

# A Compositional Analysis of Distance-Distributivity

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## 1. Distance-Distributivity Markers

One major property of *each* is that it makes the sentence have a distributive reading. (1) has two possible interpretations: 'The boys acted together as a group to lift one piano' (*collective reading*) and 'Each of the boys lifted one piano' (*distributive reading*). When the sentence includes *each* as in (2), on the other hand, it has a distributive reading only.

- (1) The boys lifted one piano.
- (2) Each boy lifted one piano.

(3) has the same meaning as (2), even though the position of *each* is different. The common truth condition is shown in (4):

- (3) The boys lifted one piano each.
- (4)  $\exists X[\text{boys}(X) \ \& \ \forall x[x \in X \rightarrow \exists Y[|Y|=1 \ \& \ \text{pianos}(Y) \ \& \ \text{lifted}(Y)(x)]]]$

(2) shows the regular pattern of universal quantification. The distributive element *each* forms a constituent with its NP-restriction *boy*, the expression it quantifies over. In (3), on the other hand, the distributive element *each* occurs at a distance to its NP-restriction *the boys*. In this sense, (3) shows 'distance-distributivity.' The term 'distance-distributivity' comes from Zimmermann (2002).

It's not just English 'binominal *each*' (Safir and Stowell 1988) which shows distance-distributivity<sup>1</sup>. Korean also has a distance-distributivity marker (D-D marker hereafter), illustrated in (5):

- (5) Namcatul i sangca twu kay *ssik* ul wunpanhayssta  
men-Nom box two-Cl-Dist-Acc carried<sup>2</sup>  
lit. 'The men carried two boxes each.'

The particle *ssik* in Korean has a property of marking distributivity. Sentences with *ssik* contrast with sentences without *ssik* in that the ones with *ssik* are characterized as necessarily having a distributive reading, which is quite marginal in sentences without *ssik*. For example, (6) is interpreted as 'the men together carried two boxes' and the distributive reading for (5) is quite marginal in this sentence. Given that

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<sup>1</sup> D-D markers are also found in other languages including German (*jeweils*) and Japanese (*zutsu*):

- (i) ...weil die Jungen jeweils zwei Bücher kauften  
because the boys each two books bought  
lit. '...because the boys bought two books each.' (Zimmermann 2002)
- (ii) Otoko huta-ri-ga sutukeisu san-ko-zutsu-o hakonda  
man two-Cl-Nom suitcase three-Cl-Dist-Acc carried  
lit. 'Two men carried three suitcases-Dist.' (Gil 1990)

<sup>2</sup> Throughout the paper, we will use the following abbreviations:  
Nom: nominative case marker, Acc: accusative case marker, Cl: classifier, Dist: (distance-) distributivity marker.

it occurs at a distance to its NP-restriction it quantifies over, just like binominal *each*, Korean *ssik* is also a D-D marker.

- (6) Namcatul i sangca twu kay lul wunpanhayssta  
 men-Nom box two-Cl-Acc carried  
 lit. 'The men carried two boxes.'

Interestingly, the *ssik*-construction<sup>3</sup> in (6) is ambiguous in meaning, as opposed to the English sentence (3), which has only one interpretation. The possible interpretations of (6) are given below:

- (7) a. The men carried two boxes each. (= Each of the men carried two boxes.)  
 $\exists Y[\text{men}(Y) \& \forall y[y \in Y \rightarrow \exists X[\text{boxes}(X) \& |X|=2 \& \exists e. y \text{ carried } X \text{ in } e]]]$   
 b. The men together carried two boxes each time/occasion.  
 $\exists e. \forall e' [e' \in e \rightarrow \exists Y[\text{men}(Y) \& \exists X[\text{boxes}(X) \& |X|=2 \& Y \text{ carried } X \text{ in } e']]]$ <sup>4</sup>

As seen from these interpretations, in the *ssik*-construction, the distribution can be over individuals or events, whereas in the binominal *each*-construction the distribution can be over individuals only.

There are two major issues related to D-D markers. First, sentences with D-D markers have been a challenge to compositional semantics. The question is: how can we account for the distributive interpretations, given that D-D markers occur at a distance to the NP-restriction which they quantify over? Second, how can we account for the ambiguous interpretations some D-D markers cause (e.g., *ssik*)<sup>5</sup>? That is, how can we derive both interpretations in a compositional way? To answer these questions, we will develop an analysis of distance-distributivity from the view of compositional semantics. The discussion will mainly focus on the Korean *ssik*-construction, and the possibility of cross-linguistic application will be suggested later.

## 2. The Semantics of *Ssik*

In Korean, the D-D marker *ssik* usually occurs with a numeral-classifier sequence within a noun phrase. Sentences given below show *ssik* in various positions<sup>6</sup>:

- (8) a. Namca twu myeng *ssik* i sangca sey kay lul wunpanhayssta  
 man two-Cl-Dist-Nom box three-Cl-Acc carried  
 lit. 'Two men-Dist carried three boxes'  
 b. Namca twu-myeng-i sangca sey-kay-*ssik*-ul wunpanhayssta  
 man two-Cl-Nom box three-Cl-Dist-Acc carried

<sup>3</sup> Let me refer to sentences containing *ssik* as the *ssik*-construction.

<sup>4</sup> In this paper, we not only employ events as a semantic object, but also assume that an event can be plural when it contains several sub-events (Landman 1996, Krifka 1992, Lasersohn 1995, Brisson 1998, among others). We assume that a plural event has sub-events as its members, following Lasersohn (1995).

<sup>5</sup> *Jewels* in German and *zutsu* in Japanese also show the behavior of a D-D marker, and sentences with these items can be ambiguous, just like the *ssik*-construction. See Zimmermann (2002) for the semantic properties of D-D markers in other languages.

