate_v(x,k)

There are two stronger alternative DRSs that may not be supported in the information state s updated by the literal meaning. This means that they may not hold in some of the possible worlds in s. In this case we are in an information state in which only primary implicatures are supported in Sauerland's terms. But it is also possible that they hold in none of them, or *hr* assumes so. In this case, we get a SI. Even in the latter case, the negation does not have to apply to the whole alternative DRS. Take the DRS (46.i) for example.

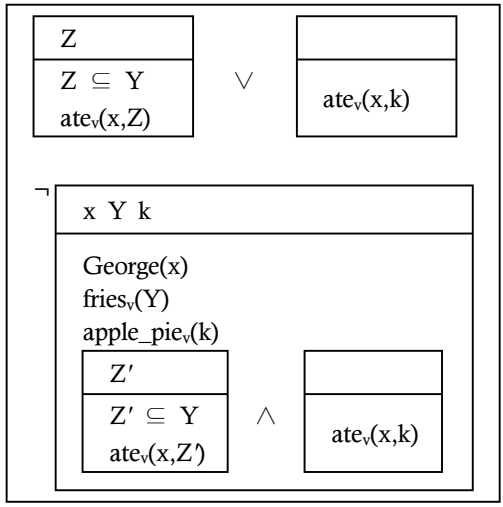
(46) (i) ¬

x Y k		
George(x) $fries_v$(Y) $apple_pie_v$(k)		
Z′ Z′ ⊆ Y ate_v(x,Z′)	∧	 ate_v(x,k)

In this DRS, the discourse referents x, Y and k are already bound because they are already introduced together with the conditions as presuppositions by the original sentence. Therefore if it is embedded in (45), the DRS is like the following:

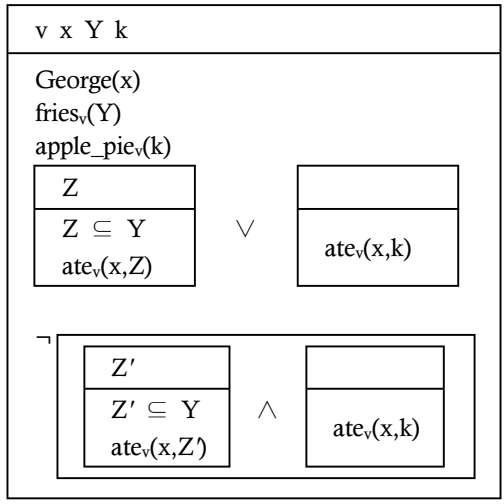
(46) (i′)

v x Y k
George(x) $fries_v$(Y) $apple_pie_v$(k)



Eliminating those presuppositions we get the DRS (46.i′), to which the negation operator applies:

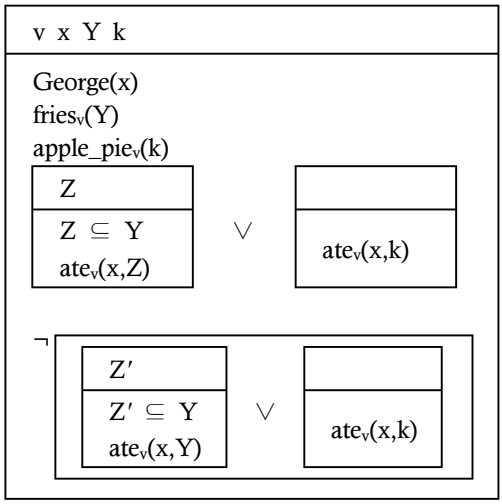
(46) (i″)



This leads to the SI that it is not the case that he (= George) ate some of them (= the fries) and ate it (= the apple pie), that is, that George did not do both.

A second stronger alternative DRS is (46.ii), after stripping presuppositions.

(46) (i′′)



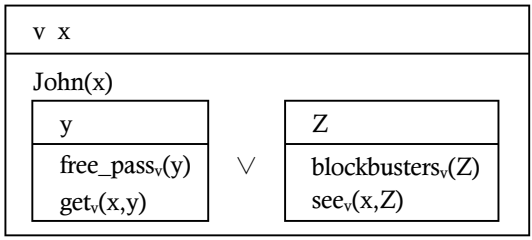
This does not lead to the SI that he (= George) did not eat some of them (= the french fries) or it (= the apple pie). The second disjunct does not play a role because it is already mentioned in the actual statement. For this reason, the effect of (46.ii) is that George did not eat all of the fries:

(47) s − s ∩ {w| George ate all of the fries or the apple pie}
= s − {w| George ate all of the fries}

Since the two disjuncts are independent of each other, the set of possible worlds in which George did not eat all of the fries can overlap with those in which he ate the apple pie, if the information state includes possible worlds in which George ate the apple pie. It means that a SI from the disjunct does not stay within it. This is true even if the possible worlds in which George ate both are excluded. This has the effect of a global implicature. We can also get the inference that George did not eat all of the fries and the apple pie, but the effect is just the combination of the other two implicatures.

