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A study on multiple interpretations of frequency adverbs in Japanese

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Abstract

This paper is concerned with frequency adverbs in Japanese. Many linguists have pointed out that frequency statements and generic sentences have multiple readings when they co-occur with a kind of adjuncts. More often than not, the interpretation is complicated by the ambiguity of temporal adverbs and the context-dependent nature of the way operator works. In fact, frequency adverbs in Japanese cause at least four readings. We resolve this ambiguity by taking into account two factors. The first one is the syntactic structure at which a temporal adverb is located: it can stand for either an interval during which events are iterated or a temporal point for a single event. Second, we illustrate how the restriction and scope, the two arguments of the frequency operator, are decided depending on the context. Lastly, we show how semantic formulas for multiple interpretations are derived as a result of combining these factors.

1. Introduction

Given that the frequency adverb can be taken as a quantifier over an event, it can easily be seen that many of sentences with this kind of adjunct are ambiguous. As shown in the following section, however, the frequency adverb in Japanese sentences cause much more ambiguity than one can expect. We address this issue which has evaded researchers' attention so far. The approach we adopt is two-fold. First, we investigate the ambiguity of temporal adverbs in terms of modification of a duration during which events are repeated or a temporal point corresponding to a single event. Second, we try to account for the remaining part of the ambiguity by assuming that the restriction and scope of the frequency operator is introduced by context, more specifically by the focus structure. We show how these factors combine to produce semantic formulas assigned to multiply ambiguous sentences with frequency adverbs.

2. Multiply ambiguous sentences with frequency adverbs

In this section, we take up examples from Japanese sentences with frequency adverbs and show how they are multiply ambiguous.

Let us see sentence (1). This is ambiguous in four ways.

(1) Kyuzitu-ni Taro-ga   tokidoki   eiga-o   mi-ta.
    holiday-on Taro-NOM   sometimes movie-ACC   see-PAST
    "On holiday(s), Taro sometimes saw a movie."

