

Parsing Light Verb Constructions in Lexical-Functional Grammar*

Jeong-Ryeol Kim

A successful parsing of light verb construction depends on how the intricate interplay of morphology and syntax is resolved. That is, all (or at least some) of the arguments are transferred from predicational nouns to the light verb mainly through word formation, but the syntactic cases are assigned by the light verb at the syntactic level. This paper demonstrates that the basic mechanisms of argument transfer and inheritance must be employed to resolve the dyadic nature of light verb construction. The paper will review the basic issues of light verb construction, argument transfer and inheritance. Interesting phenomena in light verb construction will be shown in such a way that the order of argument transfer is the reversed order of lexicalization of predicational nouns and their arguments. Two different types of argument transfer, predicational nouns plus multiple arguments, and predicational nouns plus a chain of embedded predicational nouns and their argument(s), will be exemplified and also, the monotonic single inheritance mechanism implemented in the system will be explained. Finally, the ECS Machine Translation System will be briefly introduced and followed by a demonstration combining those concepts and the briefed MT system.

Research on the topic of light verbs has been abundant in linguistics literature as our understanding on the interplay between syntax and morphology furthers (to name a few: Grimshaw 1992, Grimshaw & Mester 1988, Kim 1991, Ahn 1991). The studies have been directed to the structure of arguments of predicational nouns and the argument transfer from predicational nouns to light verbs. This paper will cast some light on parsing light verb constructions based on the knowledge we have gained from the studies on light verb constructions.

* I appreciate the comments made by two anonymous reviewers which helped me clarify some of the issues covered in the paper. However, any remaining errors are solely mine.

Parsing light verb constructions raises difficult and interesting problems in at least two components of grammar.

One is the lexicon where predicational nouns and light verbs are listed. How one can list predicational nouns and light verbs is not a simple issue of listing all the predicational noun plus light verb combination in the lexicon. There are two distinct classes of *ha*-ending verbs: lexical and syntactic (Suh 1975, Ahn 1989, Kim 1990, Kim 1991, Park 1990). For example,

- | | |
|-----------------------|----------------------|
| (1) a. ttus(*-ul) ha- | b. kongpwu(-lul) ha- |
| ak(*-ul) ha- | senmwul(-ul) ha- |
| kanung(*-ul) ha- | poko(-lul) ha- |

Listing all light verb-ending predicational nouns without the discretion of these two classes of verbs fails to capture important generalization shared by members of each group of verbs. Refer to Kim (1991) for the details of discussion on the generalization.

The other component of grammar affected by light verbs is syntax where a syntactic tree is built, and based on the tree the grammar checks whether or not all the arguments are appropriately associated with their predicate. This principle is expressed as a syntactic principle such as Biuniqueness Principle in *Lexical-Functional Grammar* (Bresnan 1982). In light verb construction, though there exist slight differences in the treatment, it is generally understood that the semantic arguments are projected from predicational nouns and syntactic cases are assigned by light verbs. The dyadic nature of light verb construction and its treatment in parsing sentences are of particular concern in this paper.

The discussion in the paper will proceed as follows: light verb construction, argument transfer, inheritance in feature-based grammars and finally, parsing light verb construction.

1. Light Verb Construction

Light verbs are generally understood to be verbs which do not have a fully specified argument structure; thus, they can be functional only when they are a part of complex predicates (Cattell 1984), and their arguments are transferred from a predicational noun (Grimshaw and Mester 1988) or some other source, such as another verb.

- (2) a. John-i cilcwu(-lul) hay-ss-ta.
 John-NOM dash(-ACC) make-PAST-DECL
 'John made a dash.'
- b. John-i hyen cwusik sicang(-uy/ul) pwunsek(-ul)
 John-NOM current stock market(-GEN/ACC) analysis(-ACC)
 hay-ss-ta.
 make-PAST-DECL
 'John made an analysis of the current stock market.'
- c. John-i kuuy chinkwu-eykey cikcang(-ul/uy)
 John-NOM his friend-DAT job(-ACC/GEN)
 ceyan(-ul) hay-ss-ta.
 suggestion(-ACC) make-PAST-DECL
 'John made an offer of a job to his friend.'
- d. hankwuk-i yangtampay(-lul) swuip(-ul) kaypang(-ul)
 Korea-NOM Western tobacco(-ACC) import(-ACC)open(-ACC)
 senen(-ul) hay-ss-ta.
 declaration(-ACC) make-PAST-DECL
 'Korea made a declaration of opening the tobacco market for the
 imported tobaccos.'
- e. John-i hankwuk-i ku keyim-ul ikyessta-ko
 John-NOM Korea-NOM the game-ACC won-that
 pangsong(-ul) hay-ss-ta.
 announcement (-ACC) make-PAST-DECL
 'John made an announcement that Korea won the game.'

Sentences in (2) show a range of possibilities in which a light verb, *ha*, cooccur with predicational nouns which in turn supply various types of their own arguments from zero (2a) through one (2b), to two (2c), to three (2d) and to sentential argument (2e).

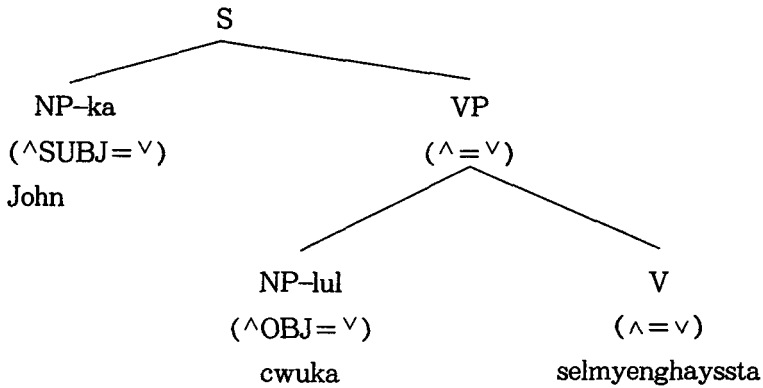
Case alternations are marked by the parentheses in (2) to indicate an argument incorporation (zero maker), an argument of predicational noun (genitive marker) and unincorporated argument (accusative marker). Consider the following examples:

- (3) a. John-i cwuka-lul selmyenghay-ss-ta.
 John-NOM stock price-ACC explain-PAST-DECL
 'John explained the stock price.'
- b. John-i cwuka-uy selmyeng-ul hay-ss-ta.
 John-NOM stock price-GEN explanation-ACC do-PAST-DECL
 'John gave an explanation of the stock price.'
- (4) a. John-i kuuy pemcoy-lul kuuy moksa-eykey
 John-NOM his crime-ACC his minister-DAT
 kopaykhay-ss-ta
 confess-PAST-DECL
 'John confessed his crime to his minister.'
- b. John-i kuuy moksa-eykey(?-uy) kuuy pemcoy-uy
 John-NOM his minister-DAT(?-GEN) his crime-GEN
 kopayk-ul hay-ss-ta
 confession-ACC do-PAST-DECL
 'John made a confession of his crime to his minister.'

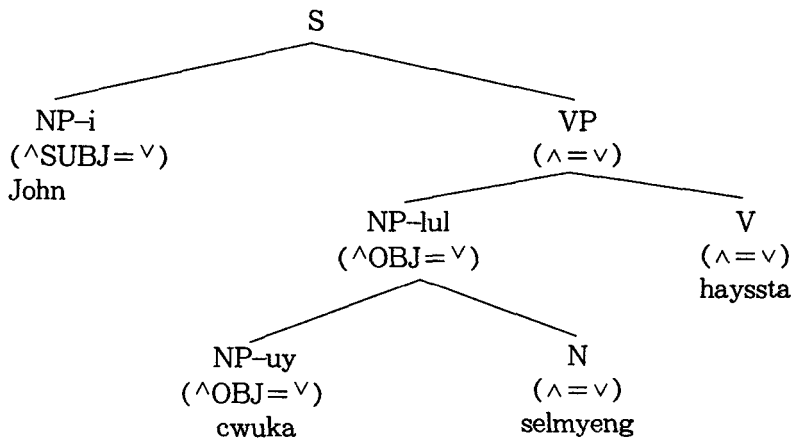
In the sentences (3-4) nominals *selmyeng* 'explanation' and *kopayk* 'confession' take their own objects marked by genitive cases, except that in the sentence (4b), the sentence becomes marginally acceptable when the word *moksa-eykey* is followed by a genitive marker *-uy*. Their incorporated verb counterparts in (a) are also transitive. The Korean incorporated verbs are in fact compound words consisting of a predicational noun and a light verb: *selmyeng* 'explanation' plus *ha-*. One thing that should be noted is that a predicational noun incorporated into a light verb cannot have its own complement (Kim 1990). Consider the following sentences:

- (5) a. John-i cwuka-lul selmyenghay-ss-ta
 John-NOM stock price-ACC explain-PAST-DECL
 'John explained the stock price.'