Next, look at a case like (34.a), where a local implicature arises. The sentence is translated into the following DRS, which I assume becomes the main DRS.

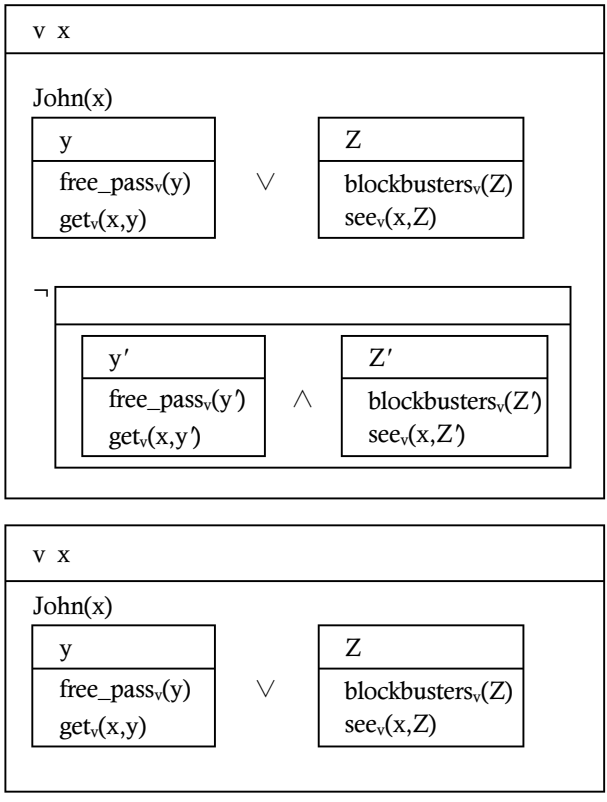
(48)



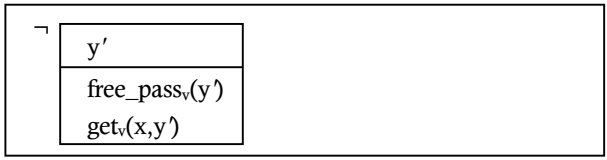
In the information state after the statement is interpreted, there are some possible worlds in which John will get a free pass for all movies and some in which John will see some blockbusters, and possibly more. The former set of possible worlds is a subset of the latter.

For this DRS, we can think of two potential SIs from two stronger alternatives. From the use of *or*, we can get a potential SI (49.i) which is embedded in the main DRS, after eliminating the presupposition that x is John:

(49) (i)



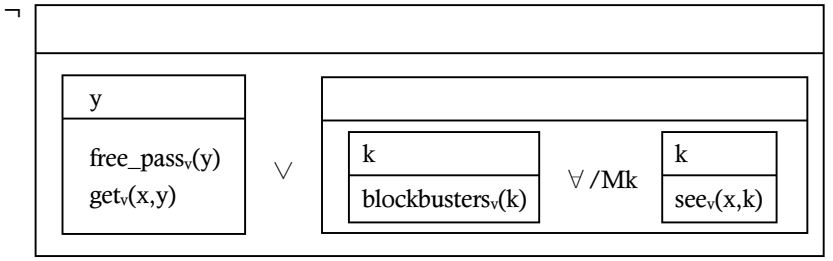
=



From (49.i), we can get the implicature that he (=John) will not both get a free pass for all movies and see some blockbusters. This has the effect of eliminating possible worlds in which John will get a free pass for all movies. This should have the effect of implicating that John will not get a free pass for all movies. However, this is not what happens. The reason is that if it happened, the first disjunct would never hold, which would lead to the violation of the maxim of manner. *Sp* would have to make a statement only with the second disjunct. Thus in the information state, there should be some possible worlds in which John will get a free pass for all movies. On the other hand, there should be some possible worlds in which John will only see some but not all blockbusters. Otherwise, the second disjunct would never hold and *sp* should violate the maxim of manner. Therefore, (49.i) does not yield a SI. Still we get the inference that there are some possible worlds in which John will get a free pass for all movies and there are some possible worlds in which John will see some, but not all or many, blockbusters, based on the maxim of manner.

