Codistributive Interpretations in Korean*

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In this study, I have focused on codistributivity, i.e., distributivity between two plural terms, in Korean and argued that Korean shows different distributive preferences with respect to predicate categories. In order to account for the distinct preferences, I have critically reviewed three current theories about codistributivity and concluded that Brisson (2003) is the most promising. To deal with diverse distributive readings, I have recast Brisson's idea in the framework of a multi-layered event structure as discussed by Bach (1986) and Link (1987), and proposed the Economy Principle on the event structure.

Keywords: distributivity, codistributivity, plural, event, event structure, predicate categories, granularity

1. Introduction

Distributivity is an important part of semantics. Although a great deal of research has focused on the diverse readings of distributivity as well as its semantic representations, more detailed analyses are still necessary. When it comes to double occurrences of plural NPs in a sentence, distributive interpretations are much more diverse than those with a single plural NP. For example, (1a) has four interpretations as in (1b-e), depending on the interpretation of the plural terms.

(1) a. The soldiers hit the targets.
   b. The group of soldiers hit the group of targets.
   c. Every soldier hit the group of targets.
   d. The group of soldiers hit every target.
   e. Every soldier hit every target.

Theoretically, a plural term may be ambiguous between a collective reading and a distributive one. *The soldiers* may be construed as either a group of sol-

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diers or every soldier.[1] As both *the soldiers* and *the targets* are ambiguous, the double occurrence of the plural terms in (1a) leads to four possible readings as in (1b-e). In addition to these, however, (1a) has an additional interpretation. Suppose that we have two soldiers s1 and s2 and three targets t1, t2, and t3 and that s1 hit t1 and t2 whereas s2 hit t3. Obviously, (1a) is as true in this situation. As this reading is not entirely distributive or collective with respect to either of the plural NPs, it is called a 'codistributive' reading in which two plural NPs are distributed internally.[2]

When a single plural NP occurs in a sentence, distributive problems are reduced to the interpretation of the plural term and its interaction with the predicate. Depending on the theory, the lexical category of the predicate may play a role in determining the interpretation. In any case, as the source of the plurality is attributed to the single plural term, the interpretation may be distributive or collective. However, when two plural terms occur together in a sentence, the double source of plurality leads to many combinations of interpretations as in (1b-e) and also triggers a new reading of codistributivity.

In this paper, I will mainly deal with diverse cases of codistributivity in Korean. I will discuss the fact that codistributive readings are sensitive to the lexical category of the predicates. To provide a proper account for codistributivity, I will review previous analyses on this issue and also propose a revised analysis of codistributivity in semantics.

2. Codistributive Interpretations in Korean

Unlike singular NPs, the interpretations of plural terms are complex. When only one plural term occurs in a sentence, it is ambiguous between distributive and collective readings. In a distributive reading, each of the individuals referred to by the plural term carries out an event denoted by the predicate. In a collective reading, all the individuals in the representation of the plural term carry out an event together. For example, the plural NP *haksayngtul* may be a distributive or collective reading depending on the interpretation of the predicate in the sentence.

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[1] I do not use 'a group' in the same technical sense as Landman (1989) and Lasersohn (1995). Rather, it is adopted here to refer to the collective reading of a plural term in an informal way, and thus it is in the same line with other terms like 'a sum' and 'a bunch.' As the distinction between these terms is not part of the main concerns in this paper, I will not go into the details of the semantics of plural terms. I will assume a semi-lattice structure for plural individuals, following Link (1983).

[2] Codistributive readings are referred to in a number of different ways: 'serially distributive' interpretations as in Kroch (1974) and 'cumulative' interpretations as in Scha (1984) and Beck and Sauerland (2000).

(2) a. Haksayngtul-i phyopon-ul mantulessta.
        students-Nom sample-Acc made
        '(The) students made a sample.'
    b. Haksayngtul-i phiano-lul olmkyessta.
        students-Nom piano-Acc carried
        '(The) students carried a piano.'

When it occurs with a distributive-oriented predicate, which refers to an event possibly carried out by a single individual, as in (2a), it is more likely to deliver a distributive reading such that each of the students made a sample. However, when it is accompanied by a collective-oriented predicate as in (2b), a more plausible interpretation is that students carried a piano together. In other words, (2a) is a plural event the number of which is as many as that of the students, while (2b) asserts the existence of a single event done by the students together.

When more than one plural term occurs in a sentence, the number of possible readings of the sentence is enlarged. Suppose that there are three students st1, st2, and st3 and four samples sp1, sp2, sp3, and sp4 in a given situation. Theoretically, (3), which includes two plural terms, may be interpreted in five different ways.

(3) Haksayngtul-i i   phyopontul-ul mantulessta.
    students-Nom these samples-Acc   made
    '(The) students made these samples.'

When both of the plural terms are interpreted collectively, (3) means that the three students as a group made the four samples together. When only *haksayngtul* is interpreted collectively, the interpretation is that the students as a group made the samples one by one. In comparison with these two interpretations, there are two less plausible interpretations such that each of the students made all the samples simultaneously or one by one. As making the same sample several times is not possible for pragmatic reasons, the distributive interpretations for *phyopontul* are not available for (3). In addition to these four possible readings, (3) may have a rather vague reading such that each of the students made at least one sample or that each of the samples are made by at least one of the students. In other words, (3) may be asserted in the situation that st1 made sp1, st2 made sp2 and sp3, and st3 made sp4 or in the situation that st1 and st2 made sp1 and st3 made sp2, sp3, and sp4. In either of the readings, the two plural terms are distributively interpreted but not in a one-to-one correspondence. These readings are called 'codistributive'.

