

A CCG FRAGMENT OF KOREAN*

Kihwang Lee

ICCS, Division of Informatics
University of Edinburgh
2 Buccleuch Place, Edinburgh EH8 9LW
United Kingdom

Email: leekh@cogsci.ed.ac.uk

ABSTRACT

Combinatory Categorical Grammar is a lexicalised formalism which is mildly context-sensitive. Recently Set Combinatory Categorical Grammar, a direct descendent of Combinatory Categorical Grammar was proposed to treat local scrambling adequately. In this paper, we briefly sketch Set Combinatory Categorical Grammar analyses of various Korean syntactic phenomena including coordination, extraction and multiple nominative construction.

1. INTRODUCTION

We briefly introduce CCG (Combinatory Categorical Grammar) and Set-CCG (Set Combinatory Categorical Grammar), a direct descendent of the former.

1.1 Combinatory Categorical Grammar

CCG, introduced by [1] as a generalisation of the Categorical Grammars (CG) of [2] and [6] is a lexicalised formalism which is mildly context-sensitive [21]. The mildly context-sensitive generative power of CCG enables it to provide adequate description of syntactic phenomena including crossing dependencies in some languages that are known to be beyond the coverage of context-free grammars [16].

For syntactic derivation, CCG utilises a system of rules which is based on the combinators of [9]. These combinators are composition (**B**), type-raising (**T**), and substitution (**S**).

CCG's view of surface structure is quite different from that of conventional grammar formalisms. Surface structures in CCG do not exhibit traditional notions of constituency or dominance and command. All the fragments that arise under coordination and related constructions are considered as surface constituents. This flexible view of surface structure provides lucid descriptions not only for bounded dependencies but also for various sorts of unbounded dependencies that occur when the complements are displaced under coordination, relativisation, etc. Thus, *it is as a theory of multiple unbounded dependency and coordinate structure that CCG has most to offer as a theory of grammar* [20].

Extensive introductions and discussions of the linguistic properties and motivations of the CCG formalism together with analyses of many constructions in English, German and Dutch are presented in [18, 19, 20].

*I would like to express many thanks to Jason Baldridge for helpful suggestions and discussions. All remaining mistakes and errors are mine.

1.2 Local Scrambling and Set-CCG

CG and CCG were originally developed for configurational languages in which the order of constituents is mostly fixed and functions of constituents are realised according to their position in sentences. Non-configurational languages including Korean exhibit local scrambling as shown in (1).¹

- (1) a. Hwanho-ka wuyu-lul masi-nta.
Hwanho-NOM milk-ACC drink-DECL
'Hwanho drinks milk.'
- b. wuyu-lul Hwanho-ka masi-nta.
milk-ACC Hwanho-NOM drink-DECL
'Hwanho drinks milk.'

Typical solutions for local scrambling in CCG are extensive use of type-raising and crossing composition rules, and assignment of additional lexical categories for predicates which allow scrambling. The defects of these two approaches were presented in [3].

[10] proposed Multiset-CCG which is an extension of CCG. Sets are incorporated into the rules and categories of CCG in order to allow flexibility for handling scrambled word orders directly with single lexical categories. However Multiset-CCG achieves higher power than CCG and other mildly context-sensitive formalisms.

[5] proposed Set-CCG, a direct descendent of CCG. Set-CCG also accepts scrambled orders with single lexical categories by incorporating sets into the categories and rules of CCG. However, the directional specifications of lexical categories and rules are retained. This allows Set-CCG to maintain the same generative capacity of CCG. The strong equivalence of CCG and Set-CCG are proved in [5]. We adopt Set-CCG for analysis of Korean throughout this study.²

2. PREVIOUS WORK

[17] applied an extended version of pure Categorical Grammar to analysis of Korean. The notion of sets and unspecified directionality similar to those of [10] was introduced to handle the relative free word order. Some principles on rule application were also suggested. This work, however, cannot provide descriptions of coordinate constructions and other complex constructions involving the unconventional constituents.

[15] and [7] incorporated sets into lexical categories, but directionality was retained. However, these studies lack format account for this extension. [7] used type-raising to treat case marking in Korean.

[8] and [13] adopted Multiset-CCG for analysis of Korean, and coordination and quantifier floating were described.

[14] adopted Set-CCG for description of Korean and showed analyses on various syntactic phenomena including coordination, relativisation, and clefting.