<sup>6</sup> So-called 'floating quantifier' construction, where a numeral quantifier appears separated from the related NP is also possible with the *ssik*-construction as in (i):

(i) Namca twu myeng i sangca lul (pang-ulo) sey kay *ssik* wunpanhayssta  
 man two Cl Nom box Acc (room-to) three Cl Dist carried  
 lit. 'Two men carried three boxes Dist (to the room)'

- lit. 'Two men carried three boxes-Dist'
- c. Namca twu-myeng-ssik-i sangca sey-kay-ssik-ul wunpanhayssta  
 man two-CI-Dist-Nom box three-CI-Dist-Acc carried  
 lit. 'Two men-Dist carried three boxes-Dist'

(8a), which has *ssik* in the subject position, has two possible interpretations<sup>7</sup>:

- (9) a. Men in pairs carried each of a set of three boxes.  
 $\exists X [X \text{ is a set of three boxes} \ \& \ \forall x [x \in X \rightarrow \exists Y [Y \text{ is a group of two men} \ \& \ \exists e. Y \text{ carried } x \text{ in } e]]]$
- b. Two men together carried three boxes (where happened more than one instance of this, simultaneously or one after another).  
 $\exists e. \forall e' [e' \in e \rightarrow \exists Y [Y \text{ is a group of two men} \ \& \ \exists X [X \text{ is a set of three boxes} \ \& \ Y \text{ carried } X \text{ in } e']] \ (|e| > 1)$

Before we get into these interpretations, a couple of terms are to be introduced for ease of exposition: *Distributive Key* and *Distributive Share* (Zimmermann 2002)<sup>8</sup>. *Distributive Key* (DistKey) refers to the argument over which the distribution occurs, that is, the argument whose part-whole structure the distribution uses. *Distributive Share* (DistShare) refers to the argument that is distributed over the DistKey, that is, the argument which takes low scope. As for the interpretation in (9a), the DistKey is *sangca sey-kay* 'three boxes' and for the interpretation in (9b), the DistKey is event, that is, the distribution occurs over event.

(8b), which has *ssik* in the object position also has two possible interpretations, given in (10):

- (10) a. Two men carried three boxes each.  
 $\exists Y [Y \text{ is a group of two men} \ \& \ \forall y [y \in Y \rightarrow \exists X [X \text{ is a set of three boxes} \ \& \ \exists e. y \text{ carried } X \text{ in } e]]]$
- b. Two men together carried three boxes (where happened more than one instance of this, simultaneously or one after another)  
 $\exists e. \forall e' [e' \in e \rightarrow \exists Y [Y \text{ is a group of two men} \ \& \ \exists X [X \text{ is a set of three boxes} \ \& \ Y \text{ carried } X \text{ in } e']] \ (|e| > 1) \quad (=9b)$

In this case, the DistKey can be either the subject NP *namca twu-myeng* 'two men' (as in (10a) or event (as in (10b)). On the other hand, (8c), which has *ssik* in both the subject and the object position, has only one possible interpretation, the event distributive reading which has event as the DistKey:

- (11) Two men together carried three boxes (where happened more than one instance of this, simultaneously or one after another)  
 $\exists e. \forall e' [e' \in e \rightarrow \exists Y [Y \text{ is a group of two men} \ \& \ \exists X [X \text{ is a set of three boxes} \ \& \ Y \text{ carried } X \text{ in } e']] \ (|e| > 1) \quad (=9b, 10b)$

<sup>7</sup> Both (9a) and (9b) are possible interpretations, even though the interpretation in (9a) is a bit more salient than the one in (9b).

<sup>8</sup> Different terms have been used in the previous literature:

Zimmermann (2002)	<i>Distributive Key</i> (DistKey)	<i>Distributive Share</i> (DistShare)
Choe (1987)	<i>Sorting Key</i>	<i>Distributive Share</i>
Safir & Stowell (1988)	<i>Range NP</i> (R-NP)	<i>Distributing NP</i> (D-NP)
Link (1987/98)	<i>Distributive domain</i>	<i>DistShare</i>

In this presentation, I will follow Zimmermann in using the terms, but in a theory-neutral way.

When we look into these possible interpretations, we can see that an argument containing *ssik* always takes lower scope than the other arguments not containing *ssik* in the same sentence, and the distribution is always over an argument other than the one containing *ssik*, which was also observed in Choe (1987). For example, in (9a), 'three boxes' takes higher scope and 'two men' which contains *ssik* takes lower scope, and in (10a), 'two men' takes higher scope and 'three boxes' which contains *ssik* takes lower scope. Given the interpretations above, events also can take higher scope than the argument containing *ssik*, as in (9b), (10b) and (11), though events are not overtly realized in the sentence. Given these, we can get the following generalizations:

- (12) Properties of the *ssik*-construction:
- a. The NP which contains *ssik* (the *ssik*-NP) is always the DistShare; it can not be the DistKey.  
(- - low scope requirement of the *ssik*-NP)
  - b. The DistKey can be either a (regular) plural NP or an event.

Now the question is how we can compositionally derive the possible interpretations, incorporating these properties. In the following section, we first review some of the previous analyses, to see whether this could be done within their frameworks.

### 3. Previous Analyses

#### 3.1 Choe (1987)

Choe (1987) tries to give a general account for distributivity, including Korean *ssik*, English *each*, and more, by a distributive relation given below:

- (13) Dist (A,B)  
 $\forall a(i \text{ part } (a, A) \rightarrow \exists B (R(a,B)))$ <sup>9</sup>  
 (the *i* parts of the denotation of A distribute over the denotation of B)

With this distributive relation, three possible interpretations of (14), which are given in (15a-c), are described as (16a-c) respectively. In (16), M denotes an action 'marked,'  $E^2$  is a variable for the plural individual 'two examiners' and  $S^6$  is a variable for the plural individual 'six scripts'. The basic assumption is that when a distributive dependency is found, distributive meaning is simply added to the (underspecified) logical form (e.g., (16a)). With no distributive relation established, the free variables will be bound by means of existential closure. With existential closure, (16a-c) will result in the representations in (17a-c) respectively.

- (14) Two examiners marked six scripts. (Choe 1987: 110)
- (15) a. A group of two examiners marked a group of six scripts.  
 b. Each of the two examiners marked a group of six scripts.  
 c. Each of the six scripts was marked by a group of two examiners.
- (16) a.  $M(E^2, S^6)$   
 b.  $M(E^2, S^6) \ \& \ \text{Dist}(E^2, S^6)$   
 c.  $M(E^2, S^6) \ \& \ \text{Dist}(E^2, S^6)$

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<sup>9</sup> *I part* stands for the individual part relation.

