# SYNTACTIC AND SEMANTIC INTERFACES FOR
# LEXICALLY UNREALIZED RELATIONS

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## 1 Introduction

Studies on unified descriptions of syntactic and semantic interfaces are conducted in HPSG(Head-driven Phrase Structure Grammar), because HPSG specifies composite aspects of these linguistic layers. The SYNSEM attribute of HPSG deals mainly with lexically specified content and context meanings of elements. But further insightful study into Korean pseudo-relative constructions in which there is no gap and the types of head nouns are restricted to some specific elements, reveals that there exist internally implicated, but lexically unrealized, relations. These relations contribute to the distinction among Korean adnominalized constructions, and provide a motivation for dividing Korean adnominalized constructions into relative, appositive, and pseudo-relative constructions. However, the relations cannot be captured in the basic frames of HPSG, on the basis of lexically specified content and context such as 'person', 'number' and so on. With the preservations of typed feature structures, HPSG formalisms instead need to be extended in order to allow implicated, but necessary relations. This work suggests new descriptions that incorporate the relations into the existing HPSG frames, and specify syntactic, semantic, and pragmatic interactions. This allows us to pursue and improve the unified and integrated descriptions of linguistic phenomena previously improperly explained.

## 2 Data

### 2.1 Syntax

Traditionally methods treat Korean relative constructions as adnominal constructions. Adnominalization is a process in which nouns or noun phrases are modified by a verb phrase with adnominalized inflections. Unlike English relative clauses, there is no relative pronoun in Korean. Instead, adnominalized verbal inflections identify the constructions, and head nouns (antecedents) appear after the relative cluase. These are salient syntactic traits contrasted to the English counterparts.

Korean adnominalized clauses can be reclassified as appositive constructions, relative constructions, and pseudo-relative constructions (Shin 1995:114). There are systematic differences among these constructions. Examples of pseudo-relative constructions are as follows.

(1) a   mwul-i                 hulu-**nun**               soli
        water-nominative        flow-relativizer (present)    sound
        *the sound in which water is flowing (i e the sound of water flowing)*
    b   loma-ka                pwulta-**nun**             kwangkyeng
        Rome-nominative         burn- relativizer(present)   view
        *the view in which Rome is burning (i e the view of Rome burning)*
    c   thayphwung-i            cinaka-**n**               huncek
        typhoon-nominative       go by-relativizer (past)     trace
        *the trace that the typhoon went by (i e the trace left behind by the typhoon)*

d John-ı        kom-ul        cwukı-**n**        sıchey
John-nomınative bear-accusatıve kıll-relatıvızer(past) dead body
*the dead body that John kılled a bear(ı e  the dead body left behınd after John kılled a bear)*

A pseudo-relatıve constructıon ıs dıstınguıshed from a typıcal relatıve clause[1] ın that firstly, there ıs no gap ın the clause, and secondly, the types of head nouns are restrıcted to sensory nouns such as sound, smell, and vıew wıth the present relatıvızer Those constructıons are also dıfferent from apposıtıve constructıons whıch have the same syntactıc structures, that ıs, there ıs no gap ın a sentence

(2)  a John-ı        tolao-n            sasıl
John-nomınatıve    return-relatıvızer     fact
*the fact that John returned*

Syntactıcally pseudo-relatıve constructıons and apposıtıve constructıons are ıdentıcal, but ın Korean, statıve expressıon '-(ta)ko ha' ( *say that*  as ın Englısh) can be added to apposıtıve constructıons, but not to pseudo-relatıve constructıons

(3)  a *mwul-ı          hulun-**tako ha**-nun        solı
water-nomınatıve      flow-that say-relatıvızer      sound
b John-ı            tolawass-**tako**   **ha**-nun      sasıl
John-nomınatıve      return-past-that say-relatıvızer   fact

In the case of apposıtıve constructıons, the head noun can be a content meanıng of adnomınal constructıons, but pseudo-relatıve constructıons do not contrıbute to the meanıng of the relatıon Furthermore, a genıtıve constructıon ıs allowed ın pseudo-relatıve constructıons, but not ın apposıtıve constructıons Nomınatıve case markers can be replaced by genıtıve markers, and these genıtıves modıfy head nouns regardless of the word order

(4)  a mwul-**ey**      hulu-nun        solı        b hulu-nun        mwul-**ey**        solı
water-**genıtıve** flow-relatıvızer  sound          flow-relatıvızer  water-**genıtıve**   sound
*'the sound of water flowıng'*
c *John-**ey**      tolao-n          sasıl       d *tolao-n          John-**ey**        sasıl
John-**genıtıve**  return-relatıvızer fact          return-relatıvızer John-**genıtıve**  fact
*'the fact of John's return'*