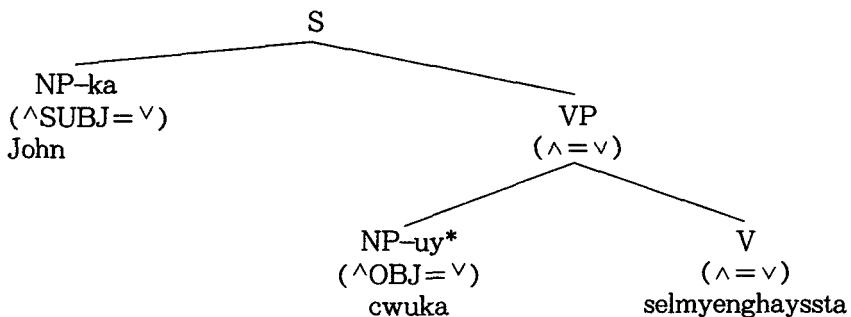
Sentence (5c) is ungrammatical in contrast to (5a) and (5b), because the verb is preceded by a genitive-marked complement which is allowed only when the noun phrase is followed by another noun in the same phrasal



- b. John-i cwuka-uy selmyeng-ul hay-ss-ta
 John-NOM stock price-GEN explanation-ACC do-PAST-DECL
 'John gave an explanation of the stock price.'



- c. *John-i cwuka-uy selmyenghay-ss-ta
 John-NOM stock price-GEN explain-PAST-DECL
 'John gave an explanation of the stock price.'



unit as in (5b). Otherwise, accusative case must be assigned to an object as in (5a).

The following is a partial list of Korean light verbs and their compatible predicational nouns, corresponding to intransitive verbs:

- (6) *HA-*: *philyo* 'need', *nolay* 'song', *ssawum* 'fight', *cencayng* 'war', *kamthan* 'amazement', *kyelhon* 'marry', *nanpha* 'wreck', *topak* 'gamble', *teyithu* 'date', *tolcin* 'aggression', *cilcwu* 'dash', *kichim* 'cough', *haphwum* 'yawn', *thongkok* 'wail', *caychayki* 'sneeze', *mokyok* 'bath', *momcis* 'gesture', *milcip* 'mass', *panhang* 'revolt', *palsayng* 'occurrence', *hwacang* 'make up', *pyencang* 'camouflage', *pyenhwa* 'change', *syawe* 'shower', *sengkong* 'success', *sengswuk* 'maturity', *sinum* 'whine', *silphay* 'failure', *ihon* 'divorce', *ilkwangyok* 'sunbathing', *chwulak* 'crash', *chimmol* 'sinking', *phamyel* 'destruction', *phasayng* 'derivation', *mal* 'speech'...
- (7) *TOY-*: *palsayng* 'occurrence', *pyenhwa* 'change', *sengswuk* 'maturity', *sengsa* 'success', *silphay* 'failure', *ihon* 'divorce', *chwulak* 'crash', *chimmol* 'sinking', *phamyel* 'destruction', *phasayng* 'derivation', *mal* 'speech'...
- (8) *PAT-*: *cel* 'big bow', *tacim* 'confirmation', *insa* 'greeting', *ungsek* 'playing on one's affections', *kothong* 'pain'...

[The Korean examples are collected from Martin, Y. Lee and S. Chang (1967), J. Yu (1985), and my own lexicon.]

This pairing between a light verb and its predicational noun can be extended to combinations corresponding to transitive verbs.

- (9) *HA-*: *pwunsek* 'analysis', *palphyo* 'announcement', *hwakin* 'confirmation', *kyeysan* 'calculation', *pwunlyu* 'classification', *kopayk* 'confession', *kipwu* 'donation', *senen* 'declaration', *senmwul* 'gift', *cosa* 'inspection', *kongpwu* 'study', *yeyen* 'prediction', *censi* 'exhibition', *yaksok* 'promise', *chwuchen* 'recommendation', *thamsa* 'exploration', *kwankwang* 'tour', *mayngse* 'vow', *sanyang* 'hunting', *sayngkak* 'thought', *tongceng* 'pity', *kyeklye* 'encouragement', *paypan* 'betrayal'...
- (10) *PAT-*: *hwakin* 'confirmation', *senmwul* 'gift', *cosa* 'inspection', *yaksok* 'promise', *tongceng* 'pity', *cinchal* 'diagnosis', *cepcong* 'vaccination',

kyoyuk 'education', *hwunlyen* 'training', *hwuwen* 'support', *chuwungko* 'advice', *kanho* 'nursing'...

- (11) *TANGHA*–: *phokkyek* 'bombing', *saki* 'swindling', *kongkyek* 'attack', *cosa* 'inspection', *kangkan* 'rape', *chwukyek* 'chase', *phaypay* 'defeat', *chwulak* 'crash', *nochwul* 'exposure', *seltuk* 'persuasion'...
- (12) *SIKHI*–: *hwakin* 'confirmation', *taycil* 'confrontation', *taylyen* 'sparing', *sacik* 'resignation', *kongpwu* 'study', *ssawum* 'fight', *colep* 'graduation', *iphak* 'entrance to school', *ipwen* 'hospitalization', *kaycong* 'conversion of religion', *cwunpi* 'preparation', *ihalok* 'escape from prison', *salhay* 'killing'...

There are different degrees of underspecification of arguments among different light verbs: *ha* 'do', *toy* 'become', *pat* 'receive', *tangha* 'receive', and *sikhi* 'make'. For example, the verbs *pat* and *tangha* are specified with regard to a recipient subject, while the verb *sikhi* is specified with both an agent subject and an experiencer or recipient indirect object.

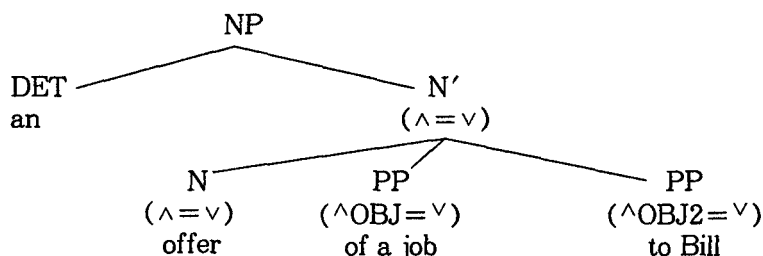
2. Light Verb Constructions in Lexical Functional Grammar (LFG)

The lexical relationship between a predicational noun phrase and its corresponding incorporated verb can be roughly represented in LFG as follows:

- (13) offer: N (^PRED) = '<(SUBJ)(OBJ)(OBJ2)>'
 offer: V (^PRED) = '<(SUBJ)(OBJ)(OBJ2)>'

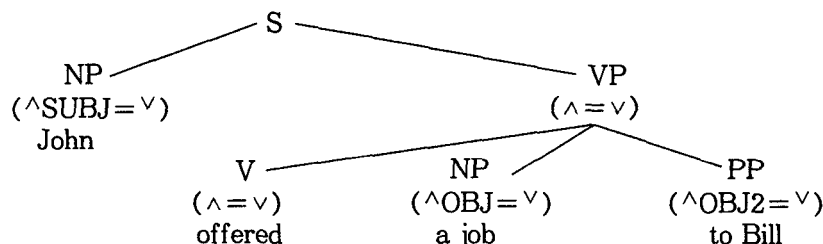
The representation given in this paper has been simplified for expository purposes (cf. Rappaport 1983). Both the noun and verb, *offer*, have the same subcategorization for grammatical functions. The only difference is in their syntactic categories and thus, they are placed in different syntactic positions in a c-structure. That is, the syntactic position of each grammatical function is different in such a way that the grammatical functions of the noun *offer* will be represented in an NP, while the grammatical functions of the verb *offer* will be represented in an S, as follows:

(14) an offer of a job to Bill



The noun *offer* is the head of an NP and the head is followed by two PPs: *of*-NP and *to*-NP, and preceded by an article. SUBJ is suppressed in this position in general, except when one wants to deliver a contrasting meaning to a hearer, as in *John made his offer of a job to Bill, but Mary made hers to somebody else*. Since the SUBJ of the noun *offer* is obligatorily controlled by the SUBJ of its superior nucleus in the *f*-structure, it does not impose any problem of interpretation due to the lack of an explicit argument. A nucleus is an *f*-structure which contains a predicate FORM and a PRED, and an instance of argument functions such as SUBJ, OBJ or OBJ2.¹

(15) John offered a job to Bill.



