SEMANTICS OF TOKYO JAPANESE

Kyouro/教育ローマ字 ver. 6.3.0

About this manuscript

This volume is intended to complement the volume titled *Proposing a New Romanization System of Japanese* (https://nihongotopics.github.io/Kyouro/), available in the following repository: https://github.com/NihongoTopics/Kyouro. The said volume is referred to as *Proposing.*

Like *Proposing*, this manuscript is expected to be updated dozens of times after the initial release. Be sure to check for the latest version from time to time.

Author: Junichi Iida, aka @awesomenewways on x.com.

Version history

- Initial release: ver. 6.0.0, December 2024 on https://github.com/NihongoTopics/Kyouro.
- Ver. 6.3.0, May 2024. Changed style to match Proposing. Fixed several errors.

Sentence initialism

Japanese sentences used in this manuscript are referred to by a sequence of initials of spaced words it contains, bounded by ##. For example, the sentence *mugi shika kawaiku nai* is referred to as #MSKN#, and *mugi mo kawaii* is referred to as #MMK#. If the sentence has a question mark at the end, the question mark is included in the initialism. For example, the sentence *doko itta?* is referred to by #DI?#.

Sometimes, an orthographic sentence has different versions depending on the positions of $. In the body text, these versions are distinguished with initialisms that include $, such as #$DI?#.

Example sentences and their associated initialisms are given at the end of this manuscript sorted in the alphabetical order. (Initialisms with $ are not included.) Sentences with the same initial letters are listed under the same initialism.

Table of contents

The table of contents is also available from the PDF menu.

CHAPTER ONE: THE FRAMEWORK

TRANSCRIPTION OF MEANING

INFORMAL TRANSCRIPTION OF MEANING

An easy way to transcribe the meaning of a sentence is to translate it into another language.

mugi mo kawaii. — Mugi, too, is cute.

We translate sentence fragments to show partial correspondences between Japanese and English:

mugi — Mugi

mo — too

kawaii — is cute

FUNCTION NOTATION

Sometimes it is difficult to establish partial bilingual correspondences. Observe the following example:

mugi shika kawaiku nai. — Only Mugi is cute.

Intuitively, this sentence can be broken down into two major parts:

mugi shika — ?

kawaiku nai — is not cute

How can we construct the meaning "only Mugi is cute" by combining two forms, one of which is "is not cute"? We can do a pseudo-math with the following equation and solve it for X.

X + is not cute = only Mugi is cute

$\therefore X =$ only Mugi $-$ not

(We use the symbol ∴ for "therefore" and = for equivalence. The symbols + and – stand for "plus" and "minus" here.)

The value represented by the tentative symbol X is something that becomes "only Mugi" when "not" is added to it. This can be understood as a function that takes "not" and returns "only Mugi," which we write:

not: only Mugi

Convention 1.1:

i) The form A: B is understood as a function that takes A and returns B.

We then obtain:

mugi shika — not: only Mugi

kawaiku nai — is not cute

which can be further broken down into:

mugi — Mugi

shika — not: only

kawaiku — is cute

nai — not

TREE NOTATION

Following *Proposing,* sentence structures are represented as trees. For semantics we put the terminal nodes at the top. A parent node is placed below its daughters. The last two sentences are represented by the following trees. (The phonetic form is italicized when included in the tree notation.)

mugi	*mo*	*kawaii*
Mugi	too	is cute
Mugi too		
Mugi, too, is cute		

mugi	*shika*	*kawaiku*	*nai*
Mugi	not: only	is cute	not
not: only Mugi		is not cute	
only Mugi is cute			

CONTEXT AND REFERENCES

CONTEXT

Consider #MSKN# again. A reasonable introspection would reveal that the meaning of the translated version of the sentence can be broken down into roughly the following:

$$\begin{cases}\text{Mugi is cute.}\\ \text{Everybody else is not cute.}\end{cases}$$

$$\left(\begin{cases}A\\ B\\ \dots\\ Z\end{cases} \text{means } A, B, \dots \text{ and } Z.\right)$$

Who is everybody else? This depends on the context. Let us say Mugi is a cat and there are two other cats, Bibi and Runa, living in the same house, and suppose that the statement is about these three cats. Now the statement can be decomposed into the following:

$$\begin{cases}\text{Mugi is cute.}\\ \text{Bibi is not cute.}\\ \text{Runa is not cute.}\end{cases}$$

In this case, the triple [*Mugi, Bibi, Runa*] is the *context* of Mugi. Each element of a context is called a *topic*. The sentence however does not specifically say that the other members of the context are *Bibi* and *Runa*. When a part of a sentence refers to an entity, the reference carries a context, but the rest of the contents of the context remain implicit as to what they refer to.

In the literature, concepts similar to our *context* are often rather informally employed. Kuroda (1965) uses the term *relativized universe* to talk about the scope of the exhaustive *ga* (see notes in pp. attention-boy) and Kuno (1973) discusses "registry of discourse" (see notes in p. bunnies). In formal semantics the term "domain" is often used to mean the set of denotations under consideration. Perhaps the defining feature of our concept of context is that it is independently postulated for each input of an article (see p. attention).

<u>Definition of context</u>:

For any referent X in a sentence, the *context* of X is the triple $[X, X', X'']$, where X' and X'' are implicit, $X \neq X'$, $X \neq X''$, and $X' \neq X''$.

($\neq$ stands for non-equivalence.)

The dichotomy between the topics with and without primes is analogous to Numata's (2009, pp. 37-58) dichotomy between *jisha* and *tasha* although, unlike our topics, Numata's terms refer to syntactic objects. Jisha and tasha do not distinguish between exhaustive and non-exhaustive references (see also p. ditto).

With the prime symbol, we can rewrite the meaning of the sentence as the following:

$$\begin{cases}\text{Mugi is cute}\\ \text{Mugi}' \text{ is not cute}\\ \text{Mugi}'' \text{ is not cute}\end{cases}$$

This is a more accurate representation of the meaning of the sentence. When we interpret a sentence, we typically process it as a component of a discourse. Some may say for this reason the meaning depends on the discourse. But surely a sentence has some intrinsic meaning. While the actual effect of the same sentence can be differently inferred from different surroundings, it would not be reasonable to claim that given the discourse, the internal elements of the sentence do not matter to the meaning. Therefore we need some way to isolate semantics from pragmatics. The idea is analogous to phonology. In phonology, we think that phones are superficial realizations of a truer, more abstract representation of a phonological segment. Here, as the worldly referents of the context of *Mugi* may vary utterance-to-utterance, we devised a means to represent contexts the way semantics should handle them.

ARTICLES

Articles of the reference dialect include *ga, mo, wa, o,* and *dakeo,* among others. They are some of what are commonly referred to as "particles," but not all particles are an article in our terms. An article generally requires some reference to the context. Each relevant topic of the context needs to be specified for the polarity of the predicate. This implies that the polarity of a sentence is more complex than it may appear.

It is widely accepted that at least two different interpretations can be associated with *ga*. One of them is called the exhaustive reading, and the other is the neutral reading, with slight variations of each term. According to Kuno (1973, p.38), this distinction was pointed out for the first time by Kuroda (1965) (this claim is dubious; see notes below). I will discuss the exhaustive reading first.

Kuno's (1973) explanations on the distinction between two types of *ga*'s are as follows:

> "c. ga *for neutral descriptions of actions or temporary states*
> *Example:*
> *Ame* ga *hutte imasu.*
> *rain falling is*
> *'It is raining.'*
> d. ga *for exhaustive listing.*[2] *"X (and only X) …" "It is X that …"*
> *Example:*
> *John* ga *gakusei desu*
> *student is*
> *'(Of all the people under discussion) John (and only John) is a student.' 'It is John who is a student.'"* (Kuno 1973, p. 38)

And in the footnotes of the same page, he argues that Kuroda (1965) was the first to point out the distinction:

> *"The distinction between the* ga *for neutral descriptions of actions or temporary states and the* ga *for exhaustive listing was first pointed out by Sige-Yuki Kuroda (1965a)."* (Kuno 1973, p. 38)

Here it needs to be pointed out that, contrary to Kuno's assertion, the distinction may have been described in 1914, long before Kuroda (1965), by William Imbrie. To see this, a quick comparison between the descriptions by Kuno and Kuroda, before comparing them with the description by Imbrie, would be worthwhile. In Kuroda (1965), exhaustive listing corresponds to *characterizational judgment* as opposed to *nonpredicational description*, which corresponds to neutral description. Kuroda explains the nonpredicational description as follows:

> *"The claim made here is that a sentence does not necessarily represent predication in the above sense but may be merely a description of a fact or situation. In such a sentence, which we shall call nonpredicational description or simply a description,*[2] *the subject can be considered neither the premise of some judgment nor something about which a predication is made. Rather, the subject of the sentence is nothing more than an item which stands in a particular relation to the verb of the sentence, just as the object, if the sentence has one is an item which stands in a particular relation to the verb.* […]*"* (Kuroda 1965, p. 37. Underlines are his.)

An example of a nonpredicational description is "hito-ga macikado-ni tat-te i-ru" (Kuroda 1965, p. 46).

Kuroda's description of the exhaustive *ga* follows below.

> *"Now if, on the one hand, use of the ga-phrase is restricted to nonpredicational descriptions and, on the other hand, use of the copulative expression byooki-da is restricted to predications, then it should follow that the ga-phrases can never be the subject of the predicate byooki-da. But this is not true, as seen below:*
> *(57) ano-hito-ga byooki-da.*
> *that man sick*
> *That man is sick*
> *(58) John-ga byooki-da.*
> *John is sick*
> *The English translations of (57) and (58) do not really help to clarify the meaning of these two sentences. The two English sentences are more naturally taken to be translation of:*
> *(59) ano-hito-wa byooki-da.*
> *That man is sick.*
> *(60) John-wa byooki-da.*
> *John is sick.*
> *which represent the familiar type of predication. But sentences (57) and (58) are not descriptions either; seeing John lying on a bed, one would say:*
> *(61) a, John-ga byooki-de ne-te i-ru.*
> *sleep (lie)*
> *Oh, John is lying sick (on the bed).*
> *but not:*
> *(61) a, John-ga byooki-da.*
> *Oh, John is sick.*

attention

The difference between the kind of judgment represented by (57) and (58) and that represented by (59) and (60) lies in the fact that (57) and (58) mean not only that that man is sick and John is sick in the usual reading of these English sentences, but also, conversely, the sick one is that man and the sick one is John. Sentences (57) and (58) characterize that man and John by the property of sickness, rather than just attributing that property to them. This characterization is, of course, made within some relativized universe. In the actual discourse the universe is explicitly or implicitly delimited, so that the characterization takes place within those limits (which may be vacuous, i.e., the relativized universe may coincide with the whole universe). Let us give an example. Assume that a doctor is called, and when he comes he finds three people, John, Bill, and Tom lying in bed. He then wants to know which one of them is sick. When his question is answered, the relativized universe includes only the three people in bed. If the answer is (58), then John, but neither Bill nor Tom, is sick. If, on the contrary, John and Bill are sick, but not Tom, the answer should be:

(63) John-to Bill-ga byooki-da.
John and Bill are sick.

On the other hand, if the doctor is given (60) as an answer, then he knows that John is sick, but he gets no information about the other two.

The following two sentences can replace (58) and (63), respectively:

(64) byooki-na-no-wa John da.
The one who is sick is John.

(65) byooki-na-no-wa John-to Bill-da
Those who are sick are John and Bill.

These forms can be considered as derived from (58) and (63) by a transformation, but we will not discuss that transformation here.

As an another example one may say:

(66) ningen-ga hane-no-na-i nihon-asi-no doobucu-da.
man feather-not two-leg animal
A man is a featherless biped.

characterizing human beings by that property. In this case one may say that the relativized universe of the characterization coincides with the whole universe, and in this sense (66) may be taken as a generic statement." (Kuroda 1965, pp. 48-50. Underlines are his.)

In Kuno (1973) and Kuroda (1965), using Kuno's terminoogy, neutral description is pure description of what can be said about the subject in an event or stiation, and exhaustive listing "singles out" the one that satisfies the predicate from the "registry" (Kuno's term) or "relativized universe" (Kuroda's term).

What seems to be the same distinction was pointed out by Imbrie (1914). Imbrie classified *ga* into four classes. Class I is the use of *ga* with a wh-word, such as *doko* or *dare*. An example of Class I *ga* is "Dare ga iin ni narimashita ka" (p. 4). Class II seems to be the exhaustive *ga* in Kuno's terms. An example of Class II *ga* is "Kore ga byōin da" (p. 6). Class III is the use of *ga* with "incisive precision." An example of Class III *ga* is "Sore ga hontō de gozaimasu" (p. 8). Class IV seems to be the descriptive *ga* in Kuno's terms. An example of Class IV *ga* is "Sakuban kaji ga arimashita" (p. 11).

By way of precaution, the following are excerpts from Imbrie's descriptions of the four classes of *ga*.

"CLASS I.

Subject and predicate are connected by Ga, when the subject is one of the interrogative pronouns. These are Dare, donata, dochira, dore (with its adjective form dono) and nani: Who? which? what? Doko, Where? (what part of?) when the subject, is also followed by Ga." (Imbrie 1914, p. 4)

"CLASS II.

Subject and predicate are connected by Ga, when the purpose of the sentence is to indicate, or (in questions) to determine, which one of a number is the subject by which in fact the predicate is qualified." (Imbrie 1914, p. 6. Underline is mine.)

"CLASS III.

Subject and predicate are connected by Ga, when the purpose of the sentence is to indicate, or (in questions) to determine, the subject with incisive precision." (Imbrie 1914, p. 8)

"CLASS IV.

Subject and predicate are connected by Ga, when attention is directed to the subject, though without the selective emphasis of Class II, or the incisive precision of Class III. Generally however, though not always, in such sentences in English there is at least an appreciable emphasis on the subject." (Imbrie 1914, pp. 10-11. Underline is mine.)

The explanations and examples suggest that Kuno (1973), Kuroda (1965), and Imbrie (1914) all highlight the same distinction. It appears, therefore, that Imbrie's description was overlooked. (To confirm my interpretation of the situation, I consulted Kondo (p.c.). After kindly reviewing Imbrie's monograph, he agreed that the two linguists seem to have overlooked this description, which preceded theirs by decades. He further noted that, to his knowledge, Imbrie's classification of *ga* has never been introduced in the literature.)

It is also notable that Imbrie (1914) classified *wa* into four classes. It seems that the distinction between Class II and Class IV well corresponds to the distinction between the contrastive and thematic *wa*'s.

Kuno (1973) puts forth the following sentence as an example of the exhaustive *ga*. In his words, this sentence means "(Of all the people we are talking about) John (and only John) is a student; it is John who is a student" (p. 51), which seems to fit well with what I can observe in my introspection.

jon ga gakusei desu. — It is John who is a student.

(The Japanese sentence and the English translation are both from Kuno 1973, pp. 38, 51, 60. Romanization of Japanese has been altered.)

Kuno's explanation of the exhaustive *ga* is sufficiently precise for our purpose. To cite his words again, "all the people we are talking about" should correspond to what we call the context (see notes below as what it takes to be "the people we are talking about" may need some attention). Within the context, John is a student, and everybody else is not a student. In our notation, Kuno's account can be represented as the following:

$$\begin{cases} \text{John is a student} \\ \text{John}' \text{ is not a student} \\ \text{John}'' \text{ is not a student} \end{cases}$$

He seems to have failed in his wording to be precise about the distinction between pragmatics and semantics. He claims that, taken literally, whether a given object or concept can be used as a theme of a sentence depends on whether the object or concept has been mentioned in the discourse:

> *"It seems that only objects and concepts that have been mentioned and recorded in the registry of the present discourse can become themes of sentences. [...] Objects of some specific references are added to the registry of the current discourse the first time they are mentioned[.] [...] Only after this entry in the registry is accomplished can they become themes of sentences."* (Kuno 1973, p. 39)

It is difficult for me to believe that he truly intended to claim what this assertion seems to contend. The grammaticality of a (non)sentence is independent of the discourse. A speaker of a language can utter a sentence that deviates from the discourse. Take the following discourse as an example:

> John said he liked Sarah.
> The cat walks, but the books need a shower and medication.

Compare:

> John said he liked Sarah.
> *Liked John she too Sarah said.

The first discourse is made of acceptable sentences only, but it is odd because the second sentence does not seem to fit into the conversation. This utterance is wellformed and deviant. The second discourse, in contrast, has an illformed utterance (a nonsentence), but a charitable mind would promptly comprehend that the second speaker wants to say "Sarah said she liked John too," which perfectly fits in the conversation. This utterance is illformed and cooperative. Illformedness and deviance are different.

Perhaps he meant some hypothetical discourse the sentence assumes which under the ideal condition the actual discourse mirrors completely. (The discussion in the body text is based on this assumption.) Maybe this kind of idealization should be understood without saying, just like other types of idealization conventionally done in linguistics. But here it seems crucial to draw the line between inferences made from the actual, objectively observable elements in a discourse and elements that a sentence or parts of a sentence refer to. When we talk about the intrinsic meaning of a sentence, we should only talk about the latter.

Some may have noticed that the semantic representation of #JGGD# above is analogous to that of #MSKN#, reproduced below:

$$\begin{cases} \text{Mugi is cute} \\ \text{Mugi}' \text{ is not cute} \\ \text{Mugi}'' \text{ is not cute} \end{cases}$$

(Reproduced)

I do not claim that *jon shika gakusei ja arimasen* is completely synonymous with #JGGD#. The difference between *ga* and *shika ... nai* comes from somewhere else than what the prime notation can cover. Part of the difference will be treated in Chapter Two. As far as the prime notation is concerned, the two constructions are equal. The prime notation is not the whole picture.

The meaning of *shika* and *ga* can be schematized as follows:

<u>Observation of *shika* and the exhaustive *ga*</u>:

The meaning of a sentence X *shika* Y *nai* is schematized as: $\begin{cases} X' \text{ not } Y \\ X'' \text{ not } Y. \\ X\ Y \end{cases}$

The meaning of a sentence X *ga* Y, where *ga* is the exhaustive *ga*, is schematized as: $\begin{cases} X\ Y \\ X' \text{ not } Y\ . \\ X'' \text{ not } Y \end{cases}$

(Seeing them as sets, they are identical, but for now we pretend that the order of elements matters without stating how.)

We can obtain the meaning of the neutral *ga* by simply removing the lines of the primed topics from the meaning of the exhaustive *ga*. As Kuno observes, the neutral *ga* is more restricted in distribution than the exhaustive *ga*. It must appear with a predicate that represents, in his words, “an action, existence, or temporary state” (p. 60).

jon ga gakusei desu. — It is John who is a student. (Exhaustive)

(Reproduced)

jon ga kita. — John came. (Neutral) / It was John who came. (Exhaustive)

(The Japanese sentence and the English translation are from Kuno 1973, pp. 53, 60. Romanization of Japanese has been altered.)

The latter can be transcribed as:

John came (Neutral)

$$\begin{cases} \text{John comes} \\ \text{John}' \text{ does not come (Exhaustive)} \\ \text{John}'' \text{ does not come} \end{cases}$$

<u>Observation of the descriptive *ga*</u>:

The meaning of a sentence X *ga* Y, where *ga* is the neutral *ga*, is schematized as: $X\ Y$.

Similarly, a sentence with *mo* can be schematized as follows (recall #MMK#):

<u>Observation of *mo*</u>:

The meaning of a sentence X *mo* Y is schematized as: $\begin{cases} X\ Y \\ X'\ Y \end{cases}$

Lastly, let us take *wa* as an example of an article. The mainstream treatment of this article is to divide it broadly into two kinds: the contrastive *wa* and the thematic *wa*. In our framework, this particular distinction is considered inessential. The prime notation treats them identically. Later chapters sporadically discuss how the conventional categories are described in our theory of semantics. Readers who are distracted by the familiar distinction are asked to interpret *wa* as the contrastive one unless otherwise noted.

Consider the following sentence:

(satoko wa pātī ni kita kedo) masao wa konakatta.

(From Tsujimura 2007, p. 408. Parentheses are mine. Romanization is altered.)

