The Japanese Sentence Structure
and Its Dependence on $BA$

Kei Yoshimoto
Tohoku University
1 Introduction

- A semantic approach to the processing of Jpn sentences (Scope Control Theory; Butler 2007)
- Japanese-specific behaviors in terms of topic/subject coreference and tense in complex sentences are nicely captured by the framework.
- How $BA$ is reflected and processed by the four-level hierarchical structure of Jpn sentences.
Scope Control Theory

– Approximates dependency structures in natural language by fine-grained and restricted scope management.

– Dependencies are established as operator-variable dependencies.

– To see if a sentence is grammatical, the sentence as an SCT expression is evaluated.

– Evaluation: either direct interpretation or translation into predicate logic.

– Evaluation is made with respect to an assignment function which captures the contribution of the context.

The hierarchy involves heterogeneous linguistic data including topic/subject coreference in complex sentences, complex tenses, word order, scope of negation and question, and focus.
Is it tenable?

- Linguistic forms assigned to more than one level.
- Inconsistency between classification criteria
- Relative and quotative clauses
The problems can be solved (Yoshimoto et al. 2009).

Jpn sentences can be processed within the framework with multiply embedded Operator-Scope relationships

<table>
<thead>
<tr>
<th>Predicate constituents</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>main verb &lt; causative</td>
<td></td>
<td>boulomaic &lt; evidential&lt;br&gt;tense &lt; evidential&lt;br&gt;deontic &lt; tense</td>
<td>&lt; epistemic</td>
<td>&lt; modal particle</td>
</tr>
<tr>
<td>&lt; {passive, potential}</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; donative &lt; honorific</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-predicative constituents</td>
<td>non-subject NP &lt; state adverbial</td>
<td>&lt; place adverbial</td>
<td>topic &lt; evidential adverbial</td>
<td>&lt; illocutionary adverbial &lt; {response, addressive}</td>
</tr>
<tr>
<td>&lt; degree adverbial</td>
<td>&lt; time adverbial</td>
<td>&lt; evaluative adverbial</td>
<td>&lt; imperative</td>
<td></td>
</tr>
<tr>
<td>&lt; adv postposition</td>
<td>&lt; adv postposition</td>
<td>&lt; volitive</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Effects on subjects given by hierarchy level of subordinate clause

<table>
<thead>
<tr>
<th>hierarchy level</th>
<th>head</th>
<th>untopicalized subjects</th>
<th>topicalized subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><em>te</em>, etc.</td>
<td>identical</td>
<td>identical</td>
</tr>
<tr>
<td>B</td>
<td><em>to</em>, etc.</td>
<td>distinct</td>
<td>identical</td>
</tr>
<tr>
<td>C</td>
<td><em>kara</em>, etc.</td>
<td>distinct</td>
<td>distinct</td>
</tr>
</tbody>
</table>
Level B Subordinate Clause

– Untopicalized subjects are non-coreferential with each other.
– A topicalized matrix subject is identical with an omitted subordinate subject.

(1) a. [Tarōi ga uwagi o nugu]B to φj hangā ni kake-NOM jacket ACC take off SUCC (SBJ) hanger LOC hang ta.
PST
‘After Taro had taken off his jacket, someone hung it on a hanger.’

b. Tarōi wa [φi uwagi o nugu]B to hangā ni kake-ta.
NAME TOP (SBJ) jacket ACC take off SUCC hanger LOC hang PST
‘After Taro had taken off his jacket, he hung it on a hanger.’
Effects on the relation of subordinate tense with respect to matrix tense by hierarchy level of subordinate clause

<table>
<thead>
<tr>
<th>hierarchy level</th>
<th>head</th>
<th>non-\textit{ta}-marked matrix</th>
<th>\textit{ta}-marked matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>\textit{nagara}, etc.</td>
<td>dependent</td>
<td>dependent</td>
</tr>
<tr>
<td>B</td>
<td>\textit{node}, etc.</td>
<td>independent</td>
<td>dependent</td>
</tr>
<tr>
<td>C</td>
<td>\textit{ga}, etc.</td>
<td>independent</td>
<td>independent</td>
</tr>
</tbody>
</table>
5  Tense in Complex Sentences (2)

**Level B Subordinate Clause**

– When the matrix predicate is marked with *ta*, the subordinate tense is interpreted in relation to the matrix one.

– When the matrix predicate is without tense marking, the subordinate tense is interpreted in relation to the utterance time.

(2) a. \([\text{Haruko ga } \text{sotsugyō-suru}]_B \text{ node issho-ni ryokō-shi- ta.}\)

   NAME NOM graduate-NPST CAUS together travel PST

   ‘Because Haruko is/was going to graduate, I made a trip with her.’

