Complex Predicates in HPSG

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1 Introduction

The properties of complex predicate have been intensively studied. Among those studies, Shibatani (1973), Sugioka (1984), and Miyagawa (1989) discuss the interaction of Japanese aspectual verbs and passivization. Miyagawa (1989) observed that the passive suffix (r)are can be attached to an aspectual verb, as in (1).

(1) a. hon ga John niyotte yomi-tuzuke-rare-ta
   book NOM by read-continue-PASS-PAST
   (The books were continuously read by John)

   b. kono hon wa ooku no sakusha niyotte youyaku kaki-oe-rare-ta
   this book TOP many GEN author by finally write-finish-PASS-PAST
   (This book was finally finished to be written by many authors)

The peculiar property of (1) is that the embedded theme (hon) is passivized and becomes the subject of the sentence in spite of the fact that the passive suffix is attached to the aspectual verb tuzuke and oe. The grammaticality of (1) cannot be explained naturally unless some sort of complex predicate formation is assumed, by which the verb sequence yomi-tuzuke and kaki-oe can be treated as a single predicate so that the embedded theme can be passivized.

There are some complicating facts in complex predicate formation. For example, Nishigauchi and Takahashi (ms) observe that sentences like (2) are ungrammatical. (2) is minimally different from (1) in that the aspectual verb tuzuke in (1) is a Control aspectual verb (e.g. V_A assigns an external θ-role) while the aspectual verb sugi in (2) is a Raising aspectual verb (e.g. V_A does not assign an external θ-role).

(2) a. * hon ga John niyotte yomi-sugi-rare-ta
   book NOM by read-excess-PASS-PAST
   (Books were excessively read by John)

   b. * dorobou ni korosi-kake-rare-ta
   thief DAT kill-be about to-PASS-PAST
   ((I) was almost killed by the thief)

There is a similar contrast in a causative sentence, namely, a Control aspectual verb can be causativized (as in (3a)), while a Raising aspectual verb cannot (as in (3b)).
In addition, it is well known that, in Japanese causative-passive verb (e.g. yom-ase-rare ‘to be forced to read’), the causee can be passivized (4a), but the embedded theme cannot (4b).

(4) a. seito wa (sensei ni) hon o yom-ase-rare-ta
   student TOP teacher DAT book ACC read-cause-PASS-PAST
   (The students were forced to read the books (by the teacher))

   b. *sono hon wa (sensei ni yotte) seito ni yom-ase-rare-ta
      that book TOP teacher by student DAT read-cause-PASS-PAST
      (The books were forced to be read by the students (by the teacher))

In this paper, I will propose a formalization for complex predicate formation based on HPSG (Pollard and Sag (1987), Pollard and Sag (forthcoming)), which explains the above contrast.

2 Complementation in HPSG

Before explaining the complex predicate formation, I will first review the complementation in HPSG.

(5) shows the simplified lexical entries of the English Control and Raising verbs try and tend.

(5) a. try

\[
\begin{array}{c}
\text{CAT} | \text{SUBCAT} (\text{NP}_{[1]} \text{ref}, \text{VP[inf, SUBCAT (NP_{-[2]}) : [3]})
\mid \text{REL} \mid \text{try} \\
\text{CONTENT} \mid \text{TRYER} [1][\text{INDEX} [2]] \\
\mid \text{SOA-ARG} [3]
\end{array}
\]

b. tend

\[
\begin{array}{c}
\text{CAT} | \text{SUBCAT} ([1]NP, \text{VP[inf, SUBCAT ([1]) : [2]})
\mid \text{REL} \mid \text{tend} \\
\text{CONTENT} \mid \text{SOA-ARG} [2]
\end{array}
\]

The lexical entries only show two features SUBCAT and CONTENT. A SUBCAT list is a list of subcategorized constituents, which are ordered in the increasing obliqueness. The CONTENT feature express the semantic content of each word. Thus the lexical entry in (5a) shows that the
Control aspectual verb *try* subcategorizes a noun phrase (NP₁) and an infinitive verb phrase. The noun phrase (NP₁) is the least oblique complement (i.e., the subject) and it is the TRYER of *try* event, and the INDEX ([2]) of the subject is identical to the INDEX of the subject of the embedded verb phrase. Also, the semantic contents ([3]) of the complement VP is identical to the state of affair argument (SOA-ARG) of the *try* event.