The part *masao wa konakatta* is represented in the prime notation as:

$$\begin{cases} \text{Masao does not come} \\ \text{Masao}' \text{ comes} \end{cases}$$

In this particular case, we can infer from the parenthesized part that the primed topic refers to *Satoko*. But primed topics are inherently implicit. This is shown by the following example:

tōkyōni wa jon ga iru.

(From Kubo 1994, p. 26. Romanization is altered.)

This sentence is interpreted as the following:

$$\begin{cases} \text{In Tokyo John is present} \\ \text{In Tokyo}' \text{ John is not present} \end{cases}$$

In this case, we do not know what the primed topic *in Tokyo′* refers to.

<u>Observation of *wa*</u>:

The meaning of a sentence X *wa* Y is schematized as: $\begin{cases} X\ Y \\ X' \text{ not } Y \end{cases}$

Compare this with the case of *ga*. In both cases, like *shika*, the semantic representation includes primed topics and each primed topic present is specified for the polarity of the predicate. The article decides which topics are present and which of them receives which polarity.

Why three topics?

Each context has exactly three topics. The prime symbol is only used for two of the topics, one with just one prime, and the other with two primes. When all three topics appear, we know that the context is exhausted. (Each primed topic does not necessarily correspond nicely to a worldly entity. Surely when you refer to a person in your sentence you can think of more than three people in the context.)

A practical implication of having more than two topics in a context is shown by #MMK#. Unlike #MSKN#, even within the context of *mugi* we do not know who else is cute. If in the context of *mugi* of #MMK# the primed topics are *Bibi* and *Runa*, the other cute one is either *Bibi* or *Runa*, but we do not know which. This is because *mugi mo* is a *non-exhaustive reference* with respect to the context of *mugi* whereas *mugi shika* is an *exhaustive reference*.

The meaning of #MMK# can be written as the following:

$$\begin{cases}\text{Mugi is cute}\\ \text{Mugi}' \text{ is cute}\end{cases}$$

<u>Convention 1.2</u>:

i) When we refer to only one of the primed topics, we use exactly one prime.

If the contents of a context are variable, why do we restrict a context to have exactly three topics? Assume that we alternatively have a context with four topics. In this case, a context would have three primed topics: $\left[X, X', X'', X'''\right]$. An exhaustive reference would make use of three primed topics, and a non-exhaustive reference one or two. Here is the problem with this alternative system: in the reference dialect, we do not (yet) find a minimal contrast between an expression that refers to exactly two out of three primed topics and one that refers to exactly one. If such a case is found, our three-topic system is then falsified.

Roughly speaking, for given X, X' is "something else," and $\{X', X''\}$ is "all else." A four-topic system would introduce another mode of quantification in between. Whether a four-topic system is generally unfit for human language would be an interesting area of investigation.

Node structures and operations

The vinculum notation

Recall that #MSKN# means $\begin{cases}\text{Mugi is cute}\\ \text{Mugi}' \text{ is not cute}\\ \text{Mugi}'' \text{ is not cute}\end{cases}$. Here, the topic *Mugi* receives *is cute* while the primed topics receive *is not cute*. We are dealing with two different *comments* for this sentence. The difference between *is cute* and *is not cute* lies in the polarity. The former is positive and the latter negative. This is an example of a case where for the same sentence topics of the same context receive comments of opposite polarities.

The semantic form of the predicate of this type of sentence contains both versions of the comments. At the same time, the sentence needs to know which topics receive which comments. We need some means to "divide" the comments and the topics into two groups: one that has the positive comment and the corresponding topics, and the other that has the negative comment and the corresponding topics. We use the following notation to implement such a mechanism (the vinculum notation):

$$\text{kawaiku nai} \text{ — } \frac{\text{is not cute}}{\text{is cute}}$$

$$\text{mugi shika} \text{ — } \frac{\text{Mugi}', \text{Mugi}''}{\text{Mugi}}$$

Each side of the vinculum (the line in the middle, as shown above) of a node is called a *half* (plural: *halves*). The one on the upper side of the vinculum is the *upper half*. The one on the lower side the *lower half*. A half may contain more than one topics, separated by commas. The usage of the comma will be explained later, but here what matters is that the primed topics of *mugi shika* are in the upper half.

When the node of the topics and the node of the predicates merge, the upper half *matches* with the other upper half, and the lower half matches with the other lower half. In the case of #MSKN#, when *mugi shika* merges with *kawaiku nai,* the topics *Mugi′* and *Mugi′′* match with the comment *is not cute,* and the topic *Mugi* matches with the comment *is cute*.

The dot notation

When halves A and B match, we write $A \cdot B$, in which the dot is called the *operator* of the match and A and B the *operands.* The terms operator and operand are used concerning a given match. When we refer to the symbol in other contexts, the dot is called simply a *dot*.

When $\frac{A}{B}$ and $\frac{C}{D}$ merge, A and C and B and D match, where A, B, C, and D are the operands of the matches. As a result, we get $\frac{A \cdot C}{B \cdot D}$. In the tree notation, this operation is represented as:

$$
\begin{array}{ll}
\frac{A}{B} & \frac{C}{D} \\
\multicolumn{2}{l}{\frac{A \cdot C}{B \cdot D}}
\end{array}
$$

An operand may be a *bundle*. A bundle is a list of topics (the order matters) represented in the form A, B or A, B, C, where A, B, and C are topics.

In the following example, the list A, B matches with X.

$$
\begin{array}{ll}
\frac{A, B}{C} & \frac{X}{Y} \\
\multicolumn{2}{l}{\frac{A, B \cdot X}{C \cdot Y}}
\end{array}
$$

#MSKN# is an example of a sentence with this exact structure:

$$
\begin{array}{ll}
\frac{\text{Mugi}', \text{Mugi}''}{\text{Mugi}} & \frac{\text{is not cute}}{\text{is cute}} \\
\multicolumn{2}{l}{\frac{\text{Mugi}', \text{Mugi}'' \cdot \text{is not cute}}{\text{Mugi} \cdot \text{is cute}}}
\end{array}
$$

Mood

Semantic derivation begins from a linear sequence of the terminal nodes of a tree corresponding to the sentence in question. This linear sequence is called the *base structure*, or the *base* for short. The tree is formed in a step-by-step fashion, with each step involving two nodes merging. The root node is obtained by merging a node with a special node called *mood*. When a node merges with a mood, the node is converted to a list of *implications*. This list is called the *body* of the clause and is shown with brackets: []. An implication represents part of the surface meaning of the sentence. Implications are represented in such a way that they are similar to natural language, but the method of precise interpretation will be discussed later.

A mood is placed in the base as the rightmost node of the clause. For example, #MSKN# is represented as the following:

$$
\begin{array}{lll}
\frac{\text{Mugi}', \text{Mugi}''}{\text{Mugi}} & \frac{\text{is not cute}}{\text{is cute}} & . \\
\multicolumn{2}{l}{\frac{\text{Mugi}', \text{Mugi}'' \cdot \text{is not cute}}{\text{Mugi} \cdot \text{is cute}}} & \\
\multicolumn{3}{l}{\begin{bmatrix} \text{Mugi}' \cdot \text{is not cute} \\ \text{Mugi}'' \cdot \text{is not cute} \\ \text{Mugi} \cdot \text{is cute} \end{bmatrix} .}
\end{array}
$$

The mood of this sentence is represented by the symbol . (period). This mood is called the indicative mood. It is used to indicate that the sentence is a declarative sentence.

In the simplest case, the body of a sentence is obtained by simply ignoring the vinculum of the node merging with the mood. $\dfrac{A \cdot C}{B \cdot D}$ is converted to $\begin{bmatrix} A \cdot C \\ B \cdot D \end{bmatrix}$. This process of converting and merging a node with a mood is called *finalization*:

Convention 1.3:

i) $\dfrac{A \cdot C}{B \cdot D} \qquad M$

$$\begin{bmatrix} A \cdot C \\ B \cdot D \end{bmatrix} M$$

(M stands for a mood.)

When merging with a mood, a node $\dfrac{A \cdot C}{B \cdot D}$ is *finalized as* a list of implications $\begin{bmatrix} A \cdot C \\ B \cdot D \end{bmatrix}$ (the vertical order matters). The product of this merge is represented as $\begin{bmatrix} A \cdot C \\ B \cdot D \end{bmatrix} M$.

ii) $\dfrac{A, B \cdot X}{C \cdot Y} \qquad M$

$$\begin{bmatrix} A \cdot X \\ B \cdot X \\ C \cdot Y \end{bmatrix} M$$

In finalization, an operand matched with a bundle is duplicated and distributed to each of the elements of the bundle.

THE NULL TOPIC

#MMK# means $\begin{cases} \text{Mugi is cute} \\ \text{Mugi}' \text{ is cute} \end{cases}$. This corresponds to the set of implications $\begin{bmatrix} \text{Mugi} \cdot \text{is cute} \\ \text{Mugi}' \cdot \text{is cute} \end{bmatrix}$. According to Convention 1.3, the implications can be obtained from:

Mugi, Mugi′ · is cute.

We want to represent this as a form with a vinculum. As a placeholder, we define the *null topic*, represented by the symbol 0 as defined in Convention 1.4:

Convention 1.4:

i) $\dfrac{X \cdot Y}{0 \cdot Z} = \dfrac{X \cdot Y}{0}$

$\dfrac{X \cdot Y}{0 \cdot Z}$ is equivalent to $\dfrac{X \cdot Y}{0}$.

ii) $\dfrac{X \cdot Y}{0} \qquad M$

$$[X \cdot Y]\, M$$

$\dfrac{X \cdot Y}{0}$ is finalized as $[X \cdot Y]\, M$.

iii) $\dfrac{X \cdot Y}{0 \cdot Z} \qquad M$

$$[X \cdot Y]\, M$$

Therefore, $\dfrac{X \cdot Y}{0 \cdot Z}$ is finalized as $[X \cdot Y]\, M$.

Consequently, the meaning of #MMK# is given as follows:

$$\frac{\text{Mugi, the other}}{0}\ \frac{\text{is cute}}{\text{is not cute}}\ .$$

$$\frac{\text{Mugi, Mugi}' \cdot \text{is cute}}{0 \cdot \text{is not cute}} = \frac{\text{Mugi, Mugi}' \cdot \text{is cute}}{0}$$

$$\begin{bmatrix} \text{Mugi} \cdot \text{is cute} \\ \text{Mugi}' \cdot \text{is cute} \end{bmatrix}.$$

The dummy

In some cases we want the structure $\frac{X \cdot Y}{0}$ but do not want X to have a concrete meaning. For such cases we use the symbol α and obtain $\frac{\alpha \cdot Y}{0}$. The symbol α is called a *dummy*.

Dummies are necessary only for derivation. On finalization, we apply the following convention:

<u>Convention 1.5</u>:

i) $[\alpha \cdot X] \to [X]$

When an implication would otherwise have α, the α and the accompanying dot are deleted.

Negation

Yasashii and *yasashiku nai* take the following forms:

yasashii — $\frac{\text{is kind}}{\text{is not kind}}$

yasashiku nai — $\frac{\text{is not kind}}{\text{is kind}}$

Shika is sensitive to negation (**Mugi shika kawaii*). There must be some way to structurally distinguish the negative form such as *yasashiku nai* and the positive form of the same "basic" item such as *yasashii*. To accomplish this, we introduce the forms $\frac{\neg X}{X}$ and $\frac{X}{\neg X}$. The former corresponds to the negative version of a predicate, and the latter the positive version. We may refer to the former a negative predicate and the latter a positive predicate.

<u>Convention 1.6</u>:

i) $\neg X$ denotes the negative counterpart of X.

The nodes of *yasashii* and *yasashiku nai* are represented as follows:

yasashii — $\frac{\text{is kind}}{\neg\text{is kind}}$

yasashiku nai — $\frac{\neg\text{is kind}}{\text{is kind}}$

The new notation allows us to express *shika*'s sensitivity to negation:

<u>Observation</u>:

A phrase headed by *shika* requires $\frac{\neg X}{X}$.

An interesting case regarding this requirement is illustrated by the following example:

> erebētāde shika idō ga muzukashii kata ga imasu. — There are those for whom only using an elevator it is not difficult to move. (Naturally: "For some people, it is difficult to move without an elevator.")
>
> (<u>https://www.asahi.com/articles/DA3S15370750.html</u>)

The form *muzukashii* used here is not a typical negative form. For this reason, some people question the correctness of this sentence. It is likely that the sentence is ungrammatical for some people and grammatical for the others. It is possible that the two groups of people have different grammars, but a simpler solution is to attribute the difference to lexical entries. Suppose that the form *muzukashii* corresponds to either one of the following semantic forms depending on the speaker:

$\frac{\text{is difficult}}{\neg\text{is difficult}}$

$\frac{\neg\text{is not difficult}}{\text{is not difficult}}$

They mean roughly the same thing, but the former does not satisfy the requirement of *shika* while the latter does as it is in the form of $\frac{\neg X}{X}$.

Hence, it can be hypothesized that those who accept this sentence have the latter form as a semantic form of *muzukashii* in their lexicon, perhaps with a semantic feature (see *Proposing*, p. lungs) that indicates the item is "non-standard" (e.g., [+ colloquial]), and those who reject it does not.

Serials and parallels

To obtain the forms such as $\frac{\textit{is kind}}{\neg \textit{is kind}}$ and $\frac{\neg \textit{is kind}}{\textit{is kind}}$ from a more "basic" form like *is kind*, we define two forms as possible nodes: $X : \frac{X}{\neg X}$ and $X : \frac{\neg X}{X}$.

These are functions that take some input X and return $\frac{X}{\neg X}$ and $\frac{\neg X}{X}$, respectively. If the input is *is kind*, the outputs are $\frac{\textit{is kind}}{\neg \textit{is kind}}$ and $\frac{\neg \textit{is kind}}{\textit{is kind}}$. This allows us to treat *is kind* as a node. The following sentences are examples of how the functions work with the input.

yasashii. — is kind.

$$\text{is kind} \quad X : \frac{X}{\neg X}$$
$$\frac{\text{is kind}}{\neg\text{is kind}}$$

and,

yasashiku nai — is not kind

$$\text{is kind} \quad X : \frac{\neg X}{X}$$
$$\frac{\neg\text{is kind}}{\text{is kind}}$$

A node in the form $\frac{X}{Y}$ is a *parallel*. As a parallel has one operand on each side of a vinculum, it needs to merge another parallel for the operands to match.

Once two parallels, for example, $\frac{X}{Y}$ and $\frac{A}{B}$, merge, the resulting node, $\frac{X \cdot A}{Y \cdot B}$, is not a parallel. A node in the form of $\frac{X \cdot A}{Y \cdot B}$ is treated as the same type as a node in the form of X. These forms are called *serial*. A serial cannot merge with a parallel, but it can be taken as an input by a function that returns a parallel. Such a function as a node is called a *parallelizer.*

Nest

There are a few caveats as to when the input of a parallelizer is a complex node like $\frac{X \cdot A}{Y \cdot B}$. Take the following example:

mugi wa miruku wa nonda. — Specifically Mugi drank specifically milk.

$$\text{mugi} \quad X : \frac{X}{X'} \qquad \text{milk} \quad X : \frac{X}{X'} \qquad \text{drink} \; X : \frac{X}{\neg X} \quad X : \frac{X}{\neg X} \quad .$$
$$\frac{\text{Mugi}}{\text{Mugi}'} \qquad \frac{\text{milk}}{\text{milk}'} \qquad \frac{\text{drink}}{\neg\text{drink}}$$
$$\frac{\text{milk} \cdot \text{drink}}{\text{milk}' \cdot \neg\text{drink}}$$
$$\frac{\left(\frac{\text{milk} \cdot \text{drink}}{\text{milk}' \cdot \neg\text{drink}}\right)}{\neg\left(\frac{\text{milk} \cdot \text{drink}}{\text{milk}' \cdot \neg\text{drink}}\right)}$$
$$\frac{\text{Mugi} \cdot \left(\frac{\text{milk} \cdot \text{drink}}{\text{milk}' \cdot \neg\text{drink}}\right)}{\text{Mugi}' \cdot \neg\left(\frac{\text{milk} \cdot \text{drink}}{\text{milk}' \cdot \neg\text{drink}}\right)}$$
$$\begin{bmatrix} \text{Mugi} \cdot \begin{cases} \text{milk} \cdot \text{drink} \\ \text{milk}' \cdot \neg\text{drink} \end{cases} \\ \text{Mugi}' \cdot \neg \begin{cases} \text{milk} \cdot \text{drink} \\ \text{milk}' \cdot \neg\text{drink} \end{cases} \end{bmatrix} .$$

This sentence has two arguments: *mugi wa* and *miruku wa*. The first innermost argument is *miruku wa* or $\frac{milk}{milk'}$, which can be taken by $\frac{drink}{\neg drink}$. When they merge, the result is $\frac{milk \cdot drink}{milk' \cdot \neg drink}$. This form is a serial. Because of this, the second innermost argument $\frac{Mugi}{Mugi'}$ cannot directly merge with it. The predicate needs to be parallelized once again: $\frac{\left(\frac{milk \cdot drink}{milk' \cdot \neg drink}\right)}{\neg\left(\frac{milk \cdot drink}{milk' \cdot \neg drink}\right)}$. This form looks monstrous, but it follows the same principle of X: $\frac{X}{\neg X}$. If the input is $\frac{milk \cdot drink}{milk' \cdot \neg drink}$, the output is plainly $\frac{\left(\frac{milk \cdot drink}{milk' \cdot \neg drink}\right)}{\neg\left(\frac{milk \cdot drink}{milk' \cdot \neg drink}\right)}$. The parentheses are given for visual clarity. This big parallel can finally merge with $\frac{Mugi}{Mugi'}$.

When the node $\frac{Mugi \cdot \left(\frac{milk \cdot drink}{milk' \cdot \neg drink}\right)}{Mugi' \cdot \neg\left(\frac{milk \cdot drink}{milk' \cdot \neg drink}\right)}$ is finalized, the subform $\left(\frac{milk \cdot drink}{milk' \cdot \neg drink}\right)$ is converted to the form $\begin{cases} milk \cdot drink \\ milk' \cdot \neg drink \end{cases}$ within the resulting implication. Such a structure is called a *nest*. A nest is a special type of *segment*, which we will discuss later.

Now, introspect into #MWMWN# and find that this sentence means roughly the following:

$$\begin{cases} \text{Mugi} \cdot \text{milk} \cdot \text{drink} \\ \text{Mugi} \cdot \text{milk}' \cdot \neg\text{drink} \\ \text{Mugi}' \cdot \text{milk} \cdot \neg\text{drink} \\ \text{Mugi}' \cdot \text{milk}' \cdot \neg\text{drink} \end{cases}$$

Comparing it with the root node $\begin{bmatrix} Mugi \cdot \begin{cases} milk \cdot drink \\ milk' \cdot \neg drink \end{cases} \\ Mugi' \cdot \neg \begin{cases} milk \cdot drink \\ milk' \cdot \neg drink \end{cases} \end{bmatrix}$. , we find that when interpreting an implication with a nest the operand on the left side of the nest is distributed to each of the lines inside of the nest. That is, the form $X \cdot \begin{cases} A \\ B \end{cases}$ in a root node is interpreted to mean $\begin{cases} X \cdot A \\ X \cdot B \end{cases}$.

Additionally, when negation is applied to a nest, the negator is "moved" to the top line of the nest. That is, the form $\neg\begin{cases} A \\ B \end{cases}$ in a root node is interpreted to mean $\begin{cases} \neg A \\ B \end{cases}$.

These two rules of interpretation will be restated in Chapter Two.

Identity index

A sentence with a relative clause can be decomposed into multiple sub-sentences. Take the following example:

oishii miruku shika nomanakatta. — drank only milk that is tasty.

