# Computing Implicatures: An NRP-based Approach

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**Song, Jae-gyun. 2006. Computing Implicatures: An NRP-based Approach.** *The Linguistic Association of Korea Journal, 14*(2), 217-240. In Song (2005), I claimed that Sauerland's (2004, 2005) and Gazdar's (1979) theory of clausal implicatures were conceptually and empirically inadequate, and then proposed an alternative analysis of clausal implicatures, which is based on the No Redundancy Principle (NRP), instead of the widely accepted Grician first submaxim of Quantity (Quantity-1). The NPR says, "Every meaningful expression, which is overtly said or written in a sentence or a text, must not be redundant: Either it must make a contribution to the truth-conditional interpretation, or its occurrence must be pragmatically licensed." The immediate aim of this paper is two-fold: To show that the NRP can also be applied to the computation of scalar implicatures with minor revisions to Song's (2005) analysis of clausal implicatures, and that the NRP can offer plausible accounts to two specific cases, which the Quantity-1 may have difficulties in handling: the discrepancy between clausal and scalar implicatures in defeasibility and conditional perfection. By doing so, I ultimately explore the possibility that the NRP could replace the Quantity-1 in the computation of implicatures.

**Key Words:** clausal implicatures, No Redundancy Principle, maxim of Quantity, conversational implicatures, scalar implicatures, conditional perfection

## 1. Introduction

Recently, Sauerland (2004, 2005) proposed a computation system that can account for both the clausal and scalar implicatures of a disjunction. He argued that his account of both kinds of implicatures is more satisfactory than Gazdar's

(1979), in that it shows in a more clear and uniform way the relation between the two implicatures: while Gazdar posits two distinct computation mechanisms for clausal and scalar implicatures, his own system uniformly derives the two implicatures from Horn scales, and the only difference between clausal and scalar implicatures in his system is just that the latter is epistemically strengthened from the former.

In Song (2005), focusing on clausal implicatures of a disjunction, I showed that Sauerland's and Gazdar's theory of clausal implicatures are conceptually and empirically inadequate, and then proposed an alternative analysis of clausal implicatures, which is based on what I call "the No Redundancy Principle", instead of the widely accepted Gricean first submaxim of Quantity (Quantity-1). The NRP says, "Every meaningful expression, which is overtly written or said in a sentence or a text, must not be redundant: Either it must make a contribution to the truth-conditional interpretation, or its occurrence must be pragmatically licensed."

The purpose of this paper is two-fold: To show that the NRP can also be applied to the computation of scalar implicatures with some minor revisions to my previous analysis (Song 2005) of clausal implicatures, and then that the NRP can offer plausible accounts to two specific cases, which the Quantity-1 may have difficulties in handling: the discrepancy between clausal and scalar implicatures in defeasibility and conditional perfection.

The plan of this paper is as follows: Section 2 summarizes the main aspects of Sauerland's theory of clausal and scalar implicatures, and its conceptual and empirical problems. In section 3, Song's (2005) NRP-based analysis of clausal implicatures is discussed. In section 4, I present a unified NRP-based analysis of clausal and scalar implicatures, as well as some further arguments for the NRP-based approaches.

## 2. Sauerland's Computing Mechanism of Implicatures[1]

1) For reasons of space, I will not go over here Gazdar's (1979) theory of implicatures. Refer to Song (2005) for the overview of Gazdar's theory and a critical assessment to it.

Sauerland (2004, 2005), proposing a unified analysis of clausal and scalar implicatures, argued that his account of both kinds of implicatures is more satisfactory than Gazdar's (1979), in that it shows in a more clear and uniform way the relation between the two implicatures: while Gazdar posits two distinct computation mechanisms for clausal and scalar implicatures, his system uniformly derives the two implicatures from Horn scales, and the only difference between clausal and scalar implicatures in his system is just that the latter is epistemically strengthened from the former. In this section, I summarize the main points of Sauerland's theory of implicatures.

First, Sauerland argues that both clausal and scalar implicatures are derived from Horn scales, which are $n$-tuples of alternatives $<\alpha_1, \alpha_2, ..., \alpha_n>$ ordered by entailment relation.

Following Soames (1982) and Horn (1989), Sauerland additionally assumes that implicatures come at two levels of epistemic strength: In the first step, primary implicatures of the form "The speaker is *not certain* whether $\psi$ holds." are computed, where $\psi$ is a scalar alternative that asymmetrically entails the assertion. In the second step, primary implicatures are strengthened to scalar implicatures, which Sauerland calls "secondary implicatures", of the form "The speaker is *certain* that $\psi$ does *not* hold." Sauerland employs the $K$-operator to represent epistemic certainty, and the $P$-operator for epistemic possibility (Hintikka 1962). Hence, what is implicated first is the primary implicature $\neg K\psi$ rather than the scalar implicature $K\neg\psi$. Scalar implicature $K\neg\psi$ would follow from primary implicature $\neg K\psi$ if we additionally assume that $K\psi \vee K\neg\psi$, i.e. either the speaker is certain that $\psi$ holds or he is certain that *not*-$\psi$ holds, and $K\neg\psi$ does not contradict the conjunction of the primary implicatures and the assertion.