The subscript *ref* of NP₁ means that it must be a referential object, namely non-dummy object. Thus, *try* does not allow an expletive subject, such as *it* or *there*. On the other hand, the subject of *tend* does not have the constraint, thus it does not have subscript *ref*.

(6) shows how the complementation is done in an English example *They* *try* *to* *run*. The heart of the complementation is the unification and the cancellation. When the head verb *try* is combined with the complement VP₂ (*to run*), the VP element of SUBCAT list in the head daughter is unified with the complement, and it is cancelled out in the SUBCAT list in the mother node. Thus, the SUBCAT list of the mother has one less elements than the head daughter.

Similarly, when the VP *try* *to* *run* is combined with the subject *They*, NP₁ in the SUBCAT list is unified with the subject NP, and it is cancelled out in the mother node S, whose SUBCAT list is an empty list.

(6)

\[
\begin{array}{c}
\text{S}([()]) \\
\text{NP₁} \\
\downarrow \\
\text{They} \\
\text{V}(\langle \text{NP₁}, \text{VP[inf, } \langle \text{NP₁} \rangle] \rangle) \\
\downarrow \text{try} \\
\text{VP₂[inf, } \langle \text{NP₁} \rangle] \\
\downarrow \text{to run}
\end{array}
\]

3 Complex Predicate Formation

3.1 Aspectual Verbs

To achieve the complex predicate formation, I propose a concept called substitution, instead of cancellation. (7) shows the lexical entry of the Control aspectual verb *tuzuke*, and how the complex predicates *yomi-tuzuke* (continue to read) is formed.

(7) Control Aspectual Verb *tuzuke* (continue)

\[
\begin{array}{c}
\text{CAT} | \text{SUBCAT} (\langle \text{NP₁}, \text{V[SUBCAT } \langle \text{NP-}_{-2} | \text{ }③\rangle ] : [3] \rangle ) \\
\text{CONTENT} \text{ REL continue} \\
\text{AGENT } [1][\text{INDEX}[2]] \\
\text{SOA-ARG } [3]
\end{array}
\]

(b) yomi-tuzuke
read-continue
When the head verb *tuzuke* is combined with the subpredicate *yomi*, the second element \( \langle NP_1 | R \rangle \) in the SUBCAT list of the head daughter is unified with the subpredicate. Here, \( R \) is a newly-introduced special variable, and the bar ']' before \( R \) means that the variable \( R \) is unified with the rest of the list. Thus, in this case, the \( R \) is assigned the list \( \langle NP_2 \rangle \).

In the proposed framework, after the unification, the second element of the head daughter's SUBCAT list is not cancelled, but is substituted by the value of \( R \). Thus, the mother node has the SUBCAT list \( \langle NP_1 \langle NP_2 \rangle \rangle \). If no further complex predicate formation should be applied, the embedded brackets are erased (the *bracket erasure*), and the SUBCAT list of the complex predicate *yomi-tuzuke* is \( \langle NP_1 \langle NP_2 \rangle \rangle \).

(8) shows the lexical entry of the Raising aspectual verb *sugi* (excess), and how the complex predicate *yomi-sugi* is formed. By the similar process to the previous example, the SUBCAT list of the mother node is \( \langle \langle NP_1 \langle NP_2 \rangle \rangle \rangle \), and after the embedded bracket is erased, the final SUBCAT list is \( \langle NP_1 NP_2 \rangle \). Note that although it is the same as the final result of *yomi-tuzuke*, it is produced through a different intermediate SUBCAT list, i.e., \( \langle NP_1 \langle NP_2 \rangle \rangle \) in *yomi-tuzuke* and \( \langle \langle NP_1 \langle NP_2 \rangle \rangle \rangle \) in *yomi-sugi*. I will show in the later sections how the difference of the intermediate SUBCAT list results in different behavior in more complicated complex predicate formation.

