A Disjunctive-Unconditional Analysis of Japanese *Sukunakutomo* 'at least'

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1 Introduction

In this paper, I examine the Japanese numeral modifier *sukunakutomo* as in (1), which I argue is an adverbial clause that is interpreted as an alternative/disjunctive unconditional.

(1)   **Sukunakutomo** go-nin-no gakusei-ga   odot-ta.
       at.least   five-CL-GEN students-NOM dance-PAST

      'At least five students danced.'

My analysis of *sukunakutomo* being a type of unconditional construction is based on the presence of a conjunctive morpheme *tomo* 'whether.' (2) demonstrates that the morpheme is observed in an unconditional construction.[1]

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[1] Some might argue that the unconditional *tomo* is not involved in *sukunakutomo* because although unconditionals such as (2) are grammatical without *mo* of *tomo*, *sukunakutomo* is incomplete without it.

(i)   a. Taro-ga   ko-yooto(-mo), Hanako-wa yorokoba-nai.
          Taro-NOM come-SBJV-MO, Hanako-TOP please-NEG

          'Whether Taro comes or not, Hanako won't be pleased.'

      b. Sukunakuto*(mo) go-nin-no   gakusei-ga   odot-ta.
          at.least   five-CL-GEN students-NOM dance-PAST

(2) Taro-ga   ko-yoo-**tomo**,   Hanako-wa yorokoba-nai.
    Taro-NOM come-will-TOMO Hanako-TOP please-NEG

    'Whether Taro comes or not, Hanako won't be pleased.'

<div align="right">(Hiraiwa and Nakanishi 2020, 399)</div>

By analyzing *sukunakutomo*—for example (1)—as an unconditional with *tomo*, it is possible to naturally capture what is termed as an ignorance implicature of this item (Hirayama and Brasoveanu 2018; Ihara 2020; Ihara and Mizutani 2020). The ignorance implicature that *sukunakutomo* in (1) triggers is such that the utterer is uncertain as to exactly how many students actually danced. Conversely, the unconditional in (2) implicates that the speaker is uncertain whether Taro is actually going to come. In this paper, I demonstrate through the decomposition of *sukunakutomo* that the ignorance implicature of *sukunakutomo* derives from its disjunctive-unconditional nature.

The rest of this paper is organized as follows. In the next section, I decompose *sukunakutomo* and present its structure as an adverbial clause. Then, in section 3, another inference of *sukunakutomo* is observed to illuminate that it is unconditional. Section 4 expands extensively on Rawlins 2008, 2013. In this section, I formulate the unconditional semantics of *sukunakutomo*. In section 5, I present its presupposition to derive inferences. To corroborate my analysis, I discuss, in section 6, the scope rigidity of *sukunakutomo* over negation. Some concluding remarks are provided in section 7.

2   Decomposition

As previous research, including Ihara 2020; Ihara and Mizutani 2020, has already proposed a decomposition analysis of *sukunakutomo*, I adopt a somewhat different route in this study. I decompose *sukunakutomo* into a comparative predicate *sukunaku* 'smaller' and *tomo* 'whether,' providing (1) a rough interpretation in (3), which amounts to saying that five students danced regardless of the actual number of students that danced.

'At least five students danced.'

However, the obligatory presence of *mo* is not an idiosyncratic property of *sukunakutomo*. Rather it is observed in unconditional clauses with the configuration "adjective-*tomo*" like *sukunakutomo*.

(ii) Neru-no-ga   osoku-to*(mo) go-ji-ni   oki-ro.
      sleep-thing-NOM late-**tomo**   five-o'clock-at wake-IMP

      'Whether you go to bed late or not, wake up at five.'

Therefore, though I have no ultimate answer to the reason why *mo* is required in *sukunakutomo*, it is certain that the *mo* is a general requirement in unconditional clauses with adjectives.

(3) whether 5 is smaller than the number of the students who danced, 5 students danced.