2 2  Semantıcs and Pragmatıcs

Accordıng to (1) above, pseudo-relatıve constructıons may be dıvıded ınto two cases, (1)-a,b and (1)-c,d The dıfferences result from ınternally ımplıcated semantıc propertıes wıth present and past relatıvızers (1)-a, b can take only present relatıvızer -**nun**, meanwhıle (1)-c,d can take only past relatıvızer -**n** The followıngs are examples of the wrong selectıon of relatıvızers

(5) a *mwul-ı          hulu-**n**        solı
water-nomınatıve   flow-relatıvızer(**past**)   sound
*'the sound ın whıch water flowed'*

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[1] A typıcal relatıve constructıon ıs as follows,
a [nay-ka          ____, ttaylı-n ]      John,
I-nomınatıve        hıt-relatıvızer      John
*John who I hıt*

b *John-ı        kom-ul           cwukı-**nun**            sıchey
John-nomınatıve  bear-accusatıve  kıll-**relatıvızer(present)**  dead body
*the dead body that John kılls the bear*

Detailed Analysis of pseudo-relatıve constructıons reveal two kınds of possıble types, 'sımultaneıty(1-a, b)' whıch shows a sımutaneous occurrence of the events, and 'resultatıve(1-c, d)' whıch specıfies tıme dıfferences of the events Sımultaneıty types can only occur wıth present relatıvızer *(-nun)*, whereas resultatıves appear wıth past relatıvızer *(-n)* These two classıficatıons are also dıfferent ın terms of genıtıve constructıons

(6) a mwul-**ey**      hulu-nun           solı
        water-genıtıve  flow-relatıvızer   sound
    b hulu-nun           mwul-ey          solı
        flow-relatıvızer  water-genıtıve   sound
        *'the sound of water flowıng'*
    c John-ey           kom-ul           cwukı-n          sıchey
        John-genıtıve    bear-accusatıve  kıll-relatıvızer  dead body
    d *Kom-ul           cwukı-n          John-ey          sıchey
        bear-accusatıve  kıll-relatıvızer  John-genıtıve    dead body

As seen ın (4), ın (6)-a, b, noun phrases wıth genıtıve markers are located before the head noun or the relatıve clause, and show no sıgnıficant meanıng dıfference But ın the case of (6)-d, the genıtıve phrase located before the head noun  specıfies *'sıchey(dead body)'*, not *'kom(bear)'*, whıch turns out to be wrong

Another sıgnıficant semantıc dıfference between relatıve constructıons and pseudo-relatıve constructıons ıs that a pseudo-relatıve clause does not specıfy or restrıct head nouns, whıle a relatıve clause does Rather they express sımultaneous ıncıdental sıtuatıon(sımultaneıty type wıth present relatıvızer) or resultatıve sıtuatıon(resulatıve wıth past relatıvızer) The followıng examples change relatıve constructıons to predıcatıve expressıons lıke *'beutıful gırl'* to *'the gıı l ıs beautıful'*, and show that there are no dırect relatıons between the head nouns and the relatıve clauses

(7) a *ku solı-nun                    mwul-ı                    hulunta
        the sound-topıc/nomınatıve     water-nomınatıve          flow
        **the sound ıs water flows*
    b *ku sıchey-nun                   John-ı              kom-ul           cwukınta
        the dead body-topıc/nomınatıve  John-nomınatıve     bear-accusatıve  kıll
        **the dead body ıs John Kılled the bear*

The sımultaneıty and resultatıve both mean that there exıst pragmatıc relatıons, such as tıme relatıons, whıch should be specıfied ımplıcıtly ın order to capture unrealızed relatıons The event of *'Kıllıng the bear'* precedes ıts byproduct, head noun *'the dead body'*, meanwhıle that of *'water flows'* has a sımultaneous output, *'sound'*