- (17) a.  $\exists E2 \exists S6 (M(E2, S6))$   
 b.  $\exists E2 \forall e [i \text{ part } (e, E2) \rightarrow \exists S6 (M(e, S6))]$ <sup>10</sup>  
 c.  $\exists S6 \forall s [i \text{ part } (e, S6) \rightarrow \exists E2 (M(E2, s))]$

Choe basically assumes that we can apply this account using the distributive relation to the *ssik* construction, even though he does not explicitly shows it.

Choe's work contains some valuable observations on the *ssik* construction. First of all, he observes that *ssik* always tends to take lower scope than other arguments in the sentence, which is why he characterizes it as an 'anti quantifier.' He also notices that there can be a distributive relation between an event argument ('implicit contextual element') and an overt argument, even though he does not show how this event argument works in the distributive relation he proposes. He also observes a locality condition on the *ssik* construction.

Despite these important observations, however, his analysis is not enough to explain all the properties of the *ssik*-construction. In particular, it is not clear how his analysis can derive the possible interpretations in a compositional way.

### 3.2 Gil (1990)

Gil (1990) presents a rule of semantic interpretation governing the *ssik* construction as shown in (18), and shows that this rule can capture the possible interpretations of (19).

- (18) The Semantic Interpretation of *ssik* <sup>11</sup>:  
 In every occurrence of *ssik*, a constituent X containing *ssik* distributes over a semantically plural constituent Y disjoint from X:  
 $[X \dots ssik \dots ]$  distributes over  $[Y_{[+PL]} \dots ]$

- (19) *salam twu myeng i kabang sey kay ssik ul wunpanha ess ta* (Gil 1990: 386)  
 man two Cl Nom bag three Cl Dist Acc carry Past Dec  
 lit. 'Two men carried three suitcases DIST'

- (20) Interpretation A: Two men carried three suitcases each  
 Interpretation B: Two men carried the suitcase three at a time

In Interpretation A, X is the direct object NP (*kabang sey kay ssik ul* 'three bags dist') and Y is the subject NP (*salam twumyengi* 'two men'). In Interpretation B, X is the direct object NP and Y is the verb (*wunpanhaessta* 'carried').

Even though the rule in (18) somehow captures the configuration where we get the interpretations of the *ssik* construction, it is not enough to explain the properties of the *ssik* construction we observed in the previous section. For example, as observed in Choe (1987), there is a locality condition (clause boundedness) on the *ssik* construction. But the rule in (18) can not capture this locality condition. The rule is so general as

<sup>10</sup> His original notation is ' $\exists E2 \forall e \exists S6 (M(e, S6))$ .'

<sup>11</sup> It seems that there is some difference in the way people use the expression 'distribute over,' which often leads some confusion. The rule in (20) should not be misunderstood to mean that a constituent X containing *ssik* takes scope over a semantically plural constituent Y. Instead, it should be interpreted approximately as 'The distribution takes place over Y when X interacts with Y.'

to have a problem of overgeneration. And Gil's analysis also has a compositionality problem; his account can not derive the interpretations of the *ssik* construction in a compositional way.

### 3.3 Zimmermann (2002)

Zimmermann (2002) proposes a compositional analysis to derive the interpretations of sentences with D-D markers. He argues that the German sentence (21a) is ambiguous in meaning because they are structurally ambiguous. That is, as for the interpretation in (21b), *jeweils* combines with the VP denoting an event predicate. On the other hand, for the interpretation in (21c), *jeweils* forms the object DP together with the NP *zwei Bücher* 'two books.'

- (21) a. ...weil die Jungen jeweils zwei Bücher kauften (Zimmermann 2002: 23)  
because the boys each two books bought  
b. '...because the boys bought two books each time/ at a time.'  
c. 'The boys bought two books each.' = 'Each of the boys bought two books.'

Zimmermann provides a nice compositional analysis of the *jeweils* construction in German. However, although he suggests some possibility that the analysis can be applied to other distance - distributivity markers across languages, it still remains unclear how to derive the possible interpretations of the Korean *ssik* construction with the same account. In particular, given that *ssik* can appear between an NP and its case marker, it does not seem plausible to assume that the structure is ambiguous; one instance of *ssik* is VP adjoined and another instance is forming a DP with an NP. Besides, it is not clear how to derive the interpretation of sentences with *ssik* in both subject and object positions (as seen in (8c)).

## 4. A Compositional Analysis

### 4.1 A QR Approach

Given the shortcomings of the previous analyses discussed above, I will present a new account of the *ssik*-construction in this section. In Section 2.1, we obtained two generalizations from the possible interpretations of the *ssik*-construction. One was the lower scope requirement of the *ssik*-NP; it can not be interpreted as the DistKey. Given this lower scope requirement, I propose *ssik* as a 'distributive polarity item (DPI)' which must remain within the scope of the D(istributivity) operator (Link 1983), in a parallel way to a negative polarity item (NPI) which has to be within the scope of a negator (See Ladusaw 1979, Linebarger 1980, Progovac 1988, among others, for NPI related discussion), though it is different in that the D operator is not lexically realized. The D operator has the effect of introducing universal quantification over the members of a set denoted by an argument. For *ssik* to be licensed as a DPI, the argument containing *ssik* has to be within the scope of the D operator.

- (22) Distributive Polarity Item *Ssik*:  
*Ssik* must be within the scope of the D(istributivity) operator at LF.

Another crucial point in the proposed analysis is the following:

- (23) Quantifier Raising (QR) creates an argument for the D operator.

In the *ssik* construction, the D operator is present at LF, and an argument undergoes QR for the D operator.

To clarify what I mean by this, let me present a rough structure of the *ssik* construction and the meaning of the D operator:

- (24) a.  $\begin{array}{c} 3 \\ D \quad IP \\ 6 \\ \dots ssik \dots \end{array}$   
 b.  $[[D]]: \lambda Q_{\langle e,t \rangle} \lambda X [ |X| > 1. \forall x [x \in X \rightarrow Q(x)]]$

With the meaning of the D operator in (24b), we need an argument for 'X'. In the *ssik* construction, an argument not containing *ssik* undergoes QR, and after function applications, X gets converted by the argument which has undergone QR. While an argument not containing *ssik* can undergo QR for the D operator at LF, an argument containing *ssik* can not undergo QR since *ssik*, as a DPI, must remain within the scope of the D operator. Let us consider an example to see how this analysis works.