My rationale for providing this interpretation is that *tomo* in *sukunakutomo* functions as a disjunctive unconditional morpheme, whereas *sukunaku* serves as a comparative that denotes an inequality between two numbers, namely the modified number *5* and the actual number of dancing students. In this proposal, the sentence with *sukunakutomo* involves a biclausal structure wherein *sukunakutomo* is an adverbial clause attached to the host clause with a modified numeral. Here, it is necessary to make clear how the modified numeral *5* is semantically composed both in *sukunakutomo* clause and in host clauses. Moreover elaboration is required with regard to the derivation of the comparative standard—that is what I refer to as the actual number—in the *sukunakutomo* clause. The resolutions that I postulate to these are the following two covert ingredients inside the *sukunakutomo* clause: (i) a covert pronoun indexed to the modified numeral and (ii) a covert comparative standard identified with the maximal degree of the set denoted by a QRed predicate of its host. These postulations yield the structure for (1) in (4) . In (4), the pronoun indexed to the degree *5* is present. Furthermore, degree abstraction via QR operation applies in the host clause, and the resulting predicate also appears with a maximal operator as a comparative standard in the *sukunakutomo* clause. The predicate *sukunaku* compares and denotes the inequality between these two numbers such that five is smaller than the maximal number of the students who danced. Note that the pronoun is covert and the comparative standard is not pronounced due to ellipsis under the identity of the predicate in the host clause.

(4) '*sukunakutomo* five students danced'
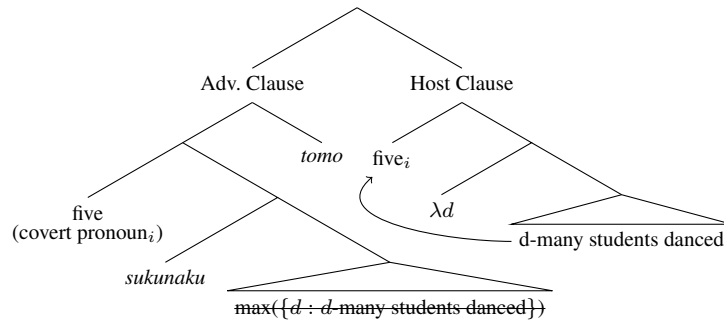
The proposition that five is smaller than the actual number is composed with the morpheme *tomo*, eventually providing an antecedent for the unconditional semantics and interpreted as 'whether or not 5 is smaller than the maximal number of the students who danced.' The more formal seman-

tics of *sukunakutomo* is elaborated in section 4; in the following section, I present relational indifference, an observed implicature to corroborate the unconditional-clause nature of *sukunakutomo*.

3   Relational Indifference

Rawlins (2013) and Nakanishi (2021) observe that unconditionals can trigger another inference of *relational indifference*. For instance, (2), repeated as (5), can express an implication that whether Taro comes is irrelevant to Hanako's pleasure.

(5)   Taro-ga ko-yoo-**tomo**,   Hanako-wa yorokoba-nai.
       Taro-NOM come-will-TOMO Hanako-TOP please-NEG

'Whether Taro comes or not, Hanako won't be pleased.'

If *sukunakutomo* is really given an unconditional interpretation, it is predicted that in some cases, *sukunakutomo* introduces a commitment to indifference rather than ignorance. This prediction is borne out in (6).

(6)   Context:
       In a city council, more than half affirmative of 18 votes were required to pass a bill, and the speaker knows that exactly 15 people have voted in favor of the relevant bill.

Sukunakutomo 10-nin sansee   sita kara   sono hooan-wa
at.least   10-CL affirmative did because that   bill-TOP
kaketu-sare-ta.
endorse-PASSIVE-PAST

'Because at least 10 voted for the bill, it was endorsed.'

This utterance is perfect even in the context where the speaker knows exactly how many members voted for the bill, suggesting that the *sukunakutomo* in (6) derives no ignorance inference. Instead, it triggers a relational indifference that is described in words as below.

(7)   Relative to the fact that the minimum requirement, namely 10 affir-
       mative votes, was satisfied, it does not matter whether the number 10
       was equal to or smaller than the actual number of 15.

The above fact that *sukunakutomo* can express such an implicature as relational indifference, in addition to that of ignorance, argues that it should be analyzed as an unconditional construction. In the following section, I enter into the formulation of unconditional semantics of *sukunakutomo* by capitalizing on a proposal made by Rawlins.

4 Unconditional Semantics of *sukunakutomo*

In this section, I apply to *sukunakutomo* the analysis of unconditionals given by Rawlins (2008, 2013), in which a disjunctive unconditional is assumed to introduce a pair of alternatives. Given this, the antecedent of the unconditional in (5) is translated, as below.