The meaning of this sentence can be broken down into:

$$\begin{cases} \text{drank milk}_1 \\ \text{didn't drink anything else} \\ \text{milk}_1 \text{ is tasty} \end{cases}$$

That is, this sentence is a combination of the following two sub-sentences, each of which can be adequately interpreted as shown:

miruku *oishii*

$$\mathrm{milk}_1 \quad X : \frac{X}{0} \ \text{is tasty} \quad X : \frac{X}{\neg X} \quad M$$

$$\frac{\mathrm{milk}_1}{0} \qquad \frac{\text{is tasty}}{\neg\text{is tasty}}$$

$$\frac{\mathrm{milk}_1 \cdot \text{is tasty}}{0}$$

$$\left[\mathrm{milk}_1 \cdot \text{is tasty}\right] M$$

miruku *shika* *nom* *anakatta*

$$\mathrm{milk}_1 \quad X : \frac{X', X''}{X} \quad \text{drink} \quad X : \frac{\neg X}{X} \quad .$$

$$\frac{\mathrm{milk}_1{}', \mathrm{milk}_1{}''}{\mathrm{milk}_1} \qquad \frac{\neg\text{drink}}{\text{drink}}$$

$$\frac{\mathrm{milk}_1{}', \mathrm{milk}_1{}'' \cdot \neg\text{drink}}{\mathrm{milk}_1 \cdot \text{drink}}$$

$$\begin{bmatrix} \mathrm{milk}_1{}' \cdot \neg\text{drink} \\ \mathrm{milk}_1{}'' \cdot \neg\text{drink} \\ \mathrm{milk}_1 \cdot \text{drink} \end{bmatrix} .$$

The symbol M stands for a mood.

Identity indexes are shown when the same meme appears in multiple terminal nodes or when two memes that need distinction happen to have the same label.

A relative clause is said to be restrictive if the antecedent refers to one of the multiple entities present that are referred to by the same noun. Compare the following:

(1) The house which is empty is available.

(2) The house, which is empty, is available.

(Both from Heim & Kratzer 1998, pp. 87-88)

(1) is intended to be a case of a restrictive relative clause and (2) non-restrictive. For (1) there are potentially multiple houses and the one that is empty is available and for (2) there is only one house and that house happens to be empty and available (Heim & Kratzer 1998, p. 88). In effect, the distinction is simply between the case where the context includes two or more houses and the case where the context includes only one house.

Role

Some lexical items can appear as part of an argument in one sentence and as part of a predicate in another. Nouns are a class of such items. (In *Proposing,* nouns are defined as tokens that are either |m-i or |m-ii, but here the precise definition is inessential.) A noun can appear as part of an argument when followed by an article and as part of a predicate when followed by a copula. Take the following sentence as an example:

saitōsan wa kagakusha desu. — Specifically Saito is a scientist.

saitōsan	*wa*	*kagakusha*	*desu*
Saito	specifically	scientist	is
specifically Saito		is scientist	
specifically Saito is scientist			

Saitōsan and *kagakusha* are nouns, and accordingly their positions can be switched (although the meaning of the sentence will be different):

kagakusha wa saitōsan desu. — Specifically the scientist is Saito.

kagakusha	*wa*	*saitōsan*	*desu*
scientist	specifically	Saito	is
specifically scientist		is Saito	
specifically scientist is Saito			

Observations made in *Proposing* as well as the informal transcriptions of the sentence examples above suggest that a copula like *desu* and a noun like *kagakusha* and *saitōsan* has node-hood in semantics. That is, a predicate like *saitōsan desu* or *kagakusha desu* is unlikely to be a terminal node. Therefore we want our grammar to have some mechanism to make the predicate *is Saito* from the combination of *Saito* and *is*, for example.

Consider the following translations of #SWKD# and #KWSD#:

A. Saito is a scientist.

B. The scientist is Saito.

They roughly mean:

A. Saito $\in$ scientist

B. scientist $\in \{\{\text{Saito}\}, \text{Saito}\}$

where *scientist* is the set of all scientists in the discourse for each sentence.

From these transcriptions and the derivational trees given in the previous page, we can infer that the meanings of *Saito* and *is Saito* are:

Saito — Saito

is Saito — $\in \{\{\text{Saito}\}, \text{Saito}\}$

The semantic representations of the original sentences will be given shortly.

Some may feel that the said difference should be attributed to the general difference between a comment and a topic instead. At the moment I am not able to dispute this. Yet, at least as a notational convention, we proceed with the role $_{is}$ placed on a copulative predicate because I feel that clearly indicating the difference with a visible marker is convenient.

We define the following function as a node:

$$X: \frac{{}_{\text{is}}X}{\neg_{\text{is}}X}$$

This function returns $\frac{{}_{is}Saito}{\neg_{is}Saito}$ for the input *Saito*:

$$\text{saito} \qquad X: \frac{{}_{\text{is}}X}{\neg_{\text{is}}x}$$

$$\frac{{}_{\text{is}}\text{Saito}}{\neg_{\text{is}}\text{Saito}}$$

#SWKD# and #KWSD# receive the following derivations:

$$\text{Saito} \qquad X: \frac{X}{X'} \qquad \text{scientist} \;\; X: \frac{{}_{\text{is}}X}{\neg_{\text{is}}X}.$$

$$\frac{\text{Saito}}{\text{Saito}'} \qquad \frac{{}_{\text{is}}\text{scientist}}{\neg_{\text{is}}\text{scientist}}$$

$$\frac{\text{Saito} \cdot_{\text{is}} \text{scientist}}{\text{Saito}' \cdot \neg_{\text{is}}\text{scientist}}$$

$$\begin{bmatrix} \text{Saito} \cdot_{\text{is}} \text{scientist} \\ \text{Saito}' \cdot \neg_{\text{is}}\text{scientist} \end{bmatrix}.$$

$$\text{scientist} \quad X: \frac{X}{X'} \qquad \text{Saito} \quad X: \frac{{}_{\text{is}}X}{\neg_{\text{is}}X}.$$

$$\frac{\text{scientist}}{\text{scientist}'} \qquad \frac{{}_{\text{is}}\text{Saito}}{\neg_{\text{is}}\text{Saito}}$$

$$\frac{\text{scientist} \cdot_{\text{is}} \text{Saito}}{\text{scientist}' \cdot \neg_{\text{is}}\text{Saito}}$$

$$\begin{bmatrix} \text{scientist} \cdot_{\text{is}} \text{Saito} \\ \text{scientist}' \cdot \neg_{\text{is}}\text{Saito} \end{bmatrix}.$$

With the semantic representation of a copula, we can now decompose some items that semantically contains a copula. *Kawaii*, for example, has been transcribed as a combination of *is cute* and $X: \frac{X}{\neg X}$, but now we can extract *is* from *is cute*:

$$\text{cute} \qquad X: \frac{{}_{\text{is}}X}{\neg_{\text{is}}X}$$

$$\frac{{}_{\text{is}}\text{cute}}{\neg_{\text{is}}\text{cute}}$$

This treatment adequately captures the inflection of adjectives. (Note, however, that *kawaii* is not an adjective.) Recall that the adjective paradigm has, among many others, the following suffixes:

i k·i\A4/R1

sa k·i\R2/m-ii

(*Proposing*, pp. meiosis, moose)

The former makes a predicate form of an adjective, and the latter a noun form of it. The following is an example of the former:

$$\text{yasashii} — \frac{{}_{\text{is}}\text{kind}}{\neg_{\text{is}}\text{kind}}$$

This form can be obtained through the following tree:

$$\text{kind} \quad X : \frac{{}_{\text{is}}X}{\neg_{\text{is}}X}$$

$$\frac{{}_{\text{is}}\text{kind}}{\neg_{\text{is}}\text{kind}}$$

The non-predicate, “bare” form of an adjective can be used as a noun. Take the following example:

atsusa ga kibishii. — Exactly the heat is harsh.

$$\text{hot} \quad X : \frac{X}{X', X''} \quad \text{harsh} \quad X : \frac{{}_{\text{is}}X}{\neg_{\text{is}}X}.$$

$$\frac{\text{hot}}{\text{hot}', \text{hot}''} \qquad \frac{{}_{\text{is}}\text{harsh}}{\neg_{\text{is}}\text{harsh}}$$

$$\frac{\text{hot} \cdot_{\text{is}} \text{harsh}}{\text{hot}', \text{hot}'' \cdot \neg_{\text{is}}\text{harsh}}$$

$$\begin{bmatrix} \text{hot} \cdot_{\text{is}} \text{harsh} \\ \text{hot}' \cdot \neg_{\text{is}}\text{harsh} \\ \text{hot}'' \cdot \neg_{\text{is}}\text{harsh} \end{bmatrix}.$$

Switching the linear positions of *hot* and *harsh* automatically switches their syntactic standings:

kibishisa ga atsui. — Exactly the harshness is hot.

$$\text{harsh} \quad X : \frac{X}{X', X''} \quad \text{hot} \quad X : \frac{{}_{\text{is}}X}{\neg_{\text{is}}X}.$$

$$\frac{\text{harsh}}{\text{harsh}', \text{harsh}''} \qquad \frac{{}_{\text{is}}\text{hot}}{\neg_{\text{is}}\text{hot}}$$

$$\frac{\text{harsh} \cdot_{\text{is}} \text{hot}}{\text{harsh}', \text{harsh}'' \cdot \neg_{\text{is}}\text{hot}}$$

$$\begin{bmatrix} \text{harsh} \cdot_{\text{is}} \text{hot} \\ \text{harsh}' \cdot \neg_{\text{is}}\text{hot} \\ \text{harsh}'' \cdot \neg_{\text{is}}\text{hot} \end{bmatrix}.$$

Given that we have only dealt with very superficial aspects of the language—we have not even considered semantic subcomponents of a noun, which probably include number, specificity, definiteness, animacy, etc—it is reasonable to suspect that what we now regard as the bare form of an adjective is not semantically equal to a noun. While further investigations into the reference dialect may reveal the necessity of additional markers for the “bare” forms of adjectives, I am currently not aware of distinctions further than the binary distinction of predicatehood.

The same treatment can be applied to adjectival nouns. Recall that the adjectival noun paradigm has, among many others, the following suffixes:

[0] km-i\C2

sa km-ii\R2/m-ii

(*Proposing*, p. phenomenal)

The former, since it is |C2, can be used with *desu* to form a predicate:

yama ga kirei desu. — Exactly the mountains are beautiful.

$$\text{mountain} \quad X : \frac{X}{X', X''} \quad \text{beautiful} \, X : \frac{{}_{\text{is}}X}{\neg_{\text{is}}X}.$$

$$\frac{\text{mountain}}{\text{mountain}', \text{mountain}''} \qquad \frac{{}_{\text{is}}\text{beautiful}}{\neg_{\text{is}}\text{beautiful}}$$

$$\frac{\text{mountain} \cdot_{\text{is}} \text{beautiful}}{\text{mountain}', \text{mountain}'' \cdot \neg_{\text{is}}\text{beautiful}}$$

$$\begin{bmatrix} \text{mountain} \cdot_{\text{is}} \text{beautiful} \\ \text{mountain}' \cdot \neg_{\text{is}}\text{beautiful} \\ \text{mountain}'' \cdot \neg_{\text{is}}\text{beautiful} \end{bmatrix}.$$

The latter can be used with *ga* to form an argument:

kenkyosa ga suki desu. — Exactly the humbleness is liked. (Naturally: (I) like the modesty.)

$$\text{humble}X: \frac{X}{X', X''} \quad \text{liked} \qquad X: \frac{{}_{\text{is}}X}{\neg_{\text{is}}X}.$$

$$\frac{\text{humble}}{\text{humble}', \text{humble}''} \qquad \frac{{}_{\text{is}}\text{liked}}{\neg_{\text{is}}\text{liked}}$$

$$\frac{\text{humble} \cdot_{\text{is}} \text{liked}}{\text{humble}', \text{humble}'' \cdot \neg_{\text{is}}\text{liked}}$$

$$\begin{bmatrix} \text{humble} \cdot_{\text{is}} \text{liked} \\ \text{humble}' \cdot \neg_{\text{is}}\text{liked} \\ \text{humble}'' \cdot \neg_{\text{is}}\text{liked} \end{bmatrix}.$$

In ${}_{\text{is}}X$, $_{is}$ is a *role* and X is a *meme.*

> The term “meme” comes from *The Selfish Gene* by Richard Dawkins. In Chapter 6, Dawkins discusses how replication and propagation of aspects of human culture can be understood in the analogy of how genes are replicated and passed down to generations. He calls the notion of a basic replicating unit of idea, habit, or any cultural component that a person can imitate by the term *meme*. Examples of memes Dawkins puts forth include tunes and clothes fashions. As it should be obvious from these examples, the notion applies to a broader context than language. I chose the term because the internal contents of a (linguistic) meme, in our terms, concerning real-world meaning, are invisible to language—it is treated as a basic unit—and because it is replicated and propagated through language—it is a currency of semantics. The former point can be seen in our semantic representations of memes. The symbols such as *humble* and *liked* are nothing more than arbitrary labels, and the grammar knows only that they are distinct; it does not care what *humble* is like to us. The latter point should be self-explanatory. We include memes in our semantic notation because we know for a fact that, trivially, they are included in the meanings of sentences. (Dawkins points out that the idea of God spreads through language.) Since the term “meme” can refer to non-linguistic cultural units of imitation, we could pinpoint the notion of the meme as a component of semantic representation by the term “linguistic meme” or perhaps “semantic meme,” but such a meticulousness would be unnecessary because in the remaining parts of this manuscript we do not mention non-linguistic memes.

Another example of a role is $_{of}$. This role, like $_{is}$, is copular. Unlike $_{is}$, $_{of}$ is used to express possession. Consider the following example:

> watashino pasokon. — it’s my computer.

$$\text{it} \quad X: \frac{X}{0} \qquad \text{computer}_1 \qquad X: \frac{{}_{\text{is}}X}{\neg_{\text{is}}X} \quad .$$

$$\frac{\text{it}}{0} \qquad \frac{{}_{\text{is}}\text{computer}_1}{\neg_{\text{is}}\text{computer}_1}$$

$$\frac{\text{it} \cdot_{\text{is}} \text{computer}_1}{0}$$

$$\left[\text{it} \cdot_{\text{is}} \text{computer}_1\right].$$

$$\text{computer}_1 \quad X: \frac{X}{0}\ \text{me} \qquad X: \frac{{}_{\text{of}}X}{\alpha}\ M$$

$$\frac{\text{computer}_1}{0} \qquad \frac{{}_{\text{of}}\text{me}}{\alpha}$$

$$\frac{\text{computer}_1 \cdot_{\text{of}} \text{me}}{0}$$

$$\left[\text{computer}_1 \cdot_{\text{of}} \text{me}\right] M$$

Combined, this reads, roughly, $\begin{cases} \text{it is computer}_1 \\ \text{computer}_1 \text{ is of me} \end{cases}.$

TYPE

NODE TYPES

The serial, the mood, and the root can be represented without a vinculum. An example of a serial is *Mugi*.

The mood is denoted by the letter M. The root is denoted by the symbol ROOT. The other types are denoted using angle braces with a template of the form inside. The serial is denoted in the form $\langle X \rangle$.

A parallel has a vinculum and a symbol on each side. An example of a parallel is $\frac{{}_{is}cute}{\neg{}_{is}cute}$. This type is denoted by the symbol $\left\langle \frac{X}{Y} \right\rangle$.

A parallelizer has a symbol on the left side followed by a colon, which is then followed by a vinculum with a symbol on each side. An example of a parallelizer is $X\colon \frac{X', X''}{X}$. This type is denoted by the symbol $\left\langle X\colon \frac{Y}{Z} \right\rangle$.

The type of a complex node

The type is determined based on the outermost structure of the node. In the following, the angle brackets $\langle\rangle$ are taken to be a function that takes a semantic object and returns its type.

$$
\begin{aligned}
\langle \text{Mugi} \rangle &= \langle X \rangle \\
\left\langle \frac{{}_{\text{is}}\text{cute}}{\neg{}_{\text{is}}\text{cute}} \right\rangle &= \left\langle \frac{X}{Y} \right\rangle \\
\left\langle X\colon \frac{X', X''}{X} \right\rangle &= \left\langle X\colon \frac{Y}{Z} \right\rangle
\end{aligned}
$$

Nested vinculums are ignored:

$$
\left\langle \frac{\left(\frac{A}{B}\right)}{\left(\frac{C}{D}\right)} \right\rangle = \left\langle \frac{X}{Y} \right\rangle
$$

We parenthesize nested vinculums for visual clarity.

A bundle is treated in the same way as a meme:

$$
\begin{aligned}
\left\langle A\colon \frac{B, C}{D} \right\rangle &= \left\langle X\colon \frac{Y}{Z} \right\rangle \\
\left\langle \frac{\text{Mugi}', \text{Mugi}''}{\text{Mugi}} \right\rangle &= \left\langle \frac{X}{Y} \right\rangle
\end{aligned}
$$

If the outermost vinculum of a form has a dot operator directly placed on it, the form is a serial:

$$
\left\langle \frac{A \cdot B}{C \cdot D} \right\rangle = \langle X \rangle
$$

Type checking on merge

Only the following combinations are allowed to merge:

(1) A serial node followed by a parallelizer node

$\langle X \rangle$ $\left\langle X\colon \frac{Y}{Z} \right\rangle$

$\left\langle \frac{X}{Y} \right\rangle$

(2) A parallel node followed by another parallel node

$\left\langle \frac{X}{Y} \right\rangle$ $\left\langle \frac{X}{Y} \right\rangle$

$\langle X \rangle$

(3) A serial node with a mood

$\langle X \rangle$ M

ROOT

Type checking on the base

At the base, only serials, parallelizers, and the mood are allowed.

CHAPTER TWO: TRUTH-CONDITIONAL MEANING

TRUTH CONDITION

Proposal, entailment, and proposition

The root node derives a *proposal*. A proposal is a structure of a list of *entailments* and the mood passed from the root node. An entailment is a statement of whether a specific *proposition* is true (+) or false (−) and is represented in the form $\pm P$, where ± stands for the truth value and P the proposition. A proposition is a statement that is true or false for some event.

Convention 2.1:

i) $\begin{bmatrix} X \\ \$Y \end{bmatrix} M \rightarrow \begin{vmatrix} \pm X \\ \pm Y \end{vmatrix} M$

When converting a root node to a proposal, $ is ignored. (The symbol $ will be explained in Chapter three.)

ii) $\begin{bmatrix} \neg X \\ Y \end{bmatrix} M \rightarrow \begin{vmatrix} -X \\ +Y \end{vmatrix} M$

(where X and Y do not contain a negater.)

An implication with a negater is converted to a negative entailment. A proposition cannot have a negater.

iii) $\left[X \cdot \begin{Bmatrix} Y \\ Z \end{Bmatrix} \right] M \rightarrow \begin{vmatrix} \pm X \cdot Y \\ \pm X \cdot Z \end{vmatrix} M$

An implication with nests, the segment governing the scope is distributed to the nests to form multiple entailments.

iv) $\left[\neg \begin{Bmatrix} X \cdot A \\ X \cdot B \end{Bmatrix} \right] M \rightarrow \begin{vmatrix} -X \cdot A \\ +X \cdot B \end{vmatrix} M$

(where X, A, and B do not contain a negator or prime symbol.)

v) $\left[\neg \begin{Bmatrix} X' \cdot Y \\ X'' \cdot Y \\ X \cdot Y \end{Bmatrix} \right] M \rightarrow \begin{vmatrix} -X' \cdot Y \\ +X \cdot Y \end{vmatrix} M$

(where X and Y do not contain a negator.)

In a tree, we put the proposal below the root node with one less tab space on the left. In the following sentence, $\begin{vmatrix} -\,strawberry' \cdot eat \\ -\,strawberry'' \cdot eat \\ +\,strawberry \cdot eat \end{vmatrix}$. is the proposal.

ichigo dakeo tabeta. — (I) ate only strawberries.

BASE strawberry $X: \dfrac{\neg(X', X'')}{\neg X}$ eat $X: \dfrac{X}{\neg X}$.

$$\dfrac{\dfrac{\neg\left(\text{strawberry}', \text{strawberry}''\right)}{\neg\text{strawberry}} \quad \dfrac{\text{eat}}{\neg\text{eat}}}{\dfrac{\text{strawberry}', \text{strawberry}'' \cdot \neg\text{eat}}{\text{strawberry} \cdot \text{eat}}}$$

ROOT $\begin{bmatrix} \text{strawberry}' \cdot \neg\text{eat} \\ \text{strawberry}'' \cdot \neg\text{eat} \\ \text{strawberry} \cdot \text{eat} \end{bmatrix}$.

