A semantic analysis of embedded tense in finite control in Japanese*

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1 Introduction

Obligatory control is standardly observed in non-finite clauses, not in finite clauses. See, for example, the contrast in (1) in English:

(1)   a.   John planned [PRO to run for the election].

   b. *John planned [that PRO would run for the election].
      (cf. John planned that he would run for the election.)

The finite/non-finite distinction plays an important role in exploring the properties of control, since PRO is standardly taken to be licensed in a non-finite clause, not in a finite clause in which the predicate inflects for tense and agreement.

   Japanese verbs lack inflections triggered by grammatical agreement with the subject; instead, they are accompanied by various suffixal endings such

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as tense, aspect and modality. It is controversial how the notion of finiteness in such a language can be defined,[1] but it has been widely noted by various authors that embedded clauses without the tense morpheme show largely parallel behaviors to infinitival clauses in English (see especially Kageyama, 1993). Consider, for example, the contrast in (2): in (2a) the embedded verb does not carry tense, whereas in (2b) the embedded verb has an overt past tense morpheme attached to it, and the former indices control but the latter doesn't.[2]

(2) a. John$_i$-wa [ϕ_i tegami-o dasi]-wasure-ta.
    J.-TOP   letter-ACC post-forget-PST

    'John forgot to post the letter.'

  b. John$_i$-wa [$\phi_{i/j}$ tegami-o dasi-ta] koto-o wasure-ta.
    J.-TOP   letter-ACC post-PST NC-ACC forget-PST

    'John forgot posting the letter.'

But Japanese exhibits control in certain tensed clauses such as *koto*-marked complements in (3). In (3a,b), the missing subject obligatorily refers to the matrix subject John, whereas in (3c) it can refer to someone else as well.

(3) a. John$_i$-wa [ϕ_i hako-o ake-ru] koto-o ketuisi-ta.
    J.-TOP   box-ACC open-NPST NC-ACC decide-PST

    'John decided to open the box.'

  b. John$_i$-wa [ϕ_i hako-o ake-ta] koto-o kookaisi-ta.
    J.-TOP   box-ACC open-PST NC-ACC regret-PST

    'John regretted having open the box.'

  c. John$_i$-wa [$\phi_{i/j}$ hako-o ake-ru] koto-o soozoosi-ta.
    J.-TOP   box-ACC open-NPST NC-ACC imagine-PST

    'John imagined that he would open the box.'

Note that, despite the different properties in terms of control, the embedded clause carries an overt tense morpheme in all these sentences. Since Japanese is a pro-drop language, the status of the missing subject in (3a,b) has been controversial in the literature (Fujii 2006, 2012; Hasegawa 1984/85; Uchibori, 2000, among others): PRO should not be able to appear in tensed clauses, but if the missing subject is pro, its obligatorily bound status remains a mystery.

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[1] See Takezawa (2016) for a recent overview and discussion of the inflection of Japanese verbs, and Tagawa (2019) for a recent morpho-syntactic discussion on the notion of finiteness in Japanese.

[2] We use the following abbreviations: TOP (topic), NOM (nominative), ACC (accusative), DAT (dative), PST (past), NPST (non-past), ASP (aspect), NC (nominal complementizer).

Following this line of research, we call control in tensed clauses 'finite control' in this paper.[3]

In the literature, syntactic approaches have been dominant as an explanation for why control is observed in tensed clauses (see, for example, Fujii, 2006 and Uchibori, 2000). Details vary, but most previous studies share the idea that PRO is licensed in certain tensed clause in which the tense is, in some sense, 'defective'. Akuzawa and Kubota (2019) have recently argued against the defective tense approach and claimed that the complement clauses in (3a,b) are fully tensed clauses and that the missing subject in (3a,b) is pro, rather than PRO. In Akuzawa and Kubota's (2019) account, finite control is induced semantically, that is, by the lexical meanings of the embedding verbs. Several pieces of evidence favor Akuzawa and Kubota's (2019) semantic analysis of finite control in Japanese over syntactic approaches, but they do not provide an explicit analysis of the embedded tense, which has been a central issue in the literature.