(8) $[\![\text{Taro-ga ko-yoo } tomo]\!]^c$
$$= \{\lambda w.\text{Taro comes in } w, \lambda w.\text{Taro does not come in } w\}$$

On par with (8), I argue that the *sukunakutomo* clause of (1), repeated in (9), is also interpreted as an alternative set. To compose it, I define the lexical entry of each item in the *sukunakutomo* clause, as below.

(9) **Sukunakutomo** go-nin-no gakusei-ga   odot-ta.
at.least   five-CL-GEN students-NOM dance-PAST

'At least five students danced.'

(10) a. $[\![tomo]\!]^c = \lambda P_{\langle s,t\rangle}.\{\lambda w.P(w), \lambda w.\neg P(w)\}$

 b. $[\![sukunaku]\!]^c = \lambda n_{\langle d\rangle}\lambda n'_{\langle d\rangle}.n' < n$

 c. $[\![\text{covert pronoun}]\!]^c = 5 = max(\{d : 0 \leq d \leq 5\})$

 d. $[\![\text{comparative standard}]\!]^c$
$$= max(\{d : d\text{-many students danced}\})$$
$\rightarrow$ abbreviated as $max(st.)$ for the sake of saving space

As the denotation in (10a) shows, *tomo* takes a proposition and returns a pair of alternatives with one negated. In addition, (10b) shows that *sukunaku* is a comparative predicate that denotes an inequality relation between two numbers, as I mentioned in section 2. Composing the lexical items in (10) with the structure in (4) yields (11) for the interpretation of the *sukunakutomo* clause.

(11) $[\![5 \; sukunaku \text{ comparative standard } tomo]\!]^c$
$$= \{\lambda w.5 < max(st.) \text{ in } w, \lambda w.5 \geq max(st.) \text{ in } w\}$$

Sukunakutomo as a pair of alternatives is then composed pointwise with its host. According to Rawlins (2008, 2013), unconditionals semantically function as ordinary conditionals, and after Kratzer (1986) a conditional is analyzed as providing a restrictor for the covert necessity modal. Given this assumption, (12) follows.

(12) $[\![(9)]\!]^c = \left\{ \begin{array}{l} [[\Box[5 < max(st.)]] \text{ 5 students danced}] \\ [[\Box[5 \geq max(st.)]] \text{ 5 students danced}] \end{array} \right\}$

To derive the conditional meaning, the necessity modal is defined as universal quantification over worlds accessible from the evaluation world according to a contextually provided accessibility function F_c (namely, the modal base), and the definition is given bellow.

(13) $[\![\Box]\!]^c = \lambda P_{\langle s,t \rangle} \lambda Q_{\langle s,t \rangle}.\lambda w.\forall w' \in F_c(w)[P(w') \rightarrow Q(w')]$

This applies to the pair in (12), and finally (14) gains.

(14) $[\![(9)]\!]^c = \left\{ \begin{array}{l} \lambda w.\forall w' \in F_c(w)[5 < max(st.) \text{ in } w' \rightarrow 5 \text{ students danced in } w'] \\ \lambda w.\forall w' \in F_c(w)[5 \geq max(st.) \text{ in } w' \rightarrow 5 \text{ students danced in } w'] \end{array} \right\}$

(14) is a pair of alternatives, such that for every accessible world w', if 5 is less than or greater than the number of the students who danced in w', then there were 5 students who danced in w'.

This is not the end of the story because the original sentence denotes not a set of propositions like in (14) but a singleton set. Thus, following Kratzer and Shimoyama (2002), a Hamblin universal operator in (15) must be assumed to assert that every proposition in the set is true.

(15) $[\![\forall \alpha]\!]^{w,g} = \{\lambda w.\forall p \in [\![\alpha]\!]^{w,g} : p(w) = 1\}$

(Kratzer and Shimoyama, 2002)

This creates the conjunction of the two alternatives, namely {if $5 < max(st.)$ then five students danced AND if $5 = max(st.)$ then five students danced}.