## 2 3  Unrealızed Relatıons of Pseudo-relatıve Constructıons

Thıs overvıew of the Korean pseudo-relatıve constructıons ın terms  of syntactıc and semantıc propertıes classıfied the structure ınto two types, 'sımultaneıty', and 'resultatıve' Agaın, another ımportant lınguıstıc observatıon ıs that there exıst 'causatıve' relatıons between the head noun and the

pseudo-relative construction This makes pseudo-relative constructions distinguished from normal relative clauses It argues that pseudo-relative constructions *'CAUSE the head noun to COME TO BE'*, therefore distinguished syntactic and semantic behaviors occur in these constructions However this causative is not lexically realized, and this is why Korean pseudo-relative constructions should be separated from a normal relative construction whose main function is to restrict and specify head nouns Compare the following two constructions,
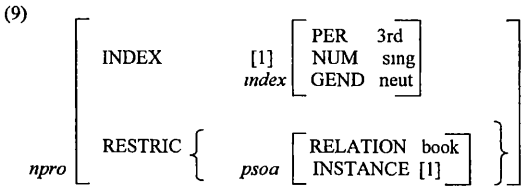
(8) a mwul-ı            hulu-nun             **solı**
      water-nominative      flow-relativizer (present)     sound
      *'the sound in which water is flowing (ı e the sound of water flowing)'*
    b kasum- ı           senulhay-cı-nun       **solı**
      heart-nominative    scare- passive-relativizer    sound
      *'the sound that makes the heart scared'*

Even though the same head noun appears above, a pseudo-relative construction 'a' can cause the head noun 'solı(sound)' to happen, but that of 'b' just specifies and restricts the head noun


## 3 Explanations in accordance with HPSG

### 3 1 Syntactic and Semantic Frames of HPSG

In the present formulation of HPSG theory, all signs at minimum possess the two attributes PHON and SYNSEM The value of PHON attribute is assumed to be some kind of feature representation of the sign's sound content that serves as the basis for phonological and phonetic interpretation (Pollard and Sag, 1994 15) The syntactic and semantic attribute of HPSG, SYNSEM has its values of LOCAL(LOC), and NONLOCAL(NONLOC) NONLOC information figures centrally in the analysis of unbounded dependency phenomena LOC is again divided into three attributes, CATEGORY(CAT), CONTENT(CONT), and CONTEXT(CONX) CAT mainly specifies syntactic information such as HEAD, SUBCATEGORIZATION(SUBCAT) The CONTENT value constitues the word's contribution to (context-independent) aspects of the semantic interpretation of any phrase that contains it Also semantic restrictions on the index can be introduced The value of the RESTRICTION attribute is a set of parametrized states-of-affairs (psoas) A (p)soa is represented by a feature structure that specifies a relation together with values for the argument roles of that relation (Pollard and Sag 1994 25) Each psoa in the RESTRICTION value is interpreted as placing semantic conditions on the entities that the indices appearing in them can be anchored to in a given context For example, the CONTENT value of the common noun *book* would be as follows,

(9)
$$\begin{bmatrix} \text{INDEX} & [1] \\ & \textit{index} \begin{bmatrix} \text{PER} & \text{3rd} \\ \text{NUM} & \text{sing} \\ \text{GEND} & \text{neut} \end{bmatrix} \\ \text{RESTRIC} & \left\{ \textit{psoa} \begin{bmatrix} \text{RELATION} & \text{book} \\ \text{INSTANCE} & [1] \end{bmatrix} \right\} \end{bmatrix}_{npro}$$

According to the RESTRICTION values, when the word *book* is used referentially, the index [1] introduced by that use must be anchored to a *book*

The CONTEXT value contains certain context-dependent linguistic information which is usually discussed under such rubrics as indexicality, presupposition, and conventional implicature Basically HPSG considers a single context attribute called BACKGROUND, whose value is a set of psoas Like the psoas in RESTRICTION values, each of these background psoas restricts the possible anchors of indices Unlike RESTRICTION psoas, however, BACKGROUND psoas are not part of the CONTENT value, but should rather be considered as felicity conditions on the utterance context That is, CONTENT values represent contributions to literal (truth-conditional) meaning, while BACKGROUND values reresent contributions on ahchors of indices that correspond to presuppositions or conventional implicatures (Pollard and Sag 1994 27) The simple example of BACKGROUND value of the proper NP *John* is as follows, where the atomic value *John* refers to the name *John*, not to an individual named *John*

(10)

$$\begin{bmatrix} \text{RELATION} & \text{naming} \\ \text{BEARER} & [1] \\ \text{NAME} & \text{John} \end{bmatrix}$$

However, the CONTENT and CONTEXT attributes of HPSG contribute mainly to the lexical information such as 'person', 'number' and other 'lexical relations' The lexically unrealized relations can not be incorporated into the current formalisms of HPSG HPSG is founded on unification grammar, and attribute-value matrices are unified in accordance with subsumption and inheritance This work focuses on the description of lexically unrealized relations, which preserves the typed feature structures of HPSG and extends the basic structures