Now the question is when this codistributive reading is available. Since codistributivity holds between two plural terms, the double occurrence of plural NPs is necessary. However, when we consider diverse sentences, the double

occurrence of plural terms does not guarantee their codistributive interpreta-
tions. First, here is a sentence with an activity predicate.

(4) Haksayngtul-i phianotul-ul olmkyessta.
    students-Nom pianos-Acc carried
    '(The) students carried (the) pianos.'

As discussed above, there are five possible interpretations for (4) depending on
their distributive relations. Some of them are more salient for pragmatic rea-
sons while some of them are implausible. Of these five readings is the codis-
tributive interpretation between *haksayngtul* and *phianotul*, which asserts that all
the students participated in at least one of the events of carrying (the) pianos
and all the pianos were carried by at least one of the students. How to match a
group of students and a piano for carrying relations may vary depending on
the situation. Some students may be involved in more than one carrying events
while some students may contribute to only a single event of carrying a piano.
As these readings are not completely collective or distributive, the sentence is
not construed to mean that all the pianos were carried at a time or that the
same pianos were carried in many instances by different students.

The codistributive-matching relation between students and pianos is sup-
ported by the fact that (5) may follow (4) in the discourse.[3]

(5) Kuliko caki-ka olmkin phiano-lul cemkemhayssta.
    and   he-Nom carrying piano-Acc inspected
    'And he inspected the piano(s) that he carried.'

When (5) follows (4) in the discourse, *caki* refers to one of the students in (4).
Note that both of the NPs in (5) are in the singular form. As the occurrence of
the plural morpheme *-tul* is not always needed to deliver a plural reading in
Korean, the singular form of *phiano* in (5) does not necessarily refer to a singu-
lar entity.[4] However, a singular reference can be one of the possible readings
for the NP. Then, it is clear that the inspecting relation asserted by (5) holds
between one of the students in (4) and the piano(s) that he carried. This pro-
vides further support for the argument that (4) has a codistributive reading.
Therefore, we can say that the codistributive relation in (4) may be verified by
the occurrence of the following sentence which shows the matching relation.
Furthermore, we can also conclude that a sentence with an activity predicate

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[3] The syntax and semantics of *caki* is not precisely the same as that of ordinary personal anaphors
     as it is a long-distance reflexive. However, this is not a primary concern here, so I will treat it like
     an ordinary anaphor for the simplicity of exposition.
[4] See E-J Kwak (2001) for more arguments on the relation between semantic plurality and plural
     morphology in Korean.

may lead to a codistributive reading.

    Second, we will consider a sentence with an accomplishment predicate.

(6) a. Ttang soyucatul-i   cenwencwuthayktul-ul ciessta.
             land owners-Nom cottages-Acc   built
             '(The) landowners built cottages.'
      b. Kuliko caki-ka ciun cwuthayk-ulo isa-lul   hayssta.
             and   he-Nom built cottage-Loc   movement did
             'And he moved to the cottage that he built.'

Following (6a), *caki* of (6b) refers to one of the landowners. Moreover, the matching relationship between one of the landowners and his cottage success-fully holds in (6b). This shows that (6a) may be interpreted in a codistributive way. In other words, (6a) may assert that each landowner built his own cottage. Thus, we can see that a sentence with an accomplishment predicate also al-lows a codistributive interpretation.

    Third, we will consider whether a sentence involving an achievement predi-cate patterns similarly to the previous instances of distributivity.

(7) a. Haksayngtul-i pancangtul-ul popassta.
             students-Nom captains-Acc elected
             '(The) students elected (the) captains.'
      b. Kuliko caki-ka ppopun pancang-uy mal-ul   cal tulessta
             and   he-Nom elected captain-Poss direction-Acc well followed
             'And he followed the captain that he elected.'

(7a) is naturally followed by (7b), which shows in turn that (7a) allows a codis-tributive reading. This reading is verified by the matching relationship between a student and the captain that he elected as asserted by (7b).

    Finally, we will check whether the last category of predicates, namely states, also shows the same distributive pattern.

(8) a. Phisilhemcatul-i mwunceytul-ul mili   alko issessta.
             subjects-Nom   questions-Acc in advance know was
             '(The) subjects knew (the) questions in advance.'
      b. #Kuliko caki-ka anun   mwuncey-lul cenghwakhi machyessta.
             and   he-Nom known questions-Acc correctly   answered
             'And he answered correctly the questions that he knew.'
      c. Kuliko tatul ku   mwunceytul-ul cenghwakhi machyessta.
             and   all   those questions-Acc correctly   answered
             'And they all answered those questions correctly.'

(8a) is a sentence with two plural terms just like the previous instances. However, (8a) cannot be followed by (8b) in a codistributive reading. Note that semantic plurality in Korean does not always require the occurrence of the plural morpheme *-tul*. Hence, *mwuncey* in (8b) may refer to either a single question entity or plural questions. When it has a singular interpretation, (8b) presupposes a codistributive relation between the students and the questions such that each of the students knew a question that was different from those that other students knew. However, this presupposition does not hold for (8b), which in turn shows that the codistributive reading is not available for (8a). This argument is further supported in that (8c) may follow (8a). The occurrence of a plural NP *ku mwunceytul* requires the collective interpretation of *mwunceytul* in (8a). Thus, we can say that (8a), involving a state predicate, may not be interpreted codistributively but may have a collective interpretation.

Although codistributivity is seen in sentences with predicates other than states, it is not allowed when they are embedded in states.

(9) a. Phulokulaym-ey chamkahan namcatul-i miintul-kwa kyelhonhayssta.
         program-Loc   participating men-Nom beauties-Conj married
         '(The) men participating in a/the program married (the) beauties.'

     b. Phulokulaym-ey chamkahan namcatul-i miintul-kwa kyelhonhako
         program-Loc   participating men-Nom beauties-Conj to-marry

         siphehayssta.
         liked

         '(The) men participating in a/the program liked to marry (the) beauties.'