3. CASE MARKING AND PREDICATE CONJUGATION

We will first look at the treatments of case marking and predicate conjugation in Korean within the framework of CCG.

¹The underlying assumption is that only the scrambling of complements are allowed and they cannot be placed after the predicate. It is true that sentences in which complements or adverbials are placed after the predicates of the sentences exist in Korean. However it is very rare phenomenon, and we will focus on predicate-final sentences. We can cover this matter if we adopt Multiset-CCG.

²Set-CCG has been successfully applied to the analyses of various syntactic phenomena in Tagalog, Toba Batak [4] and Greek [11].

3.1 Case Marking

In Korean, the grammatical case of a noun is marked by *case particles* as shown in (1). We treat NOMINATIVE and ACCUSATIVE particles as functions that take left adjacent nouns as their arguments and return case-marked noun phrases. These category assignments are shown in (2).

- (2) a. *-ka, -i, -kkeyse* NOMINATIVE := $NP_{NOM} \setminus \{N\}$
 b. *-lul, -ul* ACCUSATIVE := $NP_{ACC} \setminus \{N\}$

We assign different categories for the particles traditionally classified as *adverbial case particles* since noun phrases with these particles often used as adverbials. These particles take left adjacent nouns as their arguments and return adverbials. Category assignments for typical adverbial case particles are shown in (3).

- (3) a. *-ey* := $(S_{LOC|GOAL|TIME...} / \{S\}) \setminus \{N\}$
 b. *-eykey, -kkey* := $(S_{DAT} / \{S\}) \setminus \{N\}$
 c. *-lo* := $(S_{INST|GOAL...} / \{S\}) \setminus \{N\}$

(4) shows a derivation of a complex noun phrase in which a case particle is attached to a noun modified by two determiners.³

- (4) a. ku say cip-ese
 the new house-LOC
 'at the new house'
 b.
$$\begin{array}{ccccccc} \text{ku} & \text{say} & \text{cip} & & \text{-ese} & & \\ \hline N/\{N\} & N/\{N\} & N & & (S_{LOC}/\{S\}) \setminus \{N\} & & \\ & & \hline & & N & & > \\ & & & & \hline & & N & & > \\ & & & & \hline & & S_{LOC}/\{S\} & & < \end{array}$$

3.2 Predicate Conjugation

The existence of predicate ending is another distinctive property of Korean. Predicate endings mark various grammatical features including tense, aspect, honorification, mood, etc. They are classified into two subgroups, *pre-final endings* and *final endings*, according to their positions. (5) and (6) demonstrate category assignments for predicate endings and a derivation for a predicate wordform.

- (5) a. *-ess-, -ass-, -ss-* PAST := $S_{VP,PAST} \setminus \{S_{VP}\}$
 b. *-si-* HONORIFICATION := $S_{VP,HON} \setminus \{S_{VP}\}$
 c. *-ta, -nunta, -nta* DECLARATIVE := $S_{IP,DEC} \setminus \{S_{VP}\}$
 d. *-nunya, -nya* INTERROGATIVE := $S_{IP,INTR} \setminus \{S_{VP}\}$

- (6) a. ka-si-ess-nunya
 go-HON-PAST-INTR
 'Did (somebody) go?'
 b.
$$\begin{array}{ccccccc} \text{ka-} & & \text{-si-} & & \text{-ess-} & & \text{-nunya} \\ \hline S_{VP} \setminus \{NP_n\} & S_{VP,HON} \setminus \{S_{VP}\} & S_{VP,PAST} \setminus \{S_{VP}\} & S_{IP,INTR} \setminus \{S_{VP}\} & & & \\ & & & & & & < \mathbf{B} \\ & & & & & & \hline & & & & S_{VP,HON} \setminus \{NP_n\} & & < \mathbf{B} \\ & & & & & & \hline & & & & S_{VP,HON,PAST} \setminus \{NP_n\} & & < \mathbf{B} \\ & & & & & & \hline & & & & S_{IP,HON,PAST,INTR} \setminus \{NP_n\} & & < \mathbf{B} \end{array}$$

³A complete list of combinatory rules used in this study is provided in appendix.