The present paper addresses this important remaining issue in the semantic analysis of finite control in Japanese, focusing on *koto*-taking control verbs. Specifically, we show that once we make explicit the lexical semantic properties of control verbs pertaining to the temporal relations between the matrix and embedded events, the observations which have (sometimes) been taken to support the defectiveness of embedded tense fall out straightforwardly as a consequence of the inherent semantic properties of the control verbs.

2 Two observations about embedded tense in control clauses

This section introduces two empirical observations about the temporal interpretations of control clauses: tense alternation possibilities and the restrictions on the distributions of temporal adverbials.

Before moving on to the specific phenomena, we introduce here a semantic classification of typical control verbs on the basis of their lexical meanings. For the purpose of the present paper, we focus on the following four classes: attitudinal, factive, attemptive and implicative. A non-exhaustive list of verbs from each category is given below:

(4)   a. **Attitudinal:** *ketui-suru* ('decide'), *siburu* ('hesitate'), *kuwadateru* ('plan')

      b. **Factive:** *kookai-suru* ('regret'), *hansei-suru* ('reflect on'), *zihu-suru* ('take pride in')

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[3] Finite control is not a phenomenon peculiar to Japanese; it has been noted in various languages including Balkan languages (Zec, 1987; Landau, 2004, 2006), Korean (Gamerschlag, 2007; Lee, 2009) and Chinese (Wang, 2011).

    c. **Attemptive:** *kokoromiru* ('try'), *kokoro-gakeru* ('keep in mind'), *torikumu* ('set about')

    d. **Implicative:** *sippai-suru* ('fail'), *seikoo-suru* ('succeed'), *zityoo-suru* ('refrain from')

Let us now turn to the first observation, pertaining to the alternation of embedded tense. It is well known that control verbs impose certain restrictions on the embedded tense (Fujii, 2006, 2016; Nakau, 1973; Sakaguchi, 1990; Uchibori, 2000). Here, we take up Fujii's (2006, 2016) observation, according to which control verbs do not allow tense alternation in the embedded clause. In (5), control verbs listed above in (4) exhibit a pattern in which they are compatible with either the nonpast or the past tense only. By contrast, non-control verbs typically do not impose any such restriction on the tense form of the embedded clause; note that the non-control verb *soozoo-suru* ('imagine') in (6) is compatible with both nonpast and past complements.

(5)   a. John-wa [hako-o ake-ru/*ta]   koto-o ketuisi-ta.
            J.-TOP   box-ACC open-NPST/PST NC-ACC decide-PST

       b. John-wa [hako-o ake-*ru/ta]   koto-o kookaisi-ta.
            J.-TOP   box-ACC open-NPST/PST NC-ACC regret-PST

       c. John-wa [hako-o ake-ru/*ta]   koto-o kokoromi-ta.
            J.-TOP   box-ACC open-NPST/PST NC-ACC try-PST

       d. John-wa [hako-o ake-ru/*ta]   koto-ni seikoosi-ta.
            J.-TOP   box-ACC open-NPST/PST NC-DAT succeed-PST

(6)   John-wa [hako-o ake-ru/ta]   koto-o soozoosi-ta.
         J.-TOP   box-ACC open-NPST/PST NC-ACC imagine-PST

Based on this observation, Fujii (2006, 2016) claims that control verbs do not allow tense alternation in the embedded clause.

The other important observation about the embedded tense is that different types of control verbs behave differently as to whether they allow for separate temporal adverbials in the matrix and embedded clauses (Nakau, 1973; Uchibori, 2000; Fujii, 2012). Unlike attitudinal verbs and factive verbs, attemptive verbs and implicative verbs do not allow for separate temporal adverbials:

