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The Japanese Sentence Structure and Its Dependence on *BA*

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- 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.

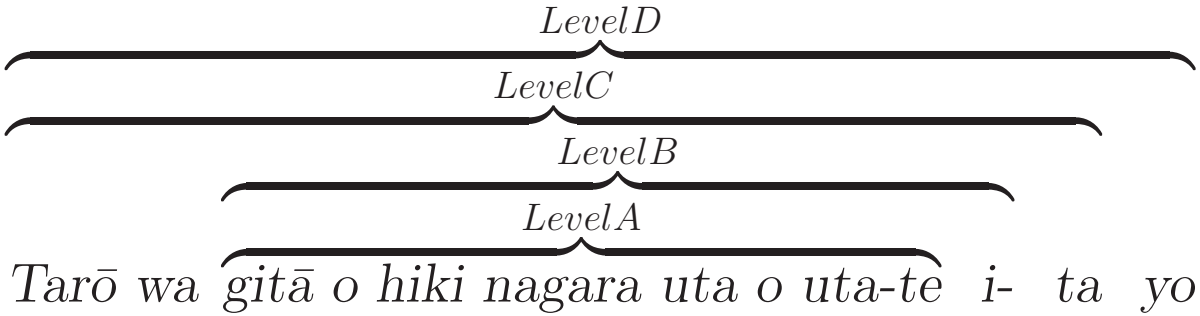
– Dependencies are established as operator-variable dependencies.

– 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.

Minami (1974): A layered structure in the Jpn sentence with Levels A, B, C, and D.



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>
<tr><th></th><th>A</th><th>B</th><th>C</th><th colspan="2">D</th></tr>
<tr><td rowspan="4">Predicate constituents</td><td rowspan="4">main verb < causative < {passive, potential} < donative < honorific</td><td>boulomaic < evidential$_1$ < tense < evidential$_2$</td><td rowspan="2">< epistemic</td><td></td><td rowspan="4">< modal particle</td></tr>
<tr><td>< deontic < tense</td><td></td></tr>
<tr><td rowspan="2"></td><td>< volitive</td><td></td></tr>
<tr><td></td><td>< imperative</td></tr>
<tr><td>Non-predicative constituents</td><td>non-subject NP < state adverbial < degree adverbial < adv postposition$_1$</td><td>subject NP < place adverbial < time adverbial < adv postposition$_2$</td><td>topic < evidential adverbial < evaluative adverbial</td><td colspan="2">< illocutionary adverbial < {response, addressive}</td></tr>
</table>

Effects on subjects given by hierarchy level of subordinate clause

hierarchy level	head	untopicalized subjects	topicalized subjects
A	*te*, etc.	identical	identical
B	*to*, etc.	distinct	identical
C	*kara*, etc.	distinct	distinct

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. [**Tarō**$_i$ **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.'

b. **Tarō**$_i$ **wa** [ϕ_i 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

hierarchy level	head	non-*ta*-marked matrix	*ta*-marked matrix
A	*nagara*, etc.	dependent	dependent
B	*node*, etc.	independent	dependent
C	*ga*, etc.	independent	independent

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. [Haruko ga *sotsugyō-suru*]$_B$ **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. [Haruko ga *yasun-de iru*]$_B$ **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).

