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Downward Unbounded Discontinuities in Korean: An IPSG Analysis of Concord Adverbial Constructions

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2.1 Introduction

Although there is a lot of literature dealing with the classification and distribution of Korean adverbials, there does not seem to be any satisfactory work. This is partly due to the properties of the adverbials themselves, whose classification and distribution vary depending not only on the lexical properties of each adverbial but also on its distributional environment. However, the distinction between "regular adverbials" and "concord adverbials (CAs)" is very clear and plays a significant role in elucidating the properties of the adverbials as a whole. The former have only the function of modifying other phrases, while the latter show a correspondence to some specified elements in the sentence. One of the major differences between them is that a CA and what it corresponds to can be separated from each other unboundedly across clausal boundaries.

CAs are comprised of such "modality adverbials" as those indicating 'concession,' 'condition,' 'possibility,' 'necessity,' and so on (Chae 2002). These adverbials require the existence of a verb with a particular ending ("VE," henceforth) in the sentence, as in (1):

(1) a. pilok yengca-ka ttena-ess-telato,
CA Youngja-Nom leave-Past-VE/although,

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(ke peulo-nun po-l manha-e).
that program-Top see-Fut be worth-Decl
'Although Youngja doesn't appear, (that program is worth watching.)'

b. *pilok yengca-ka ttena-ess-tamyen...

Here the CA *pilok* requires that the clause-final verb have an ending with a specific meaning/function, i.e. *-telato* or *-eto*. Constructions containing CAs ("Concord Adverbial Constructions: CACs") show some special properties which cannot be easily accounted for. One such property in (1) is that the CA and the verb with the VE are not always adjacent.

In this paper, we will provide an "Indexed Phrase Structure Grammar (IPSG)" analysis of CACs. One of the most noticeable properties of these constructions is that they exhibit downward unbounded discontinuities. In section 2, we will elucidate their downward movement properties. In section 3, we will examine how the relationships between the CA and the VE can be characterized. The best hypothesis is to assume that the CA licenses the VE syntactically. In section 4, we will explore some frameworks of Head-driven Phrase Structure Grammar (HPSG) to see if they can be adapted to analyze the CAC properties. Lastly, in section 5, we will introduce an IPSG framework developed in Chae (1992). We will see that the unusual properties of CACs can be accounted for very effectively under this framework.

2.2 Downward Unbounded Discontinuities

We have seen in sentence (1) that the CA and the VE do not occur contiguously in CACs even though they are related closely. They show discontinuous dependencies within a clause. In addition, they can be separated from each other across clause boundaries, as well:

(2) salam-tul-i [[yengca-ka pilok ttena-se] caemi-ka
people-Pl-Nom [[Youngja-Nom CA leave-as] interest-Nom
telhata-ko] ha-telato, ...
be less-Comp] do-VE/although
'Although people say that (it) is less interesting because Youngja left, ...'

Here the CA *pilok* occurs two clauses down from the clause containing the VE *-telato*, which indicates that CACs have characteristics of unbounded discontinuities.

Recently some Korean grammarians noticed that such adverbials as in (1-2), i.e. CAs, behave differently from regular adverbials (Kim 1996, Im 1998). However, they did not realize the unboundedness of the CA-

VE relationship. What is more interesting is the behavior of the CA as (a part of) a modifier phrase. In some cases, the CA can modify a predicate in an upper clause, which shows that the CA modifier and what is modified by it can also be separated from each other unboundedly:

(3) chelswu-nun [[cikwu-ka amuli yelsimhi
Chulsoo-Top [[earth-Nom CA/however laboriously
phenphenhata-ko] wuki-taka] kkwucilam-ul tut -eto
be flat-Comp] argue-Comp] be scolded -VE/although
'Even though Chelsoo has been scolded (severely) by arguing very tenaciously that the earth is flat, ...'

In this sentence the CA *amuli*, which is in the lowest clause, modifies the predicate in the intermediate clause, together with the manner adverb *yelsimhi*. Notice that *amuli yelsimhi* is not compatible with the lowest or the highest predicates (*phenphenha-* or *kkwucilam-ul tut-*). If they are compatible, the sentence would be ambiguous.

We have seen that there are two different types of unbounded relationships involved in the CACs. One is the relation between the CA and the VE. The other is the relation between the CA as a modifier and the predicate which is modified by it. The two types of unbounded relationships in such sentences as (2-3) can be represented schematically as follows: s [s [s [CA ... Pred3] ... Pred2] ... Pred1-VE] . The CA which occurs in the clause of Pred3 or Pred2 can license the VE in the highest clause of Pred1. In addition, the CA can modify not only Pred3 but also Pred2 or Pred1, depending on their compatibility.

These CA-VE and modifier-modified relationships are not ordinary ones because they exhibit "downward movement" phenomena rather than "upward movement" phenomena. Firstly, the CA can only be on the same clause as or on a lower clause than the one containing the VE. For example, in (2), the CA sits on the lowest clause while the VE is on the highest clause. It can also occur in a higher clause as far as it does not stay outside of the clause containing the VE:

(4) a. salam-tul-i [[yengca-ka ttena-se] pilok caemi-ka telhata-ko] ha-telato, ...
b. salam-tul-i [pilok [yengca-ka ttena-se] caemi-ka telhata-ko] ha-telato, ...
c. salam-tul-i pilok [[yengca-ka ttena-se] caemi-ka telhata-ko] ha-telato, ...
d. pilok salam-tul-i [[yengca-ka ttena-se] caemi-ka telhata-ko] ha-telato, ...

The CA can occur in the middle clause as in (a-b) or in the highest clause as in (c-d)[1]. Although all of these sentences including (2) are just fine, sentence (4c) or (4d), where the CA occurs in the clause containing the VE, is the most "unmarked" one intuitively. Most of the CAC sentences we encounter are of this type. Hence, from a "deep structure" point of view, the CA should be on the same clause as the VE. On the surface, however, it can stay on a lower clause doing its own function of, at least, indicating focus[2].