¹ Jackendoff (1972) made a distinction between cases of obligatory control, optional control, and no control.

Cattell (1984: 25) illustrates each instance:

- (1) a. John tried to leave.
b. *John tried for Bill to leave.
- (2) a. John waited for Bill to leave.
b. John waited to leave.
- (3) a. John believed himself to be going.
b. John believed Bill to be going.
c. *John believed to be going.

In contrast with (14), the c-structure of (15) shows that the verb *offer* is followed by NP and PP, and preceded by NP. Also, there is a VP node distinguishing internal arguments from an external argument (Williams 1981).

As we can see in (14) and (15), though their difference appears to be great by looking at two c-structures, these two different c-structures end up with almost identical f-structures, with only a couple of differences, as follows:

<p>(16) <i>f</i>-structure of (14)</p> <div style="border-left: 1px solid black; border-right: 1px solid black; padding: 10px; display: inline-block;"> <p>SUBJ []</p> <p>OBJ [FORM 'job' PFORM 'of']</p> <p>OBJ2 [FORM 'Bill' PFORM 'to']</p> <p>FORM 'offer' PRED<(SUBJ)(OBJ)(OBJ2)></p> </div>	<p><i>f</i>-structure of (15)</p> <div style="border-left: 1px solid black; border-right: 1px solid black; padding: 10px; display: inline-block;"> <p>SUBJ [FORM 'John' CASE NOM]</p> <p>OBJ [FORM 'job' PFORM 'of']</p> <p>OBJ2 [FORM 'Bill' PFORM 'to']</p> <p>FORM 'offer' TENSE PAST PRED<(SUBJ)(OBJ)(OBJ2)></p> </div>
--	---

The SUBJ and TENSE are unspecified in the *f*-structure of the NP, while the SUBJ and TENSE are fully specified in the *f*-structure of the S. This is a reflection of the fact that an NP is tensefree and an S is tenseconstrained. Also, remember that the SUBJ of *offer* has to be controlled by the SUBJ of its immediately superior nucleus. Thus, it is left unspecified and it will be controlled by a matrix SUBJ, as is embedded in a sentence.

3. Argument Transfer and its Order

When a light verb combines with a predicational noun, the arguments of the predicational noun are transferred to be arguments of the light verb. When this transfer of arguments is performed, it must keep the order of arguments such as the precedence of OBJ2-recipient over OBJ-theme. The purpose of this section is to show how argument transfer is done and how transfer of arguments is ordered. It is important to keep in mind here that the argument structure of certain predicates is something more than a pure flat list of arguments.

3. 1. Overview

Various interesting proposals have been made regarding this issue (Grimshaw and Mester (1988) and Ahn (1989)). Before presenting my analysis on argument transfer, I would like to review Grimshaw and Mester's proposal which serves the basis of the discussion in this paper.

Grimshaw and Mester (1988) described a similar phenomenon with the Japanese verb *suru* 'do'. Although much of their attention was directed to a syntactically fully case-marked phrasal level combination of *suru* with its preceding predicational noun, it was indicated in their conclusion that argument transfer works in the same way in an incorporation construction as it does in a syntactically alternative expression. When these verbs combine with predicational nouns, the thematic structure of the predicational nouns is transferred to the corresponding light verbs. For example,

- (17) a. keikoku (agent, goal, theme) 'warning'
 b. suru () <acc> 'do'
 c. keikoku (theme) +suru (agent, goal) <acc> 'warn'

When a predicational noun (17a) is followed by the light verb *suru* with an empty argument structure as in (17b), the argument structure of the predicational noun except for (theme) is transferred to the light verb *suru*, as in (17c). It should be noted that the light verb *suru* retains the accusative case-assigning capability, and the light verb *suru* assigns the accusative case to the preceding predicational noun.

The next important issue they raise in the paper is that the argument structure is hierarchically structured, not simply a list of arguments. In the opening remarks of this section, I indicated that the argument structure is more than a simple list of arguments. Their paper provides useful insight on how these arguments are in fact structured. Grimshaw and Mester (1988: 215) make the following generalization:

For nouns that take a theme and a goal, if the theme argument is realized outside NP, the goal must also be realized outside NP.

What this generalization implies is that goal precedes theme in the argument transfer hierarchy. In other words, when a predicational noun with its argument, theme and goal, transfers its arguments to a light verb, it has

two variable options: 1) the goal is transferred and the theme remains inside the government of the predicational noun, or 2) both the theme and goal are transferred. A third option proves to be untenable: 3) the theme is transferred and goal remains inside the government of the predicational noun.

3.2. The Precedence of Argument Transfer

We can learn various interesting facts from the interaction of f-structure and c-structure with regard to argument transfer (Grimshaw and Mester 1988). Light verbs have been informally understood to have an empty or incomplete predicate argument structure to project onto syntactic structures, and thus, they are accompanied by predicational nouns which in turn supply argument structures (Jespersen 1965 Part III 358–363, Cattell 1984, and Grimshaw and Mester 1988). We have noted that the SUBJ of *make* is selectionally restricted by the predicational noun, *offer*, in *John made an offer of a job to Bill*. In fact, the obligatory control between the SUBJ of *make* and the SUBJ of *offer* is understood as an obligatory transfer of the SUBJ function from the PRED of *offer* in an embedded clause to the PRED of *make* in the immediately superior nucleus in the f-structure. The fact that the SUBJ function is the only obligatory function to be transferred makes us believe that SUBJ is probably the outermost layer of argument. The outermost argument in the argument structure will always be the first one to undergo argument transfer, in contrast to the innermost argument, which will be the first one to undergo a lexicalization. This precedence relationship will be clear as we go through more examples. For our understanding; the outermost argument will be marked in the following:

- (18) offer: N PRED<SUBJ, <OBJ, OBJ2>>
 make: V PRED<SUBJ, <OBJ>>
 make an offer: make<SUBJ, <OBJ>>+an offer<OBJ, OBJ2>

PRED<gfl <gf2... <gfn>...>> indicates that the subcategorized grammatical functions are not a flat list, but belong to a hierarchical structure in terms of the degree of cohesive relationship with the predicate and the precedence of argument transfer, as pointed out by Grimshaw and Mester (1988). Two arguments which have not been transferred, <OBJ, OBJ2> of

the noun *offer*, are not equally treated in the transfer of remaining arguments, which will be optional. If the transfer of one more argument occurs, it should be OBJ2, not OBJ. Consider the following sentences:

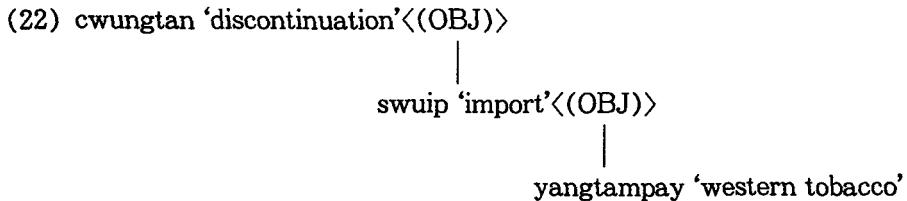
- (19) a. John made Bill an offer of a job.
 b. *John made a job an offer to Bill.
- (20) a. John-i kuuy chinkwu-eykey cikcang-uy ceyan-ul
 John-NOM his friend -DAT job-GEN suggestion-ACC
 hay-ss-ta
 make-PAST-DECL
 'John made Bill an offer of a job.'
- b. *John-i cikcang-ul kuuy chinkwu-eykey-uy ceyan-ul
 John-NOM job-ACC his friend-DAT-GEN suggestion-ACC
 hay-ss-ta
 make-PAST-DECL
 'John made a job an offer to Bill.'

Sentences (19a and 20a) are grammatical, since they do not violate the precedence of argument transfer, OBJ2 before OBJ, but (19b and 20b) are ungrammatical, since they violate this precedence. The consequence of this observation would require another order of hierarchy in the predicate structure for the noun *offer*: <SUBJ <OBJ2 <OBJ>>> and *ceyan* 'offer': <SUBJ <OBJ2 <OBJ>>> separately.