In this analysis, we adopt the structure presented in Heim and Kratzer (1998), including the details of QR. In their framework, a sentence without *ssik* has the structure given in (25):

- (25) a. Namca twu myeng i sangca sey kay lul wunpanhayssta  
 man two CI Nom box three CI Acc carried  
 lit. 'Two men carried three boxes'  
 b.  $\begin{array}{c} IP \\ 3 \\ two\ men\ 3VP \\ 1\ 3 \\ three\ boxes\ 3VP \\ 2\ 3 \\ t_1\ 3 \\ t_2\ carried \end{array}$

Following them, we adopt the VP internal Subject Hypothesis (Kitagawa 1986; Fukui and Speas 1986; Koopman and Sportiche 1991; Huang 1993, among others), and assume that a quantifier phrase (QP) in the object position can undergo QR to the VP adjoined position to avoid a type mismatch problem, while a subject QP is interpreted in the IP spec position.

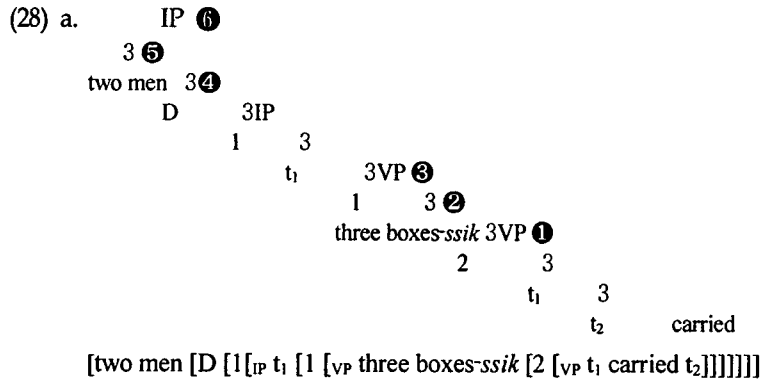
Sentence (26) has two possible interpretations given in (27). In one reading, 'two men' is the DistKey (*two men*-distributive reading), and in the other reading, event is the DistKey (event-distributive reading). First, the LF representation of the sentence for the *two men*-distributive reading is presented in (28a)<sup>12</sup>.

- (26) Namca twu myeng i sangca sey kay ssik ul wunpanhayssta  
 man two CI Nom box three CI Dist Acc carried  
 lit. 'Two men carried three boxes Dist'

- (27) a. Two men carried three boxes each.  
 $\exists Y [Y \text{ is a group of two men} \ \& \ \forall y [y \in Y \rightarrow \exists X [X \text{ is a set of three boxes} \ \& \ \exists e. y \text{ carried } X \text{ in } e]]]$

<sup>12</sup> Throughout the paper, I will use English glosses instead of actual Korean words, except *ssik*. And also, irrelevant structural details will be ignored.

- b. Two men together carried three boxes (where happened more than one instance of this, simultaneously or one after another)  
 $\exists e. \forall e' [e' \in e \rightarrow \exists Y [Y \text{ is a group of two men} \ \& \ \exists X [X \text{ is a set of three boxes} \ \& \ Y \text{ carried } X \text{ in } e']] \ (|e| > 1)$



- b. [[ two men ]]:  $\lambda R_{\langle e, t \rangle} \exists M [\text{men}(M) \ \& \ |M|=2 \ \& \ R(M)]$   
 [[ three boxes ]]:  $\lambda P_{\langle e, t \rangle} \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ P(B)]$   
 [[ D ]]:  $\lambda Q_{\langle e, t \rangle} \lambda X_{\langle e \rangle} : |X| > 1. [\forall x [x \in X \rightarrow Q(x)]]$

- ① carried(x)(y)  
 ②  $\lambda x. \text{carried}(x)(y)$   
 ③  $\exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \text{carried}(B)(y)]$   
 ④  $\lambda y. \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \text{carried}(B)(y)]$   
 ⑤  $\lambda X : |X| > 1. [\forall x [x \in X \rightarrow \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \text{carried}(B)(x)]]]$   
 ⑥  $\exists M [\text{men}(M) \ \& \ |M|=2 \ \& \ \forall x [x \in M \rightarrow \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \text{carried}(B)(x)]]]$

In contrast to (25b), this structure of the *ssik*-construction has a D-operator and involves an instance of QR of the subject additionally.<sup>13</sup> *Two men*, which does not have *ssik*, undergoes QR for the D operator and gets interpreted distributively. As a result, we get the *two men* distributive reading (i.e., each man carried three boxes). In the structure, *three boxes ssik* remains within the scope of the D operator, satisfying the licensing condition on *ssik* as a DPI. (28b) shows the compositional interpretation in detail.<sup>14</sup> At the end, we get the interpretation in (28) ⑥: *There is a group of two men and for each member x of the two men, there is a set of three boxes B and x carried B.*

Then how do we get the event distributive reading of (26)? This case seems to be a challenge to our compositional analysis, since the distribution has to be over an event, instead of other (regular) NPs, and the

<sup>13</sup> Having a D operator in the structure and a QR'ed element above it is not directly adopted from Heim and Kratzer (1998), though I adopt the possibility from them that an argument undergoes QR and an index is created below the QR'ed element. I follow Beck (2000) regarding the possibility that the D operator can appear between a QR'ed element and an index.

<sup>14</sup> As we can see from the compositional interpretation in (38), we will get the same result even without additional QR of the subject if we have the D operator right below the subject:

[<sub>IP</sub> two men [D [1<sub>VP</sub> three boxes-ssik [2<sub>VP</sub> carried ]]]]]]

So, as for a subject NP distributive reading, we can go with either option; we can have the D operator right above or below the subject NP. However, if it is a case of an object NP distributive reading, we will have to have the D operator above the subject. Just to make it consistent and avoid unnecessary confusion, we will continue to place the D operator above the subject in every relevant case



event is not overtly realized in the structure. Is there any way to account for the event distributive reading just as we did for the *two men* distributive reading, as shown above in (28)? To account for the event distributive reading, I suggest a new approach to events:

(29) An event argument can be present in the LF structure.