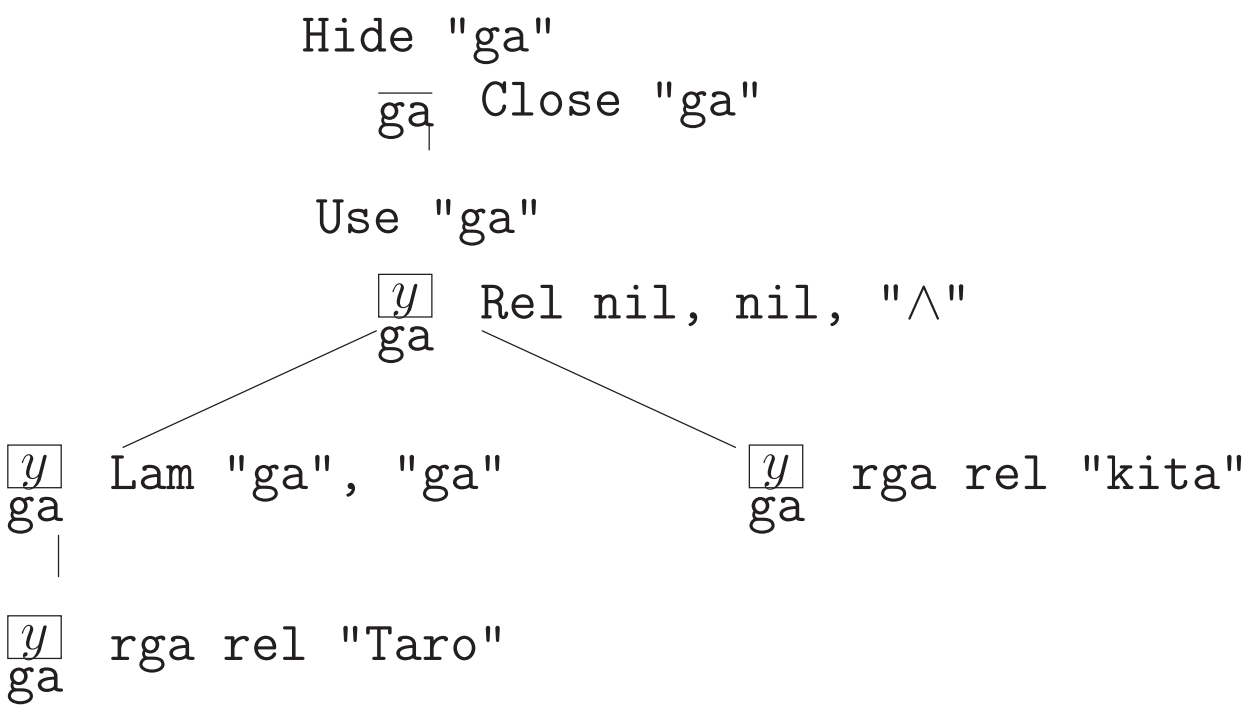
The scope for "ga" is introduced within Level B and inaccessible from outside.

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

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

a″. $\exists y(\text{Taro}(y) \wedge \text{kita}(y))$

a‴.



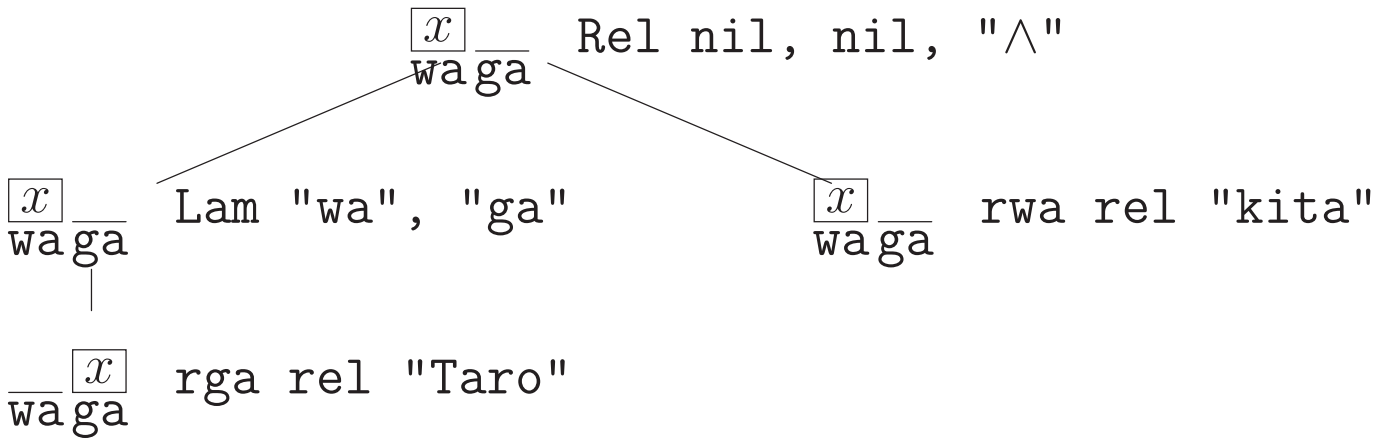
The denotation of the topic links to a "wa" binding already open in the context.