When the plural terms *namcatul* and *miintul* are taken as the arguments of an achievement predicate such as *kyelhonhayssta* in (9a), the sentence leads to a codistributive reading. That is, each of the men participating in a/the program married one of the beauties and each of the beauties was married to one of the men. However, when *kyelhonhata* is embedded in a state predicate such as *siphehayssta* in (9b), the codistributive reading is not maintained. (9b) allows distributivity only for *namcatul*, and thus it is construed that each of the men liked to marry (the) beauties. This shows that the occurrence of a state is crucial in canceling codistributivity.

I have shown that the double occurrence of plural terms is not enough to trigger codistributivity. Codistributivity between two plural terms can occur when their predicates are activities, accomplishments, or achievements but not when the predicates are states. Given the different patterns of codistributivity with regard to predicate categories, we need to consider how codistributivity is related to the semantics of predicates. To answer this question, one must con-

sider previous analyses for codistributivity and provide a revised analysis to account for codistributive readings in Korean.

3. Previous Analyses

Codistributivity may be understood as bi-distributivity or internal distributivity between two terms. As codistributivity also results in distributive relations, most theories on this assume a distributive operator. However, they are divided as to how many arguments a distributive operator takes and whether theoretical focus is anchored to the semantics of NPs or predicates. I will review three current theories that maintain different positions on these issues and discuss which theory is the most promising for the present problem.

3.1. Winter (2000): A Dependency Analysis

Winter (2000) starts from the fact that codistributivity holds only between two definite NPs. He argues that definites in English may play a role of lexical anaphors and assumes that one of the plurals in a codistributive relation contains an implicit variable bound by the other one. Suppose that (11) is uttered in context (10).

(10) At a shooting range, each soldier was assigned a different set of targets and had to shoot them. At the end of shooting we discovered that

(11) the soldiers hit the targets.

Because there is no unique set of targets for all the soldiers in this context, the denotation of *the targets* in (11) needs to be varied in accordance with the identity of each solider. In other words, its denotation is dependent on that of *the soldiers*, and thus *the targets* is similar to an anaphor *their targets* in its semantics. Hence, Winter assumes that one of the plural definites in a codistributive sentence acts like a lexical anaphor, which may be bound syntactically or contextually. He also argues that the anaphoric property of the definite article is further supported by the fact that conjunctive plurals like *John and Mary* do not license codistributivity.

Then, the interpretation of (11) is represented as in (12), where *t* is a contextual function for the anaphoric relation between the soldiers and the targets.

(12) $\forall x[\text{soldier}(x) \rightarrow \text{hit}(t(x))(x)]$
  t: a contextually salient function from individuals to individuals mapping each solider to a target

(12) asserts that for every x, where x is a soldier, there is an event that x hits the targets that he is matched with. In other words, the semantics of (11) is more or less like that of (13).

(13) Each soldier hit the target(s) assigned to him.

As the codistributive effect is realized by the assumption of dependent definites, the distributive operator takes only one plural definite in Winter's analysis. Beck and Sauerland (2000) discuss the problems of Winter's analysis in detail, which I will not repeat here. Instead, I will point out that since Winter's dependency analysis crucially hinges on the semantics of definite NPs, it is less useful in languages like Korean, where definiteness is not as prominent. Moreover, his analysis does not consider different distributive patterns as to predicate categories, and therefore it cannot provide a satisfying account for the present problem.

3.2. Beck and Sauerland (2000): A Double QR Analysis

Contrasting with Winter's (2000) analysis based on the unary operator for distributivity, Beck and Sauerland (2000) assume that the operator for codistributivity should be polyadic. Following Sternefeld (1998), they assume that the distributive operator takes two plural terms as its arguments to form a codistributive relation. They call this operator the '**-operator', which is defined in (14)

(14) $[**R](X)(Y) = 1$ iff $\forall x \in X\ \exists y \in Y\ R(x)(y)$ and $\forall y \in Y\ \exists x \in X\ R(x)(y)$

Having two plural terms as arguments, the ** operator returns binary distributivity as to both of the terms. (14) says that taking the plural terms X and Y, and their relational predicate R as arguments, the ** operator asserts that for every x of X, there is y of Y in the relation R and that for every y of Y, there is x of X in the relation R. They argue that the ** operator is a syntactic one, and can be applied to any pair of plural terms in a sentence.

In addition to the assumption of the polyadic distributor, Beck and Sauerland propose that definite plurals can undergo quantifier raising (QR), and that this QR can create the binary predicate required for the application of the codistributive operators. Then, the semantics of (15a) is represented as in (15b).

(15) a. The soldiers hit the targets.
      b. [the soldiers][the targets]**$\lambda y \lambda x$[x hit y]

Both *the soldiers* and *the targets* move from their surface position to the scope position by QR, leaving their variables in the original place. These variables are bound by the ** operator, which has the effect of binary distributivity. This is how the codistributive reading of the sentence is derived.

Beck and Sauerland's analysis crucially hinges on the idea that definites undergo QR and provide variables for the ** operator. However, they do not provide sufficient evidence to justify the quantifier properties of definites. They do not deal with relevant issues such as whether definite singulars also undergo QR, how definite plurals and ordinary quantifiers show similarities, whether definite plurals always undergo QR even when they do not have codistributive relations, and so on. They argue that codistributive relations are under the same syntactic restrictions as other QR phrases, which will justify definites' QR. I agree that this observation may provide empirical evidence for their proposal, but still they do not have any account for the more fundamental questions mentioned in the above.