MEANING $\begin{vmatrix} -\,\text{strawberry}' \cdot \text{eat} \\ -\,\text{strawberry}'' \cdot \text{eat} \\ +\,\text{strawberry} \cdot \text{eat} \end{vmatrix}$.

To be precise, the semantic form of this sentence should include the agent. Here and elsewhere, some covert arguments may be omitted for simplicity. When arguments are omitted from the tree structure, the corresponding parallelizers are also omitted. See Chapter Four for why this is necessary.

Henceforth, we use labels for visual clarity. BASE, ROOT, and MEANING are given alongside the base structure, the root node, and the surface meaning of the sentence, respectively. Later we will use the labels SYNTAX and PHONOLOGY for syntactic and phonological structures, respectively.

The article *dakeo* and related conventions are covered in Chapter Three.

Event

An *event* is a set of segments. A proposition is true for an event iff all of its segments are included in the event. Suppose that the speaker is aware of the following two events:

event_1 = {festival, tomorrow, I, you, Yoshimi, go, …}

event_2 = {doughnut, eat, I, yesterday, …}

To be precise about the meaning of an event, segments need to have a role. From {doughnut, eat, I, …} alone, we cannot tell if *I ate a doughnut* or *a doughnut ate me*. To determine the semantic relations, we can rewrite event_2 as:

event_2 = {$_{\text{on}}$doughnut, $_{\text{do}}$eat, $_{\text{by}}$I, $_{\text{at}}$yesterday, …}

Then we can see that, for the action (marked by $_{do}$) *eat*, the patient (marked by $_{on}$) is *doughnut,* the agent (marked by $_{by}$) is *I*, and the time (marked by $_{at}$) is *yesterday*. However, for brevity, I often leave roles implicit.

For convenience, we assume that the referent event is magically given for each proposal. Event assignment would be able to be better discussed with the notion of tense. If the sentence is in the simple past tense, it refers to a particular event that can be placed at a specific point in the timeline the sentence assumes, which would be somewhat analogous to the physical timeline we perceive extra-linguistically. If the sentence is habitual, it refers to a more abstract event that cannot be pinpointed in such a quasi-physical timeline, at least not in the same way. We discuss event assignment no further in version 6.0.

Given a reference X, the other references in the context of X are denoted as primed topics (X' and X''). This restricts the possible contents of an event somewhat. Suppose in event E involves the state of being an engineer and the themes John, Erica, and Chin-Wu. This event is represented as follows if John, Erica, and Chin-Wu are not in the same context:

E = {$_{\text{is}}$engineer, $_{\text{it}}$John, $_{\text{it}}$Erica, $_{\text{it}}$Chin-Wu}

it stands for theme, distinguished from patient.

If Erica and Chin-Wu are in the context of John, however, the event is represented as follows:

E’ = {$_{\text{is}}$engineer, $_{\text{it}}$John, $_{\text{it}}$John$'$, $_{\text{it}}$John$''$}

In an event, a segment belonging to the context of another segment must be shown as a primed topic.

The intuition behind this method of representation of events is that an event is distinguished from other events by what co-occurs in it. The formal convention of truth value of a proposition—it is true iff all of its segments are in the event—is a reflection of this intuition. We expect that we can “know” whether a given proposition is true for an event without such a formal convention. We want the meaning of an event “meaningful” extra-linguistically. (Introspection into the linguistic meaning is only possible if the linguistic meaning is defined in such a way that it has some connection to extra-linguistic meaning. This is analogous to how, no matter how abstract it can be, phonology must maintain some connection to phonetics to meaningfully describe a language. As phonetics stands between phonology and physics, events stand between semantics and worldly meanings.)

An event may have up to one comment to be referred to by a sentence. Suppose the following proposition P and its event *E:

P = $_{\text{it}}$John · $_{\text{do}}$run

*E = {$_{\text{do}}$run, $_{\text{do}}$go, $_{\text{to}}$festival, $_{\text{by}}$John, $_{\text{by}}$Erica}

$_{to}$ stands for goal. *E is illformed.

If in the same event two actions (*sleep* and *go*) and two agents (*John* and *Erica*) appear, nothing indicates which agent belongs to which action. Without a formal convention, we would not be able to tell whether P is true or false. We simply do not know what this event means. (Alternatively, we could have stated that all topics belong to all comments simultaneously, but the present convention seems more conformable to me; the choice is arbitrary.)

Having multiple topics of the same role is not a problem. All topics belong to the same comment. For the same proposition P, consider the following event F:

$$F = \{{}_{\mathrm{do}}\mathrm{run},\ {}_{\mathrm{by}}\mathrm{John},\ {}_{\mathrm{by}}\mathrm{Erica}\}$$

For F, P is true because the segments ${}_{by}John$ and ${}_{do}run$ are both included in F. For F, the following proposition Q is simultaneously true:

$$Q = {}_{\mathrm{by}}\mathrm{Erica} \cdot {}_{\mathrm{do}}\mathrm{run}$$

In event E, John ran, and Erica ran.

How do we know if a given event has no more than one comment? For a segment of an event, the role decides whether it is a comment or not. ${}_{is}$ is a role with comment-hood, as well as ${}_{of}$. I do not have a complete list of roles that make a segment the comment of an event. We just expect that such a list is obtainable.

We do not worry about “impossible” events. If the comment of a given event is *sleep*, it is unexpected that the event has a segment with the role ${}_{to}$ because the action of sleeping does not usually take a goal. It is difficult to conceptualize an event of sleeping that involves a goal, but whether it is truly impossible to conceptualize such an event is not an issue. The event $\{{}_{do}sleep,\ {}_{to}festival,\ {}_{by}John\}$ has no problem with the proposition ${}_{by}John \cdot {}_{do}sleep$. The proposition is true for this event because the segments ${}_{by}John$ and ${}_{do}sleep$ are included in the event. The oddness of ${}_{to}$ *festival* in this event does not interfere with this judgment. Ultimately, the source of an event must be somewhere outside of language. For example, the speaker’s consciousness seems to have some discretion over what event the sentence refers to. (You can deliberately tell a truth or a lie.) The grammar may need to filter out incompatible events, such as an event with non-primed topics belonging to the same context, but it does not give directions on what should go into an event; events are given to language. The same can be said about an event without a comment. Since all propositions have one comment, a commentless event would falsify all propositions. This is not a problem of the grammar because we then know the truth value (false).

Allowing multiple segments to have the same role in an event is necessary for adequately assigning truth values to the propositions of a sentence such as:

jon mo hashitta. — John ran too.

which generates the following proposal:

$$\left| \begin{array}{l} +\ {}_{\mathrm{by}}\mathrm{John} \cdot {}_{\mathrm{do}}\ \mathrm{run} \\ +\ {}_{\mathrm{by}}\mathrm{John}' \cdot {}_{\mathrm{do}}\ \mathrm{run} \end{array} \right| .$$

For this sentence to be pragmatically normal and correct (that is, to be a truthful statement based on a correct assumption), the event needs to include ${}_{by}John$ and ${}_{by}John'$.

A segment in an event cannot have a negater. (This is why we need the notion of entailment on top of the notion of proposition.) The implication ${}_{by}John \cdot \neg {}_{do}sleep$ is converted to the entailment $-\ {}_{by}John \cdot {}_{do}\ sleep$, whose proposition ${}_{by}John \cdot {}_{do}\ sleep$ is false for the events $\{{}_{by}John,\ {}_{do}run\}$ and $\{{}_{by}Erica,\ {}_{do}sleep\}$ and true for $\{{}_{by}John,\ {}_{do}\ sleep\}$. This convention ensures that the falsehood of a proposition is simply the absence of any one of the segments it holds.

MOODS AND SENTENCE TYPES

PARTIAL INTERROGATIVE

Consider the following:

yoshimi wa isogashii? — Is specifically Yoshimi busy?

The speaker expects that somebody else is not busy, and based on this assumption he asks if Yoshimi is busy or not.

$$
\begin{array}{ll}
\textsc{base} & \text{Yoshimi}\;\; X:\dfrac{X}{X'} \qquad \text{busy}\;\; X:\dfrac{{}_{\text{is}}X}{\neg_{\text{is}}X} \quad ? \\
& \dfrac{\text{Yoshimi}}{\text{Yoshimi}'} \qquad \dfrac{{}_{\text{is}}\text{busy}}{\neg_{\text{is}}\text{busy}} \\
& \dfrac{\text{Yoshimi} \cdot_{\text{is}} \text{busy}}{\text{Yoshimi}' \cdot \neg_{\text{is}}\text{busy}} \\
\textsc{root} & \begin{bmatrix} \text{Yoshimi} \cdot_{\text{is}} \text{busy} \\ \text{Yoshimi}' \cdot \neg_{\text{is}}\text{busy} \end{bmatrix} ? \\
\textsc{meaning} & \begin{vmatrix} +\,\text{Yoshimi} \cdot_{\text{is}} \text{busy} \\ -\,\text{Yoshimi}' \cdot {}_{\text{is}}\text{busy} \end{vmatrix} ?
\end{array}
$$

Only the top entailment + *Yoshimi · is busy* is the target of the question. We call this mood symbolized as *?* the *partial interrogative mood*.

In the following sentence, it is assumed by the speaker that Yoshimi is busy, and the question asks *whether everybody else is not busy*.

> yoshimi shika isogashiku nai? — Is only Yoshimi busy? (Perhaps more naturally: "Is Yoshimi the only one that is busy?")

$$
\begin{array}{ll}
\textsc{base} & \text{Yoshimi}\;\; X:\dfrac{X', X''}{X} \qquad \text{busy}\;\; X:\dfrac{{}_{\text{is}}X}{\neg_{\text{is}}X} ? \\
& \dfrac{\text{Yoshimi}', \text{Yoshimi}''}{\text{Yoshimi}} \qquad \dfrac{\neg_{\text{is}}\text{busy}}{{}_{\text{is}}\text{busy}} \\
& \dfrac{\text{Yoshimi}', \text{Yoshimi}'' \cdot \neg_{\text{is}}\text{busy}}{\text{Yoshimi} \cdot_{\text{is}} \text{busy}} \\
\textsc{root} & \begin{bmatrix} \text{Yoshimi}' \cdot \neg_{\text{is}}\text{busy} \\ \text{Yoshimi}'' \cdot \neg_{\text{is}}\text{busy} \\ \text{Yoshimi} \cdot_{\text{is}} \text{busy} \end{bmatrix} ? \\
\textsc{meaning} & \begin{vmatrix} -\,\text{Yoshimi}' \cdot {}_{\text{is}}\text{busy} \\ -\,\text{Yoshimi}'' \cdot {}_{\text{is}}\text{busy} \\ +\,\text{Yoshimi} \cdot_{\text{is}} \text{busy} \end{vmatrix} ?
\end{array}
$$

In both #YWI?# and #YSIN?#, only the first entailment is the point of the question. This is why the order of entailments matters. The first entailment of a proposal is called the *primary entailment* and the rest the *secondary entailments.*

The case of *mo* is another good example:

> yoshimi mo kuru? — Is Yoshimi coming too?

This question assumes that somebody else is coming, and based on this assumption it asks whether Yoshimi is coming. We need an entailment that roughly means "Yoshimi is coming" as the primary entailment and one that roughly means "somebody else is coming" as the secondary entailment. Our specification of *mo* naturally achieves this result:

$$
\begin{array}{ll}
\textsc{base} & \text{Yoshimi}\;\; X:\dfrac{X, X'}{0} \qquad \text{come}\;\; X:\dfrac{X}{\neg X} \quad ? \\
& \dfrac{\text{Yoshimi}, \text{Yoshimi}'}{0} \qquad \dfrac{\text{come}}{\neg\text{come}} \\
& \dfrac{\text{Yoshimi}, \text{Yoshimi}' \cdot \text{come}}{0} \\
\textsc{root} & \begin{bmatrix} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \text{come} \end{bmatrix} ? \\
\textsc{meaning} & \begin{vmatrix} +\,\text{Yoshimi} \cdot \text{come} \\ +\,\text{Yoshimi}' \cdot \text{come} \end{vmatrix} ?
\end{array}
$$

Observe another example below:

> yoshimi wa isogashiku nai? — Is specifically Yoshimi not busy?

This question assumes that *somebody else is busy* and asks *whether Yoshimi is not busy*.

$$
\begin{array}{ll}
\textsc{base} & \text{Yoshimi}\;\; X:\dfrac{X}{X'} \qquad \text{busy}\;\; X:\dfrac{\neg_{\text{is}}X}{{}_{\text{is}}X} ? \\
& \dfrac{\text{Yoshimi}}{\text{Yoshimi}'} \qquad \dfrac{\neg_{\text{is}}\text{busy}}{{}_{\text{is}}\text{busy}} \\
& \dfrac{\text{Yoshimi} \cdot \neg_{\text{is}}\text{busy}}{\text{Yoshimi}' \cdot_{\text{is}} \text{busy}} \\
\textsc{root} & \begin{bmatrix} \text{Yoshimi} \cdot \neg_{\text{is}}\text{busy} \\ \text{Yoshimi}' \cdot_{\text{is}} \text{busy} \end{bmatrix} ? \\
\textsc{meaning} & \begin{vmatrix} -\,\text{Yoshimi} \cdot {}_{\text{is}}\text{busy} \\ +\,\text{Yoshimi}' \cdot_{\text{is}} \text{busy} \end{vmatrix} ?
\end{array}
$$

Total interrogative

A total interrogative sentence has the total interrogative mood, symbolized as *;*.

Consider the following:

tarō ga waratta?

whose meaning is represented as the following structure of a root node.

$$\begin{bmatrix} \text{Taro} \cdot \text{laughed} \\ \text{Taro}' \cdot \neg\text{laughed} \\ \text{Taro}'' \cdot \neg\text{laughed} \end{bmatrix};$$

This amounts to asking if X in the following template, if it is to produce a completely truthful proposal, is *Taro*.

$$\begin{bmatrix} X \cdot \text{laughed} \\ X' \cdot \neg\text{laughed} \\ X'' \cdot \neg\text{laughed} \end{bmatrix}.$$

which could be translated roughly as "Is it Taro who laughed?." We call this type of question the total interrogative because the scope of interrogation includes all implications of the root node.

So-called wh-questions typically falls in the category of total interrogative.

Supposing a separate mood for the wh-questions as opposed to the typical yes-no questions implies that these two types of questions have distinct predicate forms underlyingly. In the reference dialect, the distinction is not necessarily reflected to the phonetic forms. *Nani o mimashitaka?* ("What did you see?") and *nanika mimashitaka?* ("Did you see anything?") have the phonetically identical predicate form *mimashitaka* (Kyouro: **¿ˈmi·ˈmasıtaka**). In English, the wh-questions and the yes-no questions receive different intonations. How moods are mapped onto the phonological forms is discussed in Chapter Four.

Imperative

The imperative mood is denoted by the symbol *!*. The following sentence assumes that something else than peach is not eaten, and commands that peach be eaten.

momo wa tabete. — Eat at least peach.

The meaning of this sentence can be derived as follows:

BASE $\quad \text{peach} \quad X : \dfrac{X}{X'} \qquad \text{eat} \quad X : \dfrac{X}{\neg X} \quad !$

$$\frac{\text{peach}}{\text{peach}'} \qquad \frac{\text{eat}}{\neg\text{eat}}$$

$$\frac{\text{peach} \cdot \text{eat}}{\text{peach}' \cdot \neg\text{eat}}$$

ROOT $\quad \begin{bmatrix} \text{peach} \cdot \text{eat} \\ \text{peach}' \cdot \neg\text{eat} \end{bmatrix}!$

MEANING $\quad \begin{vmatrix} +\,\text{peach} \cdot \text{eat} \\ -\,\text{peach}' \cdot \text{eat} \end{vmatrix}!$

Observe how *!* interacts with *mo*. The following sentence assumes that something else will be eaten, and commands that peach be eaten too:

momo mo tabete. — Eat peach too. (e.g., "You will eat apple, but eat peach too.")

BASE $\quad \text{peach} \quad X : \dfrac{X, X'}{0}\text{eat} \quad X : \dfrac{X}{\neg X} \quad !$

$$\frac{\text{peach, peach}'}{0} \qquad \frac{\text{eat}}{\neg\text{eat}}$$

$$\frac{\text{peach, peach}' \cdot \text{eat}}{0}$$

ROOT $\quad \begin{bmatrix} \text{peach} \cdot \text{eat} \\ \text{peach}' \cdot \text{eat} \end{bmatrix}!$

MEANING $\quad \begin{vmatrix} +\,\text{peach} \cdot \text{eat} \\ +\,\text{peach}' \cdot \text{eat} \end{vmatrix}!$

Other articles work the same way.

momo shika tabenaide. — Eat only peach. (e.g., “You will eat peach and not pear, and do not eat apple.”)

BASE peach $X\colon \dfrac{X', X''}{X}$ eat $X\colon \dfrac{\neg X}{X}$!

$$\dfrac{\text{peach}', \text{peach}''}{\text{peach}} \qquad \dfrac{\neg\text{eat}}{\text{eat}}$$

$$\dfrac{\text{peach}', \text{peach}'' \cdot \neg\text{eat}}{\text{peach} \cdot \text{eat}}$$

ROOT $\begin{bmatrix} \text{peach}' \cdot \neg\text{eat} \\ \text{peach}'' \cdot \neg\text{eat} \\ \text{peach} \cdot \text{eat} \end{bmatrix}$!

MEANING $\begin{vmatrix} -\text{peach}' \cdot \text{eat} \\ -\text{peach}'' \cdot \text{eat} \\ +\text{peach} \cdot \text{eat} \end{vmatrix}$!

DECLARATIVE

Recall:

Observation of *shika* and the exhaustive *ga*:

The meaning of a sentence X *shika* Y *nai* is schematized as: $\begin{cases} X' \text{not } Y \\ X'' \text{not } Y. \\ X\ Y \end{cases}$

The meaning of a sentence X *ga* Y, where *ga* is the exhaustive *ga*, is schematized as: $\begin{cases} X\ Y \\ X' \text{not } Y\ . \\ X'' \text{not } Y \end{cases}$

(Seeing them as sets, they are identical, but for now we pretend that the order of elements matters without stating how.)

(Reproduced from p. bunnies)

Part of the difference between *X shika Y nai* and *X ga Y* is their orders of implications. In the former, a negative statement is placed on top while in the latter the positive statement is placed on top. As proposals, they can be written as:

$$\begin{vmatrix} -X' \cdot Y \\ -X'' \cdot Y \\ +X \cdot Y \end{vmatrix}.$$

$$\begin{vmatrix} +X \cdot Y \\ -X' \cdot Y \\ -X'' \cdot Y \end{vmatrix}.$$

In a declarative sentence, the difference between the primary and the secondary entailments may appear less clear. It may be worth thinking about what imperative or interrogative sentence it should correspond to.

OTHER MOODS

Several other moods are likely necessary to cover predicative intonations and so-called ending particles (discussed in *Proposing*, pp. clover-daydream).

CHAPTER THREE: INFORMATION STRUCTURE

PRELIMINARY

Review

<u>Definition of $</u>:

In the phonological tree of a sentence, a phrase, except for fillers, has R at its beginning iff it contains $, where $ is a feature that can be given to an AP;

a sentence has at least one AP with $; and

the distribution of $ typically mirrors the distribution of the information being asked for.

(*Proposing*, pp. scholarship-semantician)

Question types and the position of $

Consider the following example:

nani tabeta? — what did (you) eat?

BASE what $X: \frac{X}{0}$ eat $X: \frac{X}{\neg X}$;

$\frac{\text{what}}{0}$ $\frac{\text{eat}}{\neg\text{eat}}$

$\frac{\text{what} \cdot \text{eat}}{0}$

ROOT $[\text{what} \cdot \text{eat}]$;

Observe that #NT# is typically pronounced with $ at placed at the first AP only:

$nani tabeta?