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

b′. `(rga rel "Taro") wa (rwa rel "kita")`

b″. $\mathrm{Taro}(x) \wedge \mathrm{kita}(x)$

b‴.



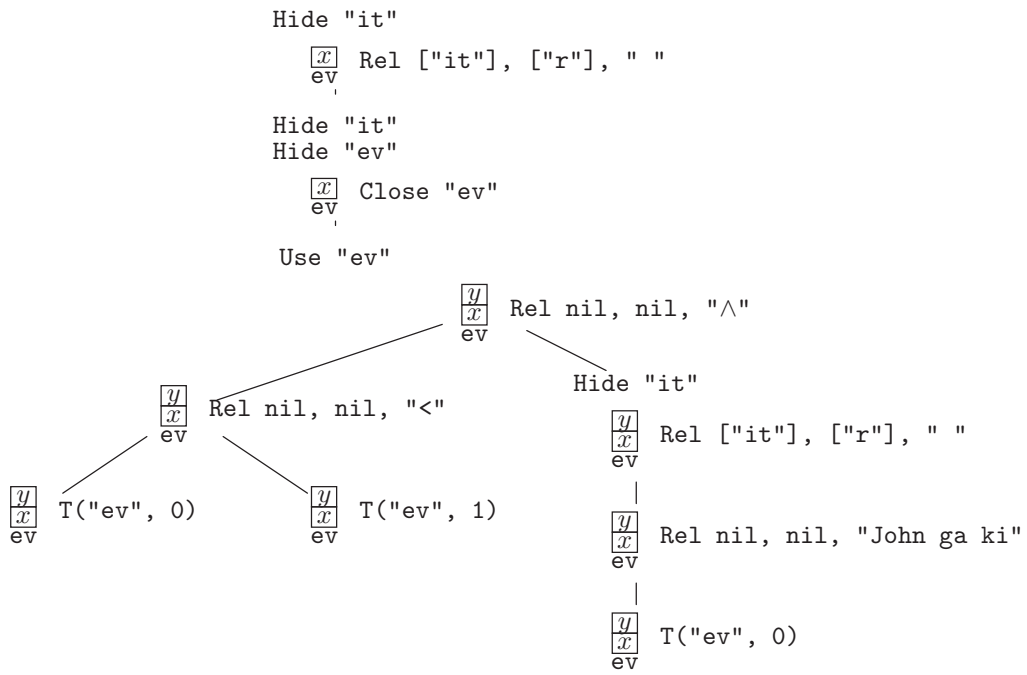
- x, the first scope for `"ev"` (= the utterance time), is open in the context.
- y, the second for `"ev"` binding (= the eventuality time), is introduced by **`ta`**.

(4) b. John ga ki-**ta**.

b′. `(rev "John ga ki") 0 ta`

b″. $\exists y < x \wedge \text{John\_ga\_ki}(y)$

b‴.