(7)   a. John-wa [rainen senkyo-ni   de-ru]   koto-o kotosi
            J.-TOP   next.year election-DAT run-NPST NC-ACC this.year
            ketuisi-ta.
            decide-PST

       b. John-wa [kyonen senkyo-ni   de-ta]   koto-o kotosi
            J.-TOP   last.year election-DAT run-PST NC-ACC this.year

kookaisi-ta.
regret-PST

c. *John-wa [rainen   senkyo-ni   de-ru]   koto-o   kotosi
   J.-TOP   next.year election-DAT run-NPST NC-ACC this.year
   kokoromi-ta.
   try-PST

d. *John-wa [rainen   senkyo-ni   de-ru]   koto-ni kotosi
   J.-TOP   next.year election-DAT run-NPST NC-DAT this.year
   seikoosi-ta.
   succeed-PST

Some of the facts noted above have been taken by previous authors to support particular types of analyses of finite control in Japanese. Due to space limitations, we cannot provide a review of these previous proposals in this paper, but we acknowledge here that, regardless of theoretical assumptions, the facts themselves need to be accounted for. Our own account, presented in section 4, differs from major accounts in the previous literature in offering a semantic explanation for these observations.

3 Is embedded tense defective?

Most previous studies attribute the observations in the previous section to the defectiveness of embedded tense. For example, Fujii (2006) suggests the following syntactic generalization dubbed 'Tense Alternation Generalization (TAG)', and assumes that the embedded tense of control verbs is defective.

(8) **Tense Alternation Generalization:** Tensed subordinate clauses in Japanese act like infinitives if and only if their predicate doesn't alternate between nonpast and past tense forms.

Similarly, Uchibori (2000) claims that some control verbs do not allow separate temporal adverbials since their embedded tenses are syntactically so defective that they cannot have independent temporal domain.

The notion of defective tense thus plays an important role in both Fujii's and Uchibori's syntactic accounts, and with respect to two related (but distinct) sets of empirical patterns, but it remains unclear what exactly is meant by this notion. In particular, it is unclear how 'defective tense' fits in the overall tense system of Japanese, which overwhelmingly exhibits relative tense in embedded contexts (Teramura, 1984; Ogihara, 1996; Kusumoto, 1999). Moreover, Uchibori's account suggests that defectiveness is a graded notion, but then, the correlation between this notion and the property of control is unclear. That is, how defective does a predicate have to be in order to license control?

In addition to the conceptual problems noted above, the 'defectiveness' approach has at least two major empirical problems. First, some control verbs such as *kookai-suru* ('regret') permit tense alternation with stative predicates as discussed in Akuzawa (2018) and Akuzawa and Kubota (2019).[4]

(9) John-wa [Tokyo-ni i-ru/ta]   koto-o kookaisi-ta.
     J.-TOP   Tokyo-in be-NPST/PST NC-ACC regret-PST
     'John regretted being/having been in Tokyo.'

Second, the missing subject can sometimes appear overtly. This is problematic because nominative case is standardly taken to be licensed by finite T(ense) (Takezawa, 1987).

(10) John$_i$-wa [ϕ_i/kare$_i$/zibun$_i$-ga hako-o   ake-ru]   koto-o
      J.-TOP   he/himself-NOM box-ACC open-NPST NC-ACC
      ketuisi-ta.
      decide-PST
      'John decided to open the box himself.'

In view of the difficulties of the 'defectiveness' approach, we take the embedded tense of *koto*-complement clauses to be non-defective. In the next section, we show that a semantic approach adequately captures the observations about tense and temporal interpretation of control verbs from section 2, which are updated and summarized in (11).

(11) Tense property of embedded clause in finite control

	tense form	separate temporal adverbials
attitudinal	*-ru/*-ta*	yes
factive	*-ru/-ta*	yes
attemptive	*-ru/*-ta*	no
implicative	*-ru/*-ta*	no

4 A non-defective analysis of embedded tense in control clauses

In this section, we show that both the tense alternation generalization (including its exceptions) and the restrictions on the distribution of temporal adverbials follow from the semantic analysis of finite control proposed by Akuzawa and Kubota (2019), once we spell out the meanings of control verbs in detail. Since our analysis crucially involves temporal interpretation, we start by laying out some assumptions about tense interpretation (in particular, in embedded contexts) and then move on to the analysis of control verbs.

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[4] The fact that *kookai-suru* allows tense alternation is originally noted by Uchibori (2000, 204), but she does not consider this verb as a control verb.