From the use of some, we can get a potential SI(49.ii).

(49) (ii)



From this, we can get the same inference as a SI. In the information state, we need to have some possible worlds in which John will get a free pass for all movies, as I mentioned. Then the only difference between the original statement and (49.ii) is a set of possible worlds in

which John will see more than just "some" blockbusters. Thus (49.ii) only has the effect of excluding possible worlds in which John will see more than just "some" blockbusters, among the possible worlds in which John will not get a free pass for all movies. That is, it implicates that John will get a free pass for all movies or see some but not more blockbusters. Even if we calculate the implicature globally, it has the effect of a local implicature.

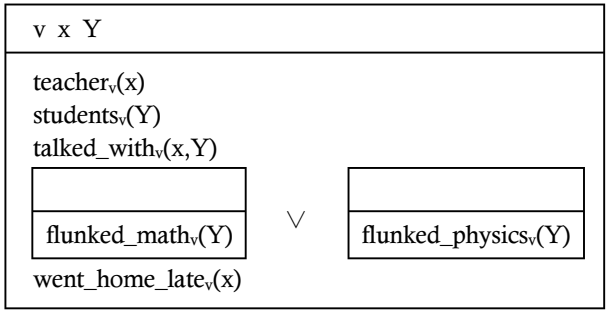
We can say the same thing about conditionals, as I mentioned in the discussion of (33) and (36-37). Since I have already explained the basic idea, I will not discuss them here again.

So far we have seen cases where a scalar expression is used in the scope of a truth-functional operator. Such an operator is one that introduces a semantically characterized context rather than a syntactic one. Let's consider an example in which a disjunction structure occurs in a syntactic island:

(38) A teacher who talked with a student who flunked math or physics went home late.

Here the disjunction structure is embedded in the relative clause, but semantically it is not different from a disjunction structure in the matrix clause in that it is not embedded in the DRS. Therefore a semantic analysis of SIs is allowed to account for why a disjunction structure in a relative clause behaves like a disjunction structure in the matrix clause in yielding a SI:

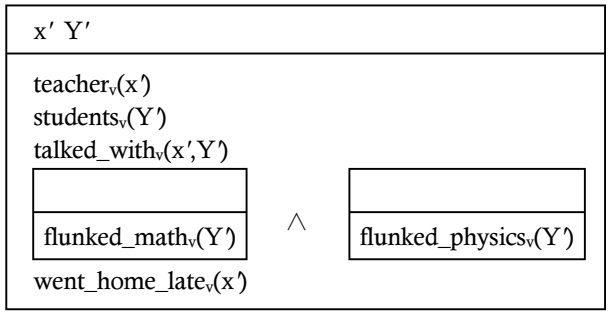
(50)



A SI can be obtained by negating a stronger alternative statement. We can think of various stronger alternatives. I will start from the follow-

ing:

(51) ¬



After the original statement is interpreted, the information in it can become presuppositions for the implicatures that are later added to it.[8] When the implicature is added, x′ and Y′ can be free or bound by x and Y in the main DRS. Therefore we can consider the following three cases:

A. x′ and Y′ are free:

This is just the case where we can get a SI from the DRS above as it is. From this we can get the following implicature:

(52) No teacher who talked with any students who flunked math and physics went home late.

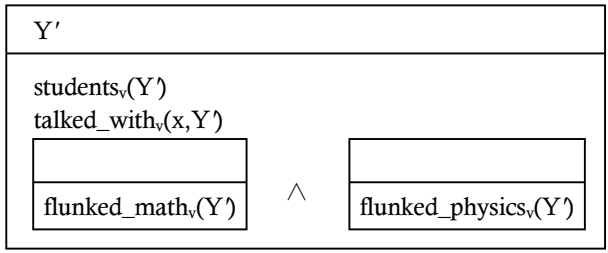
However, this is not plausible and we can ignore it.

B. x′ is bound by x and Y′ is free:

If x′ is bound by x, the conditions 'teacher(x′)' and 'went_home_late (x′)' are already established in the main DRS and the negation operator only applies to the following:

8) The idea that a previous statement becomes a presupposition for a statement that follows comes from Stalnaker (1978).