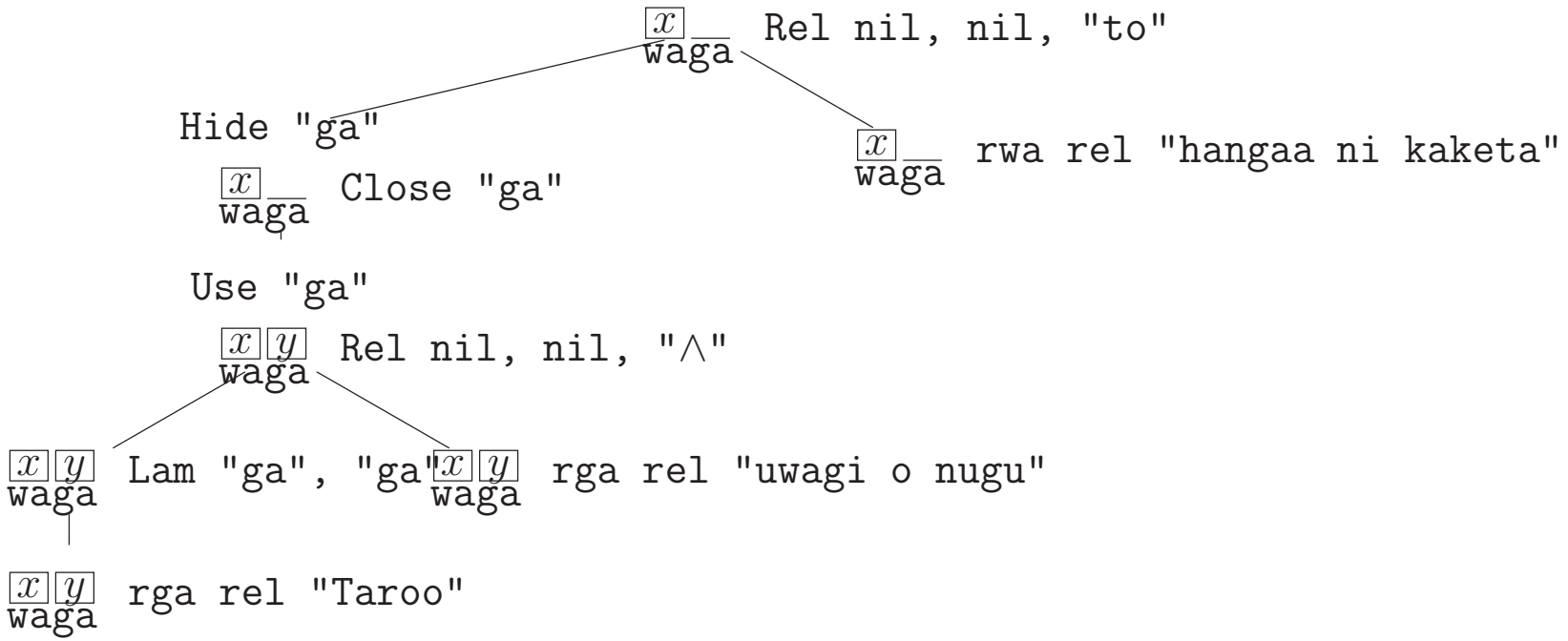
To constrains the subordinate clause to open a fresh "ga" binding independent of that of the main clause, as stipulated by ga.

(2) a. [**Tarō**$_i$ **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 "hanga ni kaketa")

a″. scc($\exists y$(Taro(y) $\wedge$ 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.



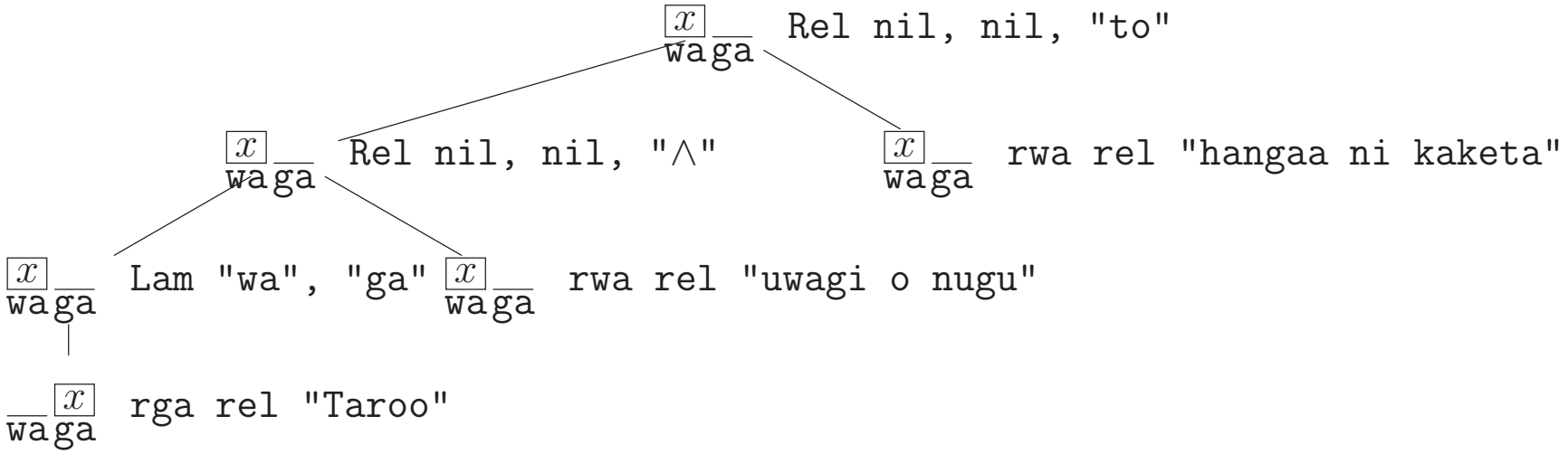
The subjects in the subordinate and main clauses share the same referent.