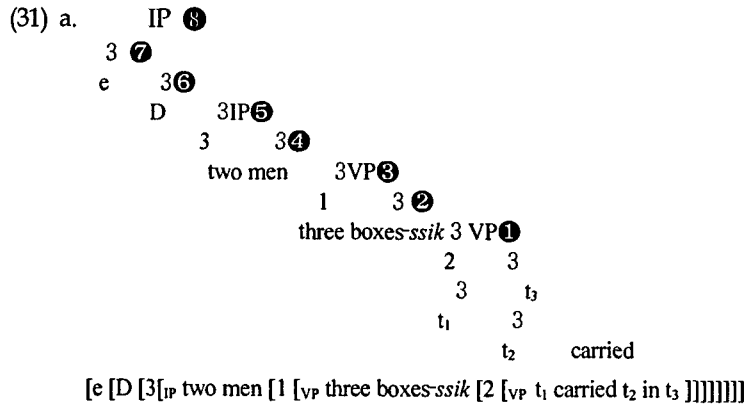
Percus (1998, 2000) proposes that situation pronouns be present at LF (see Percus 1998 or 2000 for detailed arguments). His analysis of the situation pronouns suggests the possibility that implicit arguments can be realized as explicit ones. In favor of this possibility, then, we can also assume that events are present as explicit arguments at LF.<sup>15</sup> So I assume here that events are not only present in semantics but also can be represented explicitly at LF. In the following, I will show that we need to assume this for a better account of the interpretations and the properties of the *ssik* construction.

Since now we assume that an event argument can be present in the structure, the LF structure for the *two men* distributive reading in (28) can also be modified to include the event argument:

- (30) a.
- b. ①  $\exists e.\text{carried}(x)(y)(e)$   
 ②  $\lambda x.\text{carried}(x)(y)(e)$   
 ③  $\exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \exists e.\text{carried}(B)(y)(e)]$   
 ④  $\lambda y. \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \exists e.\text{carried}(B)(y)(e)]$   
 ⑤  $\lambda X:|X|>1. [\forall x[x \in X \rightarrow \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \exists e.\text{carried}(B)(x)(e)]]]$   
 ⑥  $\exists M[\text{men}(M) \ \& \ |M|=2 \ \& \ \forall x[x \in X \rightarrow \exists B[\text{boxes}(B) \ \& \ |B|=3 \ \& \ \exists e.\text{carried}(B)(x)(e)]]]$

Turning back to the event distributive reading of (26), I propose (31a) as the LF structure. The difference between the LF structure in (30a) and the one in (31a) lies in the argument undergoing QR for the D operator; In (30a), it is 'two men,' and in (31a), it is the event argument which I assumed to be present in the LF. In this respect, I am treating the event argument in a parallel way to the argument 'two men,' as in (30a). The LF and the intermediate steps for a compositional interpretation are presented in (31b). Here I will refer to the type of an event as  $\langle i \rangle$ .

<sup>15</sup> Here it should be pointed out that I do not mean that event arguments are (newly-)inserted at LF; I mean that events can be present/realized at the LF structure just like other arguments. In fact, nothing in principle seems to prevent events from being present in overt syntax. Actually, Progovac (1998) argues for overt syntacticization of events in her discussion of event pronominal *to* in Serbo-Croatian.



- b. [[ two men ]]:  $\lambda R_{\langle e,t \rangle} \exists M [\text{men}(M) \ \& \ |M|=2 \ \& \ R(M)]$   
 [[ three boxes ]]:  $\lambda P_{\langle e,t \rangle} \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ P(B)]$   
 [[ D ]]:  $\lambda Q_{\langle t,t \rangle} \lambda X_{\langle t \rangle} |X|>1. [\forall x [x \in X \rightarrow Q(x)]]$

- ①  $\text{carried}(x)(y)(v)$
- ②  $\lambda x. \text{carried}(x)(y)(v)$
- ③  $\exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \text{carried}(B)(y)(v)]$
- ④  $\lambda y. \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \text{carried}(B)(y)(v)]$
- ⑤  $\exists M [\text{men}(M) \ \& \ |M|=2 \ \& \ \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \text{carried}(B)(M)(v)]]$
- ⑥  $\lambda v. \exists M [\text{men}(M) \ \& \ |M|=2 \ \& \ \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \text{carried}(B)(M)(v)]]$
- ⑦  $\lambda X: |X|>1. [\forall x [x \in X \rightarrow \exists M [\text{men}(M) \ \& \ |M|=2 \ \& \ \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \text{carried}(B)(M)(x)]]]]$
- ⑧  $\exists e \forall x [x \in e \rightarrow \exists M [\text{men}(M) \ \& \ |M|=2 \ \& \ \exists B [\text{boxes}(B) \ \& \ |B|=3 \ \& \ \text{carried}(B)(M)(x)]]]$

At last, we get the interpretation in (31b) ⑧: *There is an event and for every member of the event, that is, for every sub event, there is a group of two men M and a set of three boxes B, and M carried B in the sub event.* As mentioned in section 2.1, I assume that events can be plural if they contain sub events (Krifka 1992, Lasersohn 1995, Landman 1996,1997, Brisson 1998). And also, I am treating an event as an argument in a parallel way to a lexical argument, thereby having the event argument undergo QR. Some concern may arise regarding whether it is conceptually plausible to treat an event argument in this way. Heim and Kratzer (1998:210) basically assume that DPs of type e (type of an individual) can undergo QR, while DPs of type  $\langle\langle e,t \rangle, t \rangle$  (type of a quantifier) must undergo QR, and apply the idea to their analysis of VP ellipsis. If we adopt their idea, basically any DP argument can undergo QR. So I assume that an event argument can also undergo QR, once it appears as an argument in the structure. In (31), since an event argument is present in the LF structure, it can undergo QR for the D operator just as 'two men' does in (30) and this is how we get the event distributive reading.

Note that *ssik* remains within the scope of the D operator also in (31), satisfying the licensing condition. With *ssik* in the object position, the sentence (26) has two possibilities of QR: QR of 'two men,' the subject, or QR of the event argument, which result in *two men* distributive reading and event distributive reading respectively.