The first distinction in meanings involves the ambiguity in number (singular/plural) attributed to Japanese nouns. The noun *kyuzitu* is ambiguous in this sense, meaning either a series of holidays or a single holiday. In the first case, the adverbial phrase *kyuzitu-ni* provides a duration of time during which events of Taro's seeing a movie is repeated. This is the interpretation shown as (2a). We interpret this sentence as having no specific restriction, as shown by `φ'. The meaning of the sentence is diagrammatically shown in Figure 1. The restriction of the quantified sentence is taken as a set of relevant situations provided by the context.
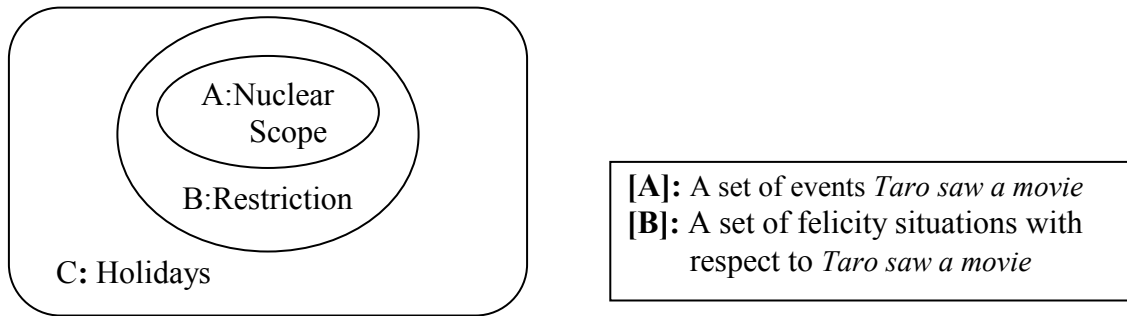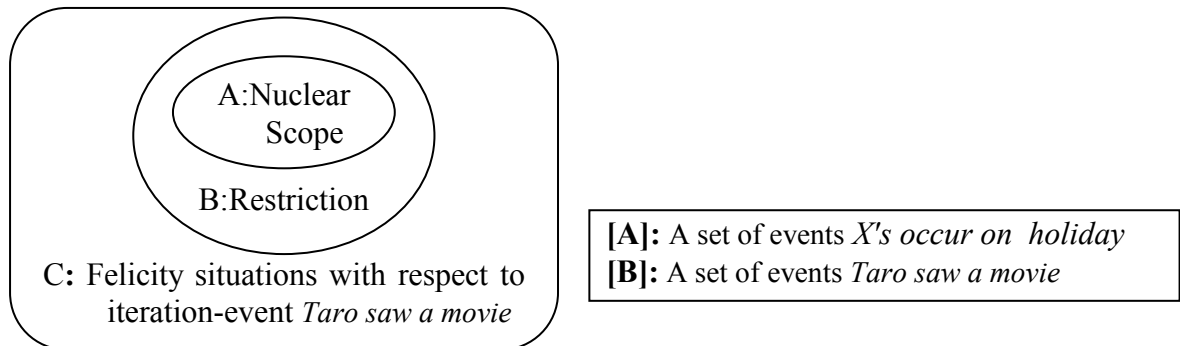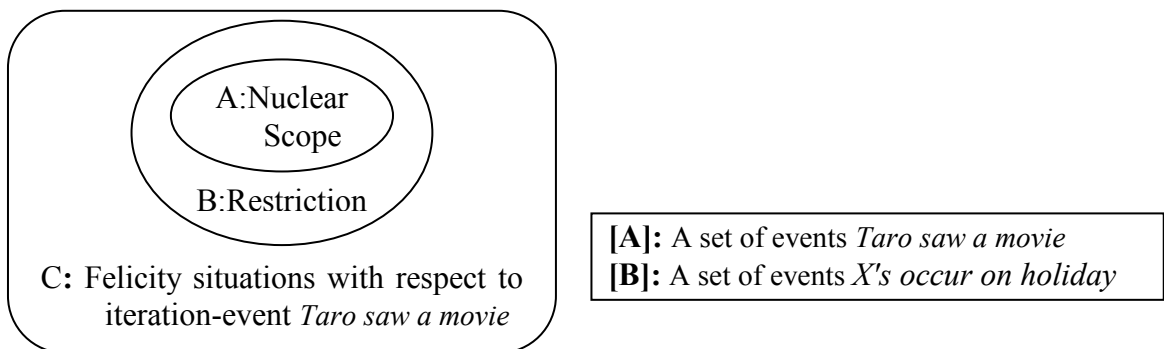
A:Nuclear Scope
B:Restriction
C: Holidays

[A]: A set of events *Taro saw a movie*
[B]: A set of felicity situations with respect to *Taro saw a movie*

Figure 1

A:Nuclear Scope
B:Restriction
C: Felicity situations with respect to iteration-event *Taro saw a movie*

[A]: A set of events *X's occur on holiday*
[B]: A set of events *Taro saw a movie*

Figure 2

A:Nuclear Scope
B:Restriction
C: Felicity situations with respect to iteration-event *Taro saw a movie*

[A]: A set of events *Taro saw a movie*
[B]: A set of events *X's occur on holiday*

Figure 3

[A]: A set of events *Taro saw a movie on holiday*
[B]: A set of felicity situations with respect to *Taro saw a movie*