This fits well with our previous observation. The distribution of $ typically mirrors the distribution of the information being asked for. In a wh-question, the wh-word, in this case, *nani*, works as a placeholder of the information being asked for.

Observe the following examples of the distributions of $ and wh-memes. (Readers who speak the language natively or fluently are asked to verify that they have $ at the most “natural” or “typical” place.)

$doko itta? — where did (you) go?

BASE where $X: \frac{X}{0}$ go $X: \frac{X}{\neg X}$;

$\frac{\text{where}}{0}$ $\frac{\text{go}}{\neg\text{go}}$

$\frac{\text{where} \cdot \text{go}}{0}$

ROOT $[\text{where} \cdot \text{go}]$;

$itsu kaeru? — when are (you) going to come back?

BASE when $X: \frac{X}{0}$ come back $X: \frac{X}{\neg X}$;

$\frac{\text{when}}{0}$ $\frac{\text{come back}}{\neg\text{come back}}$

$\frac{\text{when} \cdot \text{come back}}{0}$

ROOT $[\text{when} \cdot \text{come back}]$;

$dare kaita? — who did (you) draw?

BASE who $X: \frac{X}{0}$ draw $X: \frac{X}{\neg X}$;

$\frac{\text{who}}{0}$ $\frac{\text{draw}}{\neg\text{draw}}$

$\frac{\text{who} \cdot \text{draw}}{0}$

ROOT $[\text{who} \cdot \text{draw}]$;

Compare the above with the following, where $ is placed not on the wh-words but on the predicates:

nani $tabeta?

doko $itta?

itsu $kaeru?

dare $kaita?

These sentences probably sound unnatural. This is because $ is not placed on the information being asked for (or its placeholder).

In a partial question, $ is typically placed on the AP of the predicate:

kore $taberu? — will (you) eat this? (Naturally: “Do you want to eat this?”)

$$
\begin{array}{llll}
\textsc{base} & \text{this} \quad X : \dfrac{X}{0} & \text{eat} \quad X : \dfrac{X}{\neg X} & ? \\
& \dfrac{\text{this}}{0} & \dfrac{\text{eat}}{\neg\text{eat}} & \\
& \dfrac{\text{this} \cdot \text{eat}}{0} & & \\
\textsc{root} & \left[\text{this} \cdot \text{eat}\right] ? & &
\end{array}
$$

#K$T?# sounds natural because it is a partial question and $ is placed on the predicate, where the polarity of the sentence is manifested. (Compare with #$KT?#.)

In both total questions and partial questions semantic-$’s typically (but not obligatorily) coincide with the information being asked for. This holds true for declarative sentences too. Since the same literal declarative sentence can correspond to multiple implicit questions, it is helpful to think about what question the sentence corresponds to to determine its likely prosodic structure. The following literal sentences are natural if pronounced with $ at the same place as the corresponding question:

$kore tabeta. — (I) ate this. (Corresponding to #$NT?#)

kore $tabeta. — (I) ate this. (Corresponding to #K$T?#)

It is useful to see $ as a semantic feature because changing the position of it changes the meaning of the sentence. When the difference in pronunciation parallels the difference in meaning, it is easy to incorporate the phonetic or phonological symbol into the system of semantic representation, just like how in most practices of the study of semantics we use literal words to represent both semantic and phonetic forms. Where necessary, $ as a phonological feature is called *phonological-$* and as a semantic feature it is called *semantic-$*.

$-THEORY IN SEMANTICS

TOPIC, COMMENT, AND SEMANTIC SEGMENT

We convert each implication into a collection of *comments*. This collection is called a *commentary*. (We use the same terms “comment” and “topic” also in the context of semantic derivation and subcomponents of implications. This is intentional.) The comment is a basic unit of information structure. What this means will be explained shortly.

An implication $A \cdot B \cdot C$ is converted to the following comments:

$$
\begin{cases}
C \\
B \cdot C \\
A \cdot B \cdot C
\end{cases}
$$

This process is called *factorization* of an implication.

Convention 3.1:

i) $$A \cdot B \cdot C \cdot \ldots \cdot X \cdot Y \cdot Z \Rightarrow \begin{cases} Z \\ Y \cdot Z \\ X \cdot Y \cdot Z \\ \cdots \\ A \cdot B \cdot C \cdot \ldots \cdot X \cdot Y \cdot Z \end{cases}$$

An implication $A \cdot B \cdot C \cdot \ldots \cdot X \cdot Y \cdot Z$ is factored to comments

$$\begin{cases} Z \\ Y \cdot Z \\ X \cdot Y \cdot Z \\ \cdots \\ A \cdot B \cdot C \cdot \ldots \cdot X \cdot Y \cdot Z \end{cases}$$

This conversion is done by building a right-branching tree from the implication. The underlined nodes are the comments:

$$\begin{array}{ccc} A & B & \underline{C} \\ & \underline{B \cdot C} & \\ \underline{A \cdot B \cdot C} & & \end{array}$$

The components of an implication or a comment separated by dots are called *semantic segments* or *segments* for short. Each segment points to some *it* in the world that the sentence assumes—be it a fact, an action, a person, a point in time, a thing, or whatever—and an implication and a comment are a package of cooccurring *it*'s.

$-SPECIFICATION OF COMMENTS

Take the following sentence as an example:

ashita omatsuri iku. $\rightarrow$ $[\text{tomorrow} \cdot \text{festival} \cdot \text{go}]\,. \Rightarrow \begin{cases} \text{go} \\ \text{festival} \cdot \text{go} \\ \text{tomorrow} \cdot \text{festival} \cdot \text{go} \end{cases}$

The comment *go* refers to some action of *going* assumed in the sentence. The comment $festival \cdot go$ refers to the notion of the action of *going* involving some entity that is *festival*. The comment $tomorrow \cdot festival \cdot go$ refers to the notion of the action of *going* involving the entity *festival* and some entity that is *tomorrow*.

> Unlike entailments, comments are not about claiming facts. A sentence of a negative statement includes both the negative and positive versions of comments. (See #YWI# below.) It is also possible that a positive comment is "highlighted" in such a sentence. An example is shown on the next page as a commentary of #YWI#.

Go appears three times and *festival* appears twice. They are duplicates of the same segments. We could put indexes to show their identities:

$$\begin{cases} \text{go}_1 \\ \text{festival}_2 \cdot \text{go}_1 \\ \text{tomorrow}_3 \cdot \text{festival}_2 \cdot \text{go}_1 \end{cases}$$

Doing so, however, is not necessary because the origin of each can be seen in the implication and the derivative tree.

Some comments may be more important for the purpose of the sentence than the other comments. The "important" part is what we have discussed earlier rather informally as "the information being asked for." A native speaker of the language may variously describe the notion. Some may call it focus. Others may say it has emphasis. Consider the following sentence.

yoshimi wa $isogashii. — Specifically Yoshimi is busy.

This sentence has the following implications and comments:

#YWI# $\rightarrow \begin{bmatrix} \text{Yoshimi} \cdot_{\text{is}} \text{busy} \\ \text{Yoshimi}' \cdot \neg_{\text{is}}\text{busy} \end{bmatrix} . \Rightarrow \begin{cases} {}_{\text{is}}\text{busy} \\ \text{Yoshimi} \cdot_{\text{is}} \text{busy} \\ \neg_{\text{is}}\text{busy} \\ \text{Yoshimi}' \cdot \neg_{\text{is}}\text{busy} \end{cases}$

The last two comments (which correspond to the second implication) are noticeably unimportant. (#YW$I# is not a case of the contrastive *wa*.) They would easily go unnoticed in a normal conversation.

Now consider the following, identical in the common orthography but different to the ears:

$yoshimi wa isogashii. — Specifically Yoshimi is busy.

This sentence produces the same four comments, but this time the most important comment is the last one only. (This is a case of the contrastive *wa*.) Highlighted in this sentence is that somebody else than Yoshimi is not busy. A natural response to this sentence would be “who’s not busy?”

We speak of comments when we talk about information structure. Certain comments stand out in the information conveyed by a sentence. Our purpose here is to correctly characterize comments in such a way that phonologically contrastive sentences are distinguished in the semantic representations as well. If two sentences that yield the exact same set of comments (but with different “importance” of some of the comments) phonologically differ only by the placements of $, we want our grammar to correctly mark “importance” of the comments differently for the two sentences. For the last two examples, we want the following phonological and semantic representations. (We mark the “importance” by placing the symbol $ at the top of the comment.)

$$\text{yoshimi wa \$isogashii.} \Rightarrow \begin{cases} \$\ {}_{\mathrm{is}}\mathrm{busy} \\ \$\ \mathrm{Yoshimi} \cdot {}_{\mathrm{is}}\ \mathrm{busy} \\ \quad \neg\, {}_{\mathrm{is}}\mathrm{busy} \\ \quad \mathrm{Yoshimi}' \cdot \neg\, {}_{\mathrm{is}}\mathrm{busy} \end{cases}$$

$$\text{\$yoshimi wa isogashii.} \Rightarrow \begin{cases} \quad {}_{\mathrm{is}}\mathrm{busy} \\ \quad \mathrm{Yoshimi} \cdot {}_{\mathrm{is}}\ \mathrm{busy} \\ \quad \neg\, {}_{\mathrm{is}}\mathrm{busy} \\ \$\ \mathrm{Yoshimi}' \cdot \neg\, {}_{\mathrm{is}}\mathrm{busy} \end{cases}$$

The former is an instance of what is in the orthodox categorization called the thematic *wa*. Of course, this is at best an educated guess. We do not have means to directly communicate meaning itself. Essentially, the only evidence we have for characterizing semantics of two sentences differently is claims by linguists in such forms as “they mean different things” and phonetic transcriptions. If two sentences receive distinct phonetic transcriptions and if the author claims that they are contrastive (i.e., they are distinguished in order to convey different meanings), we take the description as evidence for associating different semantic representations to the two sentences. (Ultimately, our semantic transcription system needs to be able to capture all such claims.)

Where the symbol $ goes in the commentary depends on where $ is placed in the phonological form. This assumption does not need additional justifications. We have defined $ as a phonological feature first and the semantic difference that justifies the contrast is now marked by $. The presence of $ on a spaced item in the phonological form implies the presence of $ on at least one comment that includes a segment corresponding to the item. In the examples above, the second sentence has $ on *yoshimi*, which corresponds to the segments *Yoshimi* and *Yoshimi′*, and the comment that has the latter is given $.

The literature has a rich set of technical terms for notions similar or related to “importance” we deal with here. The terminology includes *focus, given,* and *new,* among others, each with varying definitions and theoretical backgrounds. As far as the phonological feature $ is concerned, binary specification of “importance” for each comment suffices, at least for the sentences we will examine in version 6.0. Given that binary $-specification suffices to predict phonological contrasts, any distinctions more granular than that would be overcategorization. (If we ask if binary $-specification of comments is truly enough, the question needs to be taken back to phonology. While we can think of how information is presented in a sentence from unrestrictedly many perspectives, distinctions are not justified unless phonological contrasts are evident.) I avoid conventional terms where possible. I will instead use the term *$-specification* (and *$-specify, $-specified,* etc) to talk about whether a given comment has $. $-specification of a specific comment may correspond better or worse to different conventional terms depending on the comment, the sentence, and the discourse.

We began our investigation from phonology instead of logic because our purpose is to characterize contrastive sentences from each other, but not to find logical expressions that sentences seem to fit well with. (See also the other note in this page.)

BRINGING $ FROM AN IMPLICATION TO THE COMMENTS

All information in a comment, including $, comes from an implication. (In fact, we do not add any information after the base. Semantic derivation, like syntax and phonology, only handles what has been already given in the beginning. This means that $ is present in the base. We will later discuss the procedure to deductively assign $ to the implications from a given base.) We need a precise procedure to assign $ to comments based on what is given as the corresponding implication.

> As far as our observations so far concerned, the root node and the base of a clause generally have equal or similar information. Therefore it may be generally possible to derive the base from the root node. I do not have enough knowledge to rule out either one of them being the truly initial state of sentence generation. At the moment, we assume that the root node is derived from the base and not the other way around, but this is only for convenience.

Take #AOI# as an example. This orthographic sentence has the following versions:

$$\text{\#AO\$I\#} \Rightarrow \begin{cases} \$\,\text{go} \\ \$\,\text{festival} \cdot \text{go} \\ \$\,\text{tomorrow} \cdot \text{festival} \cdot \text{go} \end{cases}$$

$$\text{\#A\$OI\#} \Rightarrow \begin{cases} \quad \text{go} \\ \$\,\text{festival} \cdot \text{go} \\ \$\,\text{tomorrow} \cdot \text{festival} \cdot \text{go} \end{cases}$$

$$\text{\#\$AOI\#} \Rightarrow \begin{cases} \quad \text{go} \\ \quad \text{festival} \cdot \text{go} \\ \$\,\text{tomorrow} \cdot \text{festival} \cdot \text{go} \end{cases}$$

As shown, the presence of $ in a comment implies the presence in all outer comments.

<u>Convention 3.2</u>:

i) $* \Rightarrow \begin{cases} \$\,B \\ \quad A \cdot B \end{cases}$

A presence of $ in a comment X implies a presence of $ on all comments that includes X.

> The purpose of this convention is to prevent overgeneration. We are trying to describe the language's semantics as a formal system of discrete symbols; we do not want our system to predict distinctions that the language never exhibits. It is not to claim that, say, there is a difference between $\begin{cases} \$\,B \\ \quad A \cdot B \end{cases}$ and $\begin{cases} \$\,B \\ \$\,A \cdot B \end{cases}$ as commentaries and only the latter can be correct. Rather, we restrict our notation in such a way that the former never appears so that the difference between them safely remains undefined.

The distribution of $ can be sufficiently described by simply inserting $ in the linear structure of the implication.

$$\text{\#AO\$I\#} \rightarrow \left[\text{tomorrow} \cdot \text{festival} \cdot \$\text{go}\right].\Rightarrow \begin{cases} \$\,\text{go} \\ \$\,\text{festival} \cdot \text{go} \\ \$\,\text{tomorrow} \cdot \text{festival} \cdot \text{go} \end{cases}$$

$$\text{\#A\$OI\#} \rightarrow \left[\text{tomorrow} \cdot \$\text{festival} \cdot \text{go}\right].\Rightarrow \begin{cases} \quad \text{go} \\ \$\,\text{festival} \cdot \text{go} \\ \$\,\text{tomorrow} \cdot \text{festival} \cdot \text{go} \end{cases}$$

$$\text{\#\$AOI\#} \rightarrow \left[\$\text{tomorrow} \cdot \text{festival} \cdot \text{go}\right].\Rightarrow \begin{cases} \quad \text{go} \\ \quad \text{festival} \cdot \text{go} \\ \$\,\text{tomorrow} \cdot \text{festival} \cdot \text{go} \end{cases}$$

Convention 3.3:

i) $[A \cdot B \cdot \$\, C] \Rightarrow \begin{cases} \$\, C \\ \$\, B \cdot C \\ \$\, A \cdot B \cdot C \end{cases}$

ii) $[A \cdot \$\, B \cdot C] \Rightarrow \begin{cases} C \\ \$\, B \cdot C \\ \$\, A \cdot B \cdot C \end{cases}$

iii) $[\$\, A \cdot B \cdot C] \Rightarrow \begin{cases} C \\ B \cdot C \\ \$\, A \cdot B \cdot C \end{cases}$

An implication having \$ on its segment X is factored into a collection of comments that has \$ on all comments that include X.

CONVENTIONS OF NESTS AND THE NEGATOR

Convention 3.4:

i) $[\neg X] \Rightarrow \begin{cases} X \\ \neg X \end{cases}$

A negative segment $\neg X$ in an implication is factored to comments $\neg X$ and X.

ii) $[\$\, \neg X] \Rightarrow \begin{cases} X \\ \$\, \neg X \end{cases}$

A negative segment $\$\, \neg X$, with \$ outside the scope of the negation, is factored into comments $\$\, \neg X$ and X.

iii) $[\neg \$\, X] \Rightarrow \begin{cases} \$\, X \\ \neg X \end{cases}$

A negative segment $\neg \$\, X$, with \$ under the scope of the negation, is factored into comments $\neg X$ and $\$\, X$.

Internal lines of a nest are recursively factored into comments. Take the following example:

$$\text{ashita wa yoshimi wa kuru} \rightarrow \begin{bmatrix} \text{tomorrow} \cdot \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \text{tomorrow}' \cdot \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \end{bmatrix}.$$

For expository purposes I begin by treating the segment $\begin{cases} \mathit{Yoshimi} \cdot \mathit{come} \\ \mathit{Yoshimi}' \cdot \neg \mathit{come} \end{cases}$ only.

This segment is factored as follows:

$$\begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \Rightarrow \begin{cases} \text{come} \\ \text{Yoshimi} \cdot \text{come} \\ \neg\text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \\ \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \end{cases}$$

Convention 3.5:

iv) $\begin{bmatrix} A \\ \begin{cases} B \\ C \cdot D \end{cases} \end{bmatrix} \Rightarrow \begin{cases} A \\ B \\ D \\ C \cdot D \\ \begin{cases} B \\ C \cdot D \end{cases} \end{cases}$

When a nest is factored, the nested lines are recursively factored.

The example above has two potential immediate sources of the segment *come*: one is $\neg$*come* and the other is *Yoshimi* $\cdot$ *come*. But *come* is only listed once. As a convention, a comment with the same identity is listed only once in the same commentary. The meme *come* in $\neg$*come* is the same meme as the one in the comment *Yoshimi* $\cdot$ *come*. (As stated in Chapter One, if two memes have different identities and have the same label, we use identity indexes.)

Convention 3.6:

i) $\begin{bmatrix} X \cdot Y \\ Z \cdot Y \end{bmatrix} \Rightarrow \begin{cases} Y \\ X \cdot Y \\ Z \cdot Y \end{cases}$

ii) $* \begin{bmatrix} X \cdot Y \\ Z \cdot Y \end{bmatrix} \Rightarrow \begin{cases} Y \\ X \cdot Y \\ Y \\ Z \cdot Y \end{cases}$

If factoring implications of the same body into a commentary yields multiple instances of the same comment, all but one of them are unlisted.

Now consider the negative version of the same segment. The segment $\neg \begin{cases} \mathit{Yoshimi} \cdot \mathit{come} \\ \mathit{Yoshimi}' \cdot \neg \mathit{come} \end{cases}$ is just a concatenation of the negator $\neg$ and $\begin{cases} \mathit{Yoshimi} \cdot \mathit{come} \\ \mathit{Yoshimi}' \cdot \neg \mathit{come} \end{cases}$. Since the latter part will be a duplicate, as Convention 3.6 states, we only need to copy the entire segment into the commentary:

$$\neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \Rightarrow \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases}$$

Now we are ready to factor #AWYWK#:

$$\begin{bmatrix} \text{tomorrow} \cdot \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \text{tomorrow}' \cdot \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \end{bmatrix} . \Rightarrow \begin{cases} \text{come} \\ \text{Yoshimi} \cdot \text{come} \\ \neg\text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \\ \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \text{tomorrow} \cdot \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \text{tomorrow}' \cdot \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \end{cases}$$

Let us now turn to how $ is assigned from implications to comments. We have already seen how it is handled inside and outside of the scope of negation. The convention is similar for nests. If $ is assigned outside of a nest, $ is not assigned to comments sourced from inside of the nest. If $ is assigned inside of a nest, $ is not inherited to comments sourced from outside of the nest.