4. LOCAL SCRAMBLING AND WORD ORDER PREFERENCE

As pointed out in Section 1.2, local scrambling is a very common phenomenon in Korean. Scrambled sentences are derived without difficulties in Set-CCG as shown in (7).⁴

- (7) a. ecey Hwanho-ka cangnankam-ul pakuni-ey neh-ess-ta.
 yesterday Hwanho-NOM toy-ACC basket-LOC put-PAST-DECL
 'Hwanho put his toys into the basket yesterday.'
- b. pakuni-ey cangnankam-ul ecey Hwanho-ka neh-ess-ta.
 basket-LOC toy-ACC yesterday Hwanho-NOM put-PAST-DECL
 'Hwanho put his toys into the basket yesterday.'
- (8) a. $\frac{ecey}{S/\{S\}}$ $\frac{Hwanho - ka}{NP_n}$ $\frac{cangnankam - ul}{NP_a}$ $\frac{pakuni - ey}{S/\{S\}}$ $\frac{neh - ess - ta}{S\{NP_n, NP_a, S/\{S\}\}}$
 $\frac{S\{NP_n, NP_a\}}{S\{NP_n\}}$
 $\frac{S}{S}$ $\rightarrow B_x$
- b. $\frac{pakuni - ey}{S/\{S\}}$ $\frac{cangnankam - ul}{NP_a}$ $\frac{ecey}{S/\{S\}}$ $\frac{Hwanho - ka}{NP_n}$ $\frac{neh - ess - ta}{S\{NP_n, NP_a, S/\{S\}\}}$
 $\frac{S\{NP_a, S/\{S\}\}}{S\{NP_a, S/\{S\}\}}$
 $\frac{S\{S/\{S\}\}}{S}$ $\rightarrow B_x$

There are tendencies toward certain types of word order, for example SOV, are preferred although local scrambling has no constraint in most cases. Word order preference seems to be dependent on predicates' characteristics as shown in (9).

- (9) a. nampi-ey mul-i kkuh-nunta.
 pot-LOC water-NOM boil-DECL
 'Water is boiling in a pot.'
- b. na-hanthe ton-i sayngki-ess-ta.
 I-DAT money-NOM occur-PAST-DECL
 'I happened to get some money.'

Word order preference can be encoded in the categories of predicates if we interpret the set in Set-CCG as an ordered set.⁵

5. COORDINATION AND EXTRACTION

One of the merits of CCG is the relatively simple treatment of unbounded dependencies that occur under coordination and extraction. This section shows CCG analyses of coordination and extraction in Korean.

⁴From now on, derivations of case marking and predicate conjugation are not shown unless needed.

⁵[11] deals with this matter in his analysis of Greek.

5.1 Coordination

A coordinate construction is formed by conjoining two or more sentences with a coordinate conjunctive ending *-ko*. (10a,b) are typical examples of coordination in Korean. Note that the PAST tense marking ending *-ess-* is dropped in (10b).⁶

- (10) a. Hwanho-ka nolay-lul pwul-ess-ko Tonami-ka chwum-ul chwu-ess-ta.
 Hwnaho-NOM song-ACC sing-PAST-CONJ Tonami-NOM dance-ACC dance-PAST-DECL
 'Hwanho sang, and Tonami danced.'
- b. Hwanho-ka nolay-lul pwulu-ko Tonami-ka chwum-ul chwu-ess-ta.
 Hwanho-NOM song-ACC sing-CONJ Tonami-NOM dance-ACC dance-PAST-DECL
 'Hwanho sang, and Tonami danced.'

Above sentences are derived as in (11).

- (11) a.
$$\begin{array}{ccccccc} \text{H} - \text{ka} & \text{nolay} - \text{lul} & \text{pwul} - \text{ess} - & -\text{ko} & \text{T} - \text{ka} & \text{chwum} - \text{ul} & \text{chwu} - \text{ess} - & -\text{ta} \\ \hline \text{NP}_n & \text{NP}_a & \text{S}_{VP} \setminus \{ \text{NP}_n, \text{NP}_a \} & \text{CONJ} & \text{NP}_n & \text{NP}_a & \text{S}_{VP} \setminus \{ \text{NP}_n, \text{NP}_a \} & \text{S}_{IP} \setminus \{ \text{S}_{VP} \} \\ \hline & & \text{S}_{VP} \setminus \{ \text{NP}_n \} & & & & \text{S}_{VP} \setminus \{ \text{NP}_n \} & \\ \hline & & \text{S}_{VP} & & & & \text{S}_{VP} & < \Phi > \\ \hline & & & & & & & \text{S}_{VP} < \Phi > \\ \hline & & & & & & & \text{S}_{IP} < \Phi > \end{array}$$
- b.
$$\begin{array}{ccccccc} \text{Hwnaho} - \text{ka} & \text{nolay} - \text{lul} & \text{pwulu} & -\text{ko} & \text{Tonami} - \text{ka} & \text{chwum} - \text{ul} & \text{chwu} - & -\text{ess} - & -\text{ta} \\ \hline \text{NP}_n & \text{NP}_a & \text{S}_{VP} \setminus \{ \text{NP}_n, \text{NP}_a \} & \text{CONJ} & \text{NP}_n & \text{NP}_a & \text{S}_{VP} \setminus \{ \text{NP}_n, \text{NP}_a \} & \text{S}_{VP} \setminus \text{S}_{VP} & \text{S}_{IP} \setminus \{ \text{S}_{VP} \} \\ \hline & & \text{S}_{VP} \setminus \{ \text{NP}_n \} & & & & \text{S}_{VP} \setminus \{ \text{NP}_n \} & & \\ \hline & & \text{S}_{VP} & & & & \text{S}_{VP} & < \Phi > \\ \hline & & & & & & & \text{S}_{VP} < \Phi > \\ \hline & & & & & & & \text{S}_{IP} < \Phi > \end{array}$$