4.1 Embedded tense in Japanese

As discussed by many authors (Teramura, 1984; Ogihara, 1996; Kusumoto, 1999), Japanese has a relative tense system. This means that tense in embedded contexts are interpreted with respect to the event time of the matrix clause rather than the speech time (as in languages with the absolute tense system such as English). This can be seen most clearly with temporal adverbial clauses such as *ato-de* ('after') and *mae-ni* ('before') clauses (see, e.g., Ogihara, 1996). In Japanese, the past tense is obligatory in 'after' clauses and the nonpast tense is obligatory in 'before' clauses:

(12) a. John-wa yuuhan-o tabe-ru/*ta-mae-ni te-o   arat-ta.
          J.-TOP   dinner-ACC eat-NPST/PST-before hand-ACC wash-PAST

          'John washed his hands before having dinner.'

    b. John-wa yuuhan-o   tabe-*ru/ta-ato-de sanpo-ni ik-u.
          J.-TOP   dinner-ACC eat-NPST/PST-after walk-DAT go-NPST

          'John will take a walk after having dinner.'

The 'before' clause locates the matrix event before the embedded event, so, the embedded event is in the future with respect to the matrix event time. Thus, the nonpast tense is obligatory, regardless of whether the embedded event is in the past or future relative to the speech time. Similarly, the past tense marking is obligatory in 'after' clauses.

There are several different ways to implement relative tense in a formal compositional system. Here, we loosely follow the approach proposed by Kubota et al. (2012), which recognizes the notion of 'evaluation time' as a key primitive concept. The idea in a nutshell is that tense locates the event time with respect to the evaluation time, and that the evaluation time is set to different times depending on the syntactic context in which the tense morpheme appears. Roughly, the evaluation time is set to the speech time in matrix clauses and to the matrix event time in embedded clauses. On this assumption, the meanings of the nonpast and past tenses can be formulated as follows, where t_{eval} designates the evaluation time:[5]

(13) a. $[\![\,\text{-}ru\,]\!] = \lambda P\lambda x\lambda t\lambda w.P(x)(t)(w) \wedge t \geq t_{eval}$
      b. $[\![\,\text{-}ta\,]\!] = \lambda P\lambda x\lambda t\lambda w.P(x)(t)(w) \wedge t < t_{eval}$

4.2 Lexical meanings of control verbs

We now move on to the analysis of the lexical meanings of the specific control verbs. In what follows, we focus on the four types of control verbs introduced

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[5] For the sake of expository ease, we treat the evaluation time as a free variable. Making the analysis fully compositional involves treating this variable as a λ-bound parameter that is explicitly passed from the embedded clause to the higher clause. Since nothing crucially hinges on this detail, we stick to the simplifying assumption in what follows.

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in section 2, specifically, attitudinal, factive, attemptive and implicative verbs. These four classes of verbs constitute the major types of *koto*-taking control verbs.[6] Attitudinal and attemptive verbs are future-oriented due to their lexical meanings, whereas factive and implicative verbs are non-future-oriented, again, due to their lexical meanings.

Among the four types of verbs, attitudinal and factive verbs allow for separate temporal adverbials in the embedded and matrix clauses, as noted in section 2. These verbs have meanings whose temporal components are easier to identify, so we deal with them first, starting with attitudinal verbs.

Intuitively, attitudinal verbs are incomparable with the past tense since the embedded clause needs to have future reference with respect to the matrix event time. To be more concrete, building on Akuzawa and Kubota's (2019) modal analysis of control verbs, the attitudinal verb *ketui-suru* ('decide') can be analyzed as follows (here and in what follows, the presuppositional component is underlined; $Alt_{x,t,w}^{volit}$ designates the set of volitional alternative worlds for x at t in w):

(14) $\lambda P \lambda x \lambda t \lambda w. \underline{\forall w' \in Alt_{x,t,w}^{epst} : \exists t' > t.\exists Q.\mathbf{discret}(Q)(x)(t)(w')}$
$\underline{\wedge [P(x)(t')(w') \to Q(x)(t)(w')]}; \forall w'' \in Alt_{x,t,w}^{volit}.Q(x)(t)(w'')$

That is, *ketui-suru* presupposes that the controller x recognizes that engaging in some activity Q that is at his/her discretion at t (i.e. the matrix time) is a necessary condition for the realization of P (i.e. the content of the embedded clause) at a future time t', and asserts that x has a volitional commitment to Q. (We leave unanalyzed the primitive predicate **discret**, where $\mathbf{discret}(P)(x)(t)(w)$ iff P is at x's discretion at t in w.) Crucially, the verb shifts the time of P to future ($t' > t$) due to its lexical meaning.