Secondly, the CA in a lower clause can modify not only its clausemate predicate but also a predicate in a higher clause. When it modifies an upper clause predicate, it is interpreted as being in that clause even though it is sitting in the lower clause. The unmarked "default" version of sentence (3) would have to be the following, as the CA *amuli* and the adverbial *yelsimhi* modifies the predicate *wuki-* in the middle clause:

(5) chelswu-nun [[cikwu-ka phenphenhata-ko] amuli yelsimhi wuki-taka] kkwucilam-ul tut-eto, ...

Advocates of movement approaches would have to posit that sentence (3) is derived from this sentence, which has the modifier phrase in the middle clause.

These downward movement phenomena may or may not be problematic to mono-stratal approaches, depending on the specific mechanisms employed. However, they pose a serious problem to multi-stratal approaches with the movement operation, including Minimalist Programs. Note that all the frameworks of movement approaches following the Transformational Grammar tradition are constructed under the assumption that there are only upward movement phenomena in natural languages. Even if one can manage to get over this problem, he will face a conflicting situation in accounting for CACs. From the viewpoint of the CA-VE relationship, the underlying structure has to be the sentence where the CA occurs on the same clause as the VE (cf. (2) and (4)). However, from the viewpoint of the modifier-modified relationship, in such cases involving (3) and (5), the underlying structure have

[1] The words in (b) and (c) occur in the same linear order, but the two sentences concerned have different structures. They seem to have different focus structures as well.

[2] Shuichi Yatabe (p.c.) suggested to me that the sentences in (2) and (4) can be analyzed as showing upward movement phenomena. For example, under the assumption that sentence (4c) is the underlying structure, sentences (2) and (4a) can be derived by moving *yengja-ka* and *yengja-ka ttena-se* in the lowest clause to the highest clause, respectively. However, these "moved" elements do not show any properties they would have if they were members of the highest clause. In addition, there would not be any plausible way of deriving (4b) from (4c).

to be a sentence where the CA occurs in a lower clause. There is no way of deciding the underlying structure in this conflicting situation.

In order to avoid the above-mentioned problems, one might propose that the CA's "original position" is in the lowest clause and it moves upward when necessary. Then, sentence (2) would be the underlying structure of the sentences in (4) and sentence (3) would be that of sentence (5). However, this approach has problems. Firstly, it cannot capture native speaker's intuition about unmarked sentences. Generally sentences which have the CA in the same clause as the VE are regarded as default ones: e.g. sentence (4c) or (4d) rather than sentence (2). Secondly, we need to come up with a special explanation why the CA can move only up to the clause containing the VE.

(6) *pilok salam-tul-i [[yengca-ka ttena-telato]
CA people-Pl-Nom [[Youngja-Nom leave-VE/although]
caemi-ka iss-ul kes-i-lako] ha-n-ta.
be interesting-Comp] do-Pres-Decl
'People say that (it) will be interesting even though Youngja does not appear.'

This sentence is ungrammatical because the CA is outside of the clause containing the VE. This kind of restriction is not likely to exist if CACs are upward movement constructions. Lastly, there are cases where we have to posit an ungrammatical sentence as the underlying structure. The underlying structure of (5) would have to be a string like (3). However, this string is problematic as an underlying structure, where the (truth-conditional) meaning of the sentence is to be determined. As we noted above, the degree phrase *amuli yelsimhi* is not compatible with the lowest predicate *phenphenha-*.

In the face of these problems, even advocates of multi-stratal approaches have to admit that the original position of the CA is in the VE clause and that it has moved downward when it occurs in a lower clause. Thus, we can conclude that CACs are downward-movement constructions rather than run-of-the-mill upward-movement constructions.

2.3 The Nature of the Unbounded Relationships

We have seen two different unbounded dependency relations in CACs: the CA-VE and modifier-modified relations. In this section, we will focus on elucidating the nature of these relationships: whether the two elements concerned have only a semantic relation or they have a syntactic relation as well. In addition, we need to consider which of the two elements licenses the other. If there is only a semantic relationship between them, we have to assume that the VE licenses the CA. Even

though the CA can be assumed to be under the semantic scope of the VE, the VE cannot be under the semantic scope of the CA in all cases. Remember that the CA can only be placed on the same clause as or on a lower clause than the VE clause. The CA on a lower clause cannot have the VE in its semantic scope.

Then, there remain three possible hypotheses to be made on the relationships between the CA and the VE. Firstly, we can assume that there is only a semantic relationship between them and the VE licenses the CA. Secondly, we can assume that there is a syntactic relationship and the VE licenses the CA. Thirdly, we can assume that there is a syntactic relationship and the CA licenses the VE. Let us consider which hypothesis is the most appropriate of all these alternatives. We have to keep in mind that, except some special cases, if two elements are related syntactically they are related semantically as well.

The semantic hypothesis is to assume that the CA is licensed by the VE semantically. We can say that the CA is licensed by the VE in case it is under the semantic scope of the VE. Such a semantic approach could account for the CA-VE unboundedness because the CA can be analyzed as being under the VE's scope however deep it may be located. As the information represented by the VE is realized as a verbal ending and the whole clause carries that information, the VE can be treated as a HEAD feature. For example, in sentence (1a) (repeated below as (7)), the meaning of the VE *-telato/eto*, i.e. 'concession,' can be represented as a HEAD feature like [CONCESSION +] .

(7) pilok yengca-ka ttena-ess-telato,
CA Youngja-Nom leave-Past-VE/although
(ke peulo-nun po-l manha-e.)
that program-Top see-Fut be worth-Decl
'Although Youngja doesn't appear, (that program is worth watching.)'