CCG offers neat descriptions for so-called *gapped* coordinate sentences. Consider the following examples in (12a). The object of the second clause is gapped in this coordinate sentence. Derivation of this sentence is trivial as shown in (12b).

- (12) a. Hwanho-ka kay-lul an-ko ssutatum-ess-ta.
 Hwanho-NOM dog-ACC hold-CONJ pat-PAST-DECL
 'Hwanho patted a dog while holding it.'
- b.
$$\begin{array}{ccccccc} \text{Hwanho} - \text{ka} & \text{kay} - \text{lul} & \text{an} - & -\text{ko} & \text{ssutatum} - & -\text{ess} - & \text{ta} \\ \hline \text{NP}_n & \text{NP}_a & \text{S}_{VP} \setminus \{ \text{NP}_n, \text{NP}_a \} & \text{CONJ} & \text{S}_{VP} \setminus \{ \text{NP}_n, \text{NP}_a \} & \text{S}_{IP} \setminus \{ \text{S}_{VP} \} \\ \hline & & \text{S}_{VP} \setminus \{ \text{NP}_n, \text{NP}_a \} & & & & < \Phi > \\ \hline & & \text{S}_{VP} \setminus \{ \text{NP}_n \} & & & & \\ \hline & & \text{S}_{VP} & & & & \\ \hline & & & & & & \text{S}_{IP} < \Phi > \end{array}$$

More seriously gapped sentences where unconventional constituents are conjoined can be derived by applying type-raising and functional composition.

- (13) a. Hwanho-ka kangaci-lul, Tonami-ka thokki-lul coaha-nta.
 Hwanho-NOM puppy-ACC, Tonami-NOM rabbit-ACC like-DECL
 'Hwanho like puppies and Tonami rabbits.'

⁶This could be an evidence that predicate endings are constituents of sentences and can have scopes.

- b. Cincwu-ekey phungsen-ul, Hyeyini-ekey inhyeng-ul Hwanho-ka cu-ess-ta.
 Cincwu-DAT balloon-ACC, Hyeyini-DAT doll-ACC Hwanho-NOM give-PAST-DECL
 ‘Hwanho gave a balloon to Cincwu, and a doll to Hyeyini.’

- (14) a.
$$\frac{\frac{\frac{NP_n}{T/\{T\{NP_n\}\}} \xrightarrow{I} \quad \frac{NP_a}{T/\{T\{NP_a\}\}} \xrightarrow{I}}{T/\{T\{NP_n\}\{NP_a\}\}} \xrightarrow{B} \quad , \quad \frac{\frac{NP_n}{T/\{T\{NP_n\}\}} \xrightarrow{I} \quad \frac{NP_a}{T/\{T\{NP_a\}\}} \xrightarrow{I}}{T/\{T\{NP_n\}\{NP_a\}\}} \xrightarrow{B}}{T/\{T\{NP_n\}\{NP_a\}\}} \xrightarrow{S} S \setminus \{NP_n, NP_a\}$$
- b.
$$\frac{\frac{\frac{S_{DAT}/\{S\}}{T/\{T\{S_{DAT}/\{S\}\}\}} \xrightarrow{I} \quad \frac{NP_a}{T/\{T\{NP_a\}\}} \xrightarrow{I}}{T/\{T\{S_{DAT}/\{S\}\}\{NP_a\}\}} \xrightarrow{B} \quad , \quad \frac{\frac{S_{DAT}/\{S\}}{T/\{T\{S_{DAT}/\{S\}\}\}} \xrightarrow{I} \quad \frac{NP_a}{T/\{T\{NP_a\}\}} \xrightarrow{I}}{T/\{T\{S_{DAT}/\{S\}\}\{NP_a\}\}} \xrightarrow{B}}{T/\{T\{S_{DAT}/\{S\}\}\{NP_a\}\}} \xrightarrow{S} S \setminus \{S_{DAT}/\{S\}, NP_a\}$$