Second, Sauerland proposes that the scale of disjunction is the partially ordered scale <A and B, {A, B}, A or B>, instead of the standard scale <and, or>:

Now, let's consider how these two assumptions work with the example in (1) below. Abbreviating *Kai saw Aaliyah* as $A$, and *Kai saw Beyonce* as $B$, we can represent the assertion in (1) as $A$ *or* $B$.

Sauerland's proposal predicts that the primary implicatures of (1) are (2a-c):[2)]

(1) Kai saw Aaliyah or Beyonce.

(2) a. +> $\neg$KA

b. +> $\neg$KB

c. +> $\neg$K(A and B)

d. +> PA ($\Leftrightarrow$ $\neg$K$\neg$A)

e. +> PB ($\Leftrightarrow$ $\neg$K$\neg$B)

In conjunction with the assertion, the primary implicatures entail furthermore (2d) and (2e), which state that each disjunct must be possible. From $\neg KB$ in (2b) together with the epistemically modified assertion *K(A or B)*,[3)] it follows that $\neg K \neg A$ ($\Leftrightarrow$ PA), i.e. *A* is possible. Similarly, $\neg K \neg B$ ($\Leftrightarrow$ PB) follows from $\neg KA$ in (2a) and *K(A or B)*. The set of these four primary implicatures, i.e. {P$\neg$A ($\Leftrightarrow$ $\neg$KA), PA ($\Leftrightarrow$ $\neg$K$\neg$A), P$\neg$B ($\Leftrightarrow$ $\neg$KB), PB ($\Leftrightarrow$ $\neg$K$\neg$B)}, give rise to the observed inference of epistemic uncertainty that the speaker is not certain whether Kai saw Aaliyah or whether Kai saw Beyonce. As is well known, Sauerland's four primary implicatures were called clausal implicatures by Gazdar (1979).

Let's continue to consider which primary implicatures can turn into scalar implicatures. First, $\neg KA$ cannot give rise to the scalar implicature $K \neg A$ because the derived primary implicature $\neg K \neg A$ ($\Leftrightarrow$ PA) contradicts the potential scalar implicature $K \neg A$. In a similar way, $K \neg B$ is blocked. $K \neg$*(A and B)*, however, is consistent with the assertion and all the primary implicatures. So it is realized as an actual scalar implicature and gives the exclusiveness reading of disjunction. This result nicely conforms to our intuition: from the utterance in (1)

2) Throughout this paper, "+>" and "*+>" indicate "conversationally implicates" and "doesn't conversationally implicate", respectively.

3) The epistemic modification of the assertion follows from the maxim of Quality, "Do not say what you believe to be false"; therefore, the speaker is certain that his assertion is true.

above, we can have neither "Kai didn't see Aaliyah." nor "Kai didn't see Beyonce." as scalar implicatures. Only the exclusivity scalar implicature "Kai didn't see both Aaliyah and Beyonce." obtains.

Next, I will discuss some flaws of Sauerland's theory of implicatures. First, consider the example in (3a):

(3) a. Some of the boys left or all of them left.
  b. Some of the boys left, but it isn't certain whether or not all of them left.
  c. K(SOME) and P(ALL) and P¬(ALL)

Intuitively, (3a) implicates (3b). Abbreviating the first disjunct of (3a) as *SOME*, and the second as *ALL*, (3b) can be represented as (3c). But a problem for Sauerland's system is that it fails to predict the clausal implicatures {P(ALL), P¬(ALL)}. Assuming the partially ordered scale <A and B, {A, B}, A or B> of a disjunction, Sauerland's system predicts *ALL* as the only scalar alternative that asymmetrically entails (3a). The reason is that assertion (3a), abbreviated as *SOME or ALL* is logically equivalent to the first disjunct *SOME*, i.e. *(SOME or ALL)* ⇔ *SOME*, so the first disjunct does not *asymmetrically* entail (3a). On the other hand, the conjunction of both disjuncts, i.e. *SOME and ALL*, is logically equivalent to the second disjunct *ALL*, and *ALL* asymmetrically entails (3a). Hence, only one primary implicature — *K(ALL)* in (4b) below obtains from the epistemically modified assertion in (4a). However, there is no way to get the other clausal implicature *¬K¬(ALL)* in (4c):

(4) a. K(SOME ∨ ALL) (⇔ K(SOME))
  b. ¬K(ALL) (⇔ P¬(ALL)):
  It's possible that not all of the boys left.
  c. ¬K¬(ALL) (⇔ P(ALL)):
  It's possible that all of the boys left.

Of course, (4b) alone is not enough to predict the epistemic uncertainty inference of (3a) because it is consistent with $K\neg(ALL)$, i.e. "It's certain that not all of the boys left." It should also be noted that Sauerland's theory cannot explain why the first disjunct of (3a) gets the *obligatory* "some-but-not-all" interpretation: This reading doesn't seem to be defeasible.