Convention 3.7:

i) $\begin{bmatrix} X \\ \$ \begin{cases} Y \\ Z \end{cases} \end{bmatrix} \Rightarrow \begin{cases} X \\ Y \\ Z \\ \$ \begin{cases} Y \\ Z \end{cases} \end{cases}$

ii) $* \begin{bmatrix} X \\ \$ \begin{cases} Y \\ Z \end{cases} \end{bmatrix} \Rightarrow \begin{cases} X \\ \$\, Y \\ \$\, Z \\ \$ \begin{cases} Y \\ Z \end{cases} \end{cases}$

$ assigned to outside of a nest is not inherited to comments from inside of the nest.

iii) $\begin{bmatrix} X \\ \begin{cases} \$\, Y \\ Z \end{cases} \end{bmatrix} \Rightarrow \begin{cases} X \\ \$\, Y \\ Z \\ \begin{cases} Y \\ Z \end{cases} \end{cases}$

iv) $* \begin{bmatrix} X \\ \begin{cases} \$\, Y \\ Z \end{cases} \end{bmatrix} \Rightarrow \begin{cases} X \\ \$\, Y \\ Z \\ \$ \begin{cases} Y \\ Z \end{cases} \end{cases}$

$ assigned to the inside of a nest is not copied to comments from outside of the nest. If $ is assigned to a comment, nested duplicates of the same comment do not receive $.

The following are some examples of #AWYWK#:

$ashita wa yoshimi wa kuru.

$$\begin{bmatrix} \text{tomorrow} \cdot \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \$\,\text{tomorrow}' \cdot \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \end{bmatrix} . \Rightarrow \begin{cases} \text{come} \\ \text{Yoshimi} \cdot \text{come} \\ \neg\text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \\ \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \text{tomorrow} \cdot \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \$\,\text{tomorrow}' \cdot \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \end{cases}$$

ashita wa $yoshimi wa kuru.

$$\begin{bmatrix} \text{tomorrow} \cdot \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \$\,\text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \text{tomorrow}' \cdot \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \$\,\text{Yoshimi}' \cdot \neg\text{come} \end{cases} \end{bmatrix} . \Rightarrow \begin{cases} \text{come} \\ \text{Yoshimi} \cdot \text{come} \\ \neg\text{come} \\ \$\,\text{Yoshimi}' \cdot \neg\text{come} \\ \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \text{tomorrow} \cdot \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \text{tomorrow}' \cdot \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \end{cases}$$

ashita wa yoshimi wa $kuru.

$$\begin{bmatrix} \text{tomorrow} \cdot \begin{cases} \text{Yoshimi} \cdot \$\,\text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \text{tomorrow}' \cdot \neg \begin{cases} \text{Yoshimi} \cdot \$\,\text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \end{bmatrix} . \Rightarrow \begin{cases} \$\,\text{come} \\ \$\,\text{Yoshimi} \cdot \text{come} \\ \neg\text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \\ \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \text{tomorrow} \cdot \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \\ \text{tomorrow}' \cdot \neg \begin{cases} \text{Yoshimi} \cdot \text{come} \\ \text{Yoshimi}' \cdot \neg\text{come} \end{cases} \end{cases}$$

Articles as $-assigners

Consider the following example.

ashita $omatsuri iku. — (I) will go to the festival tomorrow.

BASE $\quad \text{tomorrow} \quad X : \dfrac{X}{0} \quad \text{festival} \quad X : \dfrac{\$\,X}{0} \quad \text{go} \quad X : \dfrac{X}{\neg X} \quad X : \dfrac{X}{\neg X} \quad .$

$$\frac{\text{tomorrow}}{0} \qquad \frac{\$\,\text{festival}}{0} \qquad \frac{\text{go}}{\neg\text{go}}$$

$$\frac{\$\,\text{festival} \cdot \text{go}}{0}$$

$$\frac{\left(\frac{\$\,\text{festival} \cdot \text{go}}{0}\right)}{\neg\left(\frac{\$\,\text{festival} \cdot \text{go}}{0}\right)}$$

$$\frac{\text{tomorrow} \cdot \left(\frac{\$\,\text{festival} \cdot \text{go}}{0}\right)}{0}$$

ROOT $\quad [\text{tomorrow} \cdot \$\text{festival} \cdot \text{go}] .$

In the base structure \$ is placed in the same place as in the phonological structure. The assumption that the base position of a semantic-\$ is identical to the corresponding phonological-\$ paves the way to connect syntax and semantics.

However, the following pair of sentences reveal that given a sequence of APs the mapping from phonological-\$ to semantic-\$ is not one-to-one:

\$kōhī ga oishii. — Exactly coffee is tasty.

$$
\begin{array}{ll}
\text{BASE} & \text{coffee} \quad X: \dfrac{\$\,X}{\$X\,', \$\,X''} \quad \text{tasty} \quad X: \dfrac{{}_{\text{is}}X}{\neg_{\text{is}}X}. \\
& \dfrac{\$\,\text{coffee}}{\$\,\text{coffee}', \$\,\text{coffee}''} \qquad \dfrac{{}_{\text{is}}\text{tasty}}{\neg_{\text{is}}\text{tasty}} \\
& \dfrac{\$\,\text{coffee} \cdot_{\text{is}} \text{tasty}}{\$\,\text{coffee}', \$\,\text{coffee}'' \cdot \neg_{\text{is}}\text{tasty}} \\
\text{ROOT} & \begin{bmatrix} \$\,\text{coffee} \cdot_{\text{is}} \text{tasty} \\ \$\,\text{coffee}' \cdot \neg_{\text{is}}\text{tasty} \\ \$\,\text{coffee}'' \cdot \neg_{\text{is}}\text{tasty} \end{bmatrix}.
\end{array}
$$

\$kōhī wa oishii. — Specifically coffee is tasty.

$$
\begin{array}{ll}
\text{BASE} & \text{coffee} \quad X: \dfrac{X}{\$\,X'} \quad \text{tasty} \quad X: \dfrac{{}_{\text{is}}X}{\neg_{\text{is}}X}. \\
& \dfrac{\text{coffee}}{\$\,\text{coffee}'} \qquad \dfrac{{}_{\text{is}}\text{tasty}}{\neg_{\text{is}}\text{tasty}} \\
& \dfrac{\text{coffee} \cdot_{\text{is}} \text{tasty}}{\$\,\text{coffee}' \cdot \neg_{\text{is}}\text{tasty}} \\
\text{ROOT} & \begin{bmatrix} \text{coffee} \cdot_{\text{is}} \text{tasty} \\ \$\,\text{coffee}' \cdot \neg_{\text{is}}\text{tasty} \end{bmatrix}.
\end{array}
$$

In both sentences phonological-\$ is assigned only to the first AP, but semantic-\$ is distributed differently across the sentences. The difference comes from the nodes $X: \dfrac{\$\,X}{\$X\,', \$\,X''}$ and $X: \dfrac{X}{\$\,X'}$. The former corresponds to *ga* and the latter *wa*. As different articles assign \$ differently, the distribution of \$ is in part determined by lexical properties.

Articles, when their corresponding AP receives phonological-\$, assign semantic-\$ to lexically specified positions inside the resulting node.

Let us take another example:

\$ninjin shika tabenai. — eats only carrot.

$$
\begin{array}{ll}
\text{BASE} & \text{carrot} \quad X: \dfrac{\$\,X', \$\,X''}{X} \quad \text{eat} \quad X: \dfrac{\neg X}{X}\ . \\
& \dfrac{\$\,\text{carrot}', \$\,\text{carrot}''}{\text{carrot}} \qquad \dfrac{\neg\text{eat}}{\text{eat}} \\
& \dfrac{\$\,\text{carrot}', \$\,\text{carrot}'' \cdot \neg\text{eat}}{\text{carrot} \cdot \text{eat}} \\
\text{ROOT} & \begin{bmatrix} \$\,\text{carrot}' \cdot \neg\text{eat} \\ \$\,\text{carrot}'' \cdot \neg\text{eat} \\ \text{carrot} \cdot \text{eat} \end{bmatrix}.
\end{array}
$$

In this case, the node $X\colon \dfrac{\$X', \$X''}{X}$, corresponding to *shika*, assigns \$ to both topics on the upper half of the resulting node.

The distribution of semantic-\$ depends both on the lexical properties of certain items and on the prosodic structure. It has been known in the literature that both "particles" and prosody are relevant to the information structure of a sentence. \$-theory naturally explains how they work together to assemble the sentence information.

Now, let us take one other example, *dakeo*, because this article is particularly interesting. Consider the following sentence:

> \$koe dakeo kiita. — (I) heard only voice.

> There seem to be two semantically similar or identical versions of the X *dakeo* construction. One is where *dakeo* receives the R tone (*Koe Dakeo kiita*) and the other is where it does not (*Koe dakeo kiita*). My guess at the moment is that the difference is at best paralinguistic. I tentatively ignore the semantic difference between them, if any.
>
> Because *dakeo* is pronounced as its own AP, it may be better to assume that the origin of semantic-\$ is not the article but the meme on the left. Under this model, $\dfrac{\$\,carrot', \$\ carrot''}{carrot}$ is obtained by merging ${}^{\$}carrot$ and ${}^{\$}X\colon \dfrac{\$X', \$X''}{X}$, where the superscript \$ is aligned to the position of phonological-\$. Regardless of the validity of this analysis, for simplicity, the superscript \$ is omitted from the notation unless otherwise noted.

Ignoring \$-specification and the covert subject, introspection would reveal that this sentence roughly means:

$$\begin{bmatrix} \text{voice}' \cdot \neg\text{hear} \\ \text{voice}'' \cdot \neg\text{hear} \\ \text{voice} \cdot \text{hear} \end{bmatrix}.$$

Note that the implications cannot be randomly reordered. Particularly, the following order changes the meaning:

$$\#\begin{bmatrix} \text{voice} \cdot \text{hear} \\ \text{voice}' \cdot \neg\text{hear} \\ \text{voice}'' \cdot \neg\text{hear} \end{bmatrix}.$$

This can be (probably) more easily seen when the mood is replaced with the partial interrogative mood:

> koe dakeo kiita? — Did (you) hear only voice?

$$\begin{bmatrix} \text{voice}' \cdot \neg\text{hear} \\ \text{voice}'' \cdot \neg\text{hear} \\ \text{voice} \cdot \text{hear} \end{bmatrix}?$$

The scope of the question is *whether something else than the voice is heard,* but *not whether the voice is heard.*

The article *dakeo* needs to be characterized in such a way that it is ensured that the implications are ordered correctly. Since in the intended order the top implication is of the single-primed topic, *dakeo* as a parallelizer must put the single-primed topic on the upper half. The problem is that the comment corresponding to the single-primed topic has a negator even though in the phonological form the predicate is in the positive form.

To solve this puzzle, the following derivative tree is postulated:

$$\begin{array}{lcc}
\text{BASE voice} & X\colon \dfrac{\neg(\$X', \$X'')}{\neg X} & \text{hear} \quad X\colon \dfrac{X}{\neg x}\,. \\
& \dfrac{\neg(\$\,\text{voice}', \$\,\text{voice}'')}{\neg\text{voice}} & \dfrac{\text{hear}}{\neg\text{hear}} \\
& \multicolumn{2}{c}{\dfrac{\neg(\$\,\text{voice}', \$\,\text{voice}'')\cdot\text{hear}}{\neg\text{voice}\cdot\neg\text{hear}} = \dfrac{\$\,\text{voice}', \$\,\text{voice}''\cdot\neg\text{hear}}{\text{voice}\cdot\text{hear}}} \\
\text{ROOT} & \begin{bmatrix} \$\,\text{voice}' \cdot \neg\text{hear} \\ \$\,\text{voice}'' \cdot \neg\text{hear} \\ \text{voice} \cdot \text{hear} \end{bmatrix}. &
\end{array}$$

> A potential problem of this characterization of *dakeo* is its convergence with *shika*. *Koe dakeo kiita* and *Koe shika kikanakatta* receive the same root node. Whether this is the correct description of the language and how, if it is wrong, we should correct it need to be further discussed. I will keep this form of *dakeo* until then.

One peculiarity of *dakeo* is that it has a negator despite the fact that it is part of an argument. In all other contexts so far, we have only seen negators on the predicate side of a clause. The reason for this surprising setting is shown in the third line. The node $\frac{\neg(\$\,\text{voice}', \$\,\text{voice}'') \cdot \text{hear}}{\neg\text{voice} \cdot \neg\text{hear}}$ is converted to equivalent $\frac{\$\,\text{voice}', \$\,\text{voice}'' \cdot \neg\text{hear}}{\text{voice} \cdot \text{hear}}$. In the conversion, the negator on the topics is shifted to the comment (the usual position of the negator), and the two negators on the lower half cancel out each other. (The parentheses are shown to make it clear that the negator belongs to the entire bundle.) The resulting form then merges with the mood. The resulting body correctly captures our previous observations.

<u>Convention 2.8</u>:

i) $\neg X \cdot Y = X \cdot \neg Y$

A negator is shifted to the comment.

ii) $\neg\neg X = X$

Negators cancel out each other.

Predicates as $-assigners

On the predicate side, if the corresponding AP has phonological-$, it has semantic-$ on the upper half. Take the following sentence as an example:

$kawaii. — (It) is cute.

$$\begin{array}{llll}
\text{BASE} & \text{it} \quad X: \frac{X}{0}\ \text{cute} & X: \frac{\$_{\text{is}} X}{\neg_{\text{is}} x}. \\
 & \frac{\text{it}}{0} & \frac{\$_{\text{is}}\text{cute}}{\neg_{\text{is}}\text{cute}} \\
\text{ROOT} & [\text{it} \cdot \$_{\text{is}}\text{cute}]\ . &
\end{array}$$

Contrastive $-specifications are only possible if the sentence has two or more APs. The following text corresponds to two possible sentences that differ only with $:

takoyaki tabeta. — (I) ate takoyaki.

If $ is placed only on the first AP:

$$\begin{array}{llll}
\text{BASE} & \text{takoyaki}\ X: \frac{\$\,X}{0} & \text{eat} \quad X: \frac{X}{\neg x} & . \\
 & \frac{\text{takoyaki}}{0} & \frac{\text{eat}}{\neg\text{eat}} & \\
\text{ROOT} & [\$\,\text{takoyaki} \cdot \text{eat}]\ . & &
\end{array}$$

If $ is placed on the second AP:

$$\begin{array}{llll}
\text{BASE} & \text{takoyaki}\ X: \frac{X}{0} & \text{eat} \quad X: \frac{\$\,X}{\neg x} & . \\
 & \frac{\text{takoyaki}}{0} & \frac{\$\,\text{eat}}{\neg\text{eat}} & \\
\text{ROOT} & [\text{takoyaki} \cdot \$\,\text{eat}]\ . & &
\end{array}$$

Again $ is simply placed on the upper half of the predicate.

Issues on complex predicates

Consider the following:

saitōsan wa takoyaki o $tabeta. — Specifically Saitō ate exactly takoyaki.

BASE Saito $X:\dfrac{X}{X'}$ takoyaki $X:\dfrac{X}{X',X''}$ eat $X:\dfrac{\$X}{\neg X}$ $X:\dfrac{X}{\neg X}$.

$$\frac{\text{Saito}}{\text{Saito}'} \qquad \frac{\text{takoyaki}}{\text{takoyaki}',\text{takoyaki}''} \qquad \frac{\$\,\text{eat}}{\neg\text{eat}}$$

$$\frac{\text{takoyaki}\cdot\$\,\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\neg\text{eat}}$$

$$\frac{\left(\dfrac{\text{takoyaki}\cdot\$\,\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\neg\text{eat}}\right)}{\neg\left(\dfrac{\text{takoyaki}\cdot\$\,\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\neg\text{eat}}\right)}$$

$$\frac{\text{Saito}\cdot\left(\dfrac{\text{takoyaki}\cdot\$\,\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\neg\text{eat}}\right)}{\text{Saito}'\cdot\neg\left(\dfrac{\text{takoyaki}\cdot\$\,\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\neg\text{eat}}\right)}$$

ROOT
$$\left[\begin{array}{l} \text{Saito}\cdot\left\{\begin{array}{l}\text{takoyaki}\cdot\$\,\text{eat}\\ \text{takoyaki}'\cdot\neg\text{eat}\\ \text{takoyaki}''\cdot\neg\text{eat}\end{array}\right. \\ \text{Saito}'\cdot\neg\left\{\begin{array}{l}\text{takoyaki}\cdot\$\,\text{eat}\\ \text{takoyaki}'\cdot\neg\text{eat}\\ \text{takoyaki}''\cdot\neg\text{eat}\end{array}\right. \end{array}\right].$$

If \$ was assigned to the second parallelizer of *tabeta*, the tree would generate the root node # $\left[\begin{array}{l} \mathit{Saito}\cdot\$\left\{\begin{array}{l}\mathit{takoyaki}\cdot\ \mathit{eat}\\ \mathit{takoyaki}'\cdot\neg\mathit{eat}\\ \mathit{takoyaki}''\cdot\neg\mathit{eat}\end{array}\right. \\ \mathit{Saito}'\cdot\neg\left\{\begin{array}{l}\mathit{takoyaki}\cdot\ \mathit{eat}\\ \mathit{takoyaki}'\cdot\neg\mathit{eat}\\ \mathit{takoyaki}''\cdot\neg\mathit{eat}\end{array}\right. \end{array}\right]$. , which, to me, seems wrong for this particular sentence.

Now consider the following:

saitōsan wa takoyaki o tabenakatta.

This orthographic sentence is ambiguous between at least two interpretations. Suppose in the context there are two people, Saito and Tanaka, and multiple dishes one of which is takoyaki. In one interpretation, Tanaka ate exactly takoyaki and nothing else, and Saito either ate something instead of takoyaki or ate nothing. A natural response based on this interpretation is “If Saito did not eat takoyai, then what did she eat?” In another interpretation, Saito ate everything but takoyaki, and Tanaka either ate something not takoyaki or ate nothing. A natural response based on this interpretation is “What, instead of takoyaki, did Tanaka not eat?” The first interpretation is probably more accessible with \$ placed only on *tabenakatta*, while the second one is probably more accessible with \$ placed only on *takoyaki o*.