5.2 Relativisation

In Korean, relativisers take the form of predicate final endings. They are assigned categories that are similar to those of relative pronouns in English. (15) shows category assignments for relativisers.

- (15) a. *-nun* RELATIVISER PRESENT := $(N/\{N\}) \setminus \{S_{VP} \setminus \{NP\}\}$
 b. *-un, -n* RELATIVISER PAST := $(N/\{N\}) \setminus \{S_{VP} \setminus \{NP\}\}$
 c. *-ul, -lul* RELATIVISER FUTURE := $(N/\{N\}) \setminus \{S_{VP} \setminus \{NP\}\}$
 d. *-ten* RELATIVISER RETROSPECTIVE := $(N/\{N\}) \setminus \{S_{VP} \setminus \{NP\}\}$

Once we have categories for relativisers, we can derive relative clauses in (16) as shown in (17).

- (16) a. Tonami-lul Kowuni-ekey sokayha-n Hwanho
 Tonami-ACC Kowuni-DAT introduce-REL Hwanho
 ‘Hwanho who introduced Tonami to Kowuni’
 b. Hwanho-ka Kowuni-ekey sokayha-n Tonami
 Hwanho-NOM Kowuni-DAT introduce-REL Tonami
 ‘Tonami who Hwanho introduced to Kowuni’

- (17) a.
$$\frac{\frac{\frac{NP_a}{S_{VP} \setminus \{NP_n, NP_a, S_{DAT}/\{S\}\}} \xrightarrow{I} \quad \frac{S_{DAT}/\{S\}}{S_{VP} \setminus \{NP_n, NP_a\}} \xrightarrow{I} \quad \frac{-n}{(N/\{N\}) \setminus \{S_{VP} \setminus \{NP\}\}} \xrightarrow{I} \quad \frac{Hwanho}{N}}{S_{VP} \setminus \{NP_n\}} \xrightarrow{I} \quad \frac{N/\{N\}}{N} \xrightarrow{I}}{N} \xrightarrow{I}$$
- b.
$$\frac{\frac{\frac{NP_n}{S_{VP} \setminus \{NP_n, NP_a, S_{DAT}/\{S\}\}} \xrightarrow{I} \quad \frac{S_{DAT}/\{S\}}{S_{VP} \setminus \{NP_n, NP_a\}} \xrightarrow{I} \quad \frac{-n}{(N/\{N\}) \setminus \{S_{VP} \setminus \{NP\}\}} \xrightarrow{I} \quad \frac{Tonami}{N}}{S_{VP} \setminus \{NP_a\}} \xrightarrow{I} \quad \frac{N/\{N\}}{N} \xrightarrow{I}}{N} \xrightarrow{I}$$

To allow the extraction of adverbial arguments, we assign different categories to relativisers. There is no difference in derivation.

- (18) a. *-un, -n* RELATIVISER PAST := $(N/\{N\}) \setminus \{S \setminus \{S/\{S\}\}\}$
 b. Hwanho-ka Tonami-lul sokayha-n Kowuni
 Hwanho-NOM Tonami-ACC introduce-REL Kowuni
 ‘Kowuni to whom Hwanho introduced Tonami.’
 c.
$$\begin{array}{c} \text{Hwanho} - \text{ka} \quad \text{Tonami} - \text{lul} \quad \text{sokayha} - \quad \text{-n} \quad \text{Kowuni} \\ \hline \text{NP}_n \quad \text{NP}_a \quad \text{S}_{VP} \setminus \{ \text{NP}_n, \text{NP}_a, \text{S}_{DAT} / \{S\} \} \quad (N/\{N\}) \setminus \{S \setminus \{S/\{S\}\}\} \quad N \\ \hline \text{S}_{VP} \setminus \{ \text{NP}_n, \text{S}_{DAT} / \{S\} \} \\ \hline \text{S}_{VP} \setminus \{ \text{S}_{DAT} / \{S\} \} \\ \hline N/\{N\} \\ \hline N \end{array}$$

5.3 Clefting

Clefting in Korean is very similar to relativisation. (19a,b) are typical clefting construction in Korean.