Another set of examples include a chain of predicational nouns which cooccur with their own arguments in a light verb construction. For example,

- (21) a. hankwuk-i yangtampay-uy swuip-ul
 Korea-NOM western tobacco-GEN import-ACC
 cwungtan-ul hayssta
 discontinuation-ACC did
 'Korea discontinued the import of western tobaccos.'
- b. *hankwuk-i yangtampay-lul swuip-uy
 Korea-NOM western tobacco-ACC import-GEN
 cwungtan-ul hayssta
 discontinuation-ACC did
 'Korea discontinued the import of western tobaccos.'

The contrast of grammaticality between two sentences in (21) is based on whether or not the precedence of argument transfer is kept. That is, (21a) shows the transfer of argument from the outer layer of arguments to the inner layer of arguments one by one, however (21b) shows otherwise.² The chain of predicational nouns in their transfer order can be illustrated as follows:



(22) shows that the predicational noun *cwungtan* ‘discontinuation’ takes another predicational noun *swuip* ‘import’ as an OBJ argument which in turn contains another noun as its OBJ argument. Thus, the argument transfer will occur from the outermost argument *cwungtan* ‘discontinuation’ through the intermediate argument *swuip* ‘import’ to the innermost argument *yangtampay* ‘western tobacco.’

We can extend this generalization of hierarchical structure of arguments to ditransitive predicational nouns in Japanese. Grimshaw and Mester (1988: 225) conclude that the Japanese predicational noun *shoomei* ‘proof’ has the following hierarchy of argument structure, in their discussion of the light verb, *suru* ‘do’: *shoomei* <Agent/Source <Goal <Theme>>>. This conclusion is compatible with our generalization of <SUBJ <OBJ2 <OBJ>>. Let’s reconsider the examples shown in Grimshaw and Mester (1988):

- (23) a. Sono deeta-ka wareware-ni [[kare-no riron-ka
 that data-NOM us-DAT he-GEN theory-NOM
 machigatte iru-to]-no shoomei]-o shiteiru
 mistaken be-COMP-GEN proof-ACC do
 ‘That data gives us the proof that his theory is mistaken.’

² Dr. Hee-Rhak Chae insightfully pointed out at the 27th (’93) Annual Linguistics Conference of the Language Research Institute of Seoul National University that this ungrammaticality is based on the violation of proper chain of command, that is, the governee is outside of the government domain by its governor in example (21b). However, the observation that the precedence of argument transfer needs to be kept still holds true probably due to what Dr. Chae noted.

- b. *Sono deeta-ka [kare-no riron-ka machigatte iru-to]
 that data -NOM he -GEN theory-NOM mistaken be-COMP
 [wareware-no shoomei]-o shiteiru
 us-GEN proof-ACC do

Assuming that the particle *-to* is a sentential complementizer headed by a verb and that the combination of particles *-to-no* is a sentential complementizer headed by a noun, (23a) does not violate the precedence of argument transfer, SUBJ-OBJ2, and the sentence is grammatical. (23b) violates the precedence of argument transfer by transferring the OBJ before the OBJ2, and the sentence is ungrammatical. Thus, we must conclude that argument transfer, if happens, must occur in the following order:

- (24) The argument transfer occurs from the outermost argument $\langle \text{gfl} \rangle$ to the innermost argument $\langle \text{gfn} \rangle$ by stripping off each layer in a list of grammatical functions, $\langle \text{gf1} \langle \text{gf2} \langle \dots \langle \text{gfn} \rangle \dots \rangle \rangle \rangle$.

3. 3. The Precedence of Lexicalization

The ordering of argument transfer is somewhat reminiscent of a universal hierarchy of thematic roles descending from agent through beneficiary, to recipient/experiencer, to theme and location, as described in various linguistic literature, (Bresnan and Kanerva 1989, Kiparsky 1987, Givón 1984, Foley and Van Valin 1984 and Jackendoff 1972). As pointed out by Bresnan and Kanerva (1989: 23), the motivation for a hierarchy of thematic roles is based on the theoretical order of the composition of arguments with a predicator: the lower roles in the hierarchy designate “inner” arguments that are semantically composed with the predicator in preference to arguments corresponding to roles higher on the hierarchy. This implies that if lexicalization occurs between a predicate and its arguments, an inner argument is more likely to be lexicalized with its predicate than an outer argument.

This implication of lexicalization precedence is also compatible with our generalization. Consider the following examples:

- (25) offer: N $\langle \wedge \text{PRED} \rangle = \langle \text{SUBJ} \langle \text{OBJ2} \langle \text{OBJ} \rangle \rangle \rangle$
 sale: N $\langle \wedge \text{PRED} \rangle = \langle \text{SUBJ} \langle \text{OBJ2} \langle \text{OBJ} \rangle \rangle \rangle$
 donation: N $\langle \wedge \text{PRED} \rangle = \langle \text{SUBJ} \langle \text{OBJ2} \langle \text{OBJ} \rangle \rangle \rangle$

- (26) a. The teacher made an offer of a job to a student.
 b. The teacher made a sale of a car to a student.
 c. The teacher made a donation of books to a library.

In (26), the prime candidates for noun compounding are the predicates *offer*, *sale*, and *donation*, and the OBJs *job*, *car*, and *book*, as in *job offer*, *car sale* and *book donation*. That is,

- (27) a. The teacher made a job offer to a student.
 b. The teacher made a car sale to a student.
 c. The teacher made a book donation to a library.

Compare these examples with those in the following examples:

- (28) a. *The teacher made a student offer of a job.
 b. *The teacher made a student sale of a car.³
 c. *The teacher made a library donation of a book.

We note that the inner argument has precedence over the outer argument in the lexicalization process with its predicate. This ordering is exactly the reverse of the ordering of argument transfer. Let's consider more examples of ditransitive predicational nouns in Korean:

- (29) *ceykong*: N 'offer'
 <^PRED>= <SUBJ <OBJ2 <OBJ>>
phanmay: N 'sale'
 <^PRED>= <SUBJ <OBJ2 <OBJ>>
kipwu: N 'donation'
 <^PRED>= <SUBJ <OBJ2 <OBJ>>

Consider the following sentences, each of which uses one of the above predicates followed by a light verb:

- (30) a. *sensayng-nim-i haksayng-eykey cikcang ceykong-ul*
 teacher-HON-ACC student-DAT job offer-ACC

³ An anonymous reviewer pointed out the grammaticality of the phrase, *a street sale of a car*, in contrast with the sentence in (28b). The grammaticality of the word, *street sale*, is predicted due to the fact that the obliqueness of location is more cohesive with the predicator than any other thematic roles. Refer to Kiparsky (1987).

hay-ss -ta
do-PAST-DECL
'The teacher made a job offer to a student.'

b. sensayng-nim-i haksayng-eykey catongcha-phanmay-lul
teacher -HON-ACC student-DAT car sale -ACC
hay-ss-ta
do-PAST-DECL
'The teacher made a car sale to a student.'

c. sensayng-nim-i tosekwan-ey chayk kipwu-lul
teacher-HON-ACC library-DAT book donation-ACC
hay-ss-ta
do-PAST-DECL
'The teacher made a book donation to a library.'

When the compounding between an OBJ and the predicational nominal occurs, the sentences are grammatical, as in (30). However, consider the cases where the compounding occurs between predicational nouns and OBJ2s:

(31) a. *sensayng-nim-i cikcang-ul haksayng ceykong-ul
teacher-HON-NOM job-ACC student offer-ACC
hay-ss -ta
do-PAST-DECL
'The teacher made a student offer of a job.'

b. *sensayng-nim-i catongcha-lul haksayng phanmay-lul
teacher-HON-ACC car -ACC student sale -ACC
hay-ss-ta
do-PAST-DECL
'The teacher made a student sale of a car.'

c. *sensayng-nim-i chayk-ul tosekwan kipwu-lul
teacher-HON-ACC book-ACC library donation-ACC
hay-ss-ta
do-PAST-DECL
'The teacher made a library donation of a book.'

When the compounding occurs between an outer argument and its predicate, the sentences are ungrammatical, as shown above. Let's turn to the same constructions in Japanese:

(32) teikyoo: N 'offer'

<^PRED>=<SUBJ <OBJ2 <OBJ>>>

hanbai: N 'sale'

<^PRED>=<SUBJ <OBJ2 <OBJ>>>

kifu: N 'donation'

<^PRED>=<SUBJ <OBJ2 <OBJ>>>

(33) a. sensei-ga gakusei-ni sigoto teikyoo-o shita ⁴

teacher-NOM student-DAT job offer-ACC did

'The teacher made an job offer to a student.'

b. sensei-ga gakusei-ni kuruma hanbai-o shita

teacher-NOM student-DAT car sale-ACC did

'The teacher made a car sale to a student.'

c. sensei-ga toshokan-ni hon kifu-o shita

teacher-NOM library-DAT book donation-ACC did

'The teacher made a book donation to a library.'