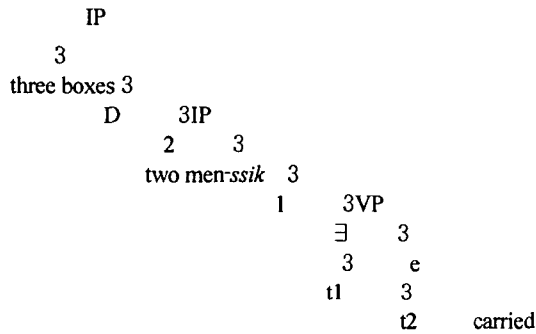
Likewise, we can account for the interpretations of (32), which has *ssik* in the subject position and two possible interpretations given in (33):

(32) Namca twu myeng ssik i sangca sey kay lul wunpanhayssta  
 man two Cl Dist Nom box three Cl Acc carried  
 lit. 'Two men Dist carried three boxes'

- (33) a.  $\exists X [X \text{ is a set of three boxes} \ \& \ \forall x [x \in X \rightarrow \exists Y [Y \text{ is a group of two men} \ \& \ \exists e. Y \text{ carried } x \text{ in } e]]]$   
 b.  $\exists e \forall e' [e' \in e \rightarrow \exists Y [Y \text{ is a group of two men} \ \& \ \exists X [X \text{ is a set of three boxes} \ \& \ Y \text{ carried } X \text{ in } e' ] ] ] (|e| > 1)$

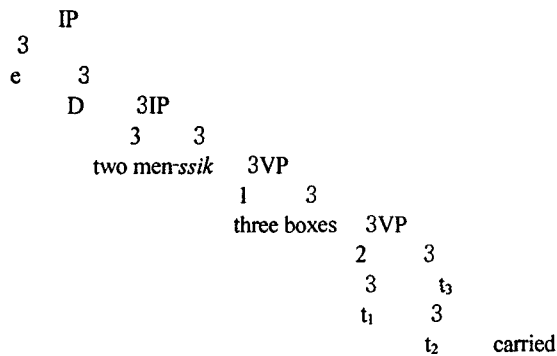
The sentence has two possible interpretations: *three boxes* distributive reading (i.e., (33a)) and event distributive reading (i.e., (33b)). In (32), *ssik* appears with 'two men,' and therefore, 'two men' has to remain under the scope of the D operator. On the other hand, 'three boxes' and the event argument can undergo QR, since they do not contain *ssik*. If 'three boxes' undergoes this movement, we will get the LF in (34a) and accordingly, the interpretation in (34b), that is, *three boxes* distributive reading. And if the event argument moves, we will get the event distributive reading in (35b) with the LF representation in (35a).

(34) a. LF: [three boxes [D [2[IP two men ssik [1 [VP t<sub>1</sub> carried t<sub>2</sub> in e]]]]]]



b.  $\exists B[|B|=3 \ \& \ \text{boxes}(B) \ \& \ \forall y[y \in B \rightarrow \exists M[|M|=2 \ \& \ \text{men}(M) \ \& \ \exists e.\text{carry}(y)(M)(e)]]]$

(35) a. LF: [e [D [3[IP two men ssik [1 [VP three boxes [2 [VP t<sub>1</sub> carried t<sub>2</sub> in t<sub>3</sub>]]]]]]]]



b.  $\exists e \forall x[x \in e \rightarrow \exists M[|M|=2 \ \& \ \text{men}(M) \ \& \ \exists B[|B|=3 \ \& \ \text{boxes}(B) \ \& \ \text{carry}(B)(M)(x)]]]$

## 4.2 More Discussion for the Analysis

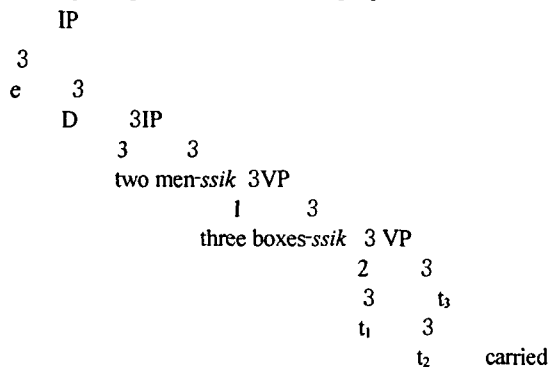
### 4.2.1 Multiple Occurrences of *Ssik*

Sentences with multiple occurrences of *ssik* support the proposed analysis further. [Since sentence (36) has *ssik* in both the subject and the object position, the only possibility for an argument to undergo QR for the D-operator lies in the event argument. When the event argument undergoes QR, we get the structure in (38a) and the interpretation in (38b). This is how sentence (36) has only one possible interpretation, event-distributive reading.

- (36) Namca twu-myeng-ssik-i sangca sey-kay-ssik-ul wunpanhayssta  
 man two-Cl-Dist-Nom box three-Cl-Dist-Acc carried  
 lit. 'Two men-Dist carried three boxes-Dist'

- (37)  $\exists e. \forall e' [e' \in e \rightarrow \exists Y [Y \text{ is a group of two men} \ \& \ \exists X [X \text{ is a set of three boxes} \ \& \ Y \text{ carried } X \text{ in } e' ] ] ] (|e| > 1)$

- (38) a. LF: [e [D [3<sub>IP</sub> two men *ssik* [1 [VP three boxes *ssik* [2 [VP t<sub>1</sub> carried t<sub>2</sub> in t<sub>3</sub> ]]]]]]]]]



- b.  $\exists e \forall x [x \in e \rightarrow \exists M [ |M| = 2 \ \& \ \text{men}(M) \ \& \ \exists B [ |B| = 3 \ \& \ \text{boxes}(B) \ \& \ \text{carry}(B)(M)(x) ] ] ] ]$

In this framework, *ssik* itself does not have any semantic content. It only satisfies one condition as a DPI to be licensed in the structure. The proposed analysis has an advantage over any analysis assuming *ssik* itself has the denotation of the D-operator which involves universal quantification over the domain, since it is not clear how we can derive the interpretation of the sentence (36). (36) has *ssik* both in the subject and the object positions, but the distributive interpretation of (36) does not really seem to involve double-layered distribution, which we would normally expect if we apply the distributive meaning twice during the derivation.