3.3. Brisson (2003): An Analysis with 'DO'

Discussing the maximizing effect of *all*, Brisson (2003) considers codistributivity in the framework of event semantics. She uses the term 'event' for both events and states, adopting a rather broad concept of events in the spirit of Bach (1981). As an event argument on a verb is introduced, the semantics of a proposition is reinterpreted as the assertion of the existence of an event that is described by the proposition.[5]

(16) a. John ate beans.
     b. $\exists e[\text{ate'}(e) \ \& \ Ag(e,J) \ \& \ Th(e, \text{beans'})]$

The predicate *ate* is treated as a predicate of events, and individuals participating in the event as an agent or theme are linked to the event by means of thematic roles. Hence, (16a) is construed that there is an event e such that e is an eating event and takes J as its agent and beans as its theme. In event semantics, events are treated as individuals just like other ordinary individuals like *John* and *Mary*.
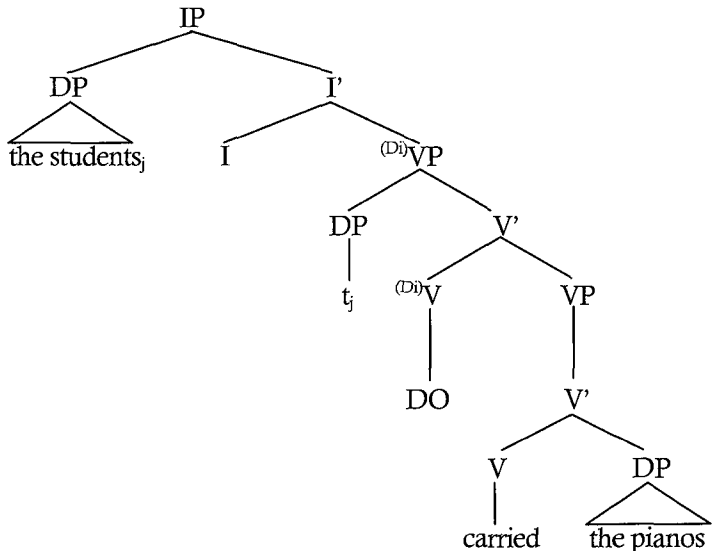
To derive (co)distributive readings, Brisson proposes a bleached-out activity predicate called 'DO', which is a subcomponent of the meaning of verbs (see

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[5] The event semantics is divided into two categories depending on how nominal arguments are connected to events. In the Davidsonian semantics, events and nominal arguments are treated equally as arguments taken by predicates. In the neo-Davidsonian semantics, however, events are connected to nominal arguments indirectly through thematic roles. Brisson adopts the neo-Davidsonian semantics here. For the discussions of these semantics, see Davidson (1967), Parsons (1990), Krifka (1992), Lasersohn (1995), and Schein (1995), among others.

Dowty (1979), and Pustejovsky (1991)). Depending on the predicates, the precise meaning of DO may be explicitly represented by the meaning of the predicate. For example, a predicate like *sweep the floor* will take the act of moving a broom back and forth across the floor as part of its DO. On the other hand, a predicate like *build a raft* may include a variety of acts for its DO: hammering, sawing wood, etc. What DO consists of for each predicate is considered as part of the lexical meaning of the predicate. She further argues that activities and accomplishments have an internal structure and thus take DO as part of their lexical meaning. However, states and achievements do not have any internal structure at all, so they are assumed to lack DO.

For the syntax of DO, Brisson assumes that DO is projected as a separate and phonetically empty verbal head in the syntax and licensed by the semantics of the lexical head. She proposes that activities and accomplishments project two heads into the syntax, and that the higher head is an aspectual head that contains the DO portion of the predicate. This higher head contributes the meaning of DO to the verb and takes the subject as its argument. Then syntactic structure of (17a) is then represented as in (17b).

(17) a.   The students carried the pianos.
     b.

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                        IP
                 _____/ _____
                DP              I'
              /    \          /    \
        the students_j      I      (Di)VP
                                  /      \
                                DP        V'
                                |       /    \
                                t_j   (Di)V    VP
                                       |        |
                                      DO        V'
                                              /    \
                                             V      DP
                                             |     /  \
                                          carried  the pianos
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Given the syntactic structure of (17), the lexical semantics of the predicate *carry* is divided between two verbal heads as shown in (18a) and (18b).

(18) a. DO = $\lambda x \lambda e[DO(e)\ \&\ Ag(e,x)]$
     b. carry' = $\lambda x \lambda e\ [carry'(e)\ \&\ Th(e,x)]$

c. DO carry the pianos' = $\lambda x \lambda e[\text{carry'}(e) \text{ \& Th}(e, \text{the\_pianos}) \text{ \&}$
    $\text{DO}(e) \text{ \& Ag}(e, x)]$

Taking the subject and an event as arguments, DO asserts an agent relation between the subject denotation and the event. The lower verbal head *carry*, on the other hand, takes an object and an event as arguments and asserts a theme relation between the object denotation and the event. Since a sentence cannot assert two events at the same time, the two events introduced in (18a) and (18b) need to be combined in some way. Hence, Brisson proposes 'event composition,' revising Kratzer (1994)'s 'event identification.'[6] Applying event composition to the two verbal heads feeds into the interpretation of *DO carry the pianos* as in (18c).

Given the syntax and semantics of a sentence like (17a), Brisson argues that a distributive operator D_i may be inserted on the higher node of the VP or on the lower V node dominating DO as shown in (17b). When it is inserted on the VP, the distribution is on the predicate *carried the pianos*. As carrying the pianos is distributed over the students, each of the students is asserted to carry the pianos individually. This is obviously less plausible for pragmatic reasons. On the other hand, when the operator is on the V, it asserts the distribution of DO over the students. This will result in the reading such that each of the students does something to participate in the event of carrying the pianos. Thus, the codistributive reading is derived here.[7]

Brisson postulates that DO is part of the lexical meaning of activities and accomplishments. Her analysis accounts for the codistributive interpretation of these predicates. However, since states and achievements do not incorporate DO in their lexical meanings, the distributive operator can be inserted only on the higher VP node. Hence, these predicates are expected to lead to distributive interpretations but not codistributive readings.