Assuming that the temporal variable is existentially closed in matrix clauses, the denotations for (5a) with nonpast and past tenses come out as in (15) and (16), respectively (where t_{now} is the speech time).

(15) $\exists t < t_{now}.\underline{\forall w' \in Alt_{\mathbf{j},t,w}^{epst} : \exists t' > t.\exists Q.\mathbf{discret}(Q)(\mathbf{j})(t)(w')}$
$\underline{\wedge[[\mathbf{open\text{-}the\text{-}box}(\mathbf{j})(t')(w') \wedge t' \geq t] \to Q(\mathbf{j})(t)(w')]};$
$\forall w'' \in Alt_{\mathbf{j},t,w}^{volit}.Q(\mathbf{j})(t)(w'')$

(16) $\exists t < t_{now}.\underline{\forall w' \in Alt_{\mathbf{j},t,w}^{epst} : \exists t' > t.\exists Q.\mathbf{discret}(Q)(\mathbf{j})(t)(w')}$
$\underline{\wedge[[\mathbf{open\text{-}the\text{-}box}(\mathbf{j})(t')(w') \wedge \boxed{t' < t}] \to Q(\mathbf{j})(t)(w')]};$
$\forall w'' \in Alt_{\mathbf{j},t,w}^{volit}.Q(\mathbf{j})(t)(w'')$

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[6] But it should be kept in mind that they are by no means exhaustive. In particular, we do not deal with *koto*-taking aspectual verbs inducing control such as *hazimeru* ('begin'), *tuzukeru* ('continue') and *oeru* ('finish'). Extending the present approach to these verbs is a task for future research.

(15) is a contradiction (with $t' > t$, $t' < t$), so it follows that *ketui-suru* is incompatible with the past tense.

In contrast to the future-oriented verbs, factive verbs such as *kookai-suru* ('regret') are past-oriented (or, more precisely, non-future-oriented), given the nature of the semantic relations they express. The key idea here is that one can only regret things whose consequences are relevant at the time of regretting. This means that, for eventive predicates, the relevant event needs to have already happened (note that nonpast tense of eventive predicates in Japanese is future-oriented, thus excluding the simultaneous interpretation).[7] For stative predicates, since the nonpast tense is compatible with the simultaneous interpretation, both the past and nonpast tenses are predicted to be acceptable. Thus, an apparent exception to TAG receives a natural explanation in our semantic account.

The lexical meaning for *kookai-suru* ('regret') can be specified as follows:

(17) $\quad \lambda P \lambda x \lambda t \lambda w. \exists t', t''.t' \leq t \wedge t'' < t' \wedge P(x)(t')(w) \wedge \forall w' \in Alt_{x,t,w}^{epst}.$
$\underline{\exists Q.\mathbf{discret}(Q)(x)(t'')(w') \wedge [Q(x)(t'')(w') \rightarrow \neg P(x)(t')(w')]};$
$\forall w'' \in Alt_{x,t,w}^{desider}.Q(x)(t'')(w'')$

(17) introduces two conditions in its presupposition: (i) P (i.e. the embedded event) obtains at t', which is either simultaneous with or preceding the matrix time t (the factive component), and (ii) there was some action Q, which was at x's discretion at a time t' preceding t'' and which could have prevented P. On the basis of this presupposition, the sentence asserts that at the matrix time t, x wishes (or, finds it desirable) to have actually done Q at t''.