- (19) a. Hwanho-ka masi-n kes-i wuyu-i-ess-ta.
 Hwanho-NOM drink-REL thing-NOM milk-COP-PAST-DECL
 ‘It was milk that Hwanho drank.’
 b. wuyu-lul masi-n kes-i Hwanho-i-ess-ta.
 milk-ACC drink-REL thing-NOM Hwanho-COP-PAST-DECL
 ‘It was Hwanho who drank milk.’

Relativiser, dependent noun and copula are key elements of clefting. We can use same categories for relativisers. (20) shows category assignments for dependent noun and copula.

- (20) a. *kes* ‘thing’ := $N \setminus \{N/\{N\}\}$
 b. *-i-* COPULA := $S_{VP} \setminus \{NP_n\} \setminus \{N\}$

Derivations are straight forward.

- (21) a.
$$\begin{array}{c} \text{Hwanho} - \text{ka} \quad \text{masi} - \quad \text{-n} \quad \text{kes} \quad \text{-i} \quad \text{wuyu} - \text{i} - \text{ess} - \text{ta} \\ \hline \text{NP}_n \quad \text{S} \setminus \{ \text{NP}_n, \text{NP}_a \} \quad (N/\{N\}) \setminus \{ \text{S}_{VP} \setminus \{ \text{NP} \} \} \quad N \setminus \{ N/\{N\} \} \quad \text{NP}_n \setminus \{ N \} \quad \text{S} \setminus \{ \text{NP}_n \} \\ \hline \text{S} \setminus \{ \text{NP}_a \} \\ \hline N/\{N\} \\ \hline N \\ \hline \text{NP}_n \\ \hline S \end{array}$$

 b.
$$\begin{array}{c} \text{wuyu} - \text{lul} \quad \text{masi} - \quad \text{-n} \quad \text{kes} \quad \text{-i} \quad \text{Hwanho} - \text{i} - \text{ess} - \text{ta} \\ \hline \text{NP}_a \quad \text{S} \setminus \{ \text{NP}_n, \text{NP}_a \} \quad (N/\{N\}) \setminus \{ \text{S}_{VP} \setminus \{ \text{NP} \} \} \quad N \setminus \{ N/\{N\} \} \quad \text{NP}_n \setminus \{ N \} \quad \text{S} \setminus \{ \text{NP}_n \} \\ \hline \text{S} \setminus \{ \text{NP}_n \} \\ \hline N/\{N\} \\ \hline N \\ \hline \text{NP}_n \\ \hline S \end{array}$$

6. MULTIPLE NOMINATIVE CONSTRUCTION

There have been many efforts to describe so-called *multiple nominative construction* in Korean. (22a) is a typical double nominative sentence. This sentence is widely regarded as related to (22b).

- (22) a. Hwanho-ka elkwul-i yeypu-ta.
 Hwanho-NOM face-NOM pretty-DECL
 'Hwanho's face is pretty.'
 b. Hwanho-uy elkwul-i yeypu-ta.
 Hwanho-POS face-NOM pretty-DECL
 'Hwanho's face is pretty.'

It is also well-known that there exist certain types of semantic/pragmatic relations between multiple nominative noun phrases, and this construction can be formed only with a particular kind of predicates.

The essence of our categorial description of multiple nominative construction is treating nominative noun phrases except the first one as functions that take left adjacent noun phrase as their arguments. Two equivalent derivations for (22a) are shown in (23)

- (23) a.
$$\frac{\frac{NP_n}{NP_n} \quad \frac{elkwul-i \quad yeypu-ta}{NP_n \setminus \{NP_n\} \quad S \setminus \{NP_n\}}}{S \setminus \{NP_n\}} \langle B \rangle$$

$$\frac{S}{S} \langle$$

 b.
$$\frac{\frac{NP_n}{NP_n} \quad \frac{elkwul-i \quad yeypu-ta}{NP_n \setminus \{NP_n\} \quad S \setminus \{NP_n\}}}{NP_n} \langle$$

$$\frac{S}{S} \langle$$

(24) shows relativisation of multiple nominative construction. Our approach correctly predicts the ungrammaticality of (24b). Derivations for these constructions are given in (25). (25c) is ruled out by semantic/pragmatic filter even though it is successfully derived.