A:Nuclear Scope

B:Restriction

C: Felicity situations with respect to iteration-event *Taro saw a movie*
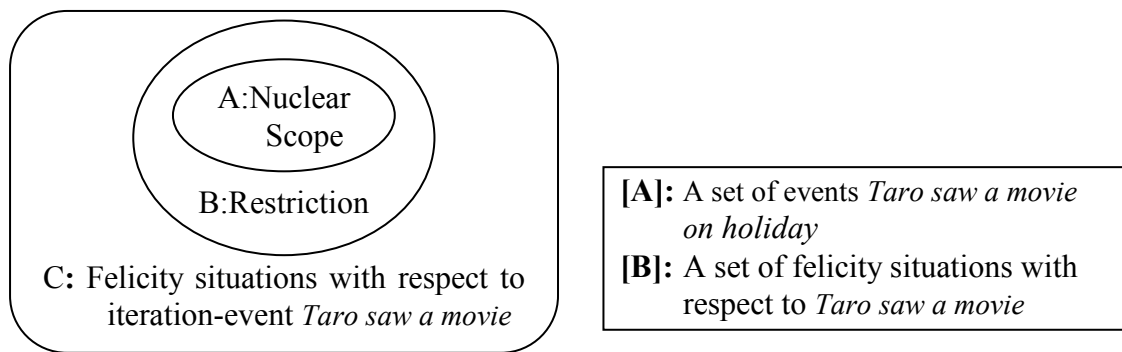
Figure 4

(2) Four interpretations in (1)

    a)   holiday (sometimes {φ}   [Taro saw a movie])
        interval   Restriction   Nuclear Scope

    b) φ (sometimes {event X occurs holidays} [Taro saw a movie])
          interval   Restriction   Nuclear Scope

    c) φ (sometimes{Taro saw a movie} [Taro saw a movie on holiday])
             interval   Restriction   Nuclear Scope

    d) φ (sometimes {φ} [Taro saw a movie on holidays]
        interval   Restriction   Nuclear Scope

    In the remaining cases (2b, c, d), there is no specific refernce to the interval during which events are repeated, as shown by `φ' as the value for the interval. In these three sentences, the AdvP *kyuzitu-ni* modifies events within the restriction or nuclear scope.

    (2b) is an interpretation according to which some proportion of the events which occur on holiday are Taro's seeing a movie. In this reading, as shown in Figure 2 and (2b), the sentence refers to the ratio between two sets of events, those occurring on holiday and those of Taro's seeing a movie.

    Interestingly, (2c) mentions a reversed relation between the two sets of events given above; it says that some proportion of the events "Taro's seeing a movie" occurs on holiday, as is also shown in Figure 3.

    (2d) has no specific restriction, either. It says that in relation to a set of relevant situations established by the context (this is shown by `a set of felicity conditions' in Figure 4), Taro's seeing a movie on holiday happens occasionally.

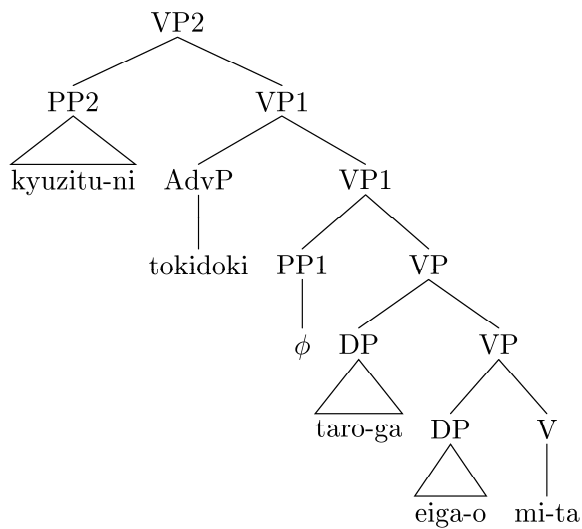## 3. Structural ambiguity of time adverbial adjuncts

    This section discusses where the difference in modification by the temporal adverbial *kyuzitu-ni* explained in the previous section derives from. What we rely on is Nakamura's (2001) observation that the tense/aspect information of the Japanese clause is composed of three strata.