   \((E_m < n, E_m < E_s)\)

b. \([\text{Haruko ga } \text{yasun-de iru}]_B \text{ node kanashii.}\)

   NAME NOM take time off PROG-NPST CAUS be sad-NPST

   ‘Because Haruko is absent, I am sad.’

   \((n \subseteq E_s, n \subseteq E_m)\)
The observed correspondence between topic/subject coreference and tense is more than coincidence.

But why?

Each hierarchical level introduces its own type of information.

SCT models the introduction and management of the layered information (＝ scopes).
The scope for "ga" is introduced within Level B and inaccessible from outside.

(3) a. Tarō ga ki-ta.
   NAME NOM come PST
   ‘Taro came.’

a’. (rga rel "Taro") ga (rga rel "kita")

a”. ∃y(Taro(y) ∧ kita(y))

a””. Hide "ga"
   ga Close "ga"

   Use "ga"
   y ga Rel nil, nil, "∧"

   y ga Lam "ga", "ga"
   y ga rga rel "kita"

   y ga rga rel "Taro"
The denotation of the topic links to a "wa" binding already open in the context.

(3) b. Tarō  wa  ki-   ta.
     NAME TOP  come  PST
     'Taro came.'

b'.  (rga rel "Taro") wa (rwa rel "kita")

b''.  Taro(x)  ∧  kita(x)

b'''.

\[
\begin{array}{c}
\text{waga} \\ x \\
\text{waga} \\
\text{waga} \\
\text{waga} \\
\text{waga}
\end{array}
\]

\text{Rel nil, nil, "∧"}

\[
\begin{array}{c}
\text{waga} \\ x \\
\text{Lam "wa", "ga"}
\end{array}
\]

\[
\begin{array}{c}
\text{waga} \\
\text{rwa rel "kita"}
\end{array}
\]

\[
\begin{array}{c}
\text{waga} \\
\text{rga rel "Taro"}
\end{array}
\]
8. Tense in Simple Sentence

- $x$, the first scope for "ev" ($\equiv$ the utterance time), is open in the context.
- $y$, the second for "ev" binding ($\equiv$ the eventuality time), is introduced by $\text{ta}$.

(4) b. John ga $\text{ki-ta}$

b'. (rev "John ga ki") 0 $\text{ta}$

b''. $\exists y < x \land \text{John ga ki(y)}$

b'''. 

\[
\begin{align*}
\text{Hide "it"} \\
& & \text{Rel ["it"], ["r"], " "} \\
& & \text{Hide "ev"} \\
& & \text{Close "ev"} \\
& & \text{Use "ev"} \\
& & \text{Rel nil, nil, "\&"} \\
& & \text{Rel nil, nil, "<"} \\
& & \text{T("ev", 0)} \\
\end{align*}
\]
To constrains the subordinate clause to open a fresh "ga" binding independent of that of the main clause, as stipulated by ga.

(2) a. [Taro, ga uwagi o nugu]_B to φ_j hangā ni kake-
NAME NOM jacket ACC take off SUCC (SBJ) hanger LOC hang
ta.
PST
‘After Taro had taken off his jacket, someone hung it on a hanger.’

a’. (((rga rel "Taro") ga (rga rel "uwagi o nugu")) coord
"to") (rwa rel "hangā ni kakeeta")

a”’. scc(∃y(Taro(y) ∧ uwagi_o_nugu(y)), hanga_ni_kaketa(x))
The main predicate is bound by a scope $x$ for "wa" (which is given by the context) in distinction from $y$, the scope for "ga" which binds the subordinate predicate.
The subjects in the subordinate and main clauses share the same referent.

(1) b. \textbf{Taro}_i \text{ wa } [\phi_i \text{ uwagi o nugu}]_B \text{ to hangā ni kake-ta.}
   NAME TOP (SBJ) jacket ACC take off SUCC hanger LOC hang PST
   ‘After Taro had taken off his jacket, he hung it on a hanger.’

b’. (((\text{rga rel "Taro"}) \text{ wa (rwa rel "uwagi o nugu"})) \text{ coord "to"}) (\text{rwa rel "hanga ni kaketa"})

b”. \text{ scc((Taro}(x) \land \text{ uwagi_o_nugu}(x)), \text{ hanga_ni_kaketa}(x))
The text reads as follows:

**rwa** attached to both predicates makes their interpretation sensitive to the value of the "**wa**" binding, which is given by the context.

