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The Particle Mo in Japanese and its Roles in Numeral Indeterminate Phrases

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Abstract

The main purpose of this paper is to provide an appropriate explanation for the so-called numeral indeterminate (NI) constructions, in which *mo* is accompanied by an indeterminate pronoun+ Cl(assifier). The quirky character of this construction is that apparently *mo* is applied to the denotation of a numeral indeterminate *nan-nin* as a syntactic binder and at the same it invokes a scalar reading. The assumption that *mo* should be a syntactic binder can be corroborated from the fact that the NI construction is degraded without the particle *mo*. Also *mo* as a scalar particle attributes an implicit large reading. This large reading can also be observed in cases where the indeterminate is replaced by a specific numeral, e.g, *yo-nin-mo* 'four-Cl-mo'. To the best of my knowledge, Kobuchi-Philip (2010) and Oda (2012) are the only works that deal with this construction. Especially Oda extensively discusses every possible means to explain this construction and works out a solution by assuming that the suffix *mo* functions multiply as an existential quantifier and a scalar particle. Through this paper, I will support her claim for its double functions, but I will clarify that the functions are both derived from a core semantic property of *mo*, namely, maximality. In other words, these functions work individually, but the component of maximality is placed in the center of the semantics of both usages.

The Particle *Mo* in Japanese and its Roles in Numeral Indeterminate Phrases

Fumio Mohri*

1 Introduction

The main purpose of this paper is to provide an appropriate explanation for the so-called numeral indeterminate (NI) constructions, in which *mo* is accompanied by an indeterminate pronoun+Cl(assifier), as in (1). I will also refer to a construction as in (2) where the indeterminate is replaced by a specific numeral.

- (1) Gakusei-ga nan-nin-*(mo) kita.
student-NOM What-Cl-Mo came
'A large number of students came.'
- (2) Gakusei-ga go-nin-mo kita.
student-NOM five-Cl-Mo came
'As many as five students came.'

The quirky character of (1) is that apparently *mo* is applied to the denotation of a numeral indeterminate *nan-nin* as a syntactic binder and at the same it invokes a scalar reading. This can also be corroborated from the fact that (1), unlike (2), is degraded without the particle *mo*. Also, *mo* as a scalar particle attributes an implicit large reading. This large reading can also be observed from (2) where the indeterminate is replaced by a specific numeral.

To the best of my knowledge, Kobuchi-Philip (2010) and Oda (2012) are the only works that deal with this construction. Especially Oda extensively discusses every possible means to explain this construction and works out a solution by assuming that the suffix *mo* functions multiply as an existential quantifier and a scalar particle. In this paper, I will support her claim for its double functions, but I will clarify that the functions are both derived from a core semantic property of *mo*, namely, maximality. My central claim through this paper is summed up as follows:

- (3) Maximality is the key semantic property of *mo*. Universal *mo* and scalar *mo* are both maximality operators that are applied over an ordered set and return the maximal entity (value).

Throughout this paper, I will develop a maximality analysis of Japanese *mo*. Specifically, I claim that *mo* serves as the iota-as-maximality operator (cf. Giannakidou and Cheng 2006) and likewise as a scalar particle. These functions work individually, but the component of maximality is placed in the center of the semantics of both usages.

Let us briefly see other cases in which the particle *mo* appears. It is well known that Japanese *mo* occurs in various semantic environments, as shown below in (4):

- (4) a. Dono hito-*mo* hasitta. (universal *mo*)
Which person-Mo ran
'Everybody ran.'
- b. Dare-*mo* hasira-na-katta. (indeterminate NPI *mo*)
Who-Mo run-NEG-PST
'Nobody ran.'
- c. Hito-ri-*mo* hasira-na-katta. (minimizer NPI *mo*)
1-Cl-Mo run-NEG-PST

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- ‘Not one person ran’
 d. John-*mo* hasitta.’ (additive *mo*)
 John-Mo ran
 ‘John also ran.’
 e. John-*mo* hasitta. (scalar particle *mo*)
 John-Mo ran
 ‘Even John ran.’

Cross-linguistically, many languages systematically compose their quantifier words from a set of particles and indeterminate pronouns. Slavic languages are also the well-known typical cases. It has also been pointed out (see Szabolcsi et al. 2014) that Japanese *mo* and Chinese *dou* have a highly similar distribution. It is by no means accidental that *mo* has those various semantic usages and thus, it is not infeasible to say that they commonly stem from a core semantic property. Kobuchi-Philip (2008, 2009), for instance, lay out the analysis in which the additivity of *mo* is the core meaning responsible for all the examples in (4) except for the scalar case (4e). When it comes to Chinese *dou*, Xiang (2008) proposes that maximality is a crucial component in the interpretations of *dou*, following Giannakidou and Cheng (2006).

The main purpose of this paper is to provide an appropriate explanation to the NI construction. I will not commit to the extensive survey of all the usages of *mo*, nor demonstrate that either one should be more appropriate than the other in accounting for the interpretations relevant to *mo*. However, I will explore the possibility of pursuing the key element of *mo* in terms of maximality, (re)defining quantificational *mo* and scalar *mo* in that direction.