- (24) a. elkwul-i yeypu-n Hwanho
 face-NOM pretty-REL Hwanho
 'Hwanho whose face is pretty'
 b. *Hwanho-ka yeypu-n elkwul
 Hwanho-NOM pretty-REL face
 'face that Hwanho's which is pretty'

- (25) a.
$$\frac{\frac{elkwul-i \quad yeypu-n}{NP_n \setminus \{NP_n\} \quad S \setminus \{NP_n\}} \quad \frac{-n \quad Hwanho}{(N/\{N\}) \setminus (S \setminus \{NP\})} \quad N}{S \setminus \{NP_n\}} \langle B \rangle$$

$$\frac{N/\{N\}}{N} \langle$$

 b.
$$\frac{\frac{Hwanho-ka \quad yeypu-n}{NP_n \quad S \setminus \{NP_n\}} \quad \frac{-n \quad elkwul}{(N/\{N\}) \setminus (S \setminus \{NP\})} \quad N}{S} \langle$$

 c.
$$\frac{\frac{Hwanho-ka \quad yeypu-n}{NP_n \setminus \{NP_n\} \quad S \setminus \{NP_n\}} \quad \frac{-n \quad elkwul}{(N/\{N\}) \setminus (S \setminus \{NP\})} \quad N}{S \setminus \{NP_n\}} \langle B \rangle$$

$$\frac{N/\{N\}}{N} \langle$$

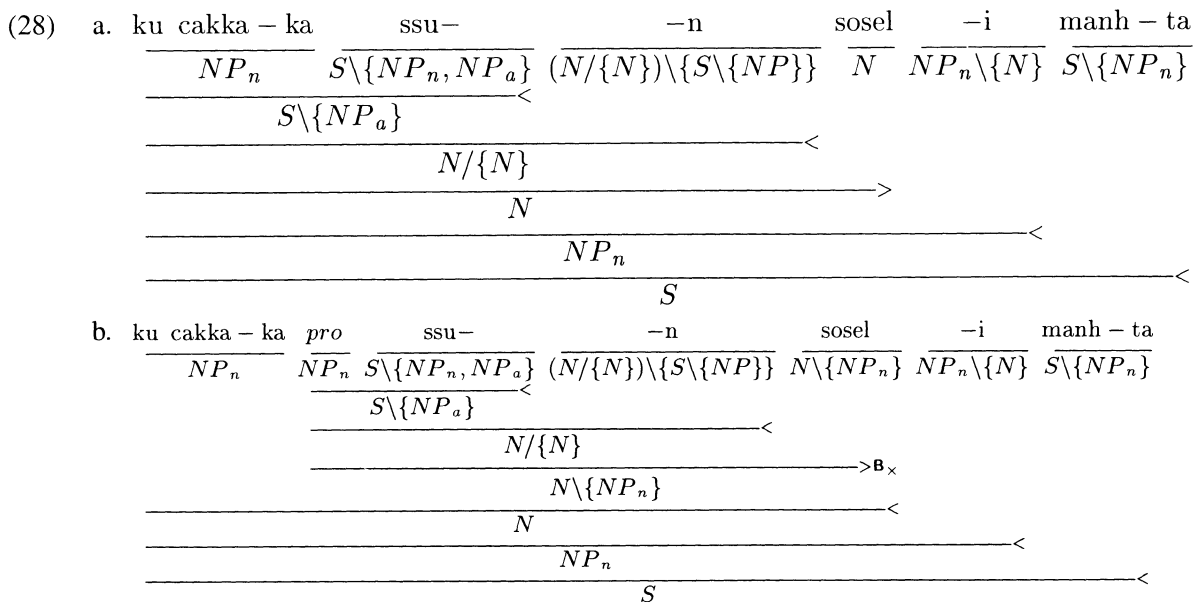
Now we move on to so-called double relatives that are related to multiple nominative constructions. A typical example of a double relative construction is (26a).⁷ It is related to the multiple nominative construction (26b).

- (26) a. ssu-n sosel-i manh-un ku cakka
 write-REL novel-NOM many-REL the writer
 ‘(lit.) the writer_i who the novels that he_i wrote are many’
 b. ku cakka-ka ssu-n sosel-i manh-ta.
 the writer-NOM write-REL novel-NOM many-DECL
 ‘There are many novels that the writer wrote.’