Brisson's main concern is how the maximizing effect of *all* can be derived from the distributivity of a sentence. For the discussion of this problem, she goes into different preferences for distributivity in accordance with predicate categories. She points out the fact that activities and accomplishments easily lead to codistributive readings whereas states and achievements do not without strong contextual necessities. She calls this the economy principle on the insertion of a D operator. Although she provides persuasive accounts on the dis-

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[6] Brisson argues that the DO part of an event is composed with the lexical meaning of the verb, possibly with the help of a separate operator for composition. As this fits with the general process of composition, I will not go into the specification of this composition process.

[7] Brisson does not use the term codistributive in the paper. Instead, she calls this a collective reading. However, the distributivity she discusses is internal distributivity based on the distribution of DO events, which is in the same line with codistributivity. Hence, I will use codistributive readings for her collective ones for the simplicity of discussion.

tributive and codistributive readings of activities and accomplishments, she does not fully spell out why states and achievements do not normally trigger codistributive interpretations. Moreover, she fails to provide a unified account of codistributivity for the four predicate categories.

4. Codistributivity in a Multi-layered Event Structure

The three analyses reviewed in the previous section incorporate different strategies to deal with codistributive readings. First, Winter (2000) starts from the observation that codistributivity stands between two definite NPs, and thus proposes that codistributivity is the result of the dependent interpretations of one of the plural terms. As noted above, this approach does not provide a solution to the current problems surrounding codistributivity. Definiteness is not as prominent in Korean as in English. Moreover, he does not consider different codistributive effects depending on predicate categories. Second, Beck and Sauerland (2000) hinge on the idea that definite NPs are quantifier-raised out of their original scope and leave two variables for the binary-distributive operator. Although codistributivity may be achieved with this mechanism, they do not discuss fundamental issues around the QR of definite NPs. Like Winter's analysis, Beck and Sauerland's analysis focuses on the semantics of definite NPs, so their analysis cannot be remodeled to cope with the different codistributive effects. Finally, Brisson (2003) starts from the different distributivity of predicates. She provides the most promising analysis for the present problems. However, her analysis does not provide a satisfying account for states and achievements. Therefore, I will propose a revised analysis based on Brisson's work.

4.1. A Multi-layered Event Structure

Although Brisson (2003) casts her analysis in the framework of event semantics and assumes that events should be treated like individuals, she does not spare enough space for the discussion of the semantics of DO. She argues that DO is a predicate both in syntax and semantics and that the meaning is like a process to represent the subparts of activities' or accomplishments' meanings. Considering her treatment of DO, it should be like subevents that are parts of events represented by the predicates. However, she does not go into the details of the relation between events and subevents. Hence, various cases of codistributivity are not fully covered in her theory.

Before moving to the problems surrounding codistributivity, I will sketch a multi-layered event structure discussed by Bach (1986) and Link (1987). First, Bach argues that category shifts may occur between count and mass terms.

Count terms may be used as mass terms, and vice versa.

(19) a. There was dog splattered all over the road.
      b. muds = kinds of mud

Dog is a count term but may be treated like a mass one as in (19a), and a mass term *mud* may also be pluralized to refer to kinds of mud. These category shifts naturally induce structural changes in their denotations. The atomicity of dog is not maintained in (19a), and mud is counted as atomic in (19b). The former procedure is dubbed 'universal grinding' and the latter 'universal packaging'. Universal grinding changes atomic individuals to mass individuals, while universal packaging involves the reverse procedure.

Bach further discusses the fact that the same universal grinding and packaging may also apply to the event structure. It is a well-known fact that lexical categories are changeable between activities and accomplishments.

(20) a. John ran (for an hour/* in an hour).
      b. John ran a mile (in an hour/* for an hour).
      c. John ran to the office (in an hour/* for an hour).

The event of an activity is more like a mass term in the sense that it is non-atomic. On the other hand, that of accomplishment is similar to a count term, referring to an atomic event. As noticed from the sentences in (20), an activity event of running may be shifted to an accomplishment event with the occurrence of *a mile* or *to the office*. This shift is supported by the change of the durational phrase from the one with *for* to that of *in*. Hence, Bach argues that shifts from activities to accomplishments are universal packaging, i.e., changing from non-atomic to atomic, while the reverse procedures are universal grinding.

To incorporate the notions of universal grinding and packaging in the domain, Link (1987) proposes a multi-layered structure of events that are sorted by 'granularity,' i.e., the degree of conceptual specificity.

(21) E is a system of lattices $(E_i)_{i \in J}$, where J is a partially ordered set of indices which represent a certain granularity of the events in the corresponding lattice.

The event structure E consists of multiple event structures $E_1, \ldots E_i, \ldots$, which are different conceptualizations of the same realm of phenomena. These structures are partially ordered by granularity, as represented by the index. Here, the events in E_i are more fine-grained than those in E_j for $i \leq j$.

To capture the relations between multiple event structures, Link assumes a

mapping function as follows:

(22)   For all $i, j \in J$ with $i \leq j$
       there is a homomorphism h_{ij} from E_j into E_i
       such that (i) for all $i \in J$ h_{ii} is the identity map on E_i
       and (ii) for all $i, j, k \in J$ with $i \leq j \leq k$, $h_{ik} = h_{ij} \bullet h_{jk}$.