These interpretations are represented as follows, respectively:

$$\left|\begin{array}{l} -\text{Saito}\cdot\text{takoyaki}\cdot\text{eat}\\ -\text{Saito}\cdot\text{takoyaki}'\cdot\text{eat}\\ +\text{Saito}'\cdot\text{takoyaki}\cdot\text{eat}\\ -\text{Saito}'\cdot\text{takoyaki}'\cdot\text{eat}\\ -\text{Saito}'\cdot\text{takoyaki}''\cdot\text{eat}\end{array}\right|.$$

$$\left|\begin{array}{l} -\text{Saito}\cdot\text{eat}\cdot\text{takoyaki}\\ +\text{Saito}\cdot\text{eat}\cdot\text{takoyaki}'\\ +\text{Saito}\cdot\text{eat}\cdot\text{takoyaki}''\\ +\text{Saito}'\cdot\text{eat}\cdot\text{takoyaki}\\ +\text{Saito}'\cdot\text{eat}\cdot\text{takoyaki}'\end{array}\right|.$$

which are obtained through the following derivative trees:

$$\textsc{base}\quad \text{Saito}\quad X:\frac{X}{X'}\quad \text{takoyaki}\quad X:\frac{X}{X',X''}\quad \text{eat}\quad X:\frac{X}{\neg X}\quad X:\frac{\$\neg X}{X}.$$

$$\frac{\text{Saito}}{\text{Saito}'}\qquad \frac{\text{takoyaki}}{\text{takoyaki}',\text{takoyaki}''}\qquad \frac{\text{eat}}{\neg\text{eat}}$$

$$\frac{\text{takoyaki}\cdot\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\neg\text{eat}}$$

$$\frac{\$\neg\left(\dfrac{\text{takoyaki}\cdot\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\neg\text{eat}}\right)}{\left(\dfrac{\text{takoyaki}\cdot\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\neg\text{eat}}\right)}$$

$$\frac{\text{Saito}\cdot\$\neg\left(\dfrac{\text{takoyaki}\cdot\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\neg\text{eat}}\right)}{\text{Saito}'\cdot\left(\dfrac{\text{takoyaki}\cdot\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\neg\text{eat}}\right)}$$

$$\textsc{root}\quad \left[\begin{array}{l} \text{Saito}\cdot\$\neg\left\{\begin{array}{l}\text{takoyaki}\cdot\text{eat}\\ \text{takoyaki}'\cdot\neg\text{eat}\\ \text{takoyaki}''\cdot\neg\text{eat}\end{array}\right. \\ \text{Saito}'\cdot\left\{\begin{array}{l}\text{takoyaki}\cdot\text{eat}\\ \text{takoyaki}'\cdot\neg\text{eat}\\ \text{takoyaki}''\cdot\neg\text{eat}\end{array}\right.\end{array}\right].$$

$$\textsc{meaning}\quad \left|\begin{array}{l} -\text{Saito}\cdot\text{takoyaki}\cdot\text{eat}\\ -\text{Saito}\cdot\text{takoyaki}'\cdot\text{eat}\\ +\text{Saito}'\cdot\text{takoyaki}\cdot\text{eat}\\ -\text{Saito}'\cdot\text{takoyaki}'\cdot\text{eat}\\ -\text{Saito}'\cdot\text{takoyaki}''\cdot\text{eat}\end{array}\right| . \left\{\begin{array}{l} \text{eat}\\ \text{takoyaki}\cdot\text{eat}\\ \neg\text{eat}\\ \text{takoyaki}'\cdot\neg\text{eat}\\ \text{takoyaki}''\cdot\neg\text{eat}\\ \left\{\begin{array}{l}\text{takoyaki}\cdot\text{eat}\\ \text{takoyaki}'\cdot\neg\text{eat}\\ \text{takoyaki}''\cdot\neg\text{eat}\end{array}\right.\\ \$\neg\left\{\begin{array}{l}\text{takoyaki}\cdot\text{eat}\\ \text{takoyaki}'\cdot\neg\text{eat}\\ \text{takoyaki}''\cdot\neg\text{eat}\end{array}\right.\\ \$\,\text{Saito}\cdot\neg\left\{\begin{array}{l}\text{takoyaki}\cdot\text{eat}\\ \text{takoyaki}'\cdot\neg\text{eat}\\ \text{takoyaki}''\cdot\neg\text{eat}\end{array}\right.\\ \text{Saito}'\cdot\left\{\begin{array}{l}\text{takoyaki}\cdot\text{eat}\\ \text{takoyaki}'\cdot\neg\text{eat}\\ \text{takoyaki}''\cdot\neg\text{eat}\end{array}\right.\end{array}\right.$$

$$\textsc{base}\quad \text{Saito}\quad X:\frac{X}{X'}\quad \text{takoyaki}\quad X:\frac{X}{X',X''}\quad \text{eat}\quad X:\frac{\$\neg X}{X}\,X:\frac{X}{\neg X}\ .$$

$$\frac{\text{Saito}}{\text{Saito}'}\qquad \frac{\text{takoyaki}}{\text{takoyaki}',\text{takoyaki}''}\qquad \frac{\$\neg\text{eat}}{\text{eat}}$$

$$\frac{\text{takoyaki}\cdot\$\neg\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\text{eat}}$$

$$\frac{\left(\dfrac{\text{takoyaki}\cdot\$\neg\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\text{eat}}\right)}{\neg\left(\dfrac{\text{takoyaki}\cdot\$\neg\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\text{eat}}\right)}$$

$$\frac{\text{Saito}\cdot\left(\dfrac{\text{takoyaki}\cdot\$\neg\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\text{eat}}\right)}{\text{Saito}'\cdot\neg\left(\dfrac{\text{takoyaki}\cdot\$\neg\text{eat}}{\text{takoyaki}',\text{takoyaki}''\cdot\text{eat}}\right)}$$

$$\textsc{root}\quad \left[\begin{array}{l} \text{Saito}\cdot\left\{\begin{array}{l}\text{takoyaki}\cdot\$\neg\text{eat}\\ \text{takoyaki}'\cdot\ \text{eat}\\ \text{takoyaki}''\cdot\ \text{eat}\end{array}\right. \\ \text{Saito}'\cdot\neg\left\{\begin{array}{l}\text{takoyaki}\cdot\$\neg\text{eat}\\ \text{takoyaki}'\cdot\ \text{eat}\\ \text{takoyaki}''\cdot\ \text{eat}\end{array}\right.\end{array}\right].$$

$$\textsc{meaning}\quad \left|\begin{array}{l} -\text{Saito}\cdot\text{eat}\cdot\text{takoyaki}\\ +\text{Saito}\cdot\text{eat}\cdot\text{takoyaki}'\\ +\text{Saito}\cdot\text{eat}\cdot\text{takoyaki}''\\ +\text{Saito}'\cdot\text{eat}\cdot\text{takoyaki}\\ +\text{Saito}'\cdot\text{eat}\cdot\text{takoyaki}'\end{array}\right| . \left\{\begin{array}{l} \text{eat}\\ \$\neg\text{eat}\\ \$\,\text{takoyaki}\cdot\neg\text{eat}\\ \text{takoyaki}'\cdot\text{eat}\\ \text{takoyaki}''\cdot\text{eat}\\ \left\{\begin{array}{l}\text{takoyaki}\cdot\neg\text{eat}\\ \text{takoyaki}'\cdot\text{eat}\\ \text{takoyaki}''\cdot\text{eat}\end{array}\right.\\ \text{Saito}\cdot\left\{\begin{array}{l}\text{takoyaki}\cdot\neg\text{eat}\\ \text{takoyaki}'\cdot\ \text{eat}\\ \text{takoyaki}''\cdot\ \text{eat}\end{array}\right.\\ \neg\left\{\begin{array}{l}\text{takoyaki}\cdot\neg\text{eat}\\ \text{takoyaki}'\cdot\text{eat}\\ \text{takoyaki}''\text{eat}\end{array}\right.\\ \text{Saito}'\cdot\neg\left\{\begin{array}{l}\text{takoyaki}\cdot\neg\text{eat}\\ \text{takoyaki}'\cdot\text{eat}\\ \text{takoyaki}''\cdot\text{eat}\end{array}\right.\end{array}\right.$$

For the former, if \$ was instead assigned to the second last parallelizer, the root node would be $\#\begin{bmatrix} \text{Saito}\cdot\neg\begin{cases}\text{takoyaki}\cdot\$\text{eat}\\ \text{takoyaki}'\cdot\quad\neg\text{eat}\\ \text{takoyaki}''\cdot\quad\neg\text{eat}\end{cases} \\ \text{Saito}'\cdot\begin{cases}\text{takoyaki}\cdot\$\,\text{eat}\\ \text{takoyaki}'\cdot\quad\neg\text{eat}\\ \text{takoyaki}''\cdot\quad\neg\text{eat}\end{cases}\end{bmatrix}.$, which again seems wrong to me for this particular sentence. Similarly, for the latter, if \$ was assigned to the last parallelizer, the root node would be $\#\begin{bmatrix} \text{Saito}\cdot\$\begin{cases}\text{takoyaki}\cdot\neg\text{eat}\\ \text{takoyaki}'\cdot\text{eat}\\ \text{takoyaki}''\cdot\text{eat}\end{cases} \\ \text{Saito}'\cdot\quad\neg\begin{cases}\text{takoyaki}\cdot\neg\text{eat}\\ \text{takoyaki}'\cdot\text{eat}\\ \text{takoyaki}''\cdot\text{eat}\end{cases}\end{bmatrix}.$, which seems wrong.

In sum, based on my introspection, it seems that when one AP corresponds to multiple parallelizers, only a specific one of them may have the right to have \$.

\$ が与えられうるスロットは正確にどこであるか、また、一つの AP にそのようなスロットが複数ある場合に、そのうちのどれに \$ が与えられるかといった問題は未解決で、ver. 6.0 でも具体的な提案は行わない。前者については、@LostmyPassword（https://x.com/LostmyPassword/status/1301347279673020416）, @wyoreorm（https://x.com/wyoreorm/status/1402827512447586307）, および筆者（https://x.com/awesomenewways/status/1301347566865592328）によって度々問題提起がされてきた。

CHAPTER FOUR: LEXICON

TYPE (CONT.)

ROLE

In the preceding chapters we assumed that roles are given by parallelizers. For the sake of syntax, in this chapter we assume that roles appear as a node in the base structure. The role is now admitted as a new type.

Convention 4.1:

i) $\langle X \rangle \quad \langle {}_{R} \rangle$

$$\langle {}_{R}X \rangle = \left\langle \frac{{}_{R}A \cdot_{R} X}{{}_{R}B \cdot_{R} Y} \right\rangle \neq \langle X \rangle$$

A role takes an immediately preceding serial to form a serial with a role. Serials with and without a role are considered different types. Only the former can be taken by serial-to-parallel.

This allows us to redefine parallelizers with roles. The copula, previously defined as $X\colon \frac{{}_{is}X}{\neg_{is}X}$ (p. gaslighting), can be now redefined as:

is $X\colon \frac{X}{\neg X}$

The following tree exemplifies that the two definitions achieve the same result:

X is $X\colon \frac{X}{\neg X}$

is$X$

$\frac{\text{is}X}{\neg\text{is}X}$

RELATIVE ROOT

Later in this chapter we will deal with the index mood, which merges with a node and finalizes it. The node finalized by the index mood is a *relative root*, a special type of root node that further merges with a serial. The index mood requires the root node to have the *index* meme, a special meme for this purpose, as its leftmost segment. When a relative root then merges with a serial, it is required that the index meme and the serial are co-indexed.

Convention 4.2:

i) $\frac{{}_{R}\text{index}_{n} \cdot X}{0} \quad i \quad X_n$

$\left[{}_{R}\text{index}_{n} \cdot X\right] i$

X_n

ii) $\frac{{}_{R}\text{index}_{n} \cdot X}{0} \quad i \quad X_m$

$\left[{}_{R}\text{index}_{n} \cdot X\right] i$

*

(where $n \neq m$)

iii) $\frac{{}_{R}A_{n} \cdot X}{0} \quad i$

*

(where $A \neq$ index)

LEXICAL INSERTION

THE TARGET OF LEXICAL INSERTION

A lexical item is a basic unit of syntax. It is the interface between sound (phonology, which then connects to phonetics) and meaning (semantics). Lexical items are inserted to the base structure. Consider the following example:

yumi ga nakimashita. — Exactly Yumi cried.

PHONOLOGY	'yumı ga		nak'		ı·'masıta
BASE	Yumi	by $X: \dfrac{X}{X', X''}$	cry	do $X: \dfrac{X}{\neg X}$	.

$$\text{by}^{\text{Yumi}} \qquad \text{do}^{\text{cry}}$$

$$\frac{\text{by}^{\text{Yumi}}}{\text{by}^{\text{Yumi}'}, \text{by}^{\text{Yumi}''}} \qquad \frac{\text{do}^{\text{cry}}}{\neg\text{do}^{\text{cry}}}$$

$$\frac{\text{by}^{\text{Yumi}} \cdot \text{do}^{\text{cry}}}{\text{by}^{\text{Yumi}'}, \text{by}^{\text{Yumi}''} \cdot \neg\text{do}^{\text{cry}}}$$

ROOT
$$\begin{bmatrix} \text{by}^{\text{Yumi}} \cdot \text{do}^{\text{cry}} \\ \text{by}^{\text{Yumi}'} \cdot \neg\text{do}^{\text{cry}} \\ \text{by}^{\text{Yumi}''} \cdot \neg\text{do}^{\text{cry}} \end{bmatrix}.$$

On top of the base are the lexical items, written in Kyouro. In the tree notation, the correspondence between phonological forms and semantic forms are indicated by left-aligning the phonological form with the sequence of semantic forms it corresponds to. Some correspondences are self-explanatory. The phonological form '**yumı** corresponds to the semantic form *Yumi*. That is,

'yumı — Yumi

nak' corresponds to the sequence of *cry*, $_{do}$, and $X: \dfrac{X}{\neg X}$.

nak' — cry $\quad$ do $\quad X: \dfrac{X}{\neg X}$

In many cases a single lexical item contains a sequence of multiple semantic forms. In order to make the correspondence visually intuitive, the following notation is employed:

$$\overbrace{\text{cry}\ \text{do}\ X: \frac{X}{\neg X}}^{\text{nak'}}$$

This says that the phonological form **nak**' corresponds to the semantic sequence of *cry*, $_{do}$, and $X: \dfrac{X}{\neg X}$ (in this order). This format will be used as the default notation of a lexical item. The item '**yumı** is represented as the following:

$$\overbrace{\text{Yumi}}^{\text{'yumı}}$$

When relevant, the syntactic labels are shown alongside the phonological form as usual:

$$\overbrace{\text{cry}\ \text{do}\ X: \frac{X}{\neg X}}^{\text{nak' . / d·v}}$$

$$\overbrace{\text{Yumi}}^{\text{'yumı R2 / m-ii}}$$

The lexical item *ga* is inserted to the sequence of $_{by}$ and $X: \dfrac{X}{X', X''}$. This correspondence can be represented as the following:

$$\overbrace{\text{by}\ X: \frac{X}{X', X''}}^{\text{ga}}$$

Lexical items do not care about the hierarchical structure. Lexical items target a partial linear sequence instead of a constituent.

In the following sentence, a partial linear sequence, but not a constituent, is mapped to a syntactic node.

shinigmi wa ringo shika tabenai. — Specifically Death eats only apples.

(Death Note, Season 1, Episode 10, at about 9 min 10 sec. Translation is mine.)

The lexical item $\overbrace{X : \frac{\neg X}{X} \; X : \frac{X}{\neg X}}^{\text{'}a\text{·}na_{\text{,}}\iota}$. does not correspond to a constituent. The first component $X : \frac{\neg X}{X}$ merges leftward, leaving the other two behind.

PHONOLOGY	sıngamı' [o]	hȧ		rınngo'	[o]	sıka	'tabė		'a·na,ı	
BASE	Death	by	$X : \frac{X}{X'}$	apple	on	$X : \frac{X', X''}{X}$	eat	do	$X : \frac{\neg X}{X}$	$X : \frac{X}{\neg X}$.

$$\text{by}^{\text{Death}} \qquad \text{on}^{\text{apple}} \qquad \text{do}^{\text{eat}}$$

$$\frac{\text{by}^{\text{Death}}}{\text{by}^{\text{Death}'}} \qquad \frac{\text{on}^{\text{apple}'},\text{on}^{\text{apple}''}}{\text{on}^{\text{apple}}} \qquad \frac{\neg_{\text{do}}{}^{\text{eat}}}{\text{do}^{\text{eat}}}$$

$$\frac{\text{on}^{\text{apple}'},\text{on}^{\text{apple}''} \cdot \neg_{\text{do}}{}^{\text{eat}}}{\text{on}^{\text{apple}} \cdot_{\text{do}}{}^{\text{eat}}}$$

$$\frac{\left(\frac{\text{on}^{\text{apple}'},\text{on}^{\text{apple}''} \cdot \neg_{\text{do}}{}^{\text{eat}}}{\text{on}^{\text{apple}} \cdot_{\text{do}}{}^{\text{eat}}}\right)}{\neg\left(\frac{\text{on}^{\text{apple}'},\text{on}^{\text{apple}''} \cdot \neg_{\text{do}}{}^{\text{eat}}}{\text{on}^{\text{apple}} \cdot_{\text{do}}{}^{\text{eat}}}\right)}$$

$$\frac{\text{by}^{\text{Death}} \cdot \left(\frac{\text{on}^{\text{apple}'},\text{on}^{\text{apple}''} \cdot \neg_{\text{do}}{}^{\text{eat}}}{\text{on}^{\text{apple}} \cdot_{\text{do}}{}^{\text{eat}}}\right)}{\text{by}^{\text{Death}'} \cdot \neg\left(\frac{\text{on}^{\text{apple}'},\text{on}^{\text{apple}''} \cdot \neg_{\text{do}}{}^{\text{eat}}}{\text{on}^{\text{apple}} \cdot_{\text{do}}{}^{\text{eat}}}\right)}$$

ROOT

$$\begin{bmatrix} \text{by}^{\text{Death}} \cdot \begin{cases} \text{on}^{\text{apple}'} \cdot \neg_{\text{do}}{}^{\text{eat}} \\ \text{on}^{\text{apple}''} \cdot \neg_{\text{do}}{}^{\text{eat}} \\ \text{on}^{\text{apple}} \cdot_{\text{do}}{}^{\text{eat}} \end{cases} \\ \text{by}^{\text{Death}} \cdot \neg \begin{cases} \text{on}^{\text{apple}'} \cdot \neg_{\text{do}}{}^{\text{eat}} \\ \text{on}^{\text{apple}''} \cdot \neg_{\text{do}}{}^{\text{eat}} \\ \text{on}^{\text{apple}} \cdot_{\text{do}}{}^{\text{eat}} \end{cases} \end{bmatrix} .$$

Arity

When the predicate receives an argument or adjunct, it must be in the form of a parallel. When a predicate merges with a parallel, it must be made back parallel to be ready for another, until the clause receives the mood. How many times it is parallelized in the clause tells its *arity:* how many parallels it merges with.

In #KYGN#, the predicate ${}_{do}cry$ is parallelized twice by two instances of $X : \dfrac{X}{\neg X}$. Because this form appears twice after ${}_{do}cry$, we can tell, even without looking at the nodes on the left, that there are two arguments or adjuncts for this predicate, provided that the derivative tree is well-formed. Arity solves some cases of structural ambiguity including the one that we saw in p. ignorance of *Proposing*.

I expect that this mechanism serves as a basis for case and valency, but in version 6.0 they are not discussed.

To accommodate both $\overbrace{cry\ {}_{do}\ X : \dfrac{X}{\neg X}}^{nak'}$ and $\overbrace{cry\ {}_{do}\ X : \dfrac{X}{\neg X}\ X : \dfrac{X}{\neg X}}^{nak'}$ as well as unrestrictedly many other possible semantic forms of **nak**' under the same entry in the lexicon, we use the notation $\Big|_n^m X$ to say X can appear minimally n times and maximally m times.

PHONOLOGY	kıno'u	[o]	'yumı	ga		nak'				ı·'masıta
BASE	yesterday	at $X : \dfrac{X}{0}$	Yumi	by $X : \dfrac{X}{X', X''}$	cry	do	$X : \dfrac{X}{\neg X}$	$X : \dfrac{X}{\neg X}$		.

$$\text{at}^{\text{yesterday}} \qquad \text{by}^{\text{Yumi}} \qquad \text{do}^{\text{cry}}$$

$$\frac{\text{at}^{\text{yesterday}}}{0} \qquad \frac{\text{by}^{\text{Yumi}}}{\text{by}^{\text{Yumi}'}, \text{by}^{\text{Yumi}''}} \qquad \frac{\text{do}^{\text{cry}}}{\neg\text{do}^{\text{cry}}}$$

$$\frac{\text{by}^{\text{Yumi}} \cdot \text{do}^{\text{cry}}}{\text{by}^{\text{Yumi}'}, \text{by}^{\text{Yumi}''} \cdot \neg\text{do}^{\text{cry}}}$$

$$\frac{\left(\dfrac{\text{by}^{\text{Yumi}} \cdot \text{do}^{\text{cry}}}{\text{by}^{\text{Yumi}'}, \text{by}^{\text{Yumi}''} \cdot \neg\text{do}^{\text{cry}}}\right)}{\neg\left(\dfrac{\text{by}^{\text{Yumi}} \cdot \text{do}^{\text{cry}}}{\text{by}^{\text{Yumi}'}, \text{by}^{\text{Yumi}''} \cdot \neg\text{do}^{\text{cry}}}\right)}$$

$$\frac{\text{at}^{\text{yesterday}} \cdot \left(\dfrac{\text{by}^{\text{Yumi}} \cdot \text{do}^{\text{cry}}}{\text{by}^{\text{Yumi}'}, \text{by}^{\text{Yumi}''} \cdot \neg\text{do}^{\text{cry}}}\right)}{0}$$

ROOT $$\begin{bmatrix} \text{at}^{\text{yesterday}} \cdot \text{by}^{\text{Yumi}} \cdot \text{do}^{\text{cry}} \\ \text{at}^{\text{yesterday}} \cdot \text{by}^{\text{Yumi}'} \cdot \neg\text{do}^{\text{cry}} \\ \text{at}^{\text{yesterday}} \cdot \text{by}^{\text{Yumi}''} \cdot \neg\text{do}^{\text{cry}} \end{bmatrix}.$$

The representation $\overbrace{cry\ _{do}\Big|_{0}^{\infty} X:\frac{X}{\neg X}}^{nak'}$ means that the phonological form **nak**' is inserted to a sequence of $X:\frac{X}{\neg X}$ optionally repeated any number of times preceded immediately by $cry\ _{do}$. It is postulated here that the minimum number of times the item **nak**' needs $X:\frac{X}{\neg X}$ is zero. This assumption is justified by #SWRST# where the verb '**tabė** lacks $X:\frac{X}{\neg X}$.