Another problem with Sauerland's theory is that it has nothing to say about why clausal implicatures seem to cancel presuppositions, except for Gazdar's stipulation that a potential presupposition is suppressed if it is in conflict with a clausal implicature. Consider the example in (5a):

(5) a. Either John has no wife or his wife is far away.
    b. John has a wife.
    c. It is possible that John has no wife.

*His wife* in the second disjunct of (5a) triggers the presupposition in (5b). But (5a) as a whole does not presuppose (5b). Gazdar argues that (5c), a clausal implicature from the first disjunct, suspends the conflicting potential presupposition (5b). Gazdar's account, however, seems a bit mysterious because a conversational implicature, which is characteristically cancellable, defeats a presupposition, which is not so easily defeated.

## 3. Song's (2005) NRP-based Analysis of Clausal Implicatures

In Song (2005), I argued that both Sauerland's and Gazdar's computing mechanism are not adequate at least for the analysis of clausal implicatures. In this section, I will briefly sketch Song's proposal, and then show how it can handle the problematic data we saw in section 2.

As a first step, Song (2005) proposed the following general condition on interpretation:

(6) No Redundancy Principle (NRP):
Every meaningful expression, which is overtly written or said in a sentence or a text must not be redundant: Either it must make a contribution to the truth-conditional interpretation, or its occurrence must be pragmatically licensed.

The underlying motivation of the constraint seems quite obvious and uncontroversial: Why should we utter any meaningful expressions at all if they play no roles in conveying information? In that case, they are simply superfluous and uninformative. In this regard, I assume that the NRP is a rule that regulates all the interpretation processes. Consider discourses in (7):

(7) a. #John left. And John and Mary left.
b. #John left. And John didn't leave or Mary left.

In (7a), *John left* has been asserted twice, and therefore one of the two is truth-conditionally redundant necessarily: The discourse (7a) as a whole is truth-conditionally equivalent to *John and Mary left* (cf. $(p \wedge (p \wedge q)) \Leftrightarrow p \wedge q$). Thus, (7a) violates the NRP, which explains why (7a) is deviant. Also, in the discourse in (7b), the first disjunct *John doesn't leave* is truth-conditionally redundant: (7b) as a whole is equivalent to *John and Mary left* (cf. $(p \wedge (\neg p \vee q)) \Leftrightarrow p \wedge q$), and therefore violates the NRP. Now consider the discourses in (8) below:

(8) a. John and Mary left. Therefore, John left.
b. (Context: *A* asks the same question again.)
A: Who left?
B: John left! John left!
Don't ask me the same question any more!

(8a) as a whole is equivalent to the first sentence *John and Mary left*, which makes the second sentence *Therefore, John left* truth-conditionally redundant. The second sentence is, however, pragmatically non-redundant if we assume that (8a) is uttered, for example, in a logic class to show the entailment relation: The second sentence is *required* in this situation, and hence, it is pragmatically and contextually licensed. Thus (8a) is felicitous. On the other hand, in (8b), *B* repeats *John left* twice, so one of the two is truth-conditionally redundant. However, since the context makes it clear that *B* intends the repetition to express something like *Listen more carefully to what I am saying*, the repetition of *John left* is pragmatically licensed.

Now Song's (2005) analysis of clausal implicatures of a disjunction is in order. Instead of Hinttika's two epistemic operators used by Sauerland, Song adopted some aspects of Groenendijk and Stokhof (2001): They define the information state of an agent who is engaged in an informative linguistic exchange as a set of possibilities, where each possibility consists of a possible world and a referent system. On the other hand, a referent system concerns the knowledge pertaining to discourse referents, which are posited to resolve anaphoric links across utterances. Since a referent system is not directly relevant to our current concern, I will assume for the sake of simplicity that a possibility consists of only a possible world. Hence, an information state is identified with a set of epistemic possibilities which are compatible with an agent's information.

Now, I will show how the NRP derives the clausal implicatures of the disjunction in (9a)(=1), which I will abbreviate as *A or B* as before:

(9) a. Kai saw Aaliyah or Beyonce. (= A or B)
    b. $\forall i \in s$: $A_i \vee B_i$ (Assertion + Maxim of Quality)

For a speaker to assert *A or B* correctly, it is required that his information state supports it, i.e. that *A or B* is true in every epistemic possibility in his information state, which follows from Grice's maxim of Quality. This may be represented as (9b) above ("i" and "s" represent a possibility and an information state, respectively.) However, according to the truth conditions of a disjunction, it will be true iff at least one of its disjuncts is true. Hence, if the speaker is certain about, for example, the first disjunct $A$, i.e. if his genuine epistemic state is $\forall i \in s{:}A_i$, then it alone can satisfy the truth-conditions in (9b), and $B$ can be ignored. However, presuming that the speaker's certainty of $A$ is enough to guarantee the truth conditions in (9b) necessarily leads to the violation of the NRP: in this case, $B$ makes no contribution to the truth-conditional interpretation, and remains redundant. Let's restate this reasoning process a bit more formally; if the speaker utters (9a) (i.e. $\forall i \in s{:}\ [A_i \vee B_i]$) and he is also certain that $A$ (i.e. $\forall i \in s{:}\ A_i$), the conjunction of the two is just equivalent to $\forall i \in s{:}A_i$, as seen in the equivalence relation in (10) below. This renders the meaningful expression $B$ redundant from the truth conditional interpretation of (9b):