(53) ¬



Even though x is included in the scope of the negation operator, it is dynamically bound by the discourse referent introduced by an indefinite 'a teacher'.[9] Therefore the SI has the following meaning:

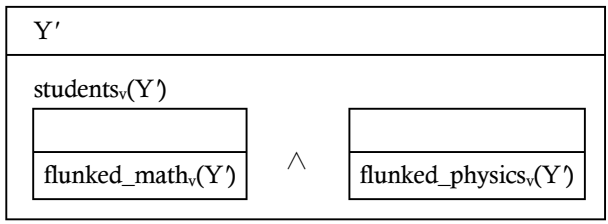
(54) He (= the teacher) talked with no students who flunked both subjects.

This SI can be true in two possible ways. First, there were some students who flunked both subjects, but the teacher did not talk with any of them. In this case the SI has the following effect:

(55) A teacher who talked with some students who flunked math or physics, but did not talk with any students who flunked math and physics, went home late.

Second, there were no students who flunked both subjects and the teacher did not talk with any such students. The second meaning can be obtained by removing the condition 'talked_with(x′,Y′)':

(56) ¬



9) This has the effect of embedding the meaning of *talked with some students who flunked math or physics* in the relative clause, as in the following:

i. A teacher came. He brought a small box.

Here the pronoun *he* is dynamically bound by *a teacher*.

From this we can get the following SI:

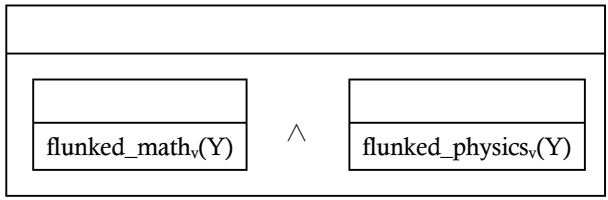
(57) No students flunked math or physics.

This is what we can get only from a semantic analysis. If it is a valid inference from the statement, it indicates that we need a semantic analysis I propose.

C. x′ and Y′ are bound by x and Y, respectively:

If x′ and Y′ are bound by x and Y, the DRS for a SI becomes the following:

(58) ¬



Since Y is dynamically bound by the discourse referent introduced by 'some students', the SI gets the following meaning:

(59) The students did not flunk both subjects.

Ultimately this has the effect of a local implicature:

(60) A teacher who talked with some students who flunked math or physics, but not both, went home late.

Even though the SI is added to the meaning of the statement, the discourse referents in it can be dynamically bound by some discourse referents in the statement, which has the effect of embedding the SI in a relative clause.

D. Y′ is bound by Y and x′ is free:

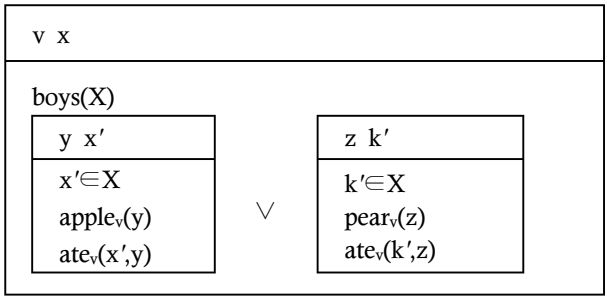
This is not a possible case when each student talked with only one teacher. And if Y′ were bound and x′ free, the disjunction structure it-

self would have wide scope over the negation operator.

5.2. Local Meaning Contributions from Disjuncts

FC effects are locally calculated from the meanings of sentences. To see how it goes, consider (5), which is interpreted as follows:

(61)



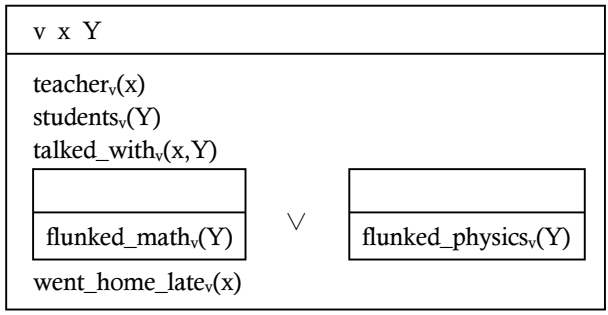
FC effects arise from an existential quantifier that has immediately wide scope over a disjunction structure. In this example, X is introduced in a DRS that is accessible to the disjunction structure and it is involved in some conditions in each of the two disjuncts. There is no other variable that satisfies such conditions. And it is implicated that there are some boys who ate an apple (but not a pear) and some boys who ate a pear (but not an apple). Therefore FC effects can be expressed as follows:

(62) FC effects:
A first variable in the path of accessibility that is involved in every disjunct of a disjunction structure has a separate value exclusively for each disjunct DRS.