Since multiple event structures are all about the same phenomena and distin-
guished only in their granularity, events in each structure are mapped to those
in a more fine-grained structure by a mapping function h. Thus, a certain event
can be atomic in a coarse-grained domain, say E_j, and still be the image under
a h_{ij} of a complex sum of events in a more fine-grained domain E_i.
    The multi-layered event structure provides the groundwork for the inte-
grated relations between the events of predicates and the subevents of DO.

(23)   a.   The students carried a piano.
       b.   The students carried the pianos.

In Brisson (2003)'s analysis, carrying a piano in (23a) is considered an event,
and each student's participation in the event is assumed to be DO, a process
constituting the carrying event. Since there is no necessity to postulate the plu-
rality of a carrying-a-piano event, (23a) is understood to assert the existence of
an atomic event of the students' carrying a piano. Then, the subevent of DO
does not have any room to be incorporated in the event structure because an
atomic event cannot have a subevent in a single-layered event structure. Al-
though Brisson assumes a part-of relation between the denotations of predi-
cates and their DOs, her analysis actually cannot provide proper interpreta-
tions for DOs. Moreover, her analysis cannot account for the fact that the
atomic event of carrying a piano in (23a) now corresponds to the DO of (23b).
In the multi-layered event structure, however, the event of (23a) is considered
more fine-grained than that of (23b) because carrying the pianos will be com-
posed of plural events of carrying a piano. In other words, the same event of
carrying a piano does not have to be considered atomic in a more fine-grained
event structure and thus may have subevents of participating in carrying a pi-
ano. On the other hand, (23b) is properly understood in a more coarse-grained
structure, where carrying a piano is an atomic event and plays the role of DO
as to the plural events of carrying the pianos. In the multi-layered event struc-
ture, the level of the atomicity of events is determined through contexts, so the
same event may be understood to be atomic in one sentence but a plural event
in another sentence.

4.2. Codistributivity and the Economy Principle

In the previous section, I have argued for a multi-layered event structure to provide proper denotations for DO. As the event structure is multi-layered, the same phenomenon may be described in various ways depending on the granularity level of event structures. For example, the same event of freezing water in (24a) may be delivered in more fine-grained ways as in (24b) and (24c).

(24) a. John froze the water solid.
    b. John cooled the water and the water froze solid.
    c. John cooled the water, the water froze, and the water became solid.

Suppose that John's freezing water solid is atomic in the event structure E_k while it is divided into two atomic events of John's cooling water and the water's freezing solid in E_j and into three atomic events of John's cooling water, the water's freezing, and the water's becoming solid in E_i. Definitely, E_k cannot be the proper level for the interpretation of (24b) and (24c) because the water's freezing or the water's freezing solid is not represented on this level. Hence, the relevant level of event structures should be fine-grained enough to provide all the necessary events for the interpretation of the given sentences. Does this mean that the more fine-grained, the better the interpretations of sentences? Although (24a) can be assigned interpretations in E_i and E_j, it sounds very awkward to assume that the event of (24a) is a plural one consisting of two or three subevents. Without any other contextual reasons, the event of (24a) is naturally considered atomic. Then, the most appropriate event structure for (24a) is E_k. Similarly, it is E_j for (24b) and E_i for (24c). Therefore, although the same phenomenon may be represented differently in different event structures, this does not mean that a sentence may be interpreted in any event structure.

Based on the observations in (24), I propose the Economy Principle for event interpretations as follows:

(25) The Economy Principle on the Multi-layered Event Structure
    The minimal event structure that meets the requirements of the context is chosen for the interpretation of a sentence.

The minimal event structure is a structure including the minimal set of events required by the context. In other words, the most coarse-grained structure that provides sufficient events for the context is understood as the minimal event structure, and this will be chosen for interpretation. For example, coarse grained structures like E_k do not meet the requirements of the contexts for (24b) and (24c) and thus cannot be chosen. But, according to the Economy Principle, structures which are too fine-grained are not chosen. Hence, E_i and

E_j are not considered appropriate for the interpretation of (24a).

Given the Economy Principle, let us consider codistributivity in the multi-layered event structure. As discussed above, the denotation of a predicate is not determined between singular and plural events by itself. For example, *phiano-lul olmkyessta* 'carried a piano' may be either singular or plural depending on the context. When it takes a plural NP as an argument as in (26a), it is more likely to be understood as a plural event to be distributed over the students.

(26) a. Haksayngtul-i phiano-lul olmkyessta.
       students-Nom piano-Acc carried
       '(The) students carried a piano.'
    b. Kicungin-i   phianotul-ul olmkyessta.
       donator-Nom pianos-Acc   carried
       'A/the donator carried (the) pianos.'
    c. Haksayngtul-i phianotul-ul olmkyessta.
       students-Nom pianos-Acc   carried
       '(The) students carried (the) pianos.'

In this case, the DO of the predicate will correspond to participating in carrying a piano, which will be distributed over the students. When the predicate denotes a singular event, on the other hand, the DO will be vacuously identical to the predicate denotation. Hence, the event of carrying a piano will be distributed over the students. This will end up with a rather awkward reading such that the same piano was carried repeatedly by the students. For this pragmatic restriction, the distributive construal of (26a) is less preferred. Contrasting with the strong tendency of the plural interpretation of the predicate in (26a), an apparently plural event of *phianotul-ul olmkeyssta* 'carried (the) pianos' may have a chance to be interpreted as singular as exemplified by (26b). Since the subject of (26b) is singular, the predicate event does not need to be distributed and therefore has no reason to be a more complex event of multiple carrying events.[8] However, when it is combined with a plural subject as in (26c), the predicate is more likely to denote a plural event. In this case, the DO of the predicate will be the event of carrying a piano and distributed over the students As discussed before, this amounts to a codistributive reading of the sentence.