(10) $(\forall i \in s{:}\ [A_i \vee B_i] \wedge \forall i \in s{:}\ A_i) \Leftrightarrow \forall i \in s{:}\ A_i$

This means that if we presume that the speaker is certain that $A$, i.e. that his information state is $\forall i \in s{:}A_i$ when he asserts that $A$ *or* $B$, then it necessarily leads to the violation of the NPR. Hence, the NRP forces the inference that the speaker is *not* certain that $A$. This inference can be represented as (11a) below, which says that there is a possibility in the speaker's information state that $A$ is false. (11a) renders the other disjunct $B$ non-redundant from the interpretation as shown in (11b), which follows from (11a) in conjunction with the assertion (9b). (11b) says that there is an epistemic possibility that $A$ is false and B is true, which in turn entails (11c), i.e. there is a possibility that B is true:

(11) a. $\neg\forall i \in s{:}\ A_i\ (\Leftrightarrow \exists i \in s\ \neg A_i)$
b. $\exists i \in s{:}\ \neg A_i \wedge B_i$
c. $\exists i \in s{:}\ B_i$

(12) a. $\neg\forall i \in s{:}\ B_i\ (\Leftrightarrow \exists_i \in s{:}\ \neg B_i])$
b. $\exists i \in s{:}\ \neg B_i \wedge A_i$
c. $\exists i \in s{:}\ A_i$

(13) $\neg\forall i \in s{:}\ A_i \wedge B_i$

In a similar way, the NRP keeps us from presuming that the speaker is certain that *B* when he utters *A or B*. This gives rise to the inference in (12a). (12a) entails (12b) and (12c) in conjunctions with the assertion in (9b). Now we see that (11a,c) and (12a,c) are equivalent to the four primary implicatures of Sauerland, i.e. $P\neg A$, $PB$, $P\neg B$ and $PA$, respectively, which are also the clausal implicatures of *A or B*. Finally note that (11a) and (12a) both entail (13), which is the remaining primary implicature of Sauerland.

Next, let's consider how the foregoing proposal can account for the problematic cases discussed in section 2. First, consider (14a)(=3a), of which clausal implicatures Sauerland's system fails to predict:

(14) a. Some of the boys left or all of them left.
 b. $\forall i \in s$: $SOME_i \vee ALL_i$
 c. $\forall i \in s$: $SOME_i$

For a speaker to assert (14a) correctly, it is required that his information state supports it, i.e. that *SOME or ALL* is true in every epistemic possibility in his information state, which may be represented as (14b). However, (14b) is problematic since it necessarily violates the NRP, as it stands: as noted in section 3, the whole disjunction *SOME or ALL* is logically equivalent to the first disjunct *SOME*, because *ALL* entails *SOME*, so (14b) is equivalent to (14c). This makes the second disjunct *ALL* necessarily redundant, which leads to the violation of the NRP. Song suggested that a disjunction *A or B*, where *B* entails *A*, should be reinterpreted as a logically equivalent disjunction *(A and not-B) or B*. This is of course a strategy to avoid the NRP: In case *B* entails *A* in a disjunction *A or B*, the whole disjunction *A or B* is equivalent to the first disjunct *A*. Hence, the other disjunct *B* is necessarily redundant and superfluous, which is a blatant violation of the NRP. The exclusion of the possibility of *B* from *A* makes *B* free from the otherwise necessary redundancy: the whole disjunction *(A and not-B) or B* is logically equivalent to *A*, but neither the first disjunct *(A and not-B)* nor the second disjunct *B* is equivalent to *A*.

In the case of (14b) above, the NRP forces it reinterpreted as (15a) below, which can be paraphrased as "Only *SOME* (but not *ALL*) is true, or *ALL* is true."

(15) a. $\forall i \in s$: $(SOME_i \wedge \neg ALL_i)$ $\vee$ $ALL_i$ ($\Leftrightarrow$ $\forall i \in s$: $SOME_i$)
b. (SOME $\wedge\neg$ALL) $\vee$ ALL $\Leftrightarrow$ SOME $\vee$ ALL $\Leftrightarrow$ SOME

Though *(SOME and not-ALL) or ALL* is logically equivalent to both *SOME or ALL* and *SOME*, as shown in (15b), the exhuastification of the first disjunct renders the second disjunct *ALL* free from necessary redundancy, and therefore the necessary violation of the NRP can be avoided: neither disjunct is logically equivalent to the whole disjunction *(SOME and not-ALL) or ALL*, which is in turn equivalent to *SOME*.