(26b) has two readings that are illustrated in (27a,b). (27c) could be an evidence of the existence of PRO.

- (27) a. [ku cakka-ka ssu-n] sosel-i manh-ta.
 the writer-NOM write-REL novel-NOM many-DECL
 ‘There are many novels that the writer wrote.’
 b. ku cakka_i-ka [*pro*_i ssu-n] sosel-i manh-ta.
 the writer_i-NOM *pro*_i write-REL novel-NOM many-DECL
 ‘The writer_i has many novels that he_i wrote.’
 c. ku cakka-ka [caki-ka ssu-n] sosel-i manh-ta.
 the writer-NOM self-NOM write-REL novel-NOM many-DECL
 ‘The writer_i has many novels that he_i wrote.’

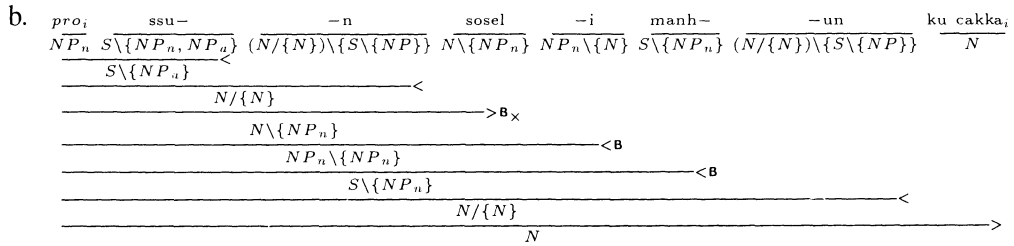
(27a) is a normal simple sentence, while (27b) is a multiple nominative sentence. Consequently, they are derived in different ways. Note that we assigned the same category for the second nominative noun phrase which was used in above analysis of multiple nominative constructions.



We can now derive the double relative construction in (26a) as follows.

- (29) a. *pro*_i ssu-n sosel-i manh-un ku cakka_i
*pro*_i write-REL novel-NOM many-REL the writer_i
 ‘(lit.) the writer_i who the novels that he_i wrote are many’

⁷The following analysis is motivated and inspired by the HPSG account of double relative construction and multiple nominative construction of [12].



7. CONCLUSION

We presented a Set-CCG analyses on various syntactic phenomena in Korean in this paper. It was proved that Set-CCG can provide not only adequate descriptions for Korean syntax but also precise predictions for many linguistic constraints.

We also showed that if we can assign proper lexical categories, complex syntactic constructions including coordination, relativisation, clefting, and multiple nominative constructions can be derived easily by applying relatively simple and small number of combinatory rules.

A closer look of the linguistic features of individual lexical items like this approach will benefit the better understanding of Korean syntax.

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A. LIST OF RULES USED IN THIS STUDY

- *Functional Applications*

- *Forward Application* ($>$)

$$X/(\alpha \uplus \{Y\}) \quad Y \quad \Rightarrow \quad X/\alpha$$

- *Backward Application* ($<$)

$$Y \quad X \setminus (\alpha \uplus \{Y\}) \quad \Rightarrow \quad X \setminus \alpha$$

- *Functional Compositions*

- *Forward Composition* ($> \mathbf{B}$)

$$X/(\alpha \uplus \{Y/\beta\}) \quad Y/(\beta \uplus \gamma) \quad \Rightarrow_{\mathbf{B}} \quad X/\alpha/\gamma$$

- *Backward Composition* ($< \mathbf{B}$)

$$Y \setminus (\beta \uplus \gamma) \quad X \setminus (\alpha \uplus \{Y \setminus \beta\}) \quad \Rightarrow_{\mathbf{B}} \quad X \setminus \alpha \setminus \gamma$$

- *Forward Crossing Composition* ($> \mathbf{B}_x$)

$$X/(\alpha \uplus \{Y/\beta\}) \quad Y \setminus (\beta \uplus \gamma) \quad \Rightarrow_{\mathbf{B}_x} \quad X \setminus \alpha \setminus \gamma$$

- *Type-raising*

- *Forward Type-raising* ($> \mathbf{T}$)

$$X \quad \Rightarrow_{\mathbf{T}} \quad T/\{T \setminus \{X\}\}$$

where $T \setminus X$ is a legal lexical syntactic type for the language

- *Coordination* ($< \Phi^n >$)

$$X \quad CONJ \quad X \quad \Rightarrow_{\Phi^n} \quad X$$