(1) b. **Tarō$_i$ wa** [ϕ_i 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.'

b′. `(((rga rel "Taro") wa (rwa rel "uwagi o nugu")) coord "to") (rwa rel "hanga ni kaketa")`

b″. scc((Taro(x) ∧ uwagi_o_nugu(x)), hanga_ni_kaketa(x))

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



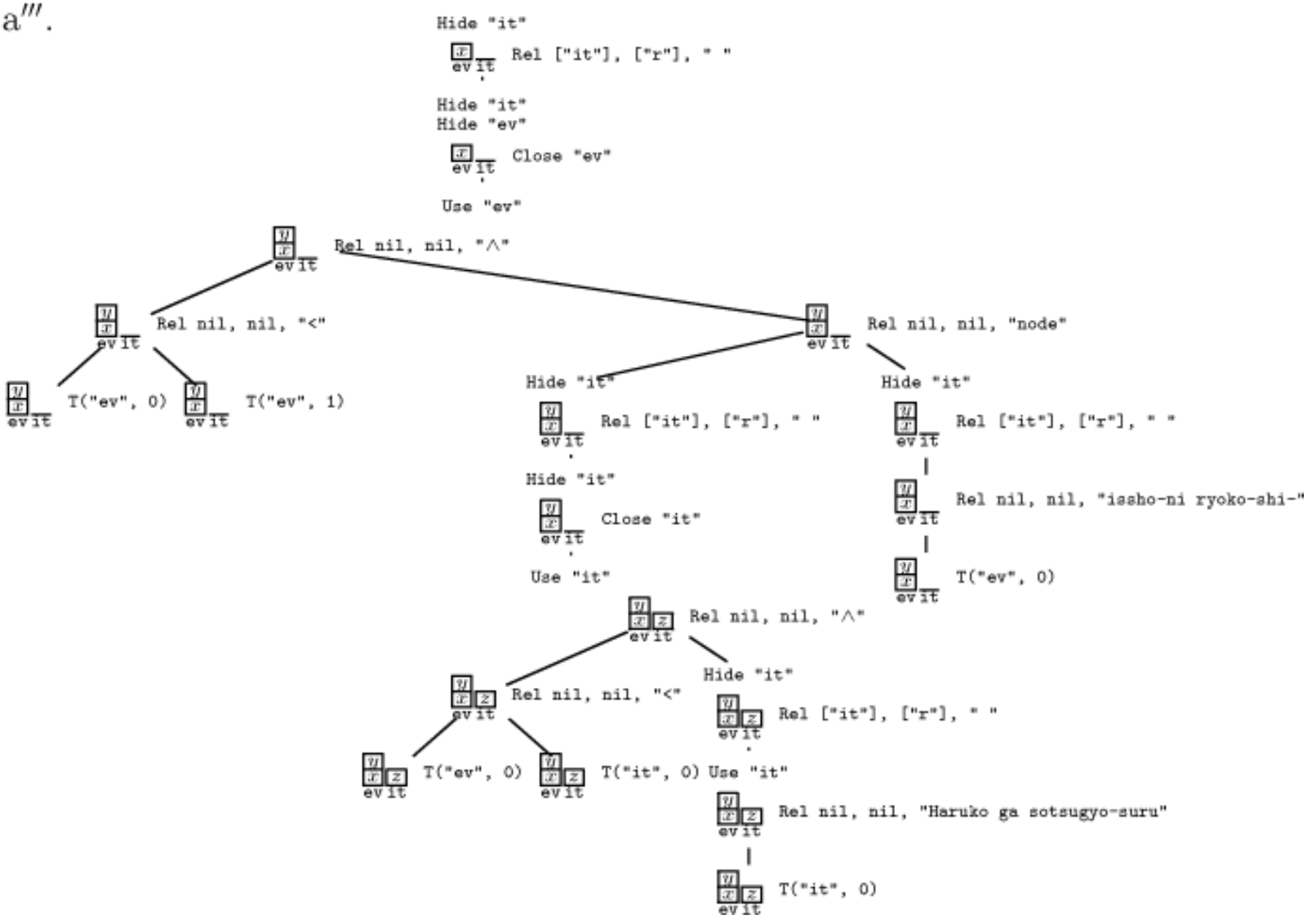
- The matrix predicate is interpreted based on the topmost `"ev"` binding introduced by `ta`.
- The subordinate clause is interpreted based on z, the `"it"` binding introduced by `non_ta_dyn` within the subordinate clause.