Though (15a) can escape the necessary violation of the NRP by the exhaustification strategy, it is still subject to a potential violation of the NRP in exactly the same way *A or B* is, where *A* and *B* do not entail each other: if the speaker's epistemic state is, for example, just the first disjunct of (15a), i.e. $\forall i \in s$: $SOME_i \wedge \neg ALL_i$, this information state satisfies the truth-conditions in (15a), regardless of whether or not he believes the second disjunct *ALL*. Thus, the second disjunct is redundant from the interpretation, which is in violation of the NPR. A bit more formally speaking, if we presume that the speaker is certain that *SOME and not-ALL*, i.e. that his information state is $\forall i \in s$: $SOME_i \wedge \neg ALL_i$ when the truth-conditions of his utterance is (15a), then it necessarily leads to the truth-conditional redundancy of the second disjunct *ALL*, as seen in the equivalence relation in (16) below: in this case, the conjunction of the two amounts to $\forall i \in s$: $SOME_i \wedge \neg ALL_i$.

(16) ($\forall i \in s$: [($SOME_i \wedge \neg ALL_i$) $\vee$ $ALL_i$] $\wedge$
$\forall i \in s$: $SOME_i \wedge \neg ALL_i$) $\Leftrightarrow$
$\forall i \in s$: $SOME_i \wedge \neg ALL_i$

Hence, the NRP forces the inference that the speaker is *not* certain that

*SOME and not-ALL*, which is represented as (17a) below. (17a) says that there is a possibility in the speaker's information state that the first disjunct *SOME and not-ALL* is false. (17a) renders the other disjunct *ALL* non-redundant from the semantic interpretation since (17b) follows from (17a) in conjunction with (15a) above: (17b) says that there is a possibility that *ALL* is true:

(17) a. $\neg\forall i\in s$: $[SOME_i \wedge \neg ALL_i]$ ($\Leftrightarrow \exists i\in s$: $[\neg SOME_i \vee ALL_i]$)
b. $\exists i\in s$: $ALL_i$

(18) a. $\neg\forall i\in s$: $ALL_i$ ($\Leftrightarrow \exists i\in s$: $\neg ALL_i$)
b. $\exists i\in s$: $[SOME_i \wedge \neg ALL_i]$

In similar vein, the NRP keeps us from presuming that the speaker is certain that *ALL* when he utters (14a). This gives rise to the inference in (18a) above. (18a) entails (18b) in conjunctions with (15a). Now we see that (17b) and (18a) together represent the epistemic uncertainty inference of the speaker such that he is not sure whether or not *ALL*. Hence, when the truth-conditions in (15a), and clausal implicatures in (17) and (18) are taken together, (14a) conveys the information that some of the boys left, but it isn't certain whether or not all of them left, and this is the intuitively correct reading of (14a).

Next, as pointed out earlier, Sauerland's mechanism has nothing to say about why a clausal implicature cancels the potential presupposition of (19b)(=5b):

(19) a. Either John has no wife or his wife is far away.
b. John has a wife.

Here is the NRP explanation. If the presupposition (19b) is projected to the whole disjunction in (19a), then it would in effect be equivalent to the unacceptable discourse in (20a) below:

(20) a. # John has a wife and
either John has no wife or she is far away.

b. John has a wife and she is far away.

Notice that (20a) violates the NRP: (20a) is truth-conditionally equivalent to (20b). Thus, the projection of the presupposition (19b) above makes the first disjunct *John has no wife* redundant, which is in violation of the NRP.[4)]

## 4. Proposal

As noted in section 2, Sauerland (2004, 2005) proposed a computation system that can account for both the clausal and scalar implicatures of a disjunction: While Gazdar posited two distinct computation mechanisms for clausal and scalar implicatures, Sauerland's system uniformly derived the two implicatures from Horn scales, and the only difference between clausal and scalar implicatures in his system is just that the latter derive from the former with the additional assumption that the speaker is well-informed, i.e. $K\phi \vee K\phi$, where $\phi$ is a stronger scalar alternative. Sauerland assumed that the underlying principle deriving the clausal and scalar implicatures is Grice's first submaxim of Quantity (Quantity-1), in conjunction with the maxim of Quality. However, I showed in Song (2005), which was outlined in the previous section, that clausal implicatures may be better explained by the NRP. A question was, however, left unanswered in Song (2005): Is it possible to derive scalar implicatures, too, from the NRP? My answer to this question is "yes" now: In this subsection, I demonstrate first that with some modifications of the computing system of Song (2005) the NRP can provide a unified account of both clausal and scalar implicatures. I will then put forth a couple of further arguments in support of the NRP approach.

4) To account for examples like (19a), van der Sandt (1992: 367) proposes a constraint which roughly goes as follows: When a presupposition is projected, it must not entail the negation of any subordinate clauses. Though this constraint makes a descriptively correct prediction, it doesn't seem to provide us with any explanation for why it should be so.