(8) Raising Aspectual Verb *sugi* (excess)

(a) \[
\begin{array}{c}
\text{CAT} \\
\text{SUBCAT} \\
\downarrow \\
\text{V[SUBCAT} \ R] : [1]) \\
\end{array}
\]

(b) yomi-sugi

\[
\begin{array}{c}
\text{read-excess} \\
\text{V[} \langle \langle NP_1 \langle NP_2 \rangle \rangle \rangle \rangle \\
\end{array}
\]

\[
\Rightarrow V[< NP_1 \langle NP_2 \rangle >] \\
R = (NP_1 \langle NP_2 \rangle)
\]
3.2 Passivization

In Pollard and Sag (1987), the English passivization is defined as a lexical rule that (a) drops the subject off the SUBCAT list of the input lexical entry, and (b) reassigns the index of the subject of the input lexical entry to an optional PP[BY], which is attached to the SUBCAT list in the output lexical entry as the most oblique element. (9) illustrates the passive lexical rule. Note that, in Pollard and Sag (1987), elements in a SUBCAT list are ordered in decreasing obliqueness, so the least oblique element [ ] [4] is the last element in the input lexical entry. In the rest of the paper, I will follow Pollard and Sag (forthcoming) in which elements in a SUBCAT list are ordered in increasing obliqueness.


\[
\begin{align*}
\text{PHON} & \ [1] \\
P\text{AST-PART} & \ [2] \\
\text{SYN} & \mid \text{LOC} \mid \text{SUBCAT} \ (\ldots, [ ] [3], [ ] [4]) \\
\text{SEM} & \mid \text{CONT}[5] \\
\rightarrow \begin{cases} \\
\text{PHON} & f_{pp}(1, [2]) \\
\text{SYN} & \mid \text{LOC} \mid \text{SUBCAT} \ (\text{PP[BY]} [4], \ldots, [ ] [3]) \\
\text{SEM} & \mid \text{CONT}[5] \\
\end{cases}
\end{align*}
\]

Using the substitution proposed in the previous section, the above passive lexical rule can be expressed by a lexical entry associated with the passive suffix \((r)\text{are}\). (10a) shows the lexical entry of the passive \((r)\text{are}\), and (10b) shows the complex predicate \(\text{yom-are}\) (be read).

(10) a. Passive Suffix \((r)\text{are}\):

\[
\begin{align*}
\text{CAT} & \mid \text{SUBCAT} \ (V[\text{SUBCAT} \ (\text{NP}[1] \mid \mathcal{R})] : [2]. (\text{NP}[1])) \\
\text{CONTENT} & \ [2] \\
\end{align*}
\]

b. \(\text{yom-are}\)

\[
\begin{align*}
\text{read-PASS} & \rightarrow V[(\text{NP}_2), (\text{NP}_1)] \\
\Rightarrow V[< \text{NP}_2 (\text{NP}_1) >] \\
\mathcal{R} & = (\text{NP}_2)
\end{align*}
\]

\[
\begin{array}{c}
yom \\
(\text{read})
\end{array}
\quad \quad
\begin{array}{c}
(r)\text{are} \\
(\text{PASS})
\end{array}
\]

In (10b), the first element \(V[(\text{NP}_1 \mid \mathcal{R})]\) of the SUBCAT list of \((r)\text{are}\) is unified with the entry of \(\text{yom}\), and it is substituted by the value of the variable \(\mathcal{R}\), which is the list \((\text{NP}_2)\). Thus, the mother node subcategorizes an noun phrase \(\text{NP}_2\), which corresponds to the theme of reading, and an optional noun phrase \(\text{NP}_1\), which is the agent of reading.

Note that the above formalization can handle the change of the obliqueness by passivization, but it says nothing about the change of case of the subcategorized noun phrase. For example, \(\text{NP}_2\) appears as an accusative noun phrase in an active sentence, while it is a nominative noun phrase in the corresponding passive sentence. In this paper, I will assume some kind of case marking rule, which determines the case marker based on the obliqueness and semantic roles.

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3.3 Aspectual Verb and Passive

Next, I will explain the contrast of the grammaticality of the passivized Control and Raising aspectual verbs. The generalization, which was mentioned in the section 1, is stated as follows.