3 2 Recent Work of Syntax-Semantics Interface within HPSG

Current research on syntactic and semantic interfaces within HPSG domains have yielded useful knowledge, and this section will briefly cover one of such approaches In order to capture the semantic genralizations concerning the Modern Greek Accusative Experiencer-Object Psych Verbs Constructions[2], Kordoni (1999 8) uses a slightly different version of Wechsler's (1995) CONCEIVES relation, and he defines CONCEIVES relation as '*a relation holding between an agent A, and individual x, at times $t_0$, and t, just in case A has a notion of x at time $t_0$ prior to the time t that x acquires a notion of A*'

$S = [s \mid s \models << \text{CONCEIVE}, x, y, t_0, t>>]$,
where $t_0 < t$

On the basis of this, Kordoni (1999) suggests the following Notation Rule,

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[2] Its argument is that the semantic argument realized in their subject position (animate or inanimate) does not have any notion of the individual denoted by their object NP, since it serves only as the cause (natural, or other) initiating the mental state experienced by the individual denoted by their object NP, while the converse entailment does actually go through (Kordoni 1998)

(11) Notation Rule

$$\begin{bmatrix} \text{RELN} & \text{R} \\ \text{ROLES} < & \text{r} & \text{r'} & > \end{bmatrix} \text{, where}$$

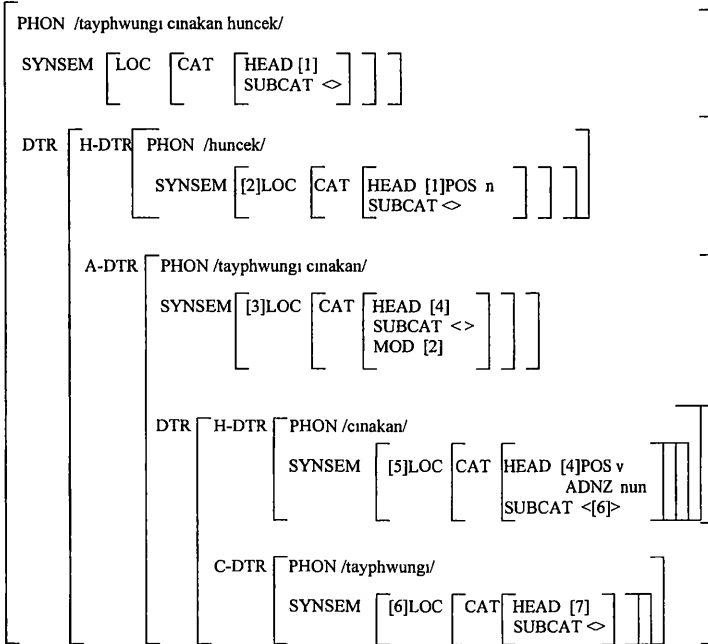$[s|s| = \;<<R,r'\; x,r\; y,t>>] => \{_{x,y}\}[s|s| = <<CONCEIVE,x,y,t>>]$

The CONCEIVE relation holds between $x$ and $y$ at times $t_0$ and $t$, where $t_0<t$, if $x$ has a notion of $y$ at a time $t_0$ prior to the time $t$ at which $y$ acquires a notion of $x$. In the case of Modern Greek Accusative Experiencer-Object Psych Verbs Constructions, time precedence relation is also required. But this description lacks the unified explanations which HPSG continuously pursues.

## 3 3 Analysis of Pseudo-relative Constructions

### 3 3 1 Syntactic Considerations

The following AVM(Attribute-Value Matrix) shows the structure of *'tayphwungı cınakan hucek(the trace left behind by the typhoon)'*

(12) AVM

PHON /tayphwungı cınakan huncek/

SYNSEM [LOC [CAT [HEAD [1] SUBCAT <>]]]

DTR [ H-DTR [ PHON /huncek/

SYNSEM [2]LOC [CAT [HEAD [1]POS n SUBCAT <>]]

A-DTR [ PHON /tayphwungı cınakan/

SYNSEM [3]LOC [CAT [HEAD [4] SUBCAT <> MOD [2]]]

DTR [ H-DTR [ PHON /cınakan/

SYNSEM [5]LOC [CAT [HEAD [4]POS v ADNZ nun SUBCAT <[6]>]

C-DTR [ PHON /tayphwungı/

SYNSEM [6]LOC [CAT [HEAD [7] SUBCAT <>]

This structure consists of head daughter(H-DTR), and adjunct daughter(A-DTR) Since pseudo-relative constructions are treated as modifiers, '*huncek(trace)*' is classified as a head daughter indexed with [1], and pseudo-relative construction as an adjunct daughter In the adjunct daughter phrase, there also exist head daughter and complement daughter(C-DTR) '*cinakan(went by)*' is a head of the phrase, and this head requires subject (typhoon) as its complement