### 4.1. A Unified Account of Clausal and Scalar Implicatures

In this subsection, I show how the NRP can eventually replace the Quantity-1 in the computation of not only clausal but also scalar implicatures. For this purpose, minor revisions of the computing system of Song (2005) are in order: There I derived clausal implicatures from epistemically modified scalar alternatives by applying the NRP, as we saw in section 3. In this section, however, both clausal and scalar implicatures will be calculated from the alternatives which are not epistemically modified. I propose that the epistemic modification should follow only after the computation of implicatures. Let's start with the computation of scalar implicatures.

#### 4.1.1. Deriving Scalar Implicatures

Dealing with scalar implicatutures first, (22a) below, which is the scalar implicature of (21), can derive in the following way: If (22b), which is (21)'s scalar alternative, is true, this inference makes the assertion in (21) necessarily redundant, as shown in the equivalence relation in (22c) below:

(21) Kai saw Aaliyah or Beyonce.

(22) a. Kai didn't see both Aaliyah and Beyonce.

b. Kai saw both Aaliyah and Beyonce.

c. (Kai saw Aaliyah or Beyonce) and (Kai saw both Aaliyah and Beyonce) $\Leftrightarrow$
Kai saw both Aaliyah and Beyonce

Therefore, the scalar alternative in (22b) cannot be true, and hence the SI in (22a) follows. And then, the epistemically modified scalar implicature in (23) below is yielded under the assumption that the implicature (22a) is a genuine reflection of the speaker's information state:

(23) Certainly Kai didn't see both Aaliyah and Beyonce.

Let's consider another example in (24):

(24) Some of the boys left.
(25) a. Not all of the boys left.
b. All of the boys left.
c. (Some of the boys left) and (all of the boys left) ⇔ All of the boys left
d. Certainly not all of the boys left.

The scalar implicature in (25a) is generated in the same way as before: If the scalar alternative (25b) is true, this inference makes the assertion in (24) necessarily redundant, as illustrated in the equivalence relation in (25c). Hence, the scalar alternative in (25b) cannot be true, so the scalar implicature in (25a) follows. The epistemically modified scalar implicature in (25d) will obtain under the assumption that the implicature (25a) is the reflection of the speaker's information state.

#### 4.1.2. Deriving Clausal Implicatures

In Song (2005), I derived the clausal implicatures of a disjunction by applying the NRP to the epistemically modified disjuncts. In the present paper, however, both clausal and scalar implicatures are calculated by applying the NRP to the bare scalar alternatives and disjuncts, which are not epistemically modified. I will illustrate in this subsection how clausal implicatures derive in the revised computing system.

Note first that the NRP disallows us to spell out either the first or the second disjunct of (26) true:

(26) Kai saw Aaliyah or Beyonce.

If the first disjunct is true, then we can say that (26) is true based on the first disjunct alone, regardless of the truth-value of the second disjunct. For the same reason, we cannot say the second disjunct is true, either. Hence, if we can tell whether one disjunct is true, the other is necessarily rendered redundant, which is in violation of the NRP.

We can pronounce neither the first nor the second disjunct of (26) false, either. If the first disjunct is false, then the second disjunct should be true, and hence (26) can be spelled out true with the second disjunct alone. For the same rationale, we cannot say the second disjunct is false, either. Therefore, assuming that this inference is a genuine reflection of the speaker's information state, we should conclude that the speaker's information state contains both the truth and falsity of each disjunct as his epistemic possibilities; this is equivalent to saying that the speaker is not certain whether or not Kai saw Aaliyah, and whether or not Kai saw Beyonce, which is the very clausal implicatures of (26).

Next, consider how the revised system derives the inference (27b) below from (27a)(=3a). As noted in section 3, (27a) yields the inference in (27b) as clausal implicatures:

(27) a. Some of the boys left or all of them left.
b. Some of the boys left, but it isn't certain whether or not all of them left.

In section 3, we saw that the first disjunct of (27a) got the obligatory *not-all* interpretation as shown in (28) below; otherwise, (27) would violate the NRP:

(28) Some, but not all of the boys left or all of them left.

When the NRP applies to (28) once again, we get from the first disjunct the inference that some boys left, but it cannot be spelled out that either all of the boys left or not all of the boys left. On the other hand, applying the NRP to the second disjunct yields the same inference: It cannot be spelled out that either all of the boys left or not all of the boys left. Assuming that this inference is a genuine reflection of the speaker's epistemic state, we get the inference given in (29), which is exactly the clausal implicatures of (27a):

(29) The speaker isn't sure whether or not all of the boys left.

### 4.2. Further Arguments for the NRP-based Computing System

In this subsection, I apply the NRP-based computing system of implicatures to two specific cases that the Quantity-1-based approaches may have difficulties in handling: The discrepancy between clausal and scalar implicatures in defeasibility and conditional perfection.