An interesting case of variable arity is found as the structural ambiguity of a part of the famous lyrics of Inaba (1993): *boku wa kimi dakeo kizutsukenai*. Taken as a sentence, the text can be understood to mean (a) "you are not the only person hurt by me" (shown below) or (b) "you are the only person not hurt by me" (shown on the next page). The ambiguity comes from the variable arities of the verb stem *kizutsuke* and the suffix *anai*, lexically represented as $\overbrace{hurt\ _{do}\Big|_{0}^{\infty} X:\frac{X}{\neg X}}^{kızu'tukė}$ and $\overbrace{X:\frac{\neg X}{X}\Big|_{0}^{\infty} X:\frac{X}{\neg X}}^{'a\cdot na_{,}ι}$., respectively.

BASE

$$\text{I} \quad \text{by}\ X:\frac{X}{X'} \quad \text{you} \quad \text{on}\ X:\frac{\neg(X',X'')}{\neg X}\ \text{hurt} \quad \text{do} \quad X:\frac{X}{\neg X}\ \ X:\frac{\neg X}{X}\ .$$

$$\text{by}^{\text{I}} \qquad \text{on}^{\text{you}} \qquad \text{do}^{\text{hurt}}$$

$$\frac{\text{by}^{\text{I}}}{\text{by}^{\text{I}'}} \qquad \frac{\neg\left(\text{on}^{\text{you}'},\text{on}^{\text{you}''}\right)}{\neg\text{on}^{\text{you}}} \qquad \frac{\text{do}^{\text{hurt}}}{\neg\text{do}^{\text{hurt}}}$$

$$\frac{\neg\left(\text{on}^{\text{you}'},\text{on}^{\text{you}''}\right)\cdot\text{do}^{\text{hurt}}}{\neg\text{on}^{\text{you}}\cdot\neg\text{do}^{\text{hurt}}} = \frac{\text{on}^{\text{you}'},\text{on}^{\text{you}''}\cdot\neg\text{do}^{\text{hurt}}}{\text{on}^{\text{you}}\cdot\text{do}^{\text{hurt}}}$$

$$\frac{\neg\left(\frac{\text{on}^{\text{you}'},\text{on}^{\text{you}''}\cdot\neg\text{do}^{\text{hurt}}}{\text{on}^{\text{you}}\cdot\text{do}^{\text{hurt}}}\right)}{\left(\frac{\text{on}^{\text{you}'},\text{on}^{\text{you}''}\cdot\neg\text{do}^{\text{hurt}}}{\text{on}^{\text{you}}\cdot\text{do}^{\text{hurt}}}\right)}$$

$$\frac{\text{by}^{\text{I}}\cdot\neg\left(\frac{\text{on}^{\text{you}'},\text{on}^{\text{you}''}\cdot\neg\text{do}^{\text{hurt}}}{\text{on}^{\text{you}}\cdot\text{do}^{\text{hurt}}}\right)}{\text{by}^{\text{I}'}\cdot\left(\frac{\text{on}^{\text{you}'},\text{on}^{\text{you}''}\cdot\neg\text{do}^{\text{hurt}}}{\text{on}^{\text{you}}\cdot\text{do}^{\text{hurt}}}\right)}$$

ROOT

$$\begin{bmatrix} \text{by}^{\text{I}}\cdot\neg\begin{cases}\text{on}^{\text{you}'}\cdot\neg\text{do}^{\text{hurt}}\\ \text{on}^{\text{you}''}\cdot\neg\text{do}^{\text{hurt}}\\ \text{on}^{\text{you}}\cdot\text{do}^{\text{hurt}}\end{cases} \\ \text{by}^{\text{I}'}\cdot\begin{cases}\text{on}^{\text{you}'}\cdot\neg\text{do}^{\text{hurt}}\\ \text{on}^{\text{you}''}\cdot\neg\text{do}^{\text{hurt}}\\ \text{on}^{\text{you}}\cdot\text{do}^{\text{hurt}}\end{cases}\end{bmatrix}.$$

BASE $\quad \mathrm{I} \quad \mathrm{by}\ X : \frac{X}{X'} \quad \mathrm{you} \quad \mathrm{on}\ X : \frac{\neg(X', X'')}{\neg X} \quad \mathrm{hurt} \quad \mathrm{do} \quad X : \frac{\neg X}{X} \quad X : \frac{X}{\neg X} \quad .$

$$\mathrm{by}^{\mathrm{I}} \qquad \mathrm{on}^{\mathrm{you}} \qquad \mathrm{do}^{\mathrm{hurt}}$$

$$\frac{\mathrm{by}^{\mathrm{I}}}{\mathrm{by}^{\mathrm{I}'}} \qquad \frac{\neg\left(\mathrm{on}^{\mathrm{you}'}, \mathrm{on}^{\mathrm{you}''}\right)}{\neg \mathrm{on}^{\mathrm{you}}} \qquad \frac{\neg \mathrm{do}^{\mathrm{hurt}}}{\mathrm{do}^{\mathrm{hurt}}}$$

$$\frac{\neg\left(\mathrm{on}^{\mathrm{you}'}, \mathrm{on}^{\mathrm{you}''}\right) \cdot \neg \mathrm{do}^{\mathrm{hurt}}}{\neg \mathrm{on}^{\mathrm{you}} \cdot \mathrm{do}^{\mathrm{hurt}}} = \frac{\mathrm{on}^{\mathrm{you}'}, \mathrm{on}^{\mathrm{you}''} \cdot \mathrm{do}^{\mathrm{hurt}}}{\mathrm{on}^{\mathrm{you}} \cdot \neg \mathrm{do}^{\mathrm{hurt}}}$$

$$\frac{\left(\dfrac{\mathrm{on}^{\mathrm{you}'}, \mathrm{on}^{\mathrm{you}''} \cdot \mathrm{do}^{\mathrm{hurt}}}{\mathrm{on}^{\mathrm{you}} \cdot \neg \mathrm{do}^{\mathrm{hurt}}}\right)}{\neg\left(\dfrac{\mathrm{on}^{\mathrm{you}'}, \mathrm{on}^{\mathrm{you}''} \cdot \mathrm{do}^{\mathrm{hurt}}}{\mathrm{on}^{\mathrm{you}} \cdot \neg \mathrm{do}^{\mathrm{hurt}}}\right)}$$

$$\frac{\mathrm{by}^{\mathrm{I}} \cdot \left(\dfrac{\mathrm{on}^{\mathrm{you}'}, \mathrm{on}^{\mathrm{you}''} \cdot \mathrm{do}^{\mathrm{hurt}}}{\mathrm{on}^{\mathrm{you}} \cdot \neg \mathrm{do}^{\mathrm{hurt}}}\right)}{\mathrm{by}^{\mathrm{I}'} \cdot \neg\left(\dfrac{\mathrm{on}^{\mathrm{you}'}, \mathrm{on}^{\mathrm{you}''} \cdot \mathrm{do}^{\mathrm{hurt}}}{\mathrm{on}^{\mathrm{you}} \cdot \neg \mathrm{do}^{\mathrm{hurt}}}\right)}$$

ROOT
$$\begin{bmatrix} \mathrm{by}^{\mathrm{I}} \cdot \begin{cases} \mathrm{on}^{\mathrm{you}'} \cdot \mathrm{do}^{\mathrm{hurt}} \\ \mathrm{on}^{\mathrm{you}''} \cdot \mathrm{do}^{\mathrm{hurt}} \\ \mathrm{on}^{\mathrm{you}} \cdot \neg \mathrm{do}^{\mathrm{hurt}} \end{cases} \\ \mathrm{by}^{\mathrm{I}'} \cdot \neg \begin{cases} \mathrm{on}^{\mathrm{you}'} \cdot \mathrm{do}^{\mathrm{hurt}} \\ \mathrm{on}^{\mathrm{you}''} \cdot \mathrm{do}^{\mathrm{hurt}} \\ \mathrm{on}^{\mathrm{you}} \cdot \neg \mathrm{do}^{\mathrm{hurt}} \end{cases} \end{bmatrix} .$$

Relative clause

To derive the meaning of a sentence having a relative clause, we simply drew a separate tree for each relative clause. It worked for meaning, but deriving a syntax tree poses a challenge. In syntax, a relative clause appears immediately left to the antecedent. Consider again #OMSN#. The following is the syntax tree along with the broad semantic notation of this sentence:

A4/R1
./A4
R2/m-ii
A4/R1 R2/m-ii A2\A4 A4/R1
oishii *miruku* *shika* *nomanakatta*
milk$_1$ is tasty milk$_1$ not: only didn't drink
milk$_1$ is tasty not: only milk$_1$
drank only milk$_1$

In order to connect the two structures we postulate the following revised structure.

The symbol *i* stands for a mood postulated for a relative clause. The symbol is taken from the first letter of *index*. Merging the clause with a mood before merging it with the antecedent ensures it can derive the proposal and the commentary. When $\left[{}_{\text{it}}\text{milk}_1 \cdot_{\text{is}} \text{tasty}\right]$ *i* merges with the head noun, *milk₁*, the root node of the relative clause is simply eliminated and then we obtain the same *milk₁*. The mood *i* ensures that the head noun has the same index with the leftmost segments of the node it merges with. It checks the indices and if they are not identical, the base structure is illformed.

Index always sits in the leftmost position of a relative clause. The checking process ensures that the relative clause obligatorily appears immediately left to its head noun.

SYNTAX			./k·ii		k·i\A4/R1		R1\R2	R2/m-ii	A1\A2	A2\A4	./d·vi		d·i\A4/R1	
PHONOLOGY	[o]		oısı'		'(_)·ı		[o]	'mıruku	[o]	sıka	'nom		a·ˌnakatta	
BASE	index_1	it	$X : \frac{X}{0}$	tasty	is	$X : \frac{X}{\neg X}$	i	milk_1	on	$X : \frac{X', X''}{X}$	drink	do	$X : \frac{\neg X}{X}$	.

$${}_{\text{it}}\text{index}_1 \qquad {}_{\text{is}}\text{tasty} \qquad {}_{\text{do}}\text{drink}$$

$$\frac{{}_{\text{it}}\text{index}_1}{0} \qquad \frac{{}_{\text{is}}\text{tasty}}{\neg_{\text{is}}\text{tasty}} \qquad \frac{\neg_{\text{do}}\text{drink}}{{}_{\text{do}}\text{drink}}$$

$$\frac{{}_{\text{it}}\text{index}_1 \cdot_{\text{is}} \text{tasty}}{0}$$

ROOT $\left[{}_{\text{it}}\text{index}_1 \cdot_{\text{is}} \text{tasty}\right] i$

$$\text{milk}_1$$

$${}_{\text{on}}\text{milk}_1$$

$$\frac{{}_{\text{on}}\text{milk}_1{}', {}_{\text{on}}\text{milk}_1{}''}{{}_{\text{on}}\text{milk}_1}$$

$$\frac{{}_{\text{on}}\text{milk}_1{}', {}_{\text{on}}\text{milk}_1{}'' \cdot \neg_{\text{do}}\text{drink}}{{}_{\text{on}}\text{milk}_1 \cdot_{\text{do}} \text{drink}}$$

ROOT
$$\begin{bmatrix} {}_{\text{on}}\text{milk}_1{}' \cdot \neg_{\text{do}}\text{drink} \\ {}_{\text{on}}\text{milk}_1{}'' \cdot \neg_{\text{do}}\text{drink} \\ {}_{\text{on}}\text{milk}_1 \cdot_{\text{do}} \text{drink} \end{bmatrix}.$$

CONCLUSION

Sentences

INITIALISM	SENTENCE	INFORMAL TRANSCRIPTION OF MEANING	INTRODUCED IN:
#AGK#	atsusa ga kibishii.	Exactly the heat is harsh.	gateau
#AOI#	ashita omatsuri iku.	(I) will go to the festival tomorrow.	jargon
#AWYWK#	ashita wa yoshimi wa kuru.	Specifically tomorrow specifically Yoshimi will come.	knowledge
#BWKDK#	boku wa kimi dakeo kizutsukenai.	You are not the only person hurt by me.	turmeric
		You are the only person not hurt by me.	uranium
#DI?#	doko itta?	Where did (you) go?	iquitos
#DK?#	dare kaita?	Who did (you) draw?	iquitos
#IDT#	ichigo dakeo tabeta.	(I) ate only strawberries.	hammer
#IK?#	itsu kaeru?	When are (you) going to come back?	iquitos
#JGK#	Jon ga kita.	John came.	cookie
		it was John who came.	cookie
#JGGD#	jon ga gakusei desu.	It is John who is a student.	bunnies
#JMH#	jon mo hashitta.	John ran too.	humor
#JSGJA#	jon shika gakusei ja arimasen.	Only John is a student.	bunnies
#K#	kawaii.	It is cute.	momentum
#KDK#	koe dakeo kiita.	(I) heard only voice.	lexington
#KDK?#	koe dakeo kiita?	Did (you) hear only voice?	lexington
#KGA#	kibishisa ga atsui.	Exactly the harshness is hot.	gateau
#KGO#	kōhī ga oishii.	Exactly coffee is tasty.	leeway
#KGSD#	kenkyosa ga suki desu.	Exactly the humbleness is liked.	gateau
#KT#	kore tabeta	(I) ate this.	japan
#KT?#	kore taberu?	Will (you) eat this?	japan
#KWO#	kōhī wa oishii.	Specifically coffee is tasty.	leeway
#KWSD#	kagakusha wa saitōsan desu.	Specifically the scientist is Saito.	garlic
#KYGN#	kinō yumi ga nakimashita.	Yesterday exactly Yumi cried.	titanium

#MMK#	mugi mo kawaii.	Mugi and the other is cute.	abstainer
#MMT#	momo mo tabete.	Eat peach too.	ice
#MSKN#	mugi shika kawaiku nai.	Only Mugi is cute.	abstainer
#MST#	momo shika tabenaide.	Eat only peach.	indict
#MWMWN#	mugi wa miruku wa nonda.	Specifically Mugi drank specifically milk.	friction
#MWK#	masao wa konakatta.	Specifically Masao did not come.	cookie
#MWT#	momo wa tabete.	Eat at least peach.	ice
#NST#	ninjin shika tabenai.	Eats only carrot.	leeway
#NT?#	nani tabeta?	What did you eat?	iquitos
#OMSN#	oishii miruku shika nomanakatta.	Drank only milk that is tasty.	fundamentals
#SWKD#	saitōsan wa kagakusha desu.	Specifically Saito is a scientist.	garlic
#SWRST#	shinigami wa ringo shika tabenai.	Specifically Death eats only apples.	surrealism
#SWTOT#	saitōsan wa takoyaki o tabeta.	Specifically Saitō ate exactly takoyaki.	momentum
	saitōsan wa takoyaki o tabenakatta.	Specifically Saitō did not exactly eat takoyaki.	nitrogen
		Specifically Saitō did not eat exactly takoyaki.	nitrogen
#TGW?#	tarō ga waratta?	Did exactly Taro laugh?	ice
#TT#	takoyaki tabeta.	I ate takoyaki.	momentum
#TWJGI#	tōkyōni wa jon ga iru.	Specifically in Tokyo John is present.	cookie
#WP#	watashino pasokon.	It is my computer.	genetics
#Y#	yasashii.	is kind.	friction
#YGKD#	yama ga kirei desu.	Exactly the mountain is beautiful.	gateau
#YGN#	yumi ga nakimashita.	Exactly Yumi cried.	stardust
#YMK?#	yoshimi mo kuru?	Is Yoshimi coming too?	ibuprofen
#YN#	yasashiku nai.	is not kind.	friction
#YSIN?#	yoshimi shika isogashiku nai?	Is only Yoshimi busy?	ibuprofen
#YWI#	yoshimi wa isogashii.	Specifically Yumi is busy.	humor
#YWIN?#	yoshimi wa isogashiku nai?	Is specifically Yoshimi not busy?	ibuprofen

References

Dawkins, R.	2016	*The Selfish Gene.* (40th anniversary edition.)	Oxford University Press.
Hasegawa, N. (Eds.) (長谷川信子)	2007	『日本語の主文現象–統語構造とモダリティ』	ひつじ書房
Heim, I. & Kratzer, A.	1998	*Semantics in Generative Grammar.*	Blackwell Publishers Ltd.
Imbrie, W.	1914	*Wa and Ga*.	Kyo Bun Kwan.
Kishimoto, H. (岸本秀樹)	2007	主文と補文：数量詞の作用域から	[Hasegawa 2007, pp. 25-72].
Kondo, Y. (@yhkondo)	p.c.	A conversation in September 2024 through DMs.	x.com
Kubo, M.	1994	*Japanese syntactic structures and their constructional meanings*.	Hituzi Syobo.
Kuno, S.	1973	*The structure of the Japanese language.*	MIT Press.
Kuroda, S-Y.	1965	Generative grammatical studies in the Japanese language.	*Thesis.* MIT.
Numata, Y. (沼田善子)	2009	『現代日本語とりたて詞の研究』	ひつじ書房
Tsujimura, N.	2007	*An introduction to Japanese linguistics.* (2nd ed.)	Blackwell Publishers LTD.

Dictionaries and literary sources

Araki, T. (director)	2006-2007	*Death Note*	Nippon Television. Obtained on Amazon Prime Video in September 2024.
Inaba, K.	1993	愛のままにわがままに 僕は君だけを傷つけない	Obtained on Apple Music in December 2024.

ENDNOTES (NOT REFERRED TO IN THE BODY TEXT)

The following are an unstructured list of notes that could have been incorporated in the body text but have yet to.

i) Kishimoto (2007, pp. 29-30) claims that the sentence b allows the interpretation "speaking of birds, it is only that they fly" but not "only birds fly." Based on this claim, he argues that the thematic *wa* cannot appear inside the scope of *dake*.

   a. tori ga tobu dake da.
   b. tori wa tobu dake da.

   This argument, however, seems to be a tautology. It is certainly possible to interpret b as $\textit{it is only that} \begin{cases} \textit{birds fly} \\ \textit{something else does not fly} \end{cases}$. Notice that the nested part patterns identically with the case of the thematic *wa* unless the second line receives $. (Compare it with #YWI# or #KWO#.) This interpretation is especially easy to access (perhaps obligatory) when the sentence is pronounced as *Tori wa tobu Dake da.* But under this interpretation, the *wa* is conventionally categorized as the contrastive *wa*. That is, any would-be counterexamples may be dismissed here because "it is not the thematic *wa.*" To non-trivially claim that the thematic *wa* cannot appear in certain position, it needs to be shown that it is *logically* possible but is never *actually* realized.

ii) The true scope of "we are talking about" for a particular sentence is generally inaccessible for the listener (the problem of whether it is accessible for the consciousness of the speaker is put aside), so studying a discourse does not reveal "the hidden meaning" of a sentence. And entities referred to in a context which are not explicitly mentioned should be semantically represented as implicit, even if the referent seems unequivocal in the discourse. The meaning of a sentence differs depending on whether *John* is merely in the context of something else, e.g., *Sarah*, or *John* is explicitly mentioned, including with a pronoun. (The *message*—the pragmatic or real-word effect—of the utterance may be identical.) Further, a context belongs to a part, not the whole, of a sentence; in "only John only speaks English," meaning, John is the only person who speaks English and no other languages, if reasonably interpreted, the context of *John* (whose worldly referents may include John, Sarah, and Sumin) and the context of *English* (whose worldly referents may include English, Japanese, and Esperanto) are distinct. It is for this reason why in our framework it is semantic or lexical objects, as opposed to a sentence or a discourse, that carry a context, such as $\left[John, John', John''\right]$.