(34) a. *sensei-ga sigoto-o gakusei teikyoo-o shita

teacher-NOM job-ACC student offer-ACC did

'The teacher made a student offer of a job.'

b. *sensei-ga kuruma-o gakusei hanbai-o shita

teacher-NOM car-ACC student sale-ACC did

'The teacher made a student sale of a car.'

c. *sensei-ga hon-o toshokan kifu-o shita

teacher-NOM book-ACC library donation-ACC did

'The teacher made a library donation of a book.'

⁴ An anonymous reader questioned the grammaticality of the sentences in (33). I asked two Japanese speakers how they would evaluate the grammaticality of these sentences on the scale of 5, 5 being grammatical. They would agree give 4 on the scale. This suggests that the contrast of grammaticality between sentences (33) and (34) hold, which is the point of the discussion.

Japanese shows the same reverse ordering of compound formation to the ordering of argument transfer: <SUBJ <OBJ2 <OBJ>>>.

In conclusion, the combination of Predicate Noun+OBJ is more likely to form a word than that of Predicate Noun+OBJ2.

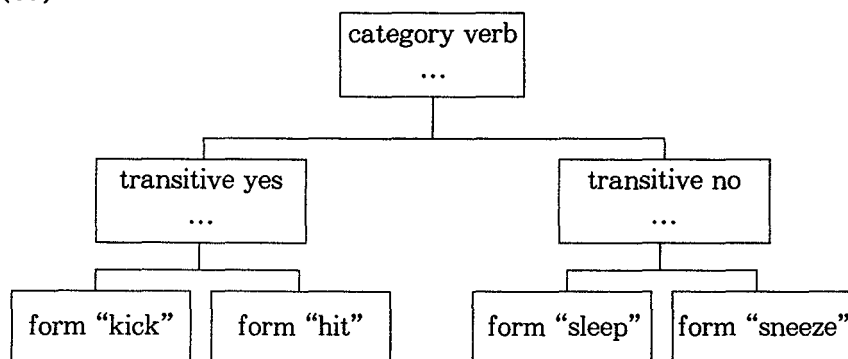
4. Feature Inheritance

In this section, feature inheritance operation is discussed with reference to feature-based grammars. Feature inheritance operation is a process applicable to feature-based grammars either explicitly (HPSG, Pollard & Sag (1987) Daelemans et al. (1992) or implicitly (LFG). Inheritance operation is classified into four different kinds of inheritance mechanisms depending on the number of features being inherited and the number of sources of inheritance: monotonic single inheritance, monotonic multiple inheritance, non-monotonic single inheritance and non-monotonic multiple inheritance. Refer to Daelemans et al. (1992) for the details. In this paper, it will be shown that the light verb constructions will be handled by the least complicated monotonic single inheritance mechanism.

4. 1. Monotonic Single Inheritance

Imagine for an expository purpose that one is constructing a verb lexicon of a language using the feature-value structure. One can list all the possible verbs of a language and fill up each individual verb with each set of feature-value pairs of its own. Soon, one will discover that a large set of features are shared across all the verbs and/or subgroups of verbs. For example, *sneeze*, *sleep*, *hit* and *kick* will share the verbal characteristics such as tense, concurrence with an auxiliary, syntactic position and so on. Also, verbs *sneeze* and *sleep* share the properties such as transitivity. Thus, one will decide that it is extremely redundant to repeat the same properties of verb with only difference of form every time when one lists a lexical item. Instead, (s)he revises the structure of lexicon in such a way that each individual verb projects only those features unique to the item and inherits all the common properties along the path of lexical network. Consider (35):

(35)



In this monotonic single inheritance operation, a verb, say *hit*, supplies the form and incorporates transitivity and category as it percolates further up in the network. Restructuring lexicon this way not only saves work and space by eliminating redundancy as much as possible, but also, more importantly, resolves linguistic problems. One of the famous example of such case is “blocking phenomena” as suggested by Flickinger, Pollard and Wasow (1985). They pointed out that the inheritance approach took care of morphological “blocking” phenomena “largely for free” (ibid, 267).⁵ Since the irregular morphology is a piece of specific information unique to a lexical item, the information will be specified lower in the network. For example, suppose that the past tense of *run* is specified as *ran* along with the present form. When the feature structure inherits any conflicting feature value higher in the network, the conflicting feature in the upper part of the network will be overwritten with the particular feature value pair from the lower end of the network, thus the blocking effect is enforced as a natural consequence of the operation. The other piece of linguistic evidence in sup-

⁵The existence of an irregular form typically means that the corresponding regular form is not a permissible option. Thus, the attachment of regular morphology onto verbs with the irregular form must be blocked out. This is known as “blocking”. An anonymous reviewer commented on the monotonic single inheritance with reference to the blocking phenomena. The use of certain inheritance networks is a matter of choice on the part of program designer based on practical reasons, and the blocking phenomena is one contributing practical reason to introduce the non-monotonic multiple inheritance. However, the non-monotonic multiple inheritance has been criticized in that it goes against generality and referential transparency (Zajac 1992: 160) and it is sometimes intractable (Etherington 1989). Thus, the use of a monotonic single inheritance network was chosen for the construction of the translation system.

port of this approach is that users of language have an implicit knowledge of the common properties of a group of verbs such as intransitive vs. transitive verbs. This implicit knowledge of verb classification in turn becomes the corner stones of linguistic competence which circumscribe a set of grammatical sentences distinct from ungrammatical sentences.

4. 2. Inheritance in Light Verb Constructions

The idea of inheritance in predicate argument structure has been suggested by Park (1993) in HPSG and O'Grady (1992) in Categorical Grammar framework. Any unsatisfied dependencies are inherited upward except <agent> argument which is suppressed when it occurs as an argument of a predicational noun (ibid, 239) in *ha*-ending verb construction.

In the treatment of light verb construction, it will be shown that the same vein of inheritance operation in the previous section will resolve the linguistic phenomena without any additional cost. The starting point of discussion is that the light verb *ha* 'do' is characterized in such a way that the grammatical function SUBJ of the light verb may be overwritten with a projected argument from a predicational noun during the syntactic processing. Consider the following examples:

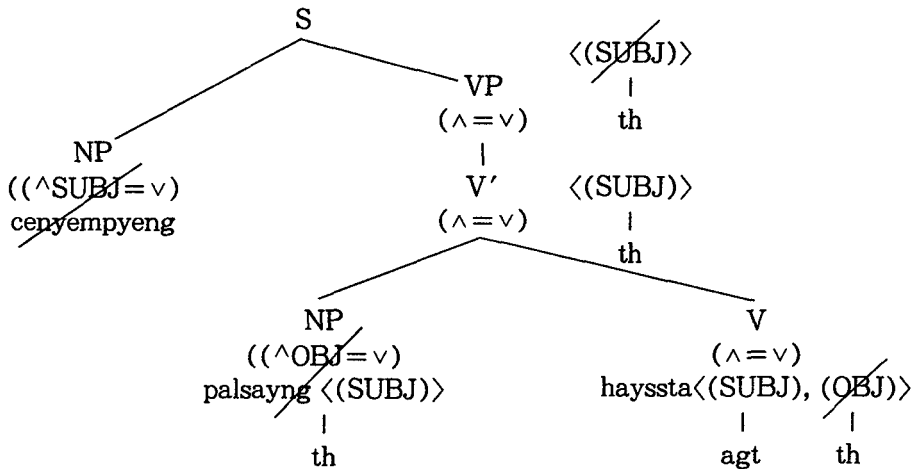
- (36) a. *Younghee-ka wuntong(-ul) hay-ss-ta*
 Younghee-NOM sport(-ACC) do-PAST-DECL
 'Younghee did a sport.'
- b. *Younghee-ka samang(-ul) hay-ss-ta*
 Younghee-NOM death(-ACC) do-PAST-DECL
 'Younghee was dead.'
- c. *cenyemyeng-i palsayng(-ul) hay-ss-ta*
 epidemic-NOM occurrence(-ACC) do-PAST-DECL
 'An epidemic occurred.'