The AVM above may be almost same as that of relative constructions The main difference is the value of SYNSEM Since a normal relative construction has a gap, the value of SYNSEM should be NONLOC(nonlocal), not LOC, which can be explained as unbounded dependencies in HPSG But structurally there is no significant difference between pseudo-relative constructions and appositive constructions with regarding to gaps in the construction
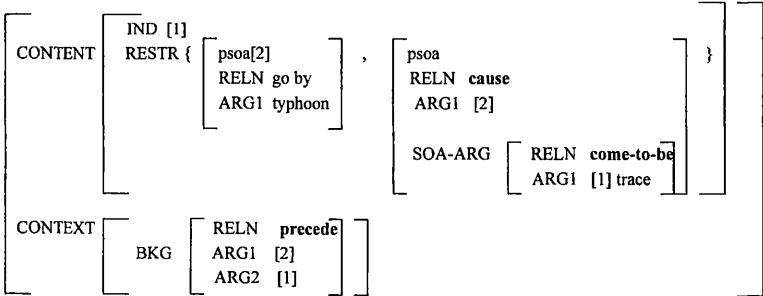
The structure here shows that only syntactic consideration without proper entailment of semantics and pragmatics does not provide plausible explanations of linguistic phenomena We need interfaces for capturing those implicated relations

3 3 2 Syntactic, Semantic and Pragmatic Interfaces for the Structure

In this work, I pointed out that Korean pseudo-relative construction is different from normal relative clause in that the former has a sort of 'causative' relation, and on the contrary, the latter has specification or restriction relations This study proposes a unified description that captures syntactic and semantic interfaces using indices and restrictions in HPSG The main focus has been on how to realize implicated relations such as 'cause', 'come-to-be', and time precedence information

The following partial structure shows that the head noun 'trace([1])' has semantic restrictions by RESTR whose value is a set of parameterized states-of-affairs(psoas), and internally implicated but lexically unrealized relations(RELN) like 'cause', and 'come-to-be' can be introduced to capture the semantic contents of pseudo-relative constructions The CONTEXT attribute, BKG(background) reveals that the value of ARG(argument)1 is coindexed with psoa[2], and [2] precedes [1]('trace'), which results in a 'resultative' type

(13) Partial structure of interfaces

$$
\begin{bmatrix}
\text{CONTENT} \begin{bmatrix} \text{IND } [1] \\ \text{RESTR } \{ \begin{bmatrix} \text{psoa}[2] \\ \text{RELN go by} \\ \text{ARG1 typhoon} \end{bmatrix}, \begin{bmatrix} \text{psoa} \\ \text{RELN cause} \\ \text{ARG1 } [2] \\ \text{SOA-ARG} \begin{bmatrix} \text{RELN come-to-be} \\ \text{ARG1 } [1] \text{ trace} \end{bmatrix} \end{bmatrix} \} \end{bmatrix} \\
\text{CONTEXT} \begin{bmatrix} \text{BKG} \begin{bmatrix} \text{RELN precede} \\ \text{ARG1 } [2] \\ \text{ARG2 } [1] \end{bmatrix} \end{bmatrix}
\end{bmatrix}
$$

The partial structure bears information on the head noun '*trace*' indexed with [1] Instead of single psoa of RESTRICTION, I set two psoas The first psoa indexed with [2] reveals the RELATION of *go by*, and its argument is '*typhoon*' The second psoa is an implicated RELATION of 'CAUSE', and its argument is the first psoa[2], which means that pseudo-relative clause CAUSE another SOA-ARG that has a RELATION of COME-TO-BE Pragmatic information of the 'time relation' is realized by BKG that specifies ARG1(pseudo-relative construction) which precedes ARG2(trace)

HPSG is a unification-based grammar, and its attributes and values are combined together, to represent the structural and meaning differences among the constructions In the case of 'simultaneity', only BACKGROUND relation is different and it has a 'COINCIDE' relation which has two arguments of simultaneous occurences


4 Conclusion

This approach focused on linguistic phenomena which require consideration for syntactic, semantic, and even pragmatic interfaces I argued that Korean adnominalized constructions can be reclassified as relative, pseudo-relative, and appositive constructions There are syntactic and semantic differences among these constructions, where pseudo-relative constructions show implicated, but lexically unrealized relations    I suggested new descriptions that incorporate lexically unrealized relations of Korean pseudo-relative constructions into the existing HPSG frames I also showed how they can be grammatically represented in the structures This new approach enables us to pursue and improve the unified and integrated descriptions of linguistic phenomena previously incompletely explained

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