#### 4.2.1. Defeasibility of Clausal and Scalar Implicatures

Sauerland (2005) observed an interesting difference between clausal and scalar implicatures: In general, it is odd to cancel clausal implicatures, while scalar implicatures aren't. For example, the sentence in (30) yields (31a) as a clausal implicature:

(30) Kai saw Aaliyah or Beyonce.
(31) a. Possibly Kai didn't see Aaliyah.
b. #Kai saw Aaliyah or Beyonce, and he definitely saw Aaliyah.

Sauerland (2005) perceives the sequence in (31b) to be odd out of the blue. He assumes the oddness of (31b) out of the blue to be due to the fact that (31a), one of the clausal implicatures of the first clause of (31b), contradicts the second sentence, *he definitely saw Aaliyah*. On the other hand, (32a) below, which is the scalar implicature of (30), can be cancelled in the context of (32b) by adding *possibly he saw both*:

(32) a. Certainly Kai didn't see both Aaliyah and Beyonce.
b. Kai saw Aaliyah or Beyonce, and possibly he saw both.

Sauerland, however, provided no explanation for why clausal implicatures are not readily suspended. In this subsection I provide an explanation of why clausal implicatures resist cancellation while scalar implicatures do not.

When the NRP comes on the scene, it is quite obvious why (31b) is deviant: (31b) violates the NRP. To see this, consider (33) below, which is a logical translation of (31b), where *definitely* is represented as an epistemic certainty operator:

(33) $(\forall i \in s: A_i \vee B_i) \wedge \forall i \in s: A_i$ $(=K(A \vee B) \wedge KA)$

(34) $(\forall i \in s: A_i \vee B_i) \wedge \forall i \in s: A_i \Leftrightarrow$
$\forall i \in s: (A_i \vee B_i) \wedge A_i \Leftrightarrow$
$\forall i \in s: A_i$ $(=KA)$

The logical equivalence relations in (34) above show that (33) as a whole is equivalent to $\forall i \in s: A_i$ (=KA) (cf. $((p \vee q) \wedge p) \Leftrightarrow p$), which paraphrases as *Kai definitely saw Aaliyah*, and therefore the first sentence *Kai saw Aaliyah or Beyonce* is rendered truth-conditionally redundant. Also, it plays no evident pragmatic role in (31b) when uttered out of the blue. Hence, the cancellation of the clausal implicature in (31b) by adding *and he definitely saw Aaliyah* necessarily violates the NRP.

In a similar vein, the NRP also explains why (35b) below, another clausal implicature of (30), cannot be cancelled in a discourse like (35a):

(35) a. #Kai saw Aaliyah or Beyonce, and he definitely didn't see Aaliyah.
b. Possibly Kai saw Aaliyah.

(36) a. $(\forall i \in s: A_i \vee B_i) \wedge \forall i \in s: \neg A_i$
b. $\forall i \in s: B_i \wedge \neg A_i$ $(=K(B \wedge \neg A))$

(36a), the logical translation of (35a), is logically equivalent to (36b), which shows that the first disjunct *Kai saw Aaliyah* is rendered truth-conditionally redundant by adding *and he definitely didn't see Aaliyah*. Also, it plays no evident pragmatic role in (35a) when uttered out of the blue. Hence, (35a) violates the NRP.

Now let us consider why scalar implicatures, differently from clausal implicatures, can be easily defeated, as shown by the discourse in (37a) below: (37b), the scalar implicature of the first conjunct of (37a), is cancelled in the discourse (37a):

(37) a. Kai saw Aaliyah or Beyonce, and possibly both.
b. Certainly Kai didn't see both Aaliyah and Beyonce.

(37a) translates into (38a) below, where *possibly* is represented as an epistemic possibility operator, and (37b) into (38b):

(38) a. $(\forall i \in s: A_i \vee B_i) \wedge \exists i \in s: (A_i \wedge B_i)$
$(=K(A \vee B) \wedge P(A \wedge B))$
b. $\forall i \in s: \neg(A_i \wedge B_i)$ $(=K\neg(A \wedge B))$

$\exists i \in s: (A_i \wedge B_i)$ in (38a), i.e. *possibly both*, sure suppresses the scalar implicature in (38b), without rendering $(\forall i \in s: A_i \vee B_i)$, i.e. *Kai saw Aaliyah or Beyonce*, redundant.

Note, however, that (38a) as whole is truth-conditionally equivalent to (39a) below, which is the truth-conditional meaning of *Kai saw Aaliyah or Beyonce*, so $\exists i \in s: (A_i \wedge B_i)$ itself is truth-conditionally redundant though it doesn't make *Kai saw Aaliyah or Beyonce* redundant:

(39) a. $\forall i \in s: A_i \vee B_i$
b. $(\forall i \in s: A_i \vee B_i) \wedge \forall i \in s: \neg(A_i \wedge B_i)$
$(=K(A \vee B) \wedge K\neg(A \wedge B))$

But obviously *possibly both* plays a role in (37a): Without it, (37a) would get, by default, the interpretation in (39b), which is the conjunction of the truth-conditional meaning of *Kai saw Aaliyah or Beyonce* and its scalar implicature in (37b). That is, the role of *possibly both* is to remove the scalar implicature inference out of *Kai saw Aaliyah or Beyonce*. Hence, its presence is pragmatically licensed, and therefore respects the NRP.