The thematic roles based on the criteria such as volition, causation and animateness (Dowty 1987, Hong 1991) indicate that *Younghee* in (36a) is agent, *Younghee* in (36b) is patient and *cenyemyeng* 'epidemic' in (36c) is theme.⁶

⁶To test the volitional characteristic of a certain word, the word *capalcekulo* 'voluntarily' can be used to see if the combination elicits any semantic oddity. If it does, the word is probably not an agent.

The light verb *ha* is specified in its argument structure $\langle\langle\text{SUBJ-agt}\rangle\langle\text{OBJ-th}\rangle\rangle$ which is the default case as in (36a). However, when it runs into a collision with an argument projected by a predicational noun as in (36b) and (36c), the default case $\langle\langle\text{SUBJ-agt}\rangle\rangle$ is overwritten by $\langle\langle\text{SUBJ-pat}\rangle\rangle$ and $\langle\langle\text{SUBJ-th}\rangle\rangle$ separately. The idea of overwriting a default case is a part of inheritance operation as shown in the previous section.⁷ This process using (36c) is shown in the following tree diagram:

(37) a.



- a. Younghee-ka *capalcekulo* wuntong(-ul) hay-ss-ta
 Younghee-NOM voluntarily sport(-ACC) do-PAST-DECL
 'Younghee did a sport.'
- b. # Younghee-ka *capalcekulo* samang(-ul) hay-ss-ta
 Younghee-NOM voluntarily death(-ACC) do-PAST-DECL
 'Younghee was dead.'
- c. #cenyempyeng-i *capalcekulo* palsayng(-ul) hay-ss-ta
 epidemic-NOM voluntarily occurrence(-ACC) do-PAST-DECL
 'An epidemic occurred.'

The causation can be determined if certain subject is compatible with the verb *sikhita* 'make'. If it is compatible, then the subject is probably an agent. The animateness is used here to distinguish roles between patient and theme.

⁷ Also, this way of expressing the relationship between a light verb and its predicational noun explains why it is often the case that predicational noun may suppress its argument $\langle\langle\text{SUBJ-agt}\rangle\rangle$; because the default argument structure projects the very grammatical expression $\langle\langle\text{SUBJ-agt}\rangle\rangle$.

b. *palsayng*: <PRED (([^]SUBJ))
 |
 th

c. *ha*: <PRED (([^]SUBJ) (([^]OBJ))
 | |
 agt th

The inheritance operation applies in such a way that the PRED feature of the light verb *ha*, ([^]SUBJ-*agt*), will be replaced by that of predicational noun *palsayng*([^]SUBJ-*th*) at VP-level. Also, the ([^]OBJ) argument is satisfied by matching the predicate argument to the predicational noun which undertakes the grammatical function. This is shown by the slashed out *palsayng* ‘occurrence’ and the slashed out grammatical function ([^]OBJ) of the light verb *ha* ‘do’.

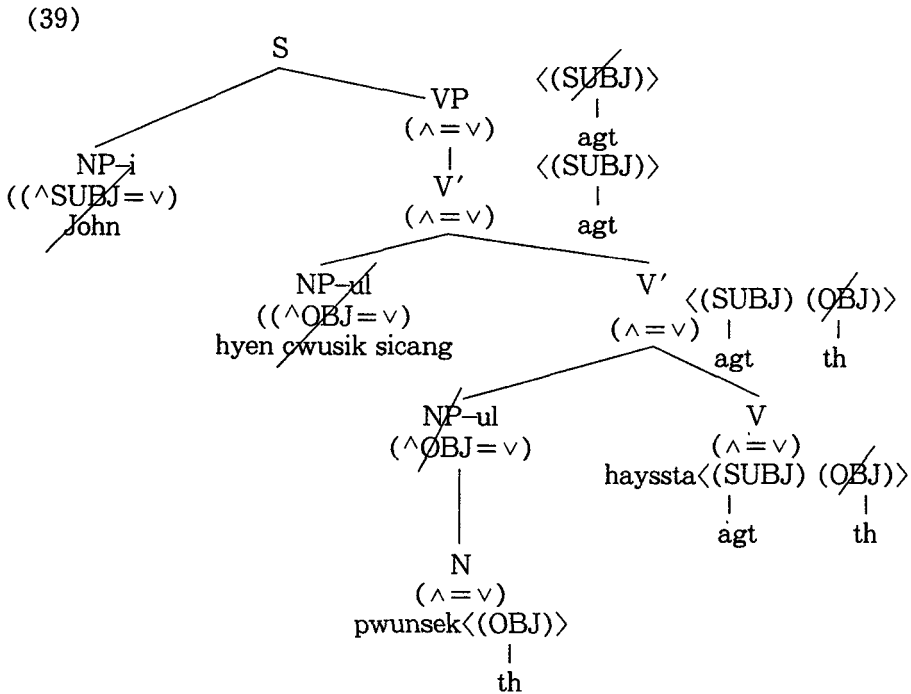
 |
 th

The unsatisfied argument ([^]SUBJ) will be inherited further up to the sentential level. Thus, the predicate argument structure in progress will be (38) at VP-level:

(38) *palsayng*(-ul) *ha*: <PRED ([^]SUBJ))
 |
 th

The inherited argument will be satisfied at the sentential level by incorporating the subject into the sentence. This is also graphically shown by the two slashes marking that the word *cenyempeyeng* ‘epidemic’ and the SUBJ argument in (38) are matched.

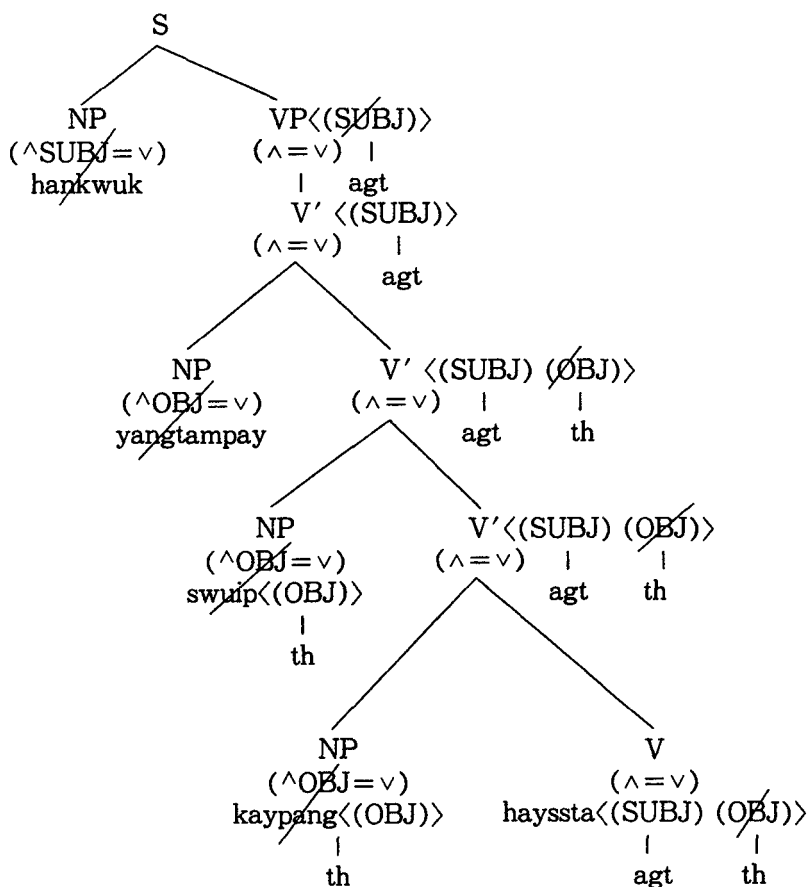
Another type of example which is slightly different from the above case (38) is where the SUBJ function of both a light verb and a predicational noun undertakes the same thematic role ‘*agt*’. In this case, the grammatical function of a predicational noun is suppressed and that of a light verb is projected. The inheritance mechanism in processing this type of light verb construction can be illustrated as follows:



First of all, the OBJ of the light verb *ha* is satisfied when the V' directly above V is built by incorporating the noun phrase, *pwunsek* 'analysis'. The unsatisfied OBJ function is inherited to the V' as shown with an arrow and then satisfied by combining the NP, *hyen cwusik sicang* 'current stock market.' Finally, the SUBJ argument is checked off at the sentential level.

Another type of light verb construction is where a light verb cooccurs with a chain of predicational nouns as in (40).

- (40) hankwuk-i yangtampay(-lul) swuip(-ul) kaypang(-ul)
 Korea-NOM Western tobacco(-ACC) import(-ACC) open(-ACC)
 hay-ss-ta.
 do-PAST-DECL
 'Korea opened the tobacco market to imported tobaccos.'