As a HEAD feature the information will pass up to the whole clause through the head projection line. Then, the CA would be under the semantic scope of the VE wherever it may be located.

It seems to be true that the VE licenses the CA semantically: the CA cannot stand alone although the VE can, and the CA is always under the semantic scope of the VE. However, semantics-only approaches would fail to handle multiple dependency constructions like the following:

(8) a. [ney-ka pilok ton ttaymun-ey manyak kwun-ey
you-Nom CA_1 money because of CA_2 military-at

ka-key toy-myen] yengja-ka ttena-lcilato
go-Comp become-VE_2 Youngja-Nom leave-VE_1
'Even though Youngja may leave you, if you join the armed service because of money, ...'

b. * [ney-ka manyak ton ttaymun-ey pilok kwun-ey ka-key toy-myen] yengja-ka ttena-lcilato

As both of the two CAs are under the semantic scope of the two VEs here, sentence (8b) is also expected to be grammatical. The sentence would have to be grammatical in whatever order the CAs are, as far as they are under the scope of their VEs. However, the grammaticality is sensitive to the relative order of the CAs in relation to their VEs, which is unusual from a semantic point of view. On the other hand, from a syntactic point of view, it is well-established that only nested dependencies are allowed in multiple-dependency constructions (*manyak* triggers *myen* 'if' and *pilok* triggers *-lcilato* 'although'). These examples imply that there is a syntactic connection between the CA and the VE, because crossed dependencies are also allowed when the dependencies are only semantic. If at least one of the two relations involved is purely semantic, crossed dependencies are allowed:

(9) a. manyak *amuto* hakkyo-ey o-ci
CA nobody school-at/to come-Comp
ahn-ulyeko ha-myen
not-Intention do-VE/if
'If nobody intends to come to school, ...'

b. *amuto* manyak hakkyo-ey o-ci *ahn*-ulyeko ha-myen

There is no syntactic relationship between the negative polarity item *amuto* and the negation auxiliary verb *(-ci) ahn-* (Chae 2002). In this case, both the nested and crossed dependency sentences are grammatical.

The unboundedness of the modifier-modified relationship is more difficult to account for under a semantic approach. There would be no easy way of accounting for the fact that *amuli yelsimhi* in a lower clause modifies *wuki-* in an upper clause in (3).

(3) chelswu-nun cikwu-ka amuli yelsimhi
Chulsoo-Top earth-Nom CA/however laboriously
phenphenhata-ko wuki-taka kkwucilam-ul tut -eto
be flat-Comp argue-Comp be scolded -VE/although
'Even though Chulsoo has been scolded (severely) by arguing very tenaciously that the earth is flat, ...'

The fact that a lower element can modify a higher element cannot

be attributable to the semantic relationship between the CA and the VE. All the special properties of CACs seem to arise from a strong "attracting force" between them. We cannot account for this force by simply assuming that the CA is under the semantic scope of the VE. There must be some formal mechanisms to connect them.

As we have shown that the two elements are related syntactically, we have two hypotheses remaining to be tested. First of all, we can assume that the CA licenses the VE. We are pursuing this option in this paper. Under this assumption, we can account for the problems posed by a semantic approach. As for the multiple dependency constructions in (8), we do not need to provide any special explanation because crossed dependencies are not allowed syntactically. The modifier-modified relationship can also be handled more easily once we have a syntactic mechanism connecting the two elements.

The other option is to assume that the VE licenses the CA. However, this option is not tenable. Empirically, this approach would be problematic in accounting for the ungrammaticality of such sentences as (10a):

(10) a. *pilok yengca-ka ttena-ess-tamyen (cf. (1))
CA Youngja-Nom leave-Past-VE/if

b. yengca-ka ttena-ess-tamyen
Youngja-Nom leave-Past-VE/if
'If Youngja left, ...'

c. manyak yengca-ka ttena-ess-tamyen
CA Youngja-Nom leave-Past-VE/if
'If Youngja left, ...'

Expression (10a) has a wrong VE: *pilok* goes with *-telato/eto/lcilato* rather than *-tamyen*. As we can see in (10b), it becomes grammatical when the adverb *pilok* is not present. This means that the VE doesn't have to license any CA, i.e. it would be an optional licensor. Therefore, we need some special mechanisms to account for the ungrammaticality of (10a). As the VE does not have to license a CA, the only possible way of ruling out (10a) is to rely on semantics or pragmatics. We can assume that the CA *pilok* cannot combine with the rest of the sentence, which has a conditional meaning, because there is a mismatch between them[3]. Then, however, we will be in an awkward situation because we have to say that *pilok* in (10a) is not allowed due to a semantic or pragmatic problem while the CA *manyak* in (10c) is licensed by a syntactic mechanism. In other words, all ungrammatical sentences would have a

[3]It is not clear whether the CA *pilok* has any truth-conditional meaning at all.

semantic/pragmatic problem while all grammatical sentences would be licensed syntactically. Remember that we are now testing a hypothesis which says that the VE syntactically license the CA.

A more serious problem arises when the CA in a lower clause is not compatible with the VE in an upper clause (cf. (2)):

(11) *salam-tul-i [[yengca-ka pilok ttena-se]
person-Pl-Nom [[Youngja-Nom CA leave-as]
caemi-ka telhata-ko] ha-n-tamyen, ...
interesting be less-Comp] do-Pres-VE/if

Under the present hypothesis, this sentence is ungrammatical because the meaning of the CA *pilok* cannot combine with that of the VE *-tamyen*. However, we need to concoct a special mechanism to make the meaning of *pilok* available at the clause where the VE is. In general, the meaning of an adverb in an (non-head) embedded clause cannot be transported to an upper clause.