[Diagram representation of a complex sentence structure with nodes labeled as follows: x, x, x, x, "wa", "ga", "∧", "to", "∧", "hangaa ni kaketa", "uwagi o nugu", "Taroo". The diagram shows how the variables and operators are connected to form the complex sentence structure.]
The matrix predicate is interpreted based on the topmost "ev" binding introduced by `ta`.

The subordinate clause is interpreted based on `z`, the "it" binding introduced by `non_ta_dyn` within the subordinate clause.

(2) a. `[Haruko ga sotsugyō-suru]_B node issho-ni ryoko-shi- ta.

   a'. (((rit "Haruko sotsugyo-suru") 0 non_ta_dyn coord "node") (rev "issho-ni ryoko-shi")(0) 0 ta

   a''. \[ \exists y(y < x \land \text{causal}(\exists z(y < z \land \text{Haruko}_{-}ga_{-}sotsugyo_{-}suru(z)), \text{isshoni}_{-}ryoko_{-}suru(y))) \]
(2) a''.

Hide "it"

Rel ["it"], ["r"], " 

Hide "it"

Hide "ev"

Close "ev"

Use "ev"

Rel nil, nil, "^"

Rel nil, nil, "<"

T("ev", 0) T("ev", 1)

Hide "it"

Rel ["it"], ["r"], " 

Hide "it"

Rel nil, nil, "node"

Rel nil, nil, "issho-ni ryoko-shi-

Use "it"

T("ev", 0)

Rel nil, nil, "^"

Rel nil, nil, "<"

T("ev", 0) T("it", 0) Use "it"

Rel nil, nil, "Haruko ga sotsugyo-suru"

T("it", 0)
The matrix predicate is interpreted based on $y$, the "it" binding introduced by non\_ta\_stat.

The subordinate predicate is interpreted based on $z$, the "it" binding introduced within the subordinate clause by non\_ta\_stat.

(2) b. [Haruko ga yasunde-iru]$_B$ node kanashii.

b'. (((rit "Haruko ga yasun-de_iri") 1 non\_ta\_stat coord "node")
(rit "kanashii")) 0 non\_ta\_stat

b''. $\exists y(x \subseteq y \land \text{causal}(\exists z(x \subseteq z \land \text{Haruko}_\text{ga}_\text{-yasun-de_iri}(z)), \text{kanashii}(y)))$
(2) b"".

```
(2) b"".

<table>
<thead>
<tr>
<th>Action</th>
<th>Event</th>
<th>Tag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hide &quot;it&quot;</td>
<td>evit</td>
<td>nil</td>
</tr>
<tr>
<td>Use &quot;it&quot;</td>
<td>evit</td>
<td>nil</td>
</tr>
<tr>
<td>Rel nil, nil, &quot;⊆&quot;</td>
<td>evit</td>
<td>nil</td>
</tr>
<tr>
<td>T(&quot;ev&quot;, 0)</td>
<td>evit</td>
<td>nil</td>
</tr>
<tr>
<td>T(&quot;it&quot;, 0)</td>
<td>evit</td>
<td>nil</td>
</tr>
<tr>
<td>Lam &quot;it&quot;, &quot;r&quot;</td>
<td>evit</td>
<td>&quot;r&quot;</td>
</tr>
<tr>
<td>Rel [&quot;it&quot;], [&quot;rf&quot;], &quot;r&quot;</td>
<td>evit</td>
<td>&quot;r&quot;</td>
</tr>
<tr>
<td>Rel nil, nil, &quot;node&quot;</td>
<td>evit</td>
<td>nil</td>
</tr>
<tr>
<td>Use &quot;it&quot;</td>
<td>evit</td>
<td>nil</td>
</tr>
<tr>
<td>Rel nil, nil, &quot;kanashii&quot;</td>
<td>evit</td>
<td>&quot;kanashii&quot;</td>
</tr>
<tr>
<td>Rel nil, nil, &quot;Haruko ga yasun-de iru&quot;</td>
<td>evit</td>
<td>&quot;Haruko ga yasun-de iru&quot;</td>
</tr>
</tbody>
</table>
```
An SCT-based account of the phenomena

- Scopes
  - "wa" and "ev": are open in the context.
  - "ga" and "it": can only have a local binding.

- Subordinate clause
  - Level A: No subject/topic or tense operations
  - Level B: Binding of "ga" and "it"
  - Level C: linking to already open "wa" and "ev"
Jpn sentences are structured as multiply embedded Operator-Scope relationships

An inner layer of the sentence structure can refer to an outer layer, but not vice versa.

- Information missing in an inner layer can be retrieved by reference to that from an outer layer.

BA in Jpn sentence structures is a relative notion—approximated by MInami’s Levels C and D.