In the example at hand, a variable that is involved in the two disjuncts and which is introduced in a larger DRS is X. Among the various values of X that verify the whole DRS, there must be some values which verify one disjunct DRS but not the other for each disjunct DRS. In this case we can get the separate meaning contribution of each disjunct to the interpretation of the quantifier *someboys*. From this we can get the implicature that some boys ate an apple, but not a pear and some boys ate a pear but not an apple.

When a disjunction structure is embedded in a relative clause, as in (38), the meanings of the expressions in the relative clause go into the main DRS:

(63)



A first variable in the accessibility path from the disjunction structure that is involved in the disjunction structure is Y. The other conditions can be taken to be presuppositions for calculating FC effects, since implicatures are calculated after we get the literal meaning. If each disjunct DRS makes a meaning contribution to the interpretation of the variable, we get the following implicature:

(64) Some of the students flunked math but not physics.
Some of the students flunked physics but not math.

Even though the disjunction structure occurs in a relative clause, it has no effect of being embedded because all variables and conditions introduced in the relative clause go into the main DRS. This shows that purely syntactic structures play no role in yielding implicatures.

Consider cases where FC effects are confined in the scope of an operator:

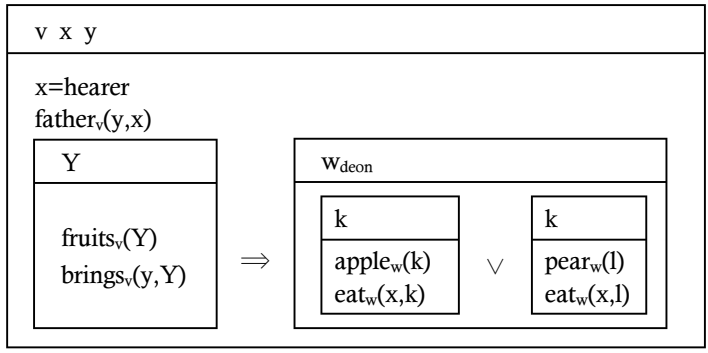
(31) Some boys sang or$_e$ danced, or$_m$ some girls bought a pen or$_e$ a book, for their teacher.

(33) If your father brings fruits, you may eat an apple or a pear.

(36) If John finishes his work by 2 o'clock, he will get some of the apples.

Among these, I will discuss the second example. It gives rise to the following DRS:

(65)



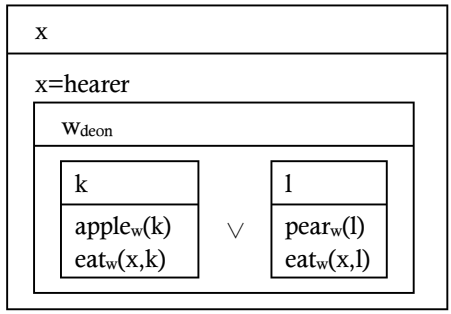
To express the meaning of permission, we need to deal with deontic alternatives. When we interpret *may*, I will analyze it as introducing a new variable over deontic alternatives. Each disjunct makes a meaning contribution to the interpretation w_{deon}, which means that there are some deontic alternatives in which one disjunct is verified but not the other. This yields the following FC effects:

(66) If your father brings more fruits, you may eat only an apple.
If your father brings more fruits, you may eat only a pear.

In this case, the condition expressed by the antecedent clause is valid for any permission to eat a fruit. This has the effect of restricting the FC effects to the consequent clause of the conditional.

But the conditional is like 'If you want to eat some fruit, you may eat an apple or a pear' has the FC effects of 'you may eat an apple' and 'you may eat a pear', because giving the permissions already presupposes that *hr* wants to eat some fruit in question. That is, *sp* assumes that *hr* wants to eat some fruit, and the antecedent clause of the conditional is trivially satisfied in the current information state. In such an information state, (65) has the same effect as the following DRS:

(67)



Therefore the conditional behaves like a disjunction structure in the main DRS.