From a technical point of view, it would not be easy to "locate" the CA, which is to be licensed by the VE, because it can sit in a lower clause than the VE. Assuming that the CA has a FOOT feature is not a good solution because we have to introduce a set of semantically oriented FOOT features such as CONDITION, CONCESSION and the like. To the worse, these features have the properties of HEAD features, as shown above.

We are now left with the last hypothesis that the CA licenses the VE syntactically. We have seen above that we can handle all the difficulties with the semantics-only hypothesis under this hypothesis. We do not face any of the problems of the second hypothesis, either. As the CA licenses the VE obligatorily, all the data in (10) can be treated naturally. Sentence (a) is ungrammatical because the VE *-tamyen* is not what is required by the CA *pilok*. The CA has to license a VE which is required by it, i.e. *-telato/eto*. Sentence (b) has nothing to do with the CA. The VE *-tamyen* itself has the meaning of condition. In sentence (c), the CA *manyak* licenses what is required by it, i.e. the VE *-tamyen*.

We have considered the nature of the unbounded relationships in CACs in this section. Although we have focused on the nature of the CA-VE relationship, the modifier-modified relationship seems to have the same properties. We have found out that there is a syntactic relation between the CA and the VE, and that the CA licenses the VE. Now we can say that the CA triggers the existence of the VE and characterizes the whole CAC construction. In this respect, we will call the CA the "trigger," and what is triggered by it, i.e. the VE, the "target."

2.4 Difficulties with HPSG Analyses

We have seen that CACs in Korean show the properties of downward unbounded discontinuities. They exhibit two different types of unbounded dependencies: the trigger-target relationship and the modifier-modified relationship. The trigger in the former relationship is the same as (a part of) the modifier in the latter relationship. These relationships can best be characterized as indicating a syntactic relationship, where the trigger licenses the target.

CACs have many properties which cannot be easily accounted for. One of them is the discontinuity between two elements. There are sentences which contain two closely related parts which are separated from each other. This relationship cannot be captured by regular tree structures because "line crossing" is not allowed[4]. The relationship between a gap and its filler, e.g. in *wh*-question constructions, is analyzed successfully by way of such mechanisms as the SLASH feature in the Generalized Phrase Structure Grammar (GPSG) tradition. However, true discontinuities like the one in the result clause construction in English, i.e. the *so...that* construction, have not been treated successfully (but cf. Chae 1992). In the Transformational Grammar tradition, they are treated on the basis of the underlying-surface structure dichotomy. In the Categorial Grammar tradition, some of them are treated with a "wrapping" operation. However, none of them seem to be successful, especially from a mono-stratal point of view.

The unboundedness between discontinuous elements is not so easy to analyze properly, either. In the GPSG tradition, mechanisms with the SLASH feature are used to deal with the unboundedness between a gap and its filler or binder. By way of this feature we can successfully transfer the information that some category is missing from a lower clause to a higher clause. However, the feature can only carry the information that a category is missing. It cannot capture the discontinuous relationship between two elements which are not empty categories. No feature introduced thus far, except the LICENSOR feature in Chae (1992), can indicate the fact that a particular lexical item has the property of licensing another part of the sentence, which can be separated from the licensor unboundedly[5].

From a multi-stratal point of view, the most difficult aspect of

[4]However, some theoretical frameworks like that in McCawley (1982) allow line crossing.

[5]The EXTRA feature introduced in Bouma, Malouf & Sag (2001) has a function similar to that of the LICENSOR feature. However, it is not clear whether their mechanism is supposed to deal with unboundedness. It is used to account for extraposition phenomena, which are clause-bound.

CACs is the downward movement property. This downward unboundedness will pose insurmountable problems to the movement approaches because rules and principles are constructed under the assumption that there are only upward movement constructions. Mono-stratal approaches do not have such problems as being caused by movement. However, even these approaches are not readily available to account for the facts here. Constructions like CACs in Korean have not been under consideration in the literature yet. These are new constructions to be dealt with. Even though their special properties may be less lethal to mono-stratal approaches than to multi-stratal approaches, they will still be a serious challenge to mono-stratal approaches as well.

In this section, we will consider how Korean CACs can be analyzed under HPSG frameworks. As no previous analyses of them have been provided yet (not only in HPSG approaches but also in other approaches), we will just try to find out whether the properties of them can be accounted for with currently available HPSG mechanisms.

We will start by going over HPSG analyses of some constructions which share similarities with the Korean CACs. One of the best candidates to consider is *tough*-constructions in English. These two types of constructions are similar in the sense that a particular lexical item is responsible for the existence of some other part in the sentence, and the trigger and (a part of) the target show an unbounded relationship.

(12) Robin isn't easy for me [to keep Dana from [criticizing *e*]] .

In this sentence the lexical item *easy* triggers the existence of a gapped VP and hence characterizes the construction. In addition, the trigger *easy* and the gap, a part of the target, can be separated from each other unboundedly.

In HPSG, as in GPSG (cf. Gazdar, et al. 1985), the *tough*-adjective is analyzed as being responsible for licensing a VP with an accusative NP gap. For example, *easy* is represented as follows (Pollard & Sag 1994: 167).

(13)
$$\left[\begin{array}{l} \text{LOC}\,|\,\text{CAT}\,|\,\text{SUBCAT} \left\langle \begin{array}{l} \text{NP}_{\boxed{1}},\ (\text{PP[for]},) \\ \text{VP[inf, INHER}\,|\,\text{SLASH} \left\{ \boxed{2}\text{NP[acc]:ppro}_{\boxed{1}},\ldots \right\} \end{array} \right\rangle \\ \\ \text{NONLOCAL}\,|\,\text{TO-BIND}\,|\,\text{SLASH} \left\{ \boxed{2} \right\} \end{array}\right]$$

As the adjective subcategorizes for an infinitive VP with a gap, which is represented by SLASH, the adjective itself takes care of discharging the gap. And the SLASH feature accounts for the unboundedness.