(3) 1st Stratum: the assignment of aspect and a temporal point to a single eventuality
      2nd Stratum: the assignment of aspect and a temporal point to a set of repeated
                eventualities
      3rd Stratum: the assignment of (relative or absolute) tense

While Nakamura regards the hierarchical structure primarily as a semantic one, we take this as being reflected as a syntactic structure.
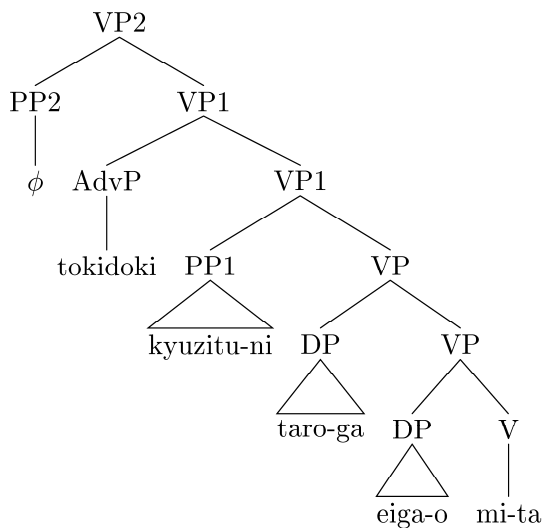
(4) is the syntactic structure we pose for the interpretation (2a) of sentence (1). The temporal AdvP *kyuzitu-ni*, appearing at PP2, the uppermost position of the sentence structure and the place for the 2nd Stratum accounted for in (3), provides a duration of time during which the events of Taro's seeing a movie are repeated. Note again that the noun *kyuzitu* is not marked for plurality.

(4) The syntactic structure for (2a)

```
                    VP2
              ┌──────┴──────┐
            PP2            VP1
          ┌──┴──┐      ┌────┴────┐
     kyuzitu-ni AdvP          VP1
                  │      ┌──────┴──────┐
               tokidoki PP1           VP
                         │        ┌────┴────┐
                         φ  DP          VP
                           ┌─┴─┐    ┌────┴───┐
                          taro-ga  DP        V
                                  ┌─┴─┐      │
                                 eiga-o    mi-ta
```

(5) is the syntactic structure for other interpretations (2b, c, d) for sentence (1).

(5) The syntactic structure for (2b-d)

```
                  VP2
            ┌──────┴──────┐
          PP2            VP1
           │        ┌─────┴─────┐
           φ  AdvP            VP1
                │        ┌──────┴──────┐
             tokidoki  PP1            VP
                      ┌──┴──┐     ┌────┴────┐
                 kyuzitu-ni DP          VP
                           ┌─┴─┐    ┌────┴───┐
                          taro-ga  DP        V
                                  ┌─┴─┐      │
                                 eiga-o    mi-ta
```

Note here that the position PP2 is left unspecified, and PP1 is assigned to the temporal AdvP *kyuzitu-ni*. This is the position for the 1st Stratum in (8), specifying the temporal information of only a single event. The AdvP is moved to the sentence-initial locus as a result of scrambling.

The difference should originate from that in lexical definitions for the two usages of the noun *kyuzitu*. After combining with the postposition *ni*, the syntactic and semantic information assigned to the AdvP looks like below:

(6) kyuzitu-ni-2

　　　　Syntax：PP-2

　　　　Semantics：$\lambda P \exists E(holiday(E) \wedge P(E))$

(7) kyuzitu-ni-1

　　　　Syntax：PP-1

　　　　　　　Semantics：$\lambda P \exists e(holiday(e) \wedge P(e))$

(6) is for the usage of the AdvP as a `2[nd] Stratum' temporal AdvP which stands for an interval during which events are repeated. Here, *holiday* is predicated of a set of events E. (7) is for the `1st Stratum' temporal AdvP which indicates the time of a single event, as represented by e.

4. Analysis based on Focus Structure

This section aims at accounting for why one and the same syntactic structure (5) leads to the three way ambiguity as shown in (2b, c, d). We attribute this to different ways of focus placement.