### 4.2.2 Plural Requirement of DistKey

There are cases where the *ssik* construction allows event distributive reading only. We have already observed one above in (36), where both the subject and the object contain *ssik*. Another case is observed from sentences like (39).

- (39) John i sangca twu kay ssik ul wunpanhayssta  
 John Nom box two Cl Dist Acc carried

lit. 'John carried two boxes Dist.'

(39) has event-distributive reading only, that is, John carried two boxes each time. This can be correctly explained in the present analysis. Consider the denotation of the D-Operator in (40):

$$(40) \quad [[D]]: \lambda Q_{\langle e/i, t \rangle} \lambda X_{\langle e/i \rangle} : |X| > 1. [\forall x [x \in X \rightarrow Q(x)]]$$

Given the denotation of the D operator, it naturally requires a set including more than one member. That is, the cardinality of X has to be more than one. If John undergoes QR in (39), the structure will be undefined since it fails to satisfy the presupposition the D-Operator carries. The event argument can satisfy the requirement, as far as it involves multiple sub-events, which is why (39) has event-distributive reading only.

#### 4.2.3 Locality Condition

As mentioned in Section 3, there is some locality condition on the *ssik*-construction:

(41) Locality condition on the *ssik*-construction:

Distributive relations in the *ssik*-construction are available only between clause-mate arguments.  
(Choe 1987)

In (42), the only available interpretation is the matrix clause event-distributive reading, as given in (43). This suggests that the plural NP in the embedded clause, *haksayngtuli* 'students,' does not cause distributive interpretations as the DistKey, interacting with *ssik*. In this sentence, a distributive reading where the plural embedded subject takes higher scope than the *ssik*-NP (that is, 'one friend per student' reading) is not possible to get.

(42) John-i cinkwu han-myeng-ssik-ekey haksayngtul-i kaswu han-myeng-ul mannassta-ko  
 John-Nom friend one-Cl-Dist-Dat students-Nom singer one-Cl-Acc met-Comp  
 malhayssta  
 said  
 lit. 'John said to one friend-Dist that students met one singer'

(43)  $\exists e \forall e' [e' \in e \rightarrow \text{in } e', \text{ John said to one friend that students met one singer}]$ .

Likewise, in (44), a distributive interpretation which has *cemwentuli* 'clerks' as the DisKey and *pwungsen hana* 'one balloon' as the DistShare is not available. The sentence has two available interpretations. One is the one which has *aituli* 'children' as the DistKey and *pwungsen hana* 'one balloon' as the DistShare as in (45a). The other is the embedded clause event-distributive reading, which has event as the DistKey and 'one balloon' as the DistShare as in (45b). Given this, distributive interpretations are possible to get only between clause-mate arguments.

(44) Cemwentul-i aitul-i phwungsen hana-ssik-ul sassta-ko malhayssta  
 clerks-Nom children-Nom balloon one-Dist-Acc bought-Comp said  
 lit. 'Store-clerks said that children bought a balloon-Dist.' (Choe 1987: 54)

(45) a. Store-clerks said that  $[\forall x [x \in \text{children} \rightarrow \exists Y \exists e [\text{one balloon}(Y) \& X \text{ bought } Y \text{ in } e]]]$

b. Store-clerks said that [ $\forall e'[e' \in e \rightarrow \exists X \exists Y [\text{children}(X) \ \& \ \text{one balloon}(Y) \ \& \ X \text{ bought } Y \text{ in } e']]$ ]

Given that the proposed analysis of *ssik* takes a QR approach, we can attribute this clause-boundness of the *ssik*-construction to the property of QR. It has been generally assumed that QR is a clause-bound operation, though not quite strict. The possible interpretations of (42) and (44) suggest that QR of arguments in the *ssik*-construction is rather strictly clause-bound. In (42), for example, the embedded subject *haksayngtuli* 'students' does not undergo QR for the D-operator in the higher clause. If it were possible, we would get the *students*-distributive reading (with 'students' as the DistKey and 'one singer' as the DistShare). But this reading is not available.

Now let us consider (46). This sentence is quite similar to (42), but now *ssik* appears in the embedded clause. This sentence has two possible interpretations, given in (47).

(46) John-i      cinkwu han-myeng-ekey haksayngtul-i      kaswu han-myeng-ssik-ul      mannassta-ko  
 John-Nom   friend one-Cl-Dat                  students-Nom   singer one-Cl-Dist-Acc                  met-Comp  
 malhayssta  
 said  
 lit. 'John said to one friend that students met one singer-Dist.'

- (47) a. John said to one friend that each of the students met one singer.  
 b. John said to one friend that students (as a group) met one singer at a time.

That is, we have two distributive interpretations for the embedded clause. We can account for these interpretations by clause-bound QR operations in the embedded clause at LF. Then what about the matrix clause? Suppose the D-operator is also present in the matrix clause, as there seems nothing to prevent this in principle. Then the event argument in the matrix clause will be available to undergo QR for the D-operator. If this happens, we will get the matrix clause event-distributive reading, though we do not get *John*-distributive reading since it is singular. However, in fact, the sentence does not have any distributive interpretation in the matrix clause. This suggests that the D-operator is not present in the matrix clause; it is only present in the embedded clause, licensing *ssik* and allowing two distributive interpretations. Given this, we may conclude that occurrences of the D-operator are also dependent on *ssik*, not only *ssik* is dependent on the D-operator for its licensing. The D-operator is not available when the clause does not include *ssik*. *Ssik* and the D-operator must be in the same clause.

## 5. Cross-linguistic Perspectives

So far, the discussion has been focused on the *ssik*-construction in Korean. However the proposed analysis can also be applied to D-D markers in other languages, including English binominal *each*, German *jeweils*, Japanese *zutsu*, and possibly more. I will not get into the details to derive the interpretations here, but basically we assume D-D markers as DPs which have to remain within the scope of the D-operator, schematized as follows:

- (48) D-D Markers as Distributive Polarity Items (DPIs)  
 D-D markers must be within the scope of the D(istributivity)-Operator at LF.

3  
 D            IP  
               6  
 ...D-D marker...

Sentences in (49) illustrate the *zutsu*-construction in Japanese. Japanese *zutsu*, which allows multiple occurrences of the item as shown in sentence (49c), further supports the proposed analysis, since this sentence has event-distributive reading only just like its Korean counterpart.