**Generalization 1** The passive form of a complex predicate $V$-$V_a$ (where $V_a$ is an aspectual verb) is $V$-$V_a$-rare if $V_a$ is a Control aspectual verb, or $V$-rare-$V_a$ if $V_a$ is a Raising aspectual verb. (Nishigauchi and Takahashi (ms))

The generalization can be explained in the following way. (11) shows complex predicates that includes the Control aspectual verb -oe (to finish).

(11) a. kaki-oe-rare
write-finish-PASS

```
 kaki
  
 oe
   write
      finish

V[(NP1, (NP2))]
```

b. * kak-are-oe
write-PASS-finish

```
*V(not unifiable)

 kaki
  
 are
   write
      finish

V[(NP2), (NP1)]
```

In the grammatical kaki-oe-rare (11a), the second element of the SUBCAT list of oe is unified with the entry of kaki, and the variable $R_1$ is set to the list (NP2). Thus, the mother node of kaki and oe has the SUBCAT list (NP2). It is then unified with the first element of the SUBCAT list of (r)are, and the variable $R_2$ is set to the list (NP2). The topmost mother node has the SUBCAT list (((NP2), (NP1)), as expected.

On the other hand, in the ungrammatical kak-are-oe (11b), the mother node of kak and (r)are has the SUBCAT list (((NP2), (NP1)). It is incompatible with the second element of the SUBCAT
list of *oe, because the first element of the formar is a list ([NP2]), while the latter is an entry of a noun phrase (NP3). Thus, the unification fails, and *kak-are-oe does not form a proper complex predicate.

(12) shows complex predicates that involves a Raising aspectual verb *kake (be about to). In (12a) where the Raising aspectual verb precedes the passive suffix (r)are, the innermost subpredicate koros (kill) is combined with the aspectual verb *kake (be about to), forming a complex predicate whose SUBCAT list is [NP1, NP2]). However, the intermediate complex predicate korosi-*kake cannot be unified with the first element of the SUBCAT list of the passive suffix for the same reason as the previous example (11b). Namely, the first element of the SUBCAT list of the formar is a list [NP1, NP2], while the first element of the SUBCAT list of the latter is an noun phrase NP3, and the unification fails. Thus, korosi-*kake-rare is ungrammatical.

On the other hand, in (12b) where the Raising aspectual verb follows the passive suffix, the unification succeeds in all the stages in the complex predicate formation. The result is a grammatical complex predicate which subcategorizes NP2 and, optionally, NP1.

(12) a. * korosi-*kake-rare
   kill-be about to-PASS
   +V(not unifiable)
   [V[[NP1, NP2]]] [V[[V[NP3 | R2]], (NP3)]]
   [V[NP1, NP2]] [V[[V[R1]]]]
   korosi
   [V[[V[NPi | R2]], (NP3)]]
   [V[NP1, NP2]]
   kake
   (be about to)

   b. koros-are-*kake
   kill-PASS-be about to
   [V[[NP2], (NP1)]]
   [V[[NP2], (NP1)]]
   koros
   [V[[V[NPi | R2]], (NP3)]]
   [V[NP1, NP2]]
   (r)are
   (PASS)
   (be about to)

3.4 Aspectual Verb and Causative

Next, I will explain the interaction between a aspectual verb and a causative predicate. Here, I assume that the causative predicate (s)ase has the lexical entry shown in (13a). It subcategorizes
three elements: the causer NP₀, causee NP₁, and the caused event which are expressed by the embedded predicate. (13b) shows the complex predicate *yom-ase* (cause to read).

(13) a. *(s)ase* (cause)

```
\[
\begin{array}{c}
\text{CAT} | \text{SUBCAT} \langle \text{NP₁}, \text{NP₂}, \text{NP₃} \rangle \text{V[SUBCAT} \langle \text{NP₋₃} | \mathcal{R} \rangle : [4] \text{]} \\
\text{REL cause} \\
\text{CONTENT} [8] \\
\text{CAUSER} \ [1] \\
\text{CAUSEE} \ [2][\text{INDEX}[3]] \\
\text{SOA-ARG} \ [4]
\end{array}
\]
```

b. \[ V[\langle \text{NP₁}, \text{NP₂}, (\text{NP₃}) \rangle] \]

As mentioned in section 1, the generalization of the interaction between an aspectual verb and the causative predicate is stated in the following.