The HPSG analysis above captures major properties of such *tough*-sentences as (12). However, it cannot account for the following sen-

tences, which have largely the same properties as *tough*-constructions:

(14) a. John is [too nasty] to ask Mary to make friends with *e*.
b. Tom is [tall enough] to imagine my little son could have seen *e*.
c. *John is very nasty to ask Mary to make friends with *e*.

(15) Kevin is an [easy man] to please *e*.

It is clear that the underlined lexical items are the trigger of the construction concerned. Notice that sentence (14c) is ungrammatical even though it has the same structure as that of sentence (14a). Then, we have to assume that the underlined words license the gapped VP in these sentences as well. But we cannot provide an analysis like (13) for these sentences. Notice that the words do not subcategorize for the gapped VP. They are not heads but modifiers of the following or preceding elements. Therefore, they cannot have lexical specifications like (13) in the sentences of (14a-b) and (15).

Flickinger & Nerbonne (1992) provide an HPSG analysis to account for such data as (14-15). They assume that the adjuncts in question, i.e. *too, enough* and *easy*, subcategorize for a gapped VP and that these complements can be transferred from adjuncts to heads. The complements here must be marked as "transferable" in the lexical entry because not all complements can be transferred. These transferable complements are subject to the following principle (p. 293)[6]:

(16) Transferable Complement Principle:
When a transferable complement on a daughter in a local subtree is not associated with some sister in that subtree, the complement becomes part of the corresponding SUBCAT list of the head daughter in that subtree.

According to their analysis, the complements of *too/enough/easy* will be transferred to their heads and these heads will take care of subcategorization.

Although their analysis can account for the data in (14-15), it is not very satisfactory. Firstly, it is not convincing to assume that adverbs like *too* and *enough* can have their complements. It is evident that the existence of the gapped VP in (14) is due to these adverbs. However, the VP does not have properties of regular complements. Most of all, it is not a sister of its head. Secondly, it would not be easy to provide a formal mechanism to implement the Transferable Complement Principle. This principle requires that the SUBCAT value of a non-head daughter to be transferred to its head daughter sister. However, this

[6] They use the term "subcats" for complements.

operation will bring about damage to other parts of the system because SUBCAT is a HEAD feature. The information which is carried by a HEAD feature can only be propagated through the head projection line. Lastly, examples of the following cannot be easily accounted for (Chae 1992: 63, 69):

(17) a. This is [[too heavy] [a ball]] to throw *e*.
b. This is [a [light enough] ball] to throw *e*.

(18) Mary is [angry enough with John] to talk to *e* about him. (Hukari & Levine 1991: 124)

In (17a) the VP complement of *too* will be transferred to *heavy*, and then the complement of *too heavy* to *a ball*. By applying the principle (16) successively, the whole NP will have the gapped VP as its complement. However, this leads to a problem because the NP, which has to be saturated with respect to its complements, have undischarged complements. The value of a SUBCAT feature must be discharged within its maximal projection. The other examples have the same kind of problems.

Bouma, et al. (2001: 20) proposes a "lexicalist alternative to configurational theories of SLASH." Here the Nonlocal Feature Principle in Pollard & Sag (1994: 164) is replaced by a lexical constraint on heads (SLASH Amalgamation) and a constraint on phrases (SLASH Inheritance) (cf. Sag & Fodor 1994, Sag 1996):

(19) SLASH Amalgamation:

$$word \Rightarrow \begin{bmatrix} \text{LOC} \begin{bmatrix} \text{DEPS} \left\langle [\text{SLASH } \boxed{1}], ..., [\text{SLASH } \boxed{n}] \right\rangle \\ \text{BIND } \boxed{0} \end{bmatrix} \\ \text{SLASH } (\boxed{1} \uplus, ... \uplus \boxed{n}) \ominus \boxed{0} \end{bmatrix}$$

(20) SLASH Inheritance:

$$hd\text{-}val\text{-}ph \Rightarrow \begin{bmatrix} \text{SLASH } \boxed{1} \\ \text{HD-DTR} \left[\text{SLASH } \boxed{1} \right] \end{bmatrix}$$

The constraint in (19) "ensures that if a dependent is slashed, then the head which selects it will also be slashed" and the constraint in (20) ensures that the values of SLASH will be inherited only from a phrase's head daughter.

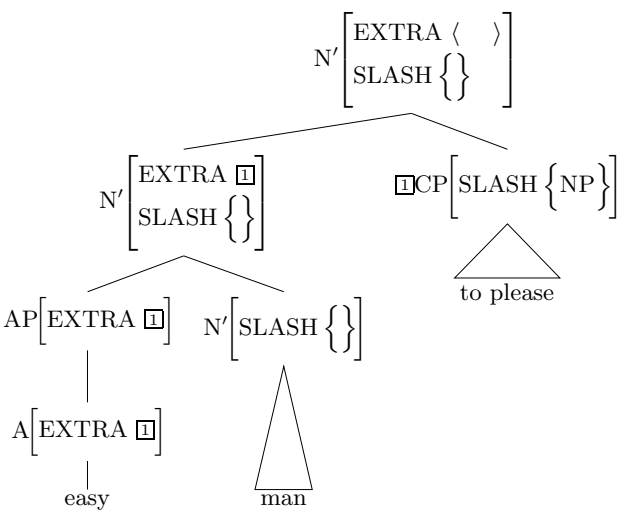
On the basis of these mechanisms, Bouma, et al. (2001) provide an alternative to Chae's (1992) LICENSOR approach (cf. footnote 17, p. 35). To handle such sentences as (14a-b) and (15), they introduce a new NONLOCAL feature EXTRA and assume that (a degree phrase

like *too/enough* and) an attributive *tough*-adjective like *easy* carries this feature with a VP/NP value. Assuming the lexical entry in (21a) for the attributive adjective *easy*, they analyze (15) as in (21b) (pp. 31-32):

(21) a.

$$\text{easy:}\begin{bmatrix}\text{BIND} & \{\boxed{2}\}\\ \text{SLASH} & \{\ \}\\ \text{EXTRA} & \langle(\text{LOC CP[to]}, \text{SLASH}\{\boxed{2}\})\ \rangle\end{bmatrix}$$

b.