The event time t' of P is constrained to either be simultaneous with or precede the matrix event time. On the standard assumption that the nonpast tense of eventive predicates has (relative) future reference, it is correctly predicted that *kookai-suru* is compatible with past tense only when the embedded verb is eventive. By contrast, with stative predicates, which allow for the simultaneous/present interpretation for the nonpast tense, the nonpast tense is predicted to be acceptable. This is indeed the case (Uchibori, 2000, 204), and, as noted by Akuzawa (2018) and Akuzawa and Kubota (2019), this fact constitutes important counterevidence to Fujii's TAG (which by assumption is a

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[7] Things are actually a bit more complex here since there are certain examples in which the nonpast tense is acceptable with eventive predicates, such as the following:

(i) John-wa kagyoo-o   tug-u   koto-o imasara   kookaisi-tei-ru.
    J.-TOP family.business-ACC take.over-NPST NC-ACC at.this.stage regret-PROG-NPST
    'John regrets having decided to take over his family business at this late stage.'

Examples such as (i) sound much better than examples such as (5b) (with the nonpast tense). It is currently unclear what the relevant factors are that improve the acceptability of factive control verbs with embedded nonpast tense. We leave this issue for future study.

purely syntactic condition).

We now turn to the other two classes of verbs, namely, attemptive and implicative verbs. As compared to attitudinal verbs, for which the relevant goal-oriented attitude is strictly inside the mind of the attitude holder (i.e. the controller), attemptive verbs have a stronger entailment with respect to how the attitude holder behaves in the actual world at the event time. Roughly, in the case of *kokoromiru* ('try'), the attitude holder has to be engaged in some activity which is a precondition for the realization of the event denoted by the embedded clause (at least in the most typical cases). Thus, the meaning of *kokoromiru* can be characterized as follows:

(18) $\lambda P \lambda x \lambda t \lambda w. \forall w' \in Alt_{x,t,w}^{epst}. \exists t' \supseteq t. P(x)(t')(w') \rightarrow$
$\mathbf{prep}(P)(x)\overline{(t)(w')}; \mathbf{prep}(P)(x)(t)(w)$

Here, $\mathbf{prep}(P)(x)(t)(w)$ is true iff x engages in some activity at t in w that counts as a preparatory stage for P. (18) presupposes that x realizes that engaging in the preparatory activity of P is a necessary condition for the realization of P, and asserts that x does actually engage in such an activity. Assuming an interval-based semantics, the temporal interval at which $\mathbf{prep}(P)$ holds has to be a subinterval of the interval at which P holds (i.e. $t' \supseteq t$). This effectively imposes a simultaneity condition on the matrix and embedded event times, predicting the obligatoriness of the embedded nonpast tense (see below) and the impossibility of separate temporal adverbial modification (which we discuss in the next section).

Given the lexical entry for *kokoromiru* in (18), the denotation for (5c) with the past tense comes out as follows:

(19) $\exists t < t_{now}. \forall w' \in Alt_{\mathbf{j},t,w}^{epst}. \exists t' \supset t.[\mathbf{open\text{-}the\text{-}box}(\mathbf{j})(t')(w') \wedge t' < t] \rightarrow$
$\mathbf{prep}(\lambda x \lambda t_0 \lambda w.\mathbf{open\text{-}the\text{-}box}(x)(t_0)(w) \wedge t_0 < t)(\mathbf{j})(t)(w');$
$\mathbf{prep}(\lambda x \lambda t_0 \lambda w.\mathbf{open\text{-}the\text{-}box}(x)(t_0)(w) \wedge t_0 < t)(\mathbf{j})(t)(w)$

Here, the embedded tense locates the event time t' of opening the box in the past relative to the matrix event time t. But this contradicts with the lexical meaning of the attemptive verb *kokoromiru* ('try'), which requires the runtime t of the preparatory stage to be a proper subinterval of the runtime t' of the whole event. Thus, the unacceptability of the past tense in (5c) is correctly predicted.

Finally, for implicative verbs, we build on Akuzawa and Kubota's (2019) idea that verbs such as *seikoo-suru* ('succeed') and *sippai-suru* ('fail') have as their presuppositions the meanings of attemptive verbs. Specifically, we assume the following meaning for *seikoo-suru*, which roughly says that 'succeed P (at t)' presupposes that at some subinterval t' of t, 'try P' is true and asserts that P actually obtains at t.