Note also that $5 > max(st.)$ is ruled out of the second alternative, and it is interpreted as $5 = max(st.)$ because its consequent asserts that there were five students. In this way, we interpret *sukunakutomo* as an unconditional construction with the meaning 'whether the modified number is equal to or less than the actual number.' In the next section, I succinctly illustrate how ignorance and indifference arise in unconditionals.

5 Presuppositions and Inferences

In this section, following Rawlins (2008, 2013), I first explicate how relational indifference arises in unconditional constructions, and then move on to the discussion of ignorance implicatures.

5.1 Relational indifference

Conducting a number of tests (see Rawlins 2013: section 3.1), Rawlins suggests that an unconditional adjunct like *whether Mary cooked pasta or pizza* is an interrogative clause and that a question operator is syntactically present within the clause, as in (16).

(16) [∀ [Q [whether Mary cooked pasta or pizza]] [John was pleased]]

Rawlins further assumes that this operator triggers the two presuppositions of domain exhaustivity and mutual exclusivity, as in (17a) and (17b), where *cs* stands for the context set provided by the input context of interpretation.

(17) $[\![[Q]\alpha]\!]^c = [\![\alpha]\!]^c$, defined for w, g, α only if $[\![\alpha]\!]^{w,g} \subseteq D_{\langle st \rangle}$ and

  a. $\forall w \in cs : \exists p \in [\![\alpha]\!]^c : p(w) = 1$ (exhaustivity)

b. $\forall p, p' \in [\![\alpha]\!]^c : (p \neq p') \rightarrow \neg \exists w \in cs : (p(w) \wedge p'(w))$ (exclusivity)

(Rawlins, 2013)

(17a) presupposes that for every possible world, either of the alternatives holds true. (17b), on the other hand, presupposes the impossibility for both the alternatives to be true in the same world.

I would like to remind the reader of two things mentioned in the last section: An unconditional adjunct provides domain restrictors for the modal [see (12)], and the final denotation of an unconditional sentence is a singleton set (see (15)). This unconditional semantics, augmented with the presuppositions, results in an unconditional adjunct that provides a jointly exhaustive set of modal restrictors. For any domain restriction for a modal we could try, the modal claim is always true (see Rawlins 2013 section 2.4 for more detail). Thus, in the case of *sukunakutomo 10 voted for the bill*, in any domain, i.e., however many voted for the bill in a world, it is necessarily true that 10 people voted for the bill, which amounts to a relational indifference.

5.2 Ignorance

Let us enter into the discussion of ignorance implicature. We have already seen that an unconditional adjunct provides exhaustive and exclusive restrictors for the modal.

Rawlins adds another assumption that has to do with the modality, according to which the modal is subject to the non-triviality presupposition in (18).

(18) $F_c(w) \cap p \neq \emptyset$,
where $F_c(w)$ is the modal base and p is the set of the worlds characterized by the restrictors

This presupposes that in the modal base contains some world in which a restrictor argument is true. Given that alternatives are composed pointwise, (18) applies to each proposition in the alternative set. For instance, the non-triviality of 'whether $5 < max(st.)$' in *sukunakutomo 5 students danced* is described as below.

(19) $\left\{ \begin{array}{l} F_c(w) \cap \{5 < max(st.), \text{not } 5 = max(st.)\} \neq \emptyset \\ F_c(w) \cap \{5 = max(st.), \text{not } 5 < max(st.)\} \neq \emptyset \end{array} \right\}$

In the above set, I add *not A* because of mutual exclusivity in (17b), i.e., both alternatives cannot simultaneously hold true. As long as the modal base $F_c(w)$ is compatible with the speaker's belief in the evaluation world, (19) denotes that the speaker's belief includes, for each alternative, at least one world in which it holds. This is equivalent to the speaker's ignorance such that she is not sure whether the actual number exceeds 5.

6 Above Negation

It follows from my account of the implicatures that *sukunakutomo* cannot be interpreted under negation. Specifically, *sukunaku* cannot take as its comparative standard a QRed predicate that negation outscopes in the host clause, which is schematized as (20).