The lexical item *easy* is specified as having [EXTRA⟨CP[SLASH{NP}⟩] in the lexicon. This feature will be transferred from A to AP via the SLASH Inheritance constraint in (20). Next, the feature is supposed to be transferred from AP to the N' category dominating *man* via the SLASH Amalgamation constraint in (19). Then, it will propagate through the nominal projection line according to SLASH Inheritance again. The SLASH feature on the CP node will not propagate to the top N' node or above because the feature is specified as being bound by the adjective *easy* itself (cf. (21a)).

This approach does not have the problems of Flickinger & Nerbonne (1992). Firstly, Bouma, et al. (2001) do not analyze the gapped VP as a complement of *too/enough* or *easy*. In addition, they provide formal mechanisms to handle the transfer of the information about the gapped VP from the adverb/adjective to higher units. As the gapped VP is not a complement of the adverb/adjective, they do not have the saturation problem observed in (17-18). We can assume that a sat-

urated phrase can have undischarged EXTRA values even though it cannot have undischarged complements.

However, the EXTRA approach suffers from some difficulties as well[7]. Firstly, the amalgamation constraint (19) must be reformulated so that the head can collect the NONLOCAL specifications not only of their complements and specifiers but also of their modifiers (to deal with such data as in (15)). This extension will probably lead to a problem in case parasitic gaps can occur in the specifier or modifier phrases[8]. Secondly, the EXTRA feature on the N' dominating *easy man* is an instantiated feature and hence it must be bound off just like the SLASH feature on the CP node. However, as they do not provide any such mechanism, we need to introduce a new extra schema for its binding. If we cannot provide one, it will propagate upward without restriction. Worst of all, the system does not seem to work as they intended. For example, in (21b), the N' dominating *man* is supposed to collect the information about the EXTRA feature from its AP sister according to the SLASH/EXTRA Amalgamation constraint (19). However, notice that the constraint does not work here because the node dominating *man* is not a lexical head. The constraint operates only on lexical heads. One might propose that the node dominating *man* can be analyzed as a lexical item N rather than as a N'. However, such an analysis is not plausible at all for examples like the following:

(22) a. Robin is [[too kind] [a person]] to take advantage of *e*.
b. Sally is [[more pleasant] [a boss]] to work for *e* than Sam is. (Chae 1992: 219)
c. [[Too many books] [have been published recently]] for me to be able to read them all. (Gueron and May 1984: 1)

In all these examples, the units containing the underlined word (i.e. the trigger of the (gapped) VP) are not the head of the phrase concerned. However, it is very clear that their heads, *a person, a boss* and *have been published recently* cannot be analyzed as lexical heads. Therefore, we can conclude that the mechanism with the EXTRA feature does not work here. The EXTRA feature cannot be transferred, for example, from the phrase *too kind* to the phrase *a person* because this latter phrase is not a lexical item.

Thus far, we have considered how we can account for *tough*- and

[7]Bouma, et al. (2001) have to posit two different lexical entries for the *tough*-adjective: one for regular *tough*-constructions like (12) and one for "attributive *tough*-constructions" like (15).

[8]Notice that the existence of parasitic gaps makes Sag (1996: 77) assume that the subject's SLASH value is "neither amalgamated nor required to be empty."

similar constructions in English within some HPSG frameworks. We saw that these frameworks cannot account for the discontinuities between the *tough*-adjective and the gapped VP. For a system with the EXTRA feature to be successful, it must have a new version of the SLASH/EXTRA Amalgamation constraint. In addition, the new version has to be a phrasal constraint rather than a lexical constraint to account for such examples as (22), which would make the SLASH/EXTRA Inheritance constraint (partly) redundant in its function.

The *tough*- and related constructions and the constructions which we are going to analyze, i.e. CACs in Korean, share the property of lexically triggered unbounded dependencies. However, CACs have some more difficult properties to handle properly. Let us consider these properties with reference to those of *tough*-constructions. Firstly, in the *tough*-construction, the adjective which triggers the existence of the gapped VP is in a fixed position. However, in CACs, the trigger, i.e. the CA, itself can "move around," which shows downward movement phenomena. Secondly, in the *tough*-construction, we can designate a specific lexical item or rule/schema which can take care of the discharge of the target. For example, in (12), we can refer to the gapped VP in the lexical specification or rule describing the adjective *easy* because they can be analyzed as belonging to the same local tree. Even in such cases as (14-15) and (17-18), we can manage to invent mechanisms to bring about the effect that they can be related even though they are not in the same local tree. The nonlocality here, however, cannot be extended outside of the clause concerned. That is, the trigger and the gapped VP cannot be in different clauses even though the gap can originate from a different clause. Therefore, the target must be discharged in the clause where the trigger is. In CACs, on the other hand, the target can be in a higher clause than the trigger. Hence, we need a mechanism which can truely handle unbounded discontinuities.

2.5 An IPSG Analysis

In this section, we will show that the special properties of CACs can be accounted for effectively under an Indexed Phrase Structure Grammar (IPSG) approach. Chae (1992), based on Gazdar (1988), develops an IPSG framework to provide a unified account of "lexically triggered unbounded discontinuities" in English:

(23) Type A Constructions
  a. This paper was tough for me to try to finish *e* in a week.
  b. The game was a breeze for Tom to convince her to win *e*.

c. The house is ready for Tom to force Jim to buy *e*.
d. John is too nasty to ask Mary to make friends with *e*.
e. Tom is tall enough to imagine my little son could have seen *e*.
f. Kevin is a tough man to convince Mary to talk to *e*.
g. The cake took Mary all day to bake *e*.