Rooth (1985, 1992) discusses that a different focus placement in the same sentence can change truth values. He pointed out that under the circumstance in (8), (8a) is true but (8b) is false. (Subscript $_F$ stands for focus phrase.)

(8) John introduced Bill and Tom to Sue.

　　a.　John only introduced Bill to [Sue]$_F$.

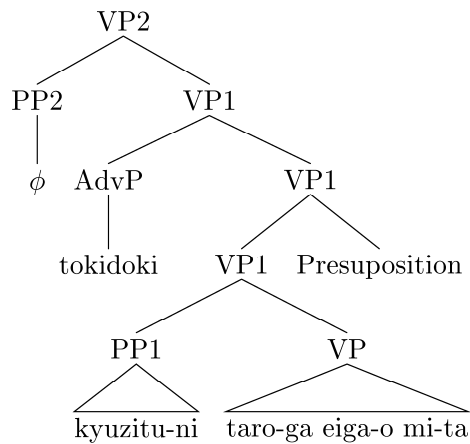　　b.　John only introduced [Bill]$_F$ to Sue.

We assume that the restriction and nuclear scope in sentences with frequency adverbs are decided depending on the information structure of the sentence. While the restriction is provided by the presupposition of the sentence, the nuclear scope is identified with its focus. See the different manners in focus placement in (9b, c, d), which each correspond to (2b, c, d). In (9b, c, d), [ ]^1 stands for a focused phrase and [ ]^0 for one without focus.

(9)　a.　[Kyuzitu-ni tokidoki [Taro-ga eiga-o mita]$_F$]^1

　　　b.　[[Kyuzitu-ni] $_F$ tokidoki Taro-ga eiga-o mita]]^1

　　　c.　[Kyuzitu-ni tokidoki Taro-ga eiga-o mita]^0

Rooth (1985,1992) proposed "P-set"(the set of preposition) and "alternative semantics". "P-sets" indicates the set of the type which corresponds to the type of focus phrase. In our case, "P-set" is the set of events. "Alternatives" means a set of presuppositions including P-sets. "Alternatives" can be represented as open sentence which is composed by the abstraction of P-sets. For (2b), "Alternatives" are calculated as follows; 1) Specify the type of the focus phrase and determine "P-sets" ("P-sets" of our example (2b) is a set of events). 2) Using "P-sets", compose the sentence (in example (2b), "event e occurs on holiday"). 3) Formulate "alternative" ({event e occurs on holiday| e

∈ a set of events}). 4) Map alternatives on syntactic structure, after syntactic structure converge (see (10))[1]. 5) Specify the variable x from the uttered sentence.

(10) "alternatives" structure in (2b)

```
                VP2
              /     \
          PP2         VP1
           |         /    \
           φ    AdvP        VP1
                 |        /     \
              tokidoki  VP1   Presuposition
                       /    \
                     PP1      VP
                    /  \     /    \
             kyuzitu-ni  taro-ga eiga-o mi-ta
```

> Presupposition in (2b) indicates ;
> {event e occurs on holiday| e ∈ a set of events}

According to this notation, we can determine the presupposition in (2c) as follows, whereas (2d) has no presupposition; in other words, all arguments are new information.

(11) Presupposition in (2c)
  a. P-sets: a set of events.
  b. Alternatives:{taro saw a movie on e| e ∈ a set of events}

From the analysis in alternative semantics, it is clear that the sentence with association with focus has two arguments. One is "alternative"(Presupposition) and the other is "the uttered sentence" (Proposition). Based on the discussion above, we can now specify the meaning of the frequency ADVP *tokidoki* as follows:

(12)   Given that P = [X [Y]$_F$]^1 and [[P]] = ∃eΠ,
        Tokidoki(E, [[P]]) = Sometimes-When(E, λeΠ, Presupposition ([[P]])),
        where Presupposition ([[P]]) is obtained by the procedure explained above.