(20) $\lambda P \lambda x \lambda t \lambda w. \underline{\exists t' \subseteq t.\mathbf{try}(P)(x)(t')(w)}; P(x)(t)(w)$

The predicate **try** is by assumption identical to the meaning of *kokoromiru* in (18).

Then, in (5d) with the past tense, given the lexical meaning of the implicative verb *seikoo-suru* ('succeed') in (20) which effectively evaluates the whole embedded event as a matrix event, the assertion of the sentence has the following form:

(21) $\exists t < t_{now}.\mathbf{open\text{-}the\text{-}box}(x)(t)(w) \wedge t < t_{eval}$

Here, $t < t_{eval}$ is the semantic contribution of the embedded past tense, and by assumption t_{eval} gets identified with the matrix event time t. But that leads to the contradiction $t < t$. Thus, implicative verbs are incomparable with embedded past tense.

In this section, we have shown that the tense restrictions that different types of control verbs in Japanese exhibit receive semantic explanations. In particular, it should now be clear that Fujii's TAG is not only redundant in most cases, but also is less plausible than the semantic analysis in certain cases (specifically, with factive verbs, which the TAG-based analysis would need to analyze as an exception without any principled reason). Our analysis finds motivation from independently motivated lexical semantic properties of the relevant verbs and the independently motivated assumption that embedded tense in Japanese is relative tense rather than absolute tense.

4.3 Temporal adverbials

The analysis of temporal adverbials is essentially parallel to the analysis of tense morpheme restrictions. Temporal adverbials introduce restrictions on the temporal locations of the events they modify, and, depending on the lexical meanings of control verbs, such restrictions may or may not lead to contradictions.

Following authors such as Dowty (1979) and Stump (1985), we assume that temporal adverbials are modifiers of temporal abstracts, formally of type $\langle\langle i, st \rangle, \langle i, st \rangle\rangle$ (where i is a variable over temporal intervals and s is a variable over worlds). For example, the denotation of *kinoo* ('yesterday') can be written as in (22), which adds the condition that the runtime of the event is temporally located within the time frame corresponding to yesterday:

(22) $\lambda P_{\langle i, st \rangle} \lambda t \lambda w. P(t)(w) \wedge t \subseteq \mathbf{yesterday}$

(7a), which has the attitudinal verb *ketui-suru* ('decide') as its main verb, receives the following translation:

(23) $\exists t < t_{now}. \underline{\forall w' \in Alt^{epst}_{\mathbf{j},t,w} : \exists t' > t.\exists Q.\mathbf{discret}(Q)(\mathbf{j})(t)(w')}$
        $\underline{\wedge [[\mathbf{run\text{-}for\text{-}el}(\mathbf{j})(t')(w') \wedge t' \subseteq \mathbf{next\text{-}yr}] \rightarrow Q(\mathbf{j})(t)(w')]};$

$$\forall w'' \in Alt^{volit}_{\mathbf{j},t,w}.Q(\mathbf{j})(t)(w'') \wedge t \subseteq \mathbf{this\text{-}yr}$$

Here, as already discussed in the previous section, the lexical meaning of the verb locates the embedded event in the future relative to the matrix event time, so the events are temporally disjoint with one another. The additional temporal restrictions introduced by the embedded and matrix temporal adverbials are consistent with this lexical meaning of the verb, so, the sentence is correctly predicted to be acceptable. The case of factive verbs can be explained similarly. Since the account is completely parallel, except that the temporal order of the matrix and embedded events is reversed, we omit the details.

Things are different in the case of the other two classes of verbs, which involve more complex relations between the matrix and embedded event times. Simply put, these verbs impose overlap conditions on the embedded event time and its evaluation time (which corresponds to the matrix event time in the case of attemptive verbs), and this conflicts with the temporal disjointness condition introduced by the temporal adverbials in the matrix and embedded clauses in (7c,d).