- (49) a. Otoko huta-ri-zutsu-ga sutukeisu san-ko-o hakonda  
 man two-CI-Dist-Nom suitcase three-CI-Acc carried  
 lit. 'Two men-Dist carried three suitcases.'
- b. Otoko huta-ri-ga sutukeisu san-ko-zutsu-o hakonda  
 man two-CI-Nom suitcase three-CI-Dist-Acc carried  
 lit. 'Two men carried three suitcases-Dist.'
- c. Otoko huta-ri-zutsu-ga sutukeisu san-ko-zutsu-o hakonda  
 man two-CI-Dist-Nom suitcases three-CI-Dist-Acc carried  
 lit. 'Two men-Dist carried three suitcases-Dist.' (Gil 1990)

Also, the clause-boundness observed in the *ssik*-construction is shared by other D-D markers, as in (50)-(52), which again suggests the possibility of applying the proposed analysis to these items.

- (50) Tennin-tachi-ga [ kodomo-tachi-ga fuusen-hitotsu-zutsu-o katta]-to itta  
 clerk-Pl-Nom child-Pl-Nom balloon-one-Dist-Acc bought]-C said  
 'Store-clerks said that children bought one balloon-Dist.'
- (51) Die Verkäufer sagen dass die Jungen jeweils einen Ballon gekauft haben  
 the store clerks say that the boys each a balloon bought have  
 'The store clerks said that the boys have bought a balloon each.'
- (52) The store clerks said that the boys bought a balloon each.

## 6. Concluding Remarks

In this paper, we have investigated the semantic behavior of D-D markers, mainly discussing the *ssik*-construction in Korean, and proposed a compositional analysis to derive the possible interpretations. By analyzing D-D markers as DPIs and adopting a QR approach, the proposed analysis can successfully derive the possible interpretations in a compositional way and account for the properties of the construction in a simpler way. Since we treat a D-D marker as a DPI and do not impose any semantic import on it, the proposed analysis has advantages in deriving the possible interpretations of the construction:

(i) We do not need to assume several different denotations/types of the D-D marker depending on the position where it occurs, (ii) We can give a better account of the interpretations of the sentences with multiple occurrences of the D-D marker (e.g., *ssik*, *zutsu*).

The proposed analysis provides a new perspective on the status of QR in Korean, where scope is fairly rigid and therefore the status of QR has been debated. That is, the proposed analysis suggests the idea that QR (or at least QR-like movement) does exist in Korean, just like English, and there are some other constraints on QR which cause the scope rigidity effects in regular quantifier constructions.<sup>16</sup>

<sup>16</sup> See also Sauerland 2001 for a similar conclusion for German, which is also known as a scope rigidity language.

## References

- Beck, S. (2000) "Star Operators Episode 1: Defense of the Double Star," in K. Kusumoto and E. Villalta eds., *UMOP 23: Issues in Semantics*, 1-23.
- Brisson, C. (1998) *Distributivity, Maximality, and Floating Quantifiers*, Ph.D. Dissertation, Rutgers University, New Brunswick, NJ.
- Choe, Jae-Woong (1987) *Anti-Quantifiers and a Theory of Distributivity*, Ph.D. Dissertation, UMass., Amherst.
- Gil, D. (1990) "Markers of Distributivity in Japanese and Korean," in H.Hoji (ed.), in *Japanese/Korean Linguistics*: 385-393, The Center for the Study of Language and Information, Stanford.
- Heim, I. and A. Kratzer (1998) *Semantics in Generative Grammar*, Blackwell Publishers.
- Krifka, M. (1992) "Thematic Relations as Links between Nominal Reference and Temporal Constitution," in Ivan Sag & Anna Szabolcsi eds., *Lexical Matters*, Chicago University Press: CSLI Publications, 29-53.
- Ladusaw, W. (1979) *Polarity Sensitivity as Inherent Scope Relations*, Ph.D. Dissertation, University of Iowa.
- Landman, F. (1996) "Plurality," in S. Lappin ed., *The Handbook of Contemporary Semantic Theory*, Oxford: Blackwell, 425-457.
- Lasersohn, P. (1995) *Plurality, Conjunction, and Events*, Dordrecht: Kluwer.
- Linebarger, M. (1980) *The Grammar of Negative Polarity*, Ph.D. Dissertation, MIT.
- Link, G. (1983) "The Logical Analysis of Plurals and Mass Terms: A Lattice-Theoretical Approach," in Landman and Veltman eds., *Meaning, Use, and Interpretation of Language*, Dordrecht: Foris.
- Link, G. (1987) "Generalized Quantifiers and Plurals," in P. Gardenfors ed., *Generalized Quantifiers. Linguistic and Logical Approaches*, Dordrecht: Reidel, 151-180.
- Link, G. (1998) *Algebraic Semantics in Language and Philosophy*, Stanford: CSLI Publications.
- Penka, D. (2003) "Negative Indefinites in German," presented at the Syntax-Semantics Reading Group at MIT.
- Percus, O. (1998) "Some Instructions for the Wordly," in K.Shahin, S.Blake, and E.Kim eds., *WCCFL* 17:522-536.
- Percus, O. (2000) "Constraints on Some Other Variables in Syntax," *Natural Language Semantics* 8, 173-229.
- Progovac, L. (1988) *A Binding Approach to Polarity Sensitivity*, Ph.D. Dissertation, University of Southern California, Los Angeles.
- Progovac, L. (1998) "Event Pronominal *to*," in *Journal of Slavic Linguistics* 6, 3-39.
- Safir, K. and T. Stowell (1988) "Binominal *each*," in *Proceedings of North Eastern Linguistic Society* 18, 426-450, GLSA, Umass, Amherst.
- Sauerland, U. (2001) "On Quantifier Raising in German," ms. Downloadable from his homepage.
- Stechow, v. A. (1993) "Die Aufgaben der Syntax," in J.Jacobs, A.von Stechow, W.Sternefeld and T.Vennemann, eds., *Syntax-Ein international Handbuch Zeitgenessischer Forschung*, de Gruyter, Berlin/New York, 1-88.
- Zimmermann, Malte (2002) *Boys Buying Two Sausages Each. On the Syntax and Semantics of Distance-Distributivity*, the Netherlands: LOT.