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[8] The identity of an event is determined by three factors, namely the identity of individuals, the event time and the event space. This means that when the participants of events are different, the events are considered to be distinct events. For example, the event of John's running is different from that of Mary's running. The same argument also applies to event times. John's running on Tuesday is a different event from John's running on Wednesday. Similarly, event spaces also play a role in differentiating events. Then, when more than one event time is prominent from the context of interpretation of (26b), a/the donator's carrying one piano may be differentiated from his/her carrying another piano. This will force the sentence to be interpreted in a more fine-grained event structure, and the predicate will be understood to denote a plural event.

Therefore, it is clear that the same predicate may have different event structures depending on the context. Furthermore, the economy principle will be useful to determine proper event structures for sentences and distributive patterns for them.

We have seen how codistributive readings are yielded by the Economy Principle. Now, let us consider why codistributive readings are not available for states. First, as the event structure is very flexible through a multi-layered system, no distributive patterns are actually impossible for a given sentence in principle. As far as the context allows, any pattern of distributivity can possibly be derived from the multi-layered event structure. This implication based on the event structure means that the distributive readings of activities are not blocked theoretically. The reason that (26c) does not yield a distributive reading is due to the contextual restriction that it is not plausible to carry the same pianos repeatedly by different (groups of) students. The other side of this argument is that a sentence with an activity predicate may have a distributive reading depending on the context. This argument is supported by (27).

(27) Haksayngtul-i sensayngnimtul-ul mannassta.
      students-Nom teachers-Acc   met
      '(The) students met (the) teachers.'

As the event of meeting (the) teachers may occur repeatedly with different students, (27) by itself does not have any restriction on or preference for the proper granularity level of event structures. When meeting (the) teachers is understood as a plural event, it is decomposed into more specific events of meeting a teacher and provides a proper denotation for DO. This will lead to the codistributive reading of the sentence. On the other hand, when it is interpreted as an atomic event, it cannot be decomposed to provide a denotation for DO. Then, meeting (the) teachers itself is distributed over the students to yield the distributive reading of (27). This means that when a sentence is ambiguous with respect to the granularity level of the event structure, the distributive pattern of the sentence is dependent on the choice of the level. When a fine-grained level is chosen, the denotation of the predicate will be plural and trigger a codistributive reading. However, when a more coarse-grained level is selected, the predicate denotes an atomic event and contributes to a distributive reading.

The same argument also applies to the predicate classes of accomplishment and achievement.

(28) a. Sicheng/ttang soyucatul-i   cenwencwuthayktul-ul ciessta.
        city/land   owners-Nom cottages-Acc   built
        'A/the city/(the) landowners built cottages.'

  b. Kyocangsensayngnim/haksayngtul-i pancangtul-ul ppopassta.
     principal/students-Nom   captains-Acc elected
     'A/the principal/(the) students elected (the) captains.'

The accomplishment predicate in (28a) and the achievement predicate in (28b) have the same ambiguity as the activity predicate. Both of the predicates may denote either a singular event, combining with an atomic agent such as *sicheng* and *kyocangsensayngnim*, or a plural event, combining with a plural individual of *ttang soyucatul* and *haksayngtul*. When the predicates are interpreted as plural events, they will have DO denotations which will be distributed over landowners and students, respectively. This will lead to the codistributive readings of the sentences. Although the distributive readings of the predicates as to landowners and students are not blocked by the theory, it is unimaginable to assume that the same cottages are built as many times as the number of the landowners or that the same captains are elected several times. Thus, a rather coarse event structure for these unrealistic interpretations is blocked by the Economy Principle. Therefore, the distributive readings of accomplishments and achievements are not impossible but less preferred for contextual reasons, and this preference is correctly captured by the Economy Principle.

    Finally, we will consider why states are reluctant to yield codistributive readings unlike other classes of predicates.

  (29) Phisilhemcatul-i mwunceytul-ul mili   alko   issessta.
       subjects-Nom   questions-Acc in advance know   was
       '(The) subjects knew (the) questions in advance.'

In an ordinary context, there is no requirement that knowing the questions should constitute a plural event. Since each person may know many questions at a time without causing any pragmatic problem, the minimal event structure for (29) will be a coarse-grained one in which knowing the questions is treated as an atomic event. As the subject is plural, this atomic event is distributed over the subjects. Then, the resulting interpretation is a distributed one such that each of the students knew the same set of questions in advance. Contrasting with other predicate classes, states are usually not involved with pragmatic restrictions to block distributive readings. In turn, this argument implies that when there is a contextual necessity, a codistributive reading is also available for (29). Suppose that an experiment is designed to fail when the subjects know at least one of the questions before the test. In this situation, when (29) is uttered as a cause for the failure of the experiment, the contextual focus lies on the fact that each of the subjects knew at least one of the questions. Then, a more plausible interpretation here is a codistributive reading between the subjects and the questions. This shows that a codistributive reading is not excluded

for a state but less preferred by the nature of the state itself.

Before leaving the issue of distributive preferences, we will consider why Korean shows more ambiguity in distributivity than English. Korean NPs are not morphologically explicit about definiteness and thus have an ambiguity between definite and indefinite interpretations. This ambiguity leads to ambiguity between codistributive and distributive interpretations.

(30) Chamkacatul-i   mohyengtul-ul ceychwulhayssta.
     participants-Nom models-Acc   submitted
     '(The) participants submitted (the) models.'

Mohyengtul in (30) may be construed either as definite 'the models' or indefinite 'models.' When it is construed as definite, it is pragmatically unrealistic for different participants to submit the same models for the competition. Hence, distributivity is blocked for pragmatic reasons, and codistributivity between the participants and the models is preferred. Then, the relevant event structure for the interpretation will be rather fine-grained. When it is understood as indefinite, however, it is possible to be construed that each of the participants submitted more than one model that was different from those of other participants. Hence, a distributive reading of the predicate is available. The relevant event structure of this reading will be more coarse-grained than that of a codistributive reading. The Economy Principle turns out to be useful again in providing a unified account for the ambiguity of Korean NPs.