(24) Type B Constructions:
a. Jane is more beautiful *than* I thought she would be.
b. I told her that so many people attended last year's concert *that* I made Mary nervous.

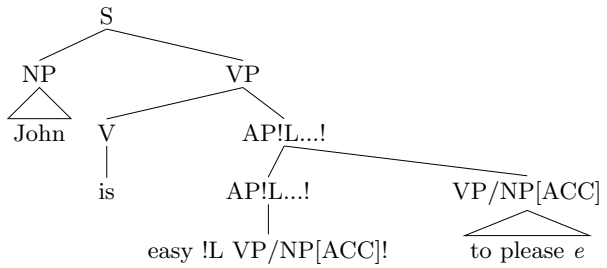
"Type A" constructions comprise *tough*- and similar constructions, and "Type B" comparative constructions and result clause constructions. These constructions contain particular lexical items (i.e. the underlined words) which characterize them, and trigger the existence of other parts in them: a gapped VP in (23) and a *than/that*-clause in (24). The trigger and the target can be separated from each other by other elements (hence, they are discontinuous). In addition, the trigger and (a part of) the target might not be elements of the same clause (hence, they are unbounded).

The main point of the present framework is that each lexical item which induces a particular construction has a "LICENSOR feature" in the stack (hence, an Indexed Grammar) as a part of its syntactic information in the lexicon. The value of this feature is what is licensed by the trigger, i.e. the target. For example, *so* in (24b) has [LICENSOR S [COMP *that*]] in the stack as a part of its lexical representation. The feature propagates through the tree as a FOOT feature, which is subject to such principles as the FOOT Feature Principle in Gazdar, et al. (1985). Popping out of the stack, it licenses the target according to the following principle:

(25) The Principle of LICENSOR Discharge:
[LICENSOR XP] in the stack of a node (pops out of the stack and) licenses one of this node's daughters when the specification of the LICENSOR's value (i.e. XP) is the same as that of this daughter node.

(26) a. John is easy to please.

b.



The lexical item *easy* has a stacked LICENSOR feature whose value is a VP with an accusative gap, i.e. !L(ICENSOR) VP/NP [ACC] ! (the stack is represented as a set of exclamation marks, !...!). This feature propagates through the tree. When it is instantiated on the upper AP node, it pops out of the stack to license the VP/NP [ACC] daughter, according to the discharge principle (25). Notice that the specification of the licensed node is the same as that of the feature's value.

Here we can effectively account for the fact that a particular lexical item is responsible for the existence of the construction concerned. In addition, there are two different kinds of relationships involved: constituency and dependency. In (24b), for example, the trigger *so* forms a constituent with *many* but it forms a dependency relation with the *that*-clause. It is difficult to capture these two relations in a single tree. However, we can do that very easily: one with the constituent structure and the other with the LICENSOR mechanisms.

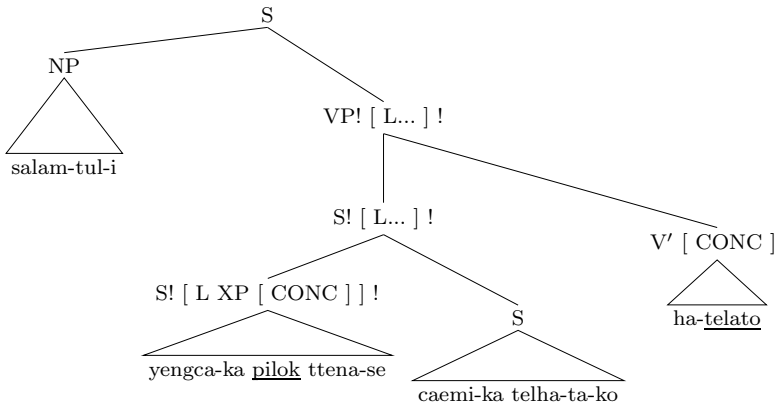
Note that we do not have any of the problems of the HPSG system employing the EXTRA feature. The LICENSOR feature, which corresponds to the EXTRA feature, binds off automatically when it licenses its value. It propagates only through the stack and it pops out of the stack when it licenses the value. On the other hand, the EXTRA feature must be licensed by a schema or a lexical item at the top so that it cannot propagate upward after it binds off the gapped VP. As for the propagation of the feature in the middle, the LICENSOR feature need not necessarily follow such constraints as SLASH Amalgamation and SLASH Inheritance even in the framework of Bouma, et al. (2001). Even though it is a FOOT feature, it is not a regular FOOT feature like SLASH but a stacked feature. Hence, it can be regarded as being subject to a different constraint/principle. Unlike regular FOOT features, it propagates through the tree only via the stack. When it gets out of the stack, the flow of the information stops.

Under the present IPSG framework, we can account for the properties of CACs in Korean without employing any additional mechanisms. We just need to assume that the CA in Korean has a LICENSOR fea-

ture with an appropriate value. For example, the adverbial *pilok* in (2) has [L XP [CONC(ession)]] in the stack[9]. The licensing mechanisms involved are exactly the same as those for the constructions in (23) and (24). We can analyze sentence (2) as in (27):

(2) salam-tul-i [[yengca-ka pilok ttena-se]
person-Pl-Nom [[Youngja-Nom CA leave-as]
caemi-ka telhata-ko] ha-telato, ...
interest-Nom be less-Comp] do-VE/although
'Although people say that (it) is less interesting because Youngja left, ...'