2 Scalar *Mo*

I assume that scalar *mo*, like English *even*, is truth-conditionally vacuous, but introduces a scalar presupposition. In the examples below, *even* and *mo* both presuppose that the assertions are less likely to occur among their alternative propositions.¹

- (5) John-*mo* kita.
 John-Mo came.
 Even John came.

Nakanishi (2008, 2010) assume that syntactically *even* undergoes movement in LF, as illustrated in (6a), and introduces a scalar presupposition (6b):

- (6) a. [even [[John]_F came]]
 b. [[even]]^w(C)(p), where $p = \text{came}(j, w)$ and $C \subseteq \{q: \exists x[q = \lambda w. \text{came}(j, w)]\}$
 $\forall q \in C [q \neq \lambda x. \text{came}(j, w) \rightarrow q >_{\text{likely}} \lambda w. x. \text{came}(j, w)]$
 (Cf. Nakanishi 2008, 2010)

Basically, I will follow her treatment of scalar *mo*, but in order to make more explicit the relation with the iota-as-maximality operator, I will redefine the definition of scalar *mo* in terms of maximality. Obviously, unlike *mo* as the iota-as-maximality, scalar *mo* does not contribute to the semantic component, but in the pragmatic component it induces a scalar reading as a maximality operator. I assume specifically that Scalar *mo* introduces the following scalar presupposition:

- (7) Presupposition of *mo*:
 The asserted proposition p and all its alternatives q are (partially) ordered on a scale about unexpectedness such that: $\forall q \in C [q \neq p \rightarrow \text{unexpected}(p) > \text{unexpected}(q)]$

Given (7), (5a) implies that the assertion *John-ga kita* ‘John came’ has the greatest degree on the

¹The argument to be laid out here is indebted to Xian’s (2006) analysis of Chinese *dou*, according to which *dou* applies to alternatives ordered on a scale about ‘unexpectedness’.

scale of unexpectedness among its alternatives. Put differently, *mo* requires that the value of the scale in question is maximally high.

Precisely speaking, however, *mo* does not require the assertion to be the most unexpected alternative among its relevant alternatives. Imagine a situation in which a professor has five students in his seminar, Arlon, Bill, Cris, Dan and Frank; Arlon is the laziest, followed by Bill and next, Cris. The rest of the students, Dan and Frank, are both diligent enough to come to the seminar regularly. In this situation, some will say,

- (8) Arlon-*mo* kita.
'Even Arlon came.'

'Arlon came' is the most unlikely alternative and of course, *mo* works nicely as a maximality operator because it conveys that *p* induces the highest value on the scale of unexpectedness. However, even if the second or third laziest student came, those alternatives hold true, too:

- (9) Bill(Cris)-*mo* kita.
'Even Bill(Cris) came.'

This fact suggests that the application of *mo* does not induce the maximal value, but requires the assertion to fall within the unexpectedness range. Apparently, appealing to maximality may sound too demanding. Note, however, that if *mo* is defined in a 'subset' of its alternatives, it should be feasible to maintain maximality as the core property, as follows:

- (10) There is a subset *C* of alternatives *q* to an asserted proposition *p* such that (a) the alternatives are ordered on a scale about unexpectedness, (b) *C* contains *p* and at least one other member, and (c) $\forall q \in C [q \neq p \rightarrow \text{unexpected}(p) > \text{unexpected}(q)]$

This revised definition even brings us one advantage: the additive usage of *mo* satisfies the maximal property of *mo* in a subdomain of the alternatives. If the subject in (9) is pronounced with a falling prosodic pattern, it is natural to take it as an additive case. In my view, the additive *mo* is syntactically vacuous as well, but it yields a pragmatic interpretation. When (9) is taken as an additive case, it implicitly says that there is at least one other person in addition to Bill (Cris). Here I assume that *mo* applies in a subset of alternative individuals to the denotation of the focused element and returns the supremum. That is, the subdomain contains the focused element and at least one individual, and also it is an ordered set in that each element is (partly) ordered on 'part-of' relation. What *mo* does is to pick out the largest element containing the focused element, introducing the implicit meaning that there is at least one individual behind the scene.

3 Numeral Indeterminate Phrases and *Mo*

There has been no compelling discussion of this construction except in Kobuchi-Phillip (2010) and Oda (2012). Pointing out some deficiencies of Kobuchi-Philip, Oda builds her argument that the suffix *mo* functions as a combination of an existential quantifier and a scalar particle.² Our analysis basically follows Oda in that the suffix *mo* plays two roles. However, in our analysis, *mo*

²Kobuchi-Philip (2008, 2009) develops her argument, based upon the assumption that *mo* itself should be associated with universal quantificational force. According to Kobuchi-Philip (2010), once *mo* combines with a wh-Cl *nan-nin*, its semantic property, universality, disappears, and instead, its presuppositional property is manifested. The so-called 'many' reading in the indeterminate-Cl-*mo* is derived from the 'higher number than expected' presupposition of *mo*. Put differently, the manifestation of the presupposition brings about the quasi-quantificational force 'many'.