(2) a. [Haruko ga *sotsugyō-suru*]$_B$ **node** issho-ni *ryokō-shi- ta*.

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

a″. $\exists y(y < x \wedge \text{causal}(\exists z(y < z \wedge \text{Haruko\_ga\_sotsugyo-suru}(z)), \text{is-shoni\_ryoko-suru}(y)))$

(2) a‴.


Hide "it"
Rel ["it"], ["r"], " "
Hide "it"
Hide "ev"
Close "ev"
Use "ev"
Rel nil, nil, "∧"
Rel nil, nil, "<"
Rel nil, nil, "node"
T("ev", 0)
T("ev", 1)
Hide "it"
Rel ["it"], ["r"], " "
Hide "it"
Close "it"
Use "it"
Hide "it"
Rel ["it"], ["r"], " "
Rel nil, nil, "issho-ni ryoko-shi-"
T("ev", 0)
Rel nil, nil, "∧"
Rel nil, nil, "<"
Hide "it"
Rel ["it"], ["r"], " "
T("ev", 0)
T("it", 0)
Use "it"
Rel nil, nil, "Haruko ga sotsugyo-suru"
T("it", 0)

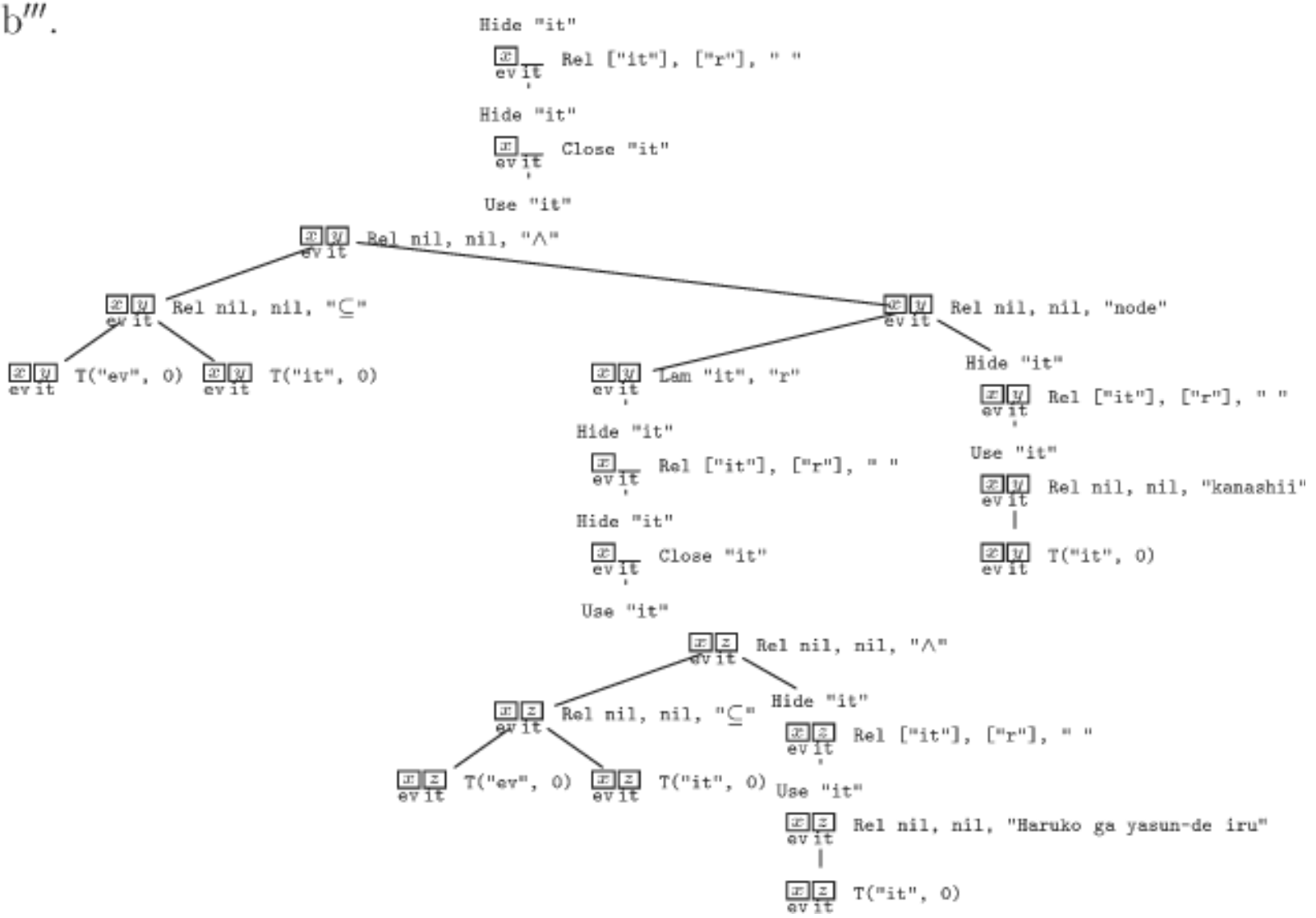
- The matrix predicate is interpreted based on y, the `"it"` binding introduced by `non_ta_stat`.
- The subordinate predicate is interpreted based on z, the `"it"` binding introduced within the subordinate clause by `non_ta_stat`.