(27) An IPSG analysis of sentence (2):



The stacked [L XP [CONC]] (i.e. ! [L XP [CONC]] !), which originates from *pilok*, propagates through the tree "until it reaches" the VP node which has V' [CONC] as one of its daughters. The propagation stops at this node because the LICENSOR pops out of the stack to license the target. Remember that the LICENSOR feature propagates through the tree only when it is in the stack.

Let us now consider how the IPSG framework can account for the special properties of Korean CACs observed in this paper. Firstly, they exhibit downward unbounded discontinuities. The discontinuities here are real ones: neither the trigger nor the target consists only of the gap. The mechanisms involving the LICENSOR feature deal with this property very naturally. The feature originates from the trigger and licenses its target even though the target may be separated from it unboundedly. The downward movement phenomena do not matter at all, because the trigger can license the target in whatever clause it may

[9]The category XP represents a verbal category of any bar-level.

be located as long as it is not on a clause higher than the one with the target. The original position of the trigger is the place where it stands and it performs its own function in that place. Secondly, we saw that the CA syntactically licenses the VE in the CA-VE relationship although the latter licenses the former semantically. The nature of this relationship can be accounted for by assuming that the CA is the trigger/licensor and the VE is what is licensed by the trigger, i.e. the target. The LICENSOR feature connecting the trigger and the target is a syntactic feature, which captures the syntactic relationship between them. Notice that once the VE is licensed by the CA syntactically, the CA is guaranteed to be under the semantic scope of the VE, which establishes their semantic relationship. Thirdly, we do not have any of the difficulties with the EXTRA feature analysis. The LICENSOR feature is bound off automatically when it pops out of the stack to license its target. And the LICENSOR feature does not have to be constrained by the same principles as those for other FOOT features. It is a special FOOT feature, a stacked feature.

To account for the modifier-modified relationship, we can assume that the CA has two features in the stack: a LICENSOR and a MODIFIER. Note that only those CAs exhibit this relationship which indicate 'degree' as well as 'concession': *amuli* and *amman* (Chae 2002)[10]. The MODIFIER feature is on the top of the stack because there is no case where the target of the MODIFIER comes later than that of the LICENSOR. The LICENSOR feature will be discharged at the same node as or at a higher node than that of the MODIFIER feature, depending on the position of the XP [CONC] node.

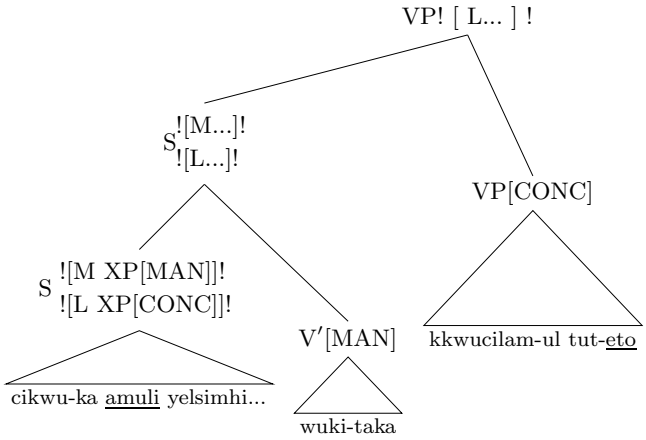
Let us consider how the modifier-modified relationship in sentence (3) can be accounted for under this extended framework:

(3) chelswu-nun [[cikwu-ka amuli yelsimhi
Chulsoo-Top [[earth-Nom CA/however laboriously

phenphenhata-ko] wuki-taka] kkwucilam-ul tut -eto
be flat-Comp] argue-Comp] be scolded -VE/although
'Even though Chulsoo has been scolded (severely) by arguing very tenaciously that the earth is flat, ...'

[10]The two CAs *amuli* and *amman* are similar in their meanings. The latter is more colloquial than the former.

(28) An IPSG analysis of sentence (3):



The trigger *amuli* has [M(ODIFIER) XP [MAN(ner)]] and [L XP [CONC]] in the stack[11]. The former feature will be discharged on the S node dominating the V' [MAN] node. The latter feature will be discharged on the upper VP node which has VP [CONC] as its daughter. This system can effectively account for the fact that the CA *amuli* in the lowest clause modifies (together with the manner adverbial *yelsimhi*) the predicate in the middle clause. Notice that neither the lowest predicate nor the highest predicate has the MAN feature.

2.6 Conclusion

In this paper, we have explored some properties of CACs in Korean. These constructions have special characteristics which have not been dealt with much in the literature. They exhibit unbounded discontinuities and the unboundedness shows downward movement phenomena. These phenomena themselves pose a serious problem to those approaches which follow the Transformational Grammar tradition. Assuming that the CA licenses the VE syntactically, we examined some HPSG frameworks. Not all the properties of CACs can be treated in these frameworks. We found out that the properties can be accounted for most successfully under an IPSG framework.

The downward unbounded discontinuity is the most peculiar property of CACs. This property seems to be induced by the "attracting

[11] We are not sure whether the value of the MODIFIER feature can only be an element with the MAN feature. This feature is related to the manner adverbial *yelsimhi*, which occurs after the CA. If other types of adverbials modified by the CA can induce the same kind of unbounded relationship, we need to have a mechanism to make the adverbial type as the value of the MODIFIER feature.

force" between the trigger and the target. We think that the effect of this force is nicely implemented into the IPSG licensing system and, accordingly, the special properties induced by this force can be accounted for naturally. Even though HPSG frameworks in their current state cannot handle the facts about CACs in Korean easily, we might be able to modify the system. One of the easiest and effective ways of handling them would be to simulate the operations of the IPSG mechanisms above into the HPSG framework. Then, the system would be an Indexed Grammar version of HPSG. Whatever framework we might end up getting at, we would have a strong case against the multi-stratal approaches adopting movement operations.

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