For example, (7c) receives the following translation:

(24) $\exists t < t_{now}.$
$\dfrac{\forall w' \in Alt^{epst}_{\mathbf{j},t,w} : \exists t' \supseteq t.[\mathbf{run\text{-}for\text{-}el}(\mathbf{j})(t')(w) \wedge t' \subseteq \mathbf{next\text{-}yr}]}{\rightarrow \mathbf{prep}(\lambda x \lambda t \lambda w.\mathbf{run\text{-}for\text{-}el}(x)(t)(w) \wedge t \subseteq \mathbf{next\text{-}yr})(\mathbf{j})(t)(w');}$
$\mathbf{prep}(\lambda x \lambda t \lambda w.\mathbf{run\text{-}for\text{-}el}(x)(t)(w) \wedge t \subseteq \mathbf{next\text{-}yr}) \wedge t \subseteq \mathbf{this\text{-}yr}$

The meaning of *kokoromiru* requires the matrix event time t (i.e. the time of the preparatory stage of the embedded event) to be a proper subinterval of the embedded event time t', given the nature of preparatory stage. However, the temporal adverbials *kotosi* ('this year') and *rainen* ('next year') do not overlap with one another, so, if t and t' are subintervals of these temporal intervals, then, t and t' will have to be completely disjoint, and the former cannot be a subinterval of the latter. Thus, (24) necessarily leads to a contradiction.

The case of implicative verbs such as *seikoo-suru* ('succeed') is slightly more complicated, but the ill-formedness of disjoint temporal modification follows from essentially the same reason. The translation for (7d) is given in (25).

(25) $\exists t < t_{now}.$
$\dfrac{\exists t' \subseteq t.\mathbf{try}(\lambda x \lambda t \lambda w.\mathbf{run\text{-}for\text{-}el}(x)(t)(w) \wedge t \subseteq \mathbf{next\text{-}yr})(\mathbf{j})(t')(w);}{[\mathbf{run\text{-}for\text{-}el}(\mathbf{j})(t)(w) \wedge t \subseteq \mathbf{next\text{-}yr}] \wedge t \subseteq \mathbf{this\text{-}yr}}$

Note crucially here that given the lexical meaning in (20), an implicative verb evaluates the embedded event P at the matrix event time t. This has the consequence that the two temporal adverbials *kotosi* ('this year') and *rainen* ('next year') from the embedded and matrix clauses both target the same event time

t. But then, the disjointness of the temporal extensions of *kotosi* and *rainen* directly leads to a contradiction.

In this section, we have shown that the two empirical phenomena discussed in the literature pertaining to the temporal interpretations of control verbs in Japanese receive independently motivated explanations by formalizing the lexical semantics of control verbs explicitly within the standard temporal/modal semantics. Note in particular that, on the proposed account, the distributional patterns that different control verbs exhibit with respect to these phenomena all fall out as natural consequences of the semantic analyses.

5 Conclusion

In this paper, we have proposed an analysis of temporal interpretation of finite control in Japanese with *koto*-taking verbs. We started with two empirical observations in the literature pertaining to the temporal interpretation of these control verbs: the 'Tense Alternation Generalization' (TAG) by Fujii (2006) and the distributional restrictions on temporal adverbial modifiers with certain control verbs. While these empirical phenomena have sometimes been used by previous authors to motivate particular syntactic assumptions about the status of the tense morpheme in the embedded clauses in *koto*-taking control verbs, we have shown in this paper that all the relevant empirical facts pertaining to these generalizations receive independently motivated semantic accounts. To demonstrate this point, we have formulated explicit analyses of selected classes of control verbs building on formal semantic approaches to modal and temporal expressions.

The results of the present paper have important implications for the wider cross-linguistic literature on finite control and defective tense (cf. Stiebels, 2007; Gamerschlag, 2007; Spyropoulos, 2008; Smirnova, 2009) in that it shows that a semantic approach offers a better explanation for TAG than a syntactic approach both empirically and conceptually. Empirically, it has a wider coverage in extending naturally to apparent exceptions with factive verbs. Conceptually, it is more explanatory in that it derives the relevant patterns from independently motivated semantic properties, rather than stipulating TAG as a separate principle.

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