All the predicational nouns in (40) share the argument structure $\langle(\text{SUBJ})\text{-agt}\rangle$, $\langle(\text{OBJ})\text{-th}\rangle$, and the agent role is suppressed since it does not collide with the $\langle(\text{SUBJ})\text{-agt}\rangle$ of the light verb *ha*. When the light verb combines with the predicational noun *kaypang* 'open', its $\langle(\text{OBJ})\text{-th}\rangle$ argument is satisfied and the OBJ argument of the predicational noun is inherited up to the first level V'. The $\langle(\text{OBJ})\text{-th}\rangle$ argument of the predicational noun *kaypang* 'open' is satisfied by incorporating another predicational noun *swuip* 'import'. The $\langle(\text{OBJ})\text{-th}\rangle$ argument of *swuip* 'import' is satisfied by absorbing *yangtampay(-lul)* 'tobacco' and finally, $\langle(\text{SUBJ})\text{-agt}\rangle$ is checked off at the sentential level.

One interesting note is that a series of predicational nouns co-occurring with the light verb *ha* need to share the same thematic role of SUBJ function. If these predicational nouns include different thematic roles, the resulting sentences will be in semantically awkward as exemplified in (41):

- (41) a. #cenyempyeng-i palsayng-ul cwungtan-ul hay-ss-ta
 epidemic-NOM occurrence-ACC discontinuation-ACC do-PAST
 -DECL
 'An epidemic stopped its occurrence.'
- b. #Younghee-ka samang-ul cwungtan-ul hay-ss-ta
 Younghee-NOM death-ACC discontinuation-ACC do-PAST-DECL
 'Younghee stopped the death.'

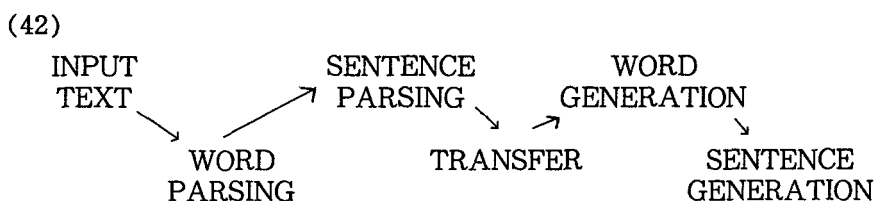
These two sentences are semantically illicit due to the conflict of the thematic role of lower predicational nouns and that of higher predicational nouns. That is, SUBJ-th and SUBJ-agt are in conflict in the first sentence, and SUBJ-pat and SUBJ-agt contradict each other in the second sentence.

5. Parsing Light Verb Constructions

Armed with both argument transfer and feature inheritance, we are ready to demonstrate how parsing light verb constructions work in the ECS machine translation system. Before we move on any further, a brief sketch of the ECS machine translation system is in order:

5. 1. ECS MT System

The ECS English-Korean Bidirectional Machine Translation System (ECS MT System) uses an indirect transfer method (Her 1990, Nirenberg 1987) and thus, it consists of three distinctive components: analysis, transfer and generation. It is useful at this point to introduce a schematic flow of the ECS MT System as follows:

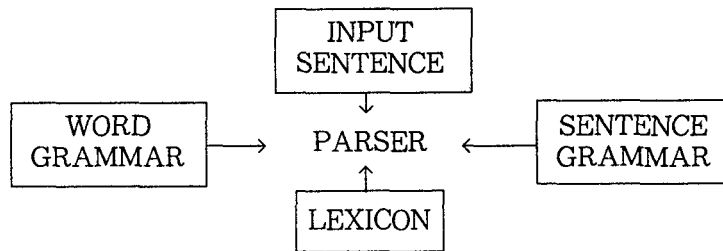


When an input sentence is introduced to the system, the parser applies the word grammar of a given language and analyses each word in the sentence. When a word is recognized by the dictionary, the system loads the

lexical information of the word from the dictionary. Having completed the analyses of all the words appeared in a sentence, the system further applies a set of sentential rules to analyze a given sentence on the basis of the lexical information provided by the dictionary. As the analysis of an input sentence is concluded, a set of transfer rules are introduced by means of a source-target language dictionary and a set of feature inheritance frameworks in the lexicon. That is, when a source word is translated into a target word, the entry will discharge a set of transfer information which will be executed upon the satisfaction of conditions.

Since this paper is mainly concerned with the analysis of an interplay between morphology and syntax, the parsing component will be our major concern. The relevant parts of the translation system to this paper are represented in (43).

(43)

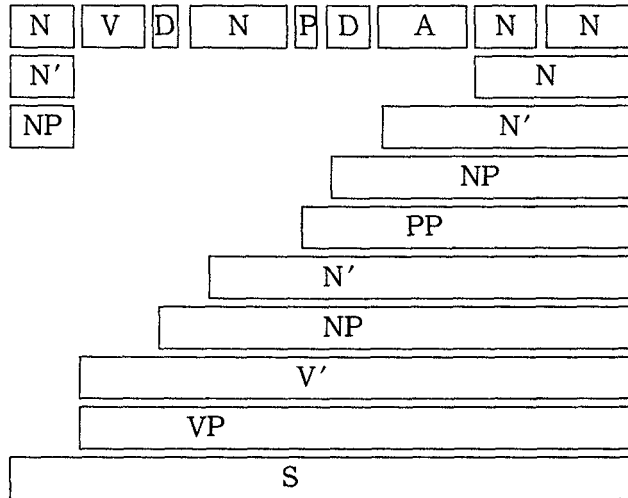


The parser interacts with a set of applicable word grammar rules in analyzing an input string to recognize words in a lexicon and project grammatical information. After all the words are parsed, the parser continues its analysis of an input string to the sentential level interacting with a set of phrase structure rules annotated with grammatical functions.

5. 2. Transfer, Inheritance and Parsing

This section will show how the transfer and the inheritance discussed in the earlier sections are practically integrated into parsing light verb constructions within the ECS System. The parsing process using sentence (44) can be schematically shown as follows:

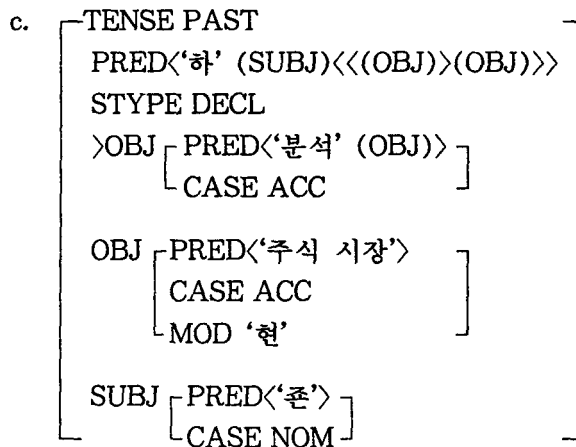
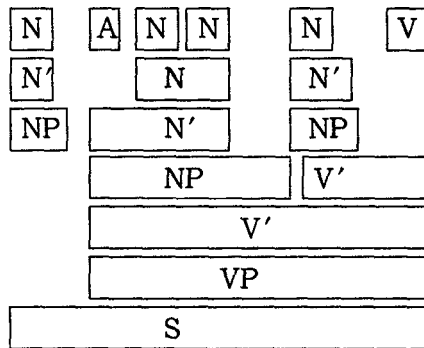
(44) John made an analysis of the current stock market.



Input string (44) is projected with a set of grammatical categories at the preterminal level including the compound word *stock market* by the interaction of the parser with the word grammar. A sequence of preterminal symbols are further analyzed to the sentential level by the parser interacting with a set of sentence grammar rules. When a sentence is successfully built, it proceeds with an argument checking in terms of the number of arguments against predicate valency. That is, a parsed sentence is converted into an f-structure using the annotated grammatical functions shown in the earlier sections of this paper. Based on the f-structure, the real occurrence of arguments in the sentence will be checked against the valency of verb inherited. One of the problematic light verb constructions in parsing can be shown as follows:

(45) a. John-i hyen cungkwen sicang-ul pwunsek-ul
 John-NOM current stock market-ACC analysis-ACC
 hay-ss-ta
 do-PAST-DECL
 존이 현 증권시장을 분석을 했다.
 'John analyzed the current stock market.'

b. 존이 현 증권시장을 분석을 했다.