(20)   The uninterpretable structure with *sukunakutomo* under negation
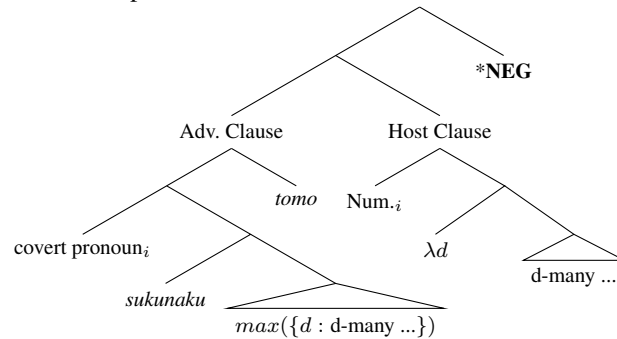
This structure is uninterpretable because a contradiction arises between the implicature introduced by *sukunakutomo* and the assertion of the host clause. As elaborated in the previous section, *sukunakutomo* induces an implicature based on the presuppositions, which are immune to the negation as a hole. Thus, the implicature obtained from (20) is that there is at least one possible world for either alternative, i.e., (i) the modified number is equal to the exact number and (ii) the modified number is smaller than the exact number, where it is true. The host clause, however, is susceptible to the existence of negation, and thus its resulting reading from the structure in (20) is such that P is true for "less than" the modified number.

To illustrate this point more clearly, it suffices to observe the uninterpretability of *sukunakutomo* in an environment in which its narrow scope reading is forced with regard to negation. For such an environment, (21a), adapted from Watanabe 2004, shows that the scope of an item under negation is determined by the relative position of a negative polarity item (NPI) like *mettani*.

(21)   a. Kaigi-ni-wa   10-nin ko-**nak**-atta.
          meeting-GEN-TOP 10-CL   come-NEG-PAST

          'It was not the case that 10 people came to the meeting.'
          'There were 10 people who did not come to the meeting'

$$(\text{not} > 10;\ 10 > \text{not})$$

          Kaigi-ni-wa   **mettani** 10-nin ko-**nak**-atta.
          meeting-GEN-TOP rarely   10-CL   come-NEG-PAST

'It was often the case that at most 9 people came to the meeting.'

(not > 10; *10 > not)

Given this, it is predicted that the sequence 'NPI ... *sukunakutomo* ... NEG' must be uninterpretable, which (22b) verifies.

(22) a. **Sukunakutomo** 10-nin mettani ko-nai.
　　　 at.least　　　　 10-CL　rarely　come-NEG

　　　 'There are at least 10 people who rarely come.'

　　 b. ?? Mettani **sukunakutomo** 10-nin ko-nai.
　　　　 rarely　 at.least　　　　 10-CL　come-NEG

　　　 'It is often the case that at most 9 people come.'

In (22a), there arises no conflict between (i) the implicature of *sukunakutomo* and (ii) the host-clause assertion: (i) 10 or more than 10 people rarely come and (ii) there are (at least) 10 people who rarely come. Conversely, (22b) invokes a conflict between the two: (i) 10 or more than 10 people come and (ii) it is often the case that at most 9 people come.[2]

In the following final section, I briefly summarize my proposal and mention a remaining question.

7　Concluding Remarks

In this paper I propose that *sukunakutomo* should be analyzed as a disjunctive unconditional construction. Through its decomposition, I demonstrate that the implicatures of *sukunakutomo*, *ignorance* and *relational indifference*, derive from its unconditional nature.

Before closing this section, I would like to mention one case where *sukunakutomo* modifies a non-numerical expression.

(23) Sukunakutomo John to　Mary-wa ki-ta.
　　 at.least　　　　 John and Mary-TOP come-PAST

　　 'At least John and Mary came.'

My current proposal indeed fails to capture the above case because it is not simple to define the maximality of John and Mary in a way that fits into the intuitive meaning of (23). However, we could solve this by revising the semantics of *sukunaku* 'smaller.' If *sukunaku* is defined in terms of a subset relation, e.g., John and Mary is a subset of the individuals who came, (23) would be interpreted in a fashion similar to what I have explicated in this

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[2] Schwarz and Shimoyama (2009) also observe that *sukunakutomo* coerces a numeral to have a wide scope wrt negation while Ihara (2020) and Ihara and Mizutani (2020) argue that the narrow-scope reading leads to "at most" interpretation. I put aside this discussion for future work.

paper. Adopting this sort of subset semantics requires us to meticulously examine numerical cases once again, though.

Acknowledgments

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