6. Conclusion

In this paper I have shown that SIs are global phenomena, while FC effects are local. In this respect, they should be considered to belong to two different inferences. In such an analysis, one possible problem is that there are cases where it seems that local implicatures are necessary when operators introduce local contexts where an implicature arises. However, this is not what really happens. When we seem to get local implicatures, the information state reflects some contextual information, which makes a global implicature get the effect of a local implicature. This does not weaken the analysis. Implicatures are calculated based on principles, independently of contexts. Contexts should be one of the main factors in determining implicatures. But they do not have to be part of the principles for calculating implicatures.

In addition, I have shown that implicatures, SIs or FC effects, are semantic and pragmatic phenomena, and no syntactic analyses can account for them properly. Some implicatures can arise from within a syntactic island, but they may not have the effect of embedding if they are not embedded semantically. Purely syntactic structures do not play a role in calculating an implicature. In this paper, semantic interpretations of statements are sources for calculating implicatures.

Reference

Chierchia, G. (2004). Scalar implicatures, polarity phenomenon, and the syntax/pragmatics interface. In A. Belletti, editor, *Structures and Beyond*, pages 39-103. Oxford University Press, Oxford.

Eckardt, Regine. (2007). Licensing 'or'. In Uli Sauerland & Penka Stateva (eds.) *Presupposition and Implicature in Compositional Semantics*. Palgrave Macmillan: pp. 34-70.

Fox, D. (2006). Free choice and the theory of scalar implicatures. manuscript.

Gazdar, G. (2000). Pragmatics: Implicature, Presupposition, and Logical Form. Academic Press, New York, 1979.

Geurts, B. (2005). Entertaining Alternatives. Disjunctions as Modals. In: Natural Language Semantics 13, 383-410.

Grice, H. P. (1975). Logic and conversation. In Donald Davidson and Gilbert H. Harman, editors, The Logic of Grammar, pages 64-75. Dickenson Publishing Co., Encino, California.

Horn, L. R. (1972). *On the Semantic Properties of Logical Operators in English.* Ph D thesis, University of California, LA.

Horn, L. R. (1989). A Natural History of Negation. University of Chicago Press, Chicago.

Horn. L. R. (2005). The border wars: A neo-gricean perspective. In K. von Heusinger and K. Turner, editors, *Where Semantics Meets Pragmatics*. Elsevier.

Kamp, H. (1973). Free choice permission, *Proceedings of the Aristotelian Society* 74, 57-74.

Kamp, H. (1981). A Theory of Truth and Semantic Representation. In J. Groenendijk and others (eds.). *Formal Methods in the Study o fLanguage.* Amsterdam: Mathematics Center.

Kamp, Hans and Uwe Reyle. (1993). *From Discourse to Logic*. Kluwer Academic Publishers.

Kamp, Hans, Josef van Genabith, and Uwe Reyle. (2011). Discourse Representation Theory. In Gabby and Guenthner (eds.), *Handbook of Philosophical Logic*. Springer: Dordrecht.

Kratzer, Angelica and J. Shimoyama. (2002). Indeterminate phrases: The view from Japanese. In Otsu, Y. (ed.), *The proceedings of the third Tokyo conference on psycholinguistics*. Tokyo: HituziSyobo. 1-15.

Krifka, M. (1995). The semantics and pragmatics of polarity items. *Linguistic Analysis* 25, 209-257.

Larson, R. (1985), On the Syntax of Disjunction Scope. *Natural Language and Linguistic Theory* 3, 217-264.

van der Sandt and Rob A. (1992). Presupposition Projection as Anaphora Resolution. *Journal of Semantics* 9, 333-377.

Sauerland, U. (2004). Scalar implicatures in complex sentences. *Linguistics and Philosophy* 27, 367-391.

Simons, M. (1998). *Issues in the Semantics and Pragmatics of Disjunction*. Ph D thesis, Cornell University, Ithaca, NY.

Simons, M. (2005). Dividing Things Up. The Semantics of "or" and the Modal/"or" interaction. In: *Natural Language Semantics* 13, 271-316.

Stalnaker, R. (1978). Assertion. In P. Cole (ed) *Syntax and Semantics 9: Pragmatics.* Academic Press, NewYork.

Zimmermann, T. E. (2000). Free choice disjunction and epistemic possibility. *Natural Language Semantics* 8, 255,290.

Jae-Il Yeom
Department of English Language and Literature
Hongik University
94 Wausan-ro, Mapo-gu, Seoul, 121-791, Korea
Email: jiyeom@hongik.ac.kr

Received: July 5, 2013
Revised version received: July 31, 2013
Accepted: August 12, 2013