**Generalization 2** A Control aspectual verb may be causativized, but a Raising aspectual verb may not.

(14a) is an example that uses a Control aspectual verb *tuzuke*, and (14b) is an example that uses a Raising aspectual verb *kake*. The contrast of the Control and Raising aspectual verbs can be explained in the similar manner as the previous aspectual verbs and passivization. Namely, the causativization of Control aspectual verb is grammatical because the unification succeeds in all the stages of the complex predicate formation. On the other hand, in (14b), when the complex predicate *yomi-kake* is combined with the causative suffix *(s)ase*, the unification of the third element \[ V[\langle \text{NP₂} | \mathcal{R}_₂ \rangle] \] of the SUBCAT list of *(s)ase* and the mother of *yomi* and *kake* fails because the first element of the SUBCAT list of the formar is a noun phrase, while the first element of the SUBCAT list of the latter is a list. Thus, the causativization of Raising aspectual verb is ungrammatical.

(14) a. Control Aspectual Verb and Causativization

```
yomi-tuzuke-sase  (cause to continue reading)  
read-continue-cause
```

```
\[
\begin{array}{c}
V[\langle \text{NP₁}, \text{NP₂}, (\text{NP₃}) \rangle] \\
V[\langle \text{NP₂}, (\text{NP₃}) \rangle] \\
V[\langle \text{NP₂}, V[\langle \text{NP₂} | \mathcal{R}_₁ \rangle] \rangle] \\
yomi \\
(tuzuke)
\end{array}
\]
```

```
\[
\begin{array}{c}
V[\langle \text{NP₁}, \text{NP₂}, (\text{NP₃}) \rangle] \\
\text{(s)ase} \\
\text{(cause)}
\end{array}
\]
```

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\[ R_1 = \langle NP_3 \rangle \]
\[ R_2 = \langle NP_3 \rangle \]

b. Raising Aspectual Verb and Causativization

yomi-kake-sase \hspace{1cm} (cause to be about to read)
read-be about to-cause

\[ *V(\text{not unifiable}) \]

\[ V[\langle NP_2, NP_3 \rangle] \]

\[ V[\langle NP_1, NP_2, V[\langle NP_2 | R_2 \rangle] \rangle] \]

\[ V[\langle NP_1, NP_2, \langle NP_3 \rangle \rangle] \]

\[ V[\langle V[R_1] \rangle] \]

\[ yomi \hspace{1cm} (read) \]
\[ kake \hspace{1cm} (be about to) \]

\[ R_1 = \langle NP_2, NP_3 \rangle \]

### 3.5 Causative-Passive

The generalization of causative-passive construction is stated in the following.

**Generalization 3** In Japanese causative-passive construction, the causee can be passivized, but the embedded theme cannot.

An example of the causative-passive construction based on a transitive verb *yom* (read) is shown in (15). In the example, the unification succeeds in all the stages in the complex predicate formation, and the final SUBCAT list of the complex predicate (after the bracket erasure) is \( \langle NP_2, NP_3, (NP_1) \rangle \), where the subject is \( NP_2 \), which is the causee. In this case, (15) is the only grammatical combination of the complex predicate *yom-ase-rare*, and there is no way to derive a complex predicate in which the embedded theme \( NP_3 \) becomes the subject. In this way, the above generalization is explained.

\[ (15) \]

\[ V[\langle NP_2, (NP_3), (NP_1) \rangle] \]

\[ V[\langle NP_1, NP_2, (NP_3) \rangle] \]

\[ V[\langle V[R_1] \rangle] \]

\[ yom \hspace{1cm} (read) \]
\[ (s)ase \hspace{1cm} (cause) \]

\[ R_1 = \langle NP_3 \rangle \]
\[ R_2 = \langle NP_2, (NP_3) \rangle \]
4 Summary

In this paper, I have proposed a framework for the complex predicate formation in HPSG. Then, I have shown that the proposed framework accounts for the generalizations concerning the interaction between aspectual verbs and passive/causative suffixes.

Acknowledgement

The author would like to thank CSLI at Stanford University, where I was a visiting researcher during my research discussed in this paper.

REFERENCES

Nishigauchi, T. and M. Takahashi, (1990), Syntactic Movement in Japanese, Ms.