### 4.2.2. Conditional Perfection

The conditional in (40a) below yields a strong tendency that besides the explicitly conveyed promise of five dollars as a reward for mowing the lawn, it also suggests another conditional in (40b). The combination of the assertion in (40a) and the implication in (40b) is tantamount to the interpretation of the antecedent as not only a sufficient, but also a necessary condition, as in (40c). This phenomenon is called "conditional perfection":

(40) a. If you mow the lawn, I'll give you five dollars.
b. If you don't mow the lawn, I won't give you five dollars.
c If and only if you mow the lawn, I'll give you five dollars.

The most popular line of approaches to conditional perfection is that conditional perfection is some sort of Gricean conversational implicature. Where the differences among Gricean analyses of conditional perfection arise is in determining precisely which Gricean maxim applies and how it applies. At present, two influential Gricean approaches to perfection are available in the literature: On the one hand, there is an explanation based on Levinson's (2000) I-principle, while on the other hand there is an explanation from Levinson's (2000) Q-principle. Song (2003), however, shows that both types of analyses currently available in the literature suffer problems of one kind or another, which I will not go over here for reasons of space. In this subsection, I will show that the NRP provides an interesting account for conditional perfection, which is free from the defects of previous analyses.

It has been pointed out in the literature that there is a close relation between yes/no-questions and conditionals. Bolinger (1978) argues that indirect questions introduced by *if* are embedded versions of yes/no-questions, and furthermore yes/no-questions are semantically very similar to conditionals in that both conditionals and yes/

no-questions are hypotheses: A conditional hypothesizes that something is true and draws a conclusion from it. A yes/no-question hypothesizes that something is true and confirmed or disconfirmed by a hearer. On the other hand, Traugott (1985) points out that yes/no-question particles are one of the major sources of conditional markers. This is clearly visible in Russian, Spanish, Hua and Bulgarian, among others.

According to Hamblin (1971), a yes/no-question, or its embedded variant, the if-question, introduces a pair of polarity propositions *p* and *not p*. Actually, it seems intuitively clear that uttering a conditional introduces a polar alternative by default. Based on the semantic similarity between yes/no-questions and conditionals, I propose that the utterance of *if p, q* should introduce, by default, a polar alternative *if not p, q*. Considering the core meaning of *if p, q* is *p*'s sufficiency for *q*, i.e. *q* is true if *p* is true, the truth of *q* is an open possibility when *p* is false, i.e when not *p*. That is, the conditional in (41a) has (41b) as its scalar alternative:

(41) a. If p, q
 b. If not p, q

Let's consider now how the NRP derives the perfection implicature. If the alternative (41b) is assumed to be true, then together with the assertion *if p, q*, the communicated meaning will be just *q*, as seen in the following equivalence relation:

(42) $(\text{if p, q}) \wedge (\text{if not p, q}) \Leftrightarrow \text{if } (\text{p} \vee \text{not p}), \text{q} \Leftrightarrow \text{q}$

Hence, the meaningful expression *p* of the assertion *if p, q* will be rendered truth-conditionally redundant. Therefore, the scalar alternative in (41b) cannot be true, and therefore, the inference *not(if not p, q)* obtains.

Note now that the negation of *If Mary doesn't come, John will leave* is naturally understood as *If Mary doesn't come, John won't leave*. As pointed out by Grice (1989), a natural interpretation of the negation of a natural language conditional sentence is the negation of the consequent of the original conditional. That is, *not(if p, q)* is naturally understood as *if p, not q*. Following von Fintel (2000), I will call this phenomena "conditional excluded middle". So, the inference *not(if not p, q)* is equivalent to *if not p, not q* by the conditional excluded middle, which is the very conditional perfection inference generated by the assertion *if p, q*.

The foregoing discussion shows that the NRP is violated not only when an alternative entails the assertion; it will be also violated when an alternative makes any parts of the assertion redundant. Hence, we may say that the first submaxim of Quantity is just a subcase of the NRP, so subsumed under the NRP.

## 5. Concluding Remarks

In the present paper, I proposed a unified NRP-based analysis of both clausal and scalar implicatures, which is hopefully free from the conceptual and empirical difficulties of the widely accepted Quantity-1-based approaches to the computation of implicatures. My main claims are summarized as below:

First, I demonstrated that the NRP can also be applied to the computation of scalar implicatures with some minor revisions to my previous analysis (Song 2005) of clausal implicatures. Song (2005) derived clausal implicatures by applying the NRP to epistemically modified scalar alternatives. But in the present paper, both scalar and clausal implicatures were first calculated with bare scalar alternatives which were not epistemically modified, and then the resulting inferences were epistemically modified.

Second, I show that the NRP-based analysis of implicatures can offer plausible accounts to two specific cases, which the Quantity-1 may have difficulties in handling: the discrepancy between clausal and scalar implicatures in defeasibility and conditional perfection.

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