4.3. A Revised Version of Brisson's Analysis

To derive different codistributivity patterns depending on the predicate classes, I basically adopt the syntactic framework as defended by Brisson (2003). Depending on which syntactic node the D operator is inserted at, either a distributive reading or a codistributive one is derived. When the D operator works on a VP node, the whole predicate is distributed over the subject NP and yields a distributive reading. On the other hand, when the operator is inserted on the DO node, the DO denotation is distributed to derive a codistributive reading.

Although Brisson assumes that the subparts of a predicate denotation are represented by a specially introduced predicate DO, she does not specify how DO denotations can be derived from an event structure. To cope with this problem, I assume a multi-layered event structure as discussed by Bach (1986) and Link (1987). In these multiple event structures, the atomicity of events is relative. A seemingly atomic event may be considered to be constituted of multiple subevents, or an apparently complex event may be considered to be atomic depending on the context. As the event structure does not allow abso-

lute atomicity, a predicate denotation in one sentence may serve as a DO de-
notation in another one, or vice versa.

The flexibility of the multi-layered event structure leads to the argument that
it is not reasonable to assume DO only for activities and accomplishments.
Depending on which granularity level is chosen, any class of predicate may be
used to describe a given situation. Hence, I do not accept Brisson's claim that
DO is lexically assigned only to activities and accomplishments. Rather, I as-
sume that DO is grammatically inserted into a syntactic representation regard-
less of predicate classes. As Brisson does not acknowledge DO for achieve-
ments and states, she cannot provide the same account for the distributivity of
these predicates as that of activities and accomplishments.

Since DO is inserted grammatically, sentences are open to all sorts of dis-
tributivity regardless of their predicate classes. This freedom, however, is re-
stricted by the Economy Principle on the multi-layered event structure. The
Economy Principle is required for sentence interpretations, independent of
distributivity. Since the minimal event structure that is licensed by the context
is chosen for the interpretation, a sentence is not susceptible to all the distribu-
tive patterns. Depending on the context, only a limited set of interpretations
are actually allowed for a given sentence.

Given the revision of the analysis, a sentence with two plural terms like (31)
may be assigned two interpretations as in (32) under the assumption that both
of the plural terms are definite.

(31) Haksayngtul-i phianotul-ul olmkyessta.
       students-Nom pianos-Acc   carried
       '(The) students carried (the) pianos.'

(32) a. $\exists e \forall z [z \subseteq [[\text{the\_students}]] \& z \in [[\text{Cov}_i]] \rightarrow \exists e"[\text{carry'}(e") \&$
          $\text{Th}(e",\text{the\_pianos}) \& \exists e'[\text{DO}(e') \& \text{Ag}(e',z) \& e' \leq e" \& e" \leq e]]]$
      b. $\exists e[\text{carry'}(e) \& \text{Th}(e,\text{the\_pianos'}) \& \exists e' \forall x \exists e"[x \subseteq [[\text{the\_students'}]]$
          $\& x \in [[\text{Cov}_i]] \rightarrow [\text{DO}(e") \& \text{Ag}(e",x)] \& e" \leq e' \& e' \leq e]]$

When the D operator works on the VP node, a distributive reading is derived
as in (32a). It asserts the existence of an event e such that for every group of
students that are contextually divided, there is a subevent of carrying the pi-
anos that takes this group as the agent. The event of this distributive reading is
in a coarse-grained event structure. However, this awkward reading is not al-
lowed by the Economy Principle. On the other hand, (32b) delivers a codis-
tributive reading. It asserts the existence of carrying the pianos, which has a
subevent of DOing for every contextually divided group of the students.
Hence, according to the revised analysis, both semantic representations are
derived, but only the codistributive reading is legitimately approved by the

Economy Principle.

5. A Concluding Remark

With the introduction of plural individuals, one of the important issues in the semantics has been how to derive proper distributive patterns of sentences. In this study, I have focused on codistributivity, which holds between two plural terms, in Korean. I have shown that Korean shows different distributive preferences as to predicate categories. Sentences with a stative predicate are quite resistant to codistributive readings unlike other predicates.

To account for the distinct preferences, I have critically reviewed three current theories about codistributivity and concluded that Brisson (2003) is the most promising in that the analysis is based on the properties of predicates. I have also pointed out that Brisson's analysis is too restrictive to encompass diverse forms of codistributivity. Brisson assumes that activities and accomplishments have different predicate structures from achievements and states. Thus her analysis needs some ad hoc treatments to deal with the codistributive readings for achievements and states.

To overcome the theoretical weaknesses of Brisson, I have adopted a multilayered event structure discussed by Bach (1986) and Link (1987). As event structures are partially ordered by granularity, the atomicity of events is considered relative and is determined by the context. The flexibility of the multilayered event structure provides the basis for diverse distributive readings. To filter out unnecessary readings, I have proposed the Economy Principle on the multi-layered event structure. Although many event structures may be considered for the interpretations of sentences, only a limited set of structures may be chosen according the Economy Principle.

Based on the flexible event structure and the Economy Principle, I have shown how diverse distributive readings are derived. Moreover, I have also argued that the codistributive readings of states are not blocked in theory but less preferred due to the nature of the states themselves. According to the Economy Principle, states need specific contexts to force plural readings of the predicate denotations, which are not prevalent in the real world. Therefore, I have concluded that the present problem of the study is best treated by revising Brisson's analysis in the framework of the multi-layered event structure.

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