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

b′. `(((rit "Haruko ga yasun-de_iru") 1 non_ta_stat coord "node") (rit "kanashii")) 0 non_ta_stat`

b″. $\exists y(x \subseteq \mathrm{y} \wedge \mathrm{causal}(\exists z(x \subseteq z \wedge \mathrm{Haruko\_ga\_yasun\text{-}de\_iru}(z)), \mathrm{kanashii}(y)))$

(2) b‴.


Hide "it"
Rel ["it"], ["r"], " "
Hide "it"
Close "it"
Use "it"
Rel nil, nil, "∧"
Rel nil, nil, "⊆"
Rel nil, nil, "node"
T("ev", 0)
T("it", 0)
Lam "it", "r"
Hide "it"
Rel ["it"], ["r"], " "
Use "it"
Rel nil, nil, "kanashii"
T("it", 0)
Hide "it"
Rel ["it"], ["r"], " "
Hide "it"
Close "it"
Use "it"
Rel nil, nil, "∧"
Rel nil, nil, "⊆"
Hide "it"
Rel ["it"], ["r"], " "
T("ev", 0)
T("it", 0)
Use "it"
Rel nil, nil, "Haruko ga yasun-de iru"
T("it", 0)

- 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.

Butler, Alastair (2007) Scope Control and Grammatical Dependencies. *Journal of Logic, Language and Information* 16, 241–264.

Butler, Alastair and Kei Yoshimoto (2008) "Shallow grammar + constrained semantics = deep grammar." 『言語処理学会第15回年次大会発表論文集』662–665.

Butler, Alastair, Chidori Nakamura and Kei Yoshimoto (2009) "Topic/Subject Coreference in the Hierarchy of Japanese Complex Sentences." In: Hiromitsu Hattori, Takahiro Kawamura, Tsuyoshi Ide, Makoto Yokoo and Yohei Murakami (eds.) *New Frontiers in Artificial Intelligence: JSAI 2008 Conference and Workshops Asahikawa, Japan, June 2008 Revised Selected Papers* (Lecture Notes in Artificial Intelligence 5447), pp. 119–132. Springer Verlag.

Butler, Alastair, Chidori Nakamura and Kei Yoshimoto (Forthcoming) "Hierarchy-based interpretation of topic/subject coreference and tense in Japanese complex sentences."

Minami, Fujio (1974) *Gendai Nihongo no Kōzō* (The Structure of Modern Japanese). Tokyo: Taishukan.

Yoshimoto, Kei (1998) *Tense and Aspect in Japanese and English.* Frankfurt am Main: Peter Lang.

Yoshimoto, Kei, Chidori Nakamura and Alastair Butler (2008) "Hierarchy-based Interpretation of Tense in Japanese Complex Sentences." *Proceedings of International Congress of Linguists 18*, 332–333.