5. Analysis for multiple meanings FAS in Japanese

From the discussions we have made so far, it is now apparent how the multiple ambiguity in sentences with a frequency adverb is derived; while there exists ambiguity as to the interval of repetition vs. temporal point of a single event denoted by the temporal AdvP, different focus interpretation further adds to ambiguity. The last task left to us is how to deal with the `frequency' meant by the adverbs involved.

Åqvist et al. (1980) regards these adverbs, including *always*, *sometimes*, *never*, *often*, and *seldom*, as an operator which takes as its arguments two predicates. Each operator specifies a proportion between two sets of relevant temporal units. Based on this framework, we formulate the semantics of some representative frequency adverbs as follows:

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[1] Notice that we use "Presupposition" instead of "alternatives" avoiding confusion. Hereafter we use "PRESUPPOSITON" in same way of "alternatives".

(13) Tokidoki(E, [[P]]) = Sometimes-When(E, λeΠ, Presupposition ([[P]]))
    Kanarazu(E, [[P]]) = Always-When(E, λeΠ, Presupposition ([[P]]))
    Yoku(E, [[P]]) = Very-Often-When(E, λeΠ, Presupposition ([[P]]))
    Hotondo-nai(E, [[P]]) = Seldom-When(E, λeΠ, Presupposition ([[P]]))
    Mattaku-nai(E, [[P]]) = Never-When(E, λeΠ, Presupposition ([[P]]))

Thus, the semantics of the frequency adverbs are given on the basis of the operators such as `Sometimes-When' following Åqvist et al. (1980). The extra argument for E is added to deal with the double-stratal temporal adverb meanings. The frequency denoted by each operator is defined as a proportion obtained by dividing the cardinality of a set by that of another, where μ is a membership function which counts the cardinality of a subset and assigns the probability. $\mu(P, Q) = |P| / |Q|$.

(14) $\models^M$ Sometimes-When(E, Π, Ψ) iff $\mu(\Pi, \Psi) \neq 0$
    $\models^M$ Always-When(E, Π, Ψ) iff $\mu(\Pi, \Psi) = 1$
    $\models^M$ Very-Often-When(E, Π, Ψ) iff $0.9 < \mu(\Pi, \Psi) < 1$
    $\models^M$ Seldom-When(E, Π, Ψ) iff $0 < \mu(\Pi, \Psi) < 0.3$
    $\models^M$ Never-When(E, Π, Ψ) iff $\mu(\Pi, \Psi) = 0$

As a result, the four meanings of (1) are formally given as below. The `zero predicate' Φ stand for a general event corresponding to non-specific restrictions adopted in section 3.

(15) Kyuzitu-ni tokidoki Taro-ga eiga-o mita.
    a. ∃E(holiday(E) ∧ Sometimes-When(E, λe∃x(see(e, t, x) ∧ movie(x)), λe'(Φ(e', t))))
    b. ∃E(Sometimes-When(E, λe∃x(see(e, t, x) ∧ movie(x) ∧ holiday(e)),
         λe'(Φ(e', t) ∧ holiday(e'))))
    c. ∃E(Sometimes-When(E, λe∃x(see(e, t, x) ∧ movie(x) ∧ holiday(e)),
         λe'∃y(see(e', t, y) ∧ movie(y))))
    d. ∃E(Sometimes-When(E, λe∃x(see(e, t, x) ∧ movie(x) ∧ holiday(e)), λe'(Φ(e', t))))

6. Conclusion

We have explained the multiply ambiguous meanings in Japanese sentences with frequency adverbs by means of two factors. One was the structural ambiguity in terms of the interpretation of a temporal adverb. Another was the contextual factor according to which the focus/presupposition interpretation is decided and as a result the restriction and nuclear scope are understood. One interesting task left for our future study would to investigate actual disambiguation process which does not seem to be so problematic despite of the theoretical complexity.

Acknowledgement

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