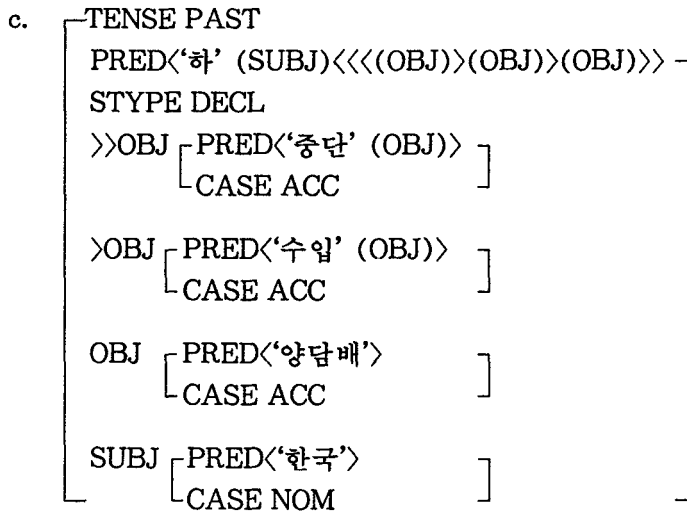
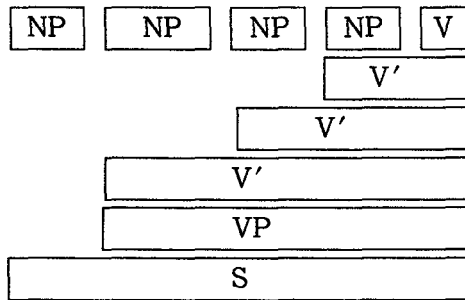


As shown earlier in this paper, the unsatisfied argument OBJ of the predicational noun *pwunsek* 'analysis' is inherited to the V' while the predicational noun itself serves as the primary OBJ of the light verb. The OBJ of the predicational noun is finally satisfied at the next level up V' by incorporating the NP, *hyen cwusik sicang* 'current stock market.' The equivalent f-structure is shown in (45c) with the ordered pairs of OBJs.

Another type of light verb construction, a chain of predicational nouns, is analyzed in the more or less the same manner as shown in the following pair of a parsed structure and its equivalent f-structure.

- (46) a. hankwuk-i yangtampay-lul swuip-ul
 Korea-NOM western tobacco-ACC import-ACC
 cwungtan-ul hay-ss-ta
 discontinuation-ACC do-PAST-DECL
 한국이 양담배를 수입을 중단을 했다.
 'Korea discontinued the import of the western tobacco.'

b. 한국이 양담배를 수입을 중단을 했다



This type of light verb construction works basically in the same way as the argument transfer shown in ditransitive cases. That is, an outlying argument is transferred before an inside argument in a hierarchically structured argument list. The only difference in (46) is that any successive number of predicational nouns can be incorporated into a light verb as long as there are resources for argument transfer and feature inheritance.

6. Conclusion

The problem in parsing light verb constructions lies in the incoherence of the projected number of arguments by a verb and the real occurrence of arguments in a sentence. This incoherence will fail syntactic parser which relies on argument checking by a piece of information given in a verb. This paper demonstrated how to resolve this conflict by employing pre-existing

concepts of transferring argument from a predicational noun to the main verb, and of feature inheritance.

The precedence of argument transfer occurs from outside-to-inside; however, the lexicalization occurs in the opposite direction, from inside-to-outside, as long as the newly lexicalized word is acceptable.

Also, the paper demonstrated that the feature inheritance which is commonly used in the electronic dictionary operation is implemented without any ad hoc operation to deal with argument transfer.

References

- Ahn, H. (1989) 'On Light Verb Constructions in Korean and Japanese,' In Hajime Hoji ed., *Proceedings of Southern California Japanese/Korean Linguistics Conference*, University of Chicago Press.
- Ahn, H. (1991) 'Remarks on Light Verb Constructions,' Unpublished Paper, Dept. of Linguistics, University of Wisconsin at Madison.
- Bresnan, J. (1982) 'Control and Complementation,' In J. Bresnan ed., *The Mental Representation of Grammatical Relations*, MIT Press, Cambridge, Massachusetts, 282-390.
- Bresnan, J. and Kanerva (1989) 'Locative Inversion in Chichewa: A Case Study of Factorization in Grammar,' *Linguistic Inquiry* 20, 1-50.
- Cattell, R. (1984) *Syntax and Semantics 17: Composite Predicates in English*, Academic Press, New York.
- Daelemans, Gazdar and De Smedt (1992) 'Inheritance in Natural Language Processing,' *Computational Linguistics* 18-2, 205-218.
- Dowty, D. (1987) 'Thematic Proto-Roles, Subject Selection, and Lexical Semantic Defaults,' Paper Presented at the 1987 Meeting of the Linguistic Society of America.
- Etherington, D. et al. (1989) 'Critical Issues in Nonmonotonic Reasoning,' In *Proceedings, 1st International Conference on Principles of Knowledge Representation and Reasoning*, Toronto, Ontario.
- Flickinger, Pollard and Wasow (1985) 'Structure Sharing in Lexical Representation.' *Proceedings, 23rd Annual Meeting of the Association for Computational Linguistics*, Chicago, 262-267.
- Foley and Van Valin (1984) *Functional Syntax and Universal Grammar*, Cambridge: Cambridge University Press.

- Givón, T. (1984) *Syntax: A Functional-Typological Introduction*, Benjamins, Amsterdam.
- Grimshaw, J. (1992) *Argument Structure*, Linguistic Inquiry Monograph 18.
- Grimshaw and Mester (1988) 'Light Verbs and Theta-marking,' *Linguistic Inquiry* 19, 205-232.
- Her, O. (1990) *Grammatical Functions and Verb Subcategorization in Mandarin Chinese*, The Crane Publishing Co., Taipei, Taiwan.
- Hong, Ki-sun (1991) 'Argument Selection and Case Marking in Korean,' Ph. D. Dissertation, Stanford University.
- Jackendoff, R. (1972) *Semantic Interpretation in Generative Grammar*, MIT Press, Cambridge, Massachusetts.
- Jespersen, O. (1965) *A Modern English Grammar on Historical Principles*, George Allen & Ewin, London.
- Kim, Jeong-Ryeol. (1990) 'Noun Incorporation of *ha*-verbs in Korean,' To Appear in *Proceedings of the Seventh International Conference on Korean Linguistics Held at Osaka, Japan*.
- Kim, Jeong-Ryeol (1991) 'A Lexical-Functional Grammar account of light verbs,' Ph. D. Dissertation, University of Hawaii.
- Kiparsky, P. (1987) *Morphology and Grammatical Relations*, Unpublished paper. Stanford University, Stanford, California.
- Martin, S., Y. Lee, and S. Chang (1967) *A Korean English Dictionary*, Yale University Press, New Haven, Connecticut.
- Nirenberg, S. (1987) *Machine Translation: Theoretical and Methodological Issues*, Cambridge University Press.
- O'Grady, W. (1992) 'On the Status of *ha-ta* in Multiple Complement Structures,' *SICOL '92 Proceedings* 238-247.
- Park, Byung-soo (1993) 'hankwuke satongkwumwunkwa nonhanghapseong,' (Korean Causative Constructions and Argument Composition), Paper Presented at the 27th Annual Linguistics Conference hosted by Seoul National University.
- Park, Ka-byeong. (1990) 'Negation, Verb Movement and Light Verbs in Korean,' Unpublished Paper, University of North Carolina, Chapel Hill, North Carolina.
- Pollard & Sag (1987) *Information-based Syntax and Semantics*, Vol. 1, Stanford University.
- Rappaport, M. (1983) 'On the Nature of Derived Nominals,' in L. Levin, M.

- Rapport and A. Zaenen, eds., *Papers in Lexical Functional Grammar*, Indiana University.
- Suh, Chung-soo (1975) *tongsa ha-uy mwunpep* (A Grammar of *ha* verbs), Hyengsel Publishing Co., Seoul, Korea.
- Williams, E. (1981) 'Argument Structure and Morphology,' *The Linguistic Review* 1, 81-114.
- Yu, Jae-won (1985) *wulimal yekswun sacen* (A Reversed Dictionary of Korean), Cengumsa, Seoul, Korea.
- Zajac, R. (1992) 'Inheritance and Constraint-Based Grammar Formalisms,' *Computational Linguistics*, 18-2, 159-182.

Faculty of Liberal Arts & Sciences
Korea Maritime University
1 Dongsam-dong, Yeongdo-ku,
Pusan 606-791
Korea

jlkim@hyowon.pusan.ac.kr