Intuitively, her analysis is very intriguing, but there are some obscure points left. As Oda (2012) has pointed out, it is not clear why the quasi-quantificational effect comes into handy only in wh-Cl-*mo*. It is also unclear why universality, the semantic property of *mo*, should be cancelled in the construction under question. It seems that the mechanism in which scalar *mo* rescues the uninterpretability of the construction and yields the quasi-quantificational effect should be made more specific.

is not an existential quantifier but a maximal operator. As will become clear later, this analysis will make a solution to some deficiencies of her analysis.

3.1 Oda (2012)

Before laying out our analysis, we will overview Oda's approach to this construction. She sets the following hypotheses, claiming that her theory could account for all the data relevant to the *wh-CI-mo* expression.

- (11) a. *Mo* itself is an \exists -quantifier that binds *nan-nin* 'what-CI'
 b. *Mo* also serves as a scalar particle, and carries the scalar presupposition that a number is large.
 (slightly modified from Oda 2012:304)

What is to note about this construction in the first place is that *na'n-nin* induces an existential reading, translated as 'a large number of students' or 'many students'. This observation seems to have motivated her to assume that *mo* is an \exists -quantifier.

Let us see in more details how Oda's hypotheses are at work. Given the hypotheses in (11), the semantics of (1), repeated below again, would be like (12a), where *mo* binds *nan-nin* 'wh-CI', inducing existentiality of a cardinal number.

- (1) Gakusei-ga nan-nin-*(mo) kita.
 student-NOM What-CI-Mo came
- (12) a. Assertion
 $\exists n[n \in \{m: \text{volumes}(m)\} \wedge \exists x[\text{student}(x) \wedge |x|=n \wedge \text{come}(x)]]$
 b. Presupposition of *mo*
 $\exists n \forall m \neq n$: that *n*-many students came is less likely than that *m*-many students came, in other words, *n* is a large number.

Further, *mo* serves as a scalar particle, introducing the presupposition in (12b). That the assertion is less likely to happen means that its alternatives all contain a smaller number of students. As we have seen in the previous section, the calculated alternative propositions are all entailed by the assertive proposition. Among the alternatives, the cardinal *n* in the assertion is the largest, thus giving rise to 'a large number of students' or 'many students'.

When the predicate is negated as in (13), things become slightly more complicated. The negated sentence has three pragmatic interpretations, as shown in (14).

- (13) Gakusei-ga nan-nin-mo ko-na-katta.
 Student-NOMwh-CI-Mo come-NEG-PST
- (14) a. It is not the case that a large number of students came.
 b. It is not the case that only such few people came.
 c. There are a large number of students who did not come.

It is still controversial how scalar particles are associated with their scalar presuppositions. The relevant analyses are roughly divided into two schools: the scope theory and the lexical theory. It seems to me that the argument in favor of the scope analysis developed in Nakanishi (2010) is highly convincing, but Oda just tentatively adopts the lexical analysis to claim that there are two types of *mo*, namely, 'large *mo*' and 'small *mo*', which respectively brings a large/small reading in a given environment (cf. Sudo 2010).

Since *mo* does not interact with scope-relevant elements in Oda's analysis, the possible truth conditions for (13) are obtained through the interaction of the negation and the existential operator over a set of cardinals. The readings in (14a) and (14b) share the same truth conditions in which the negation scopes out, as shown in (15). Their interpretive differences are merely attributed to whether 'large' or 'small' *mo* is adopted as a scalar particle, as shown in (15a) and (15b), respec-

tively.

(15) Assertion: (14a) and (14b)

$\neg\exists n[n \in \{m: \text{volumes}(m) \wedge \exists x[\text{student}(x) \wedge |x|=n \wedge \text{come}(x)]]$

a. Presupposition of large *mo* (14a)

$\exists n \forall m \neq n$: that n-many students came is less likely than that m-many students came, in other words, n is a large number.

b. Presupposition of small *mo* (14b)

$\exists n \forall m \neq n$: that n-many students came is more likely than that m-many students came, in other words, n is a small number.

In this way, when the negation takes a wider scope and large *mo* is adopted as in the case of (15a), then the assertion ends up having the large reading as its implicit meaning. On the other hand, when small *mo* is adopted, the assertion has the small reading.

As we have briefly overviewed Oda's approach to the NI construction, it seems to have successfully accounted for its quirky characters. However, there are some puzzling questions left in her analysis. First of all, if *mo* is an existential quantifier that ranges over a set of numerals, in a negated assertion like (13) we could have a reading in which the cardinal of *gakusei* 'student' is 'one'.

(16) *Gakusei-ga nan-nin-mo ko-nakat-ta. #Hito-ri-mo/Futa-ri-mo ko-nakat-ta.*
Student-NOM wh-Cl-Mo come-NEG-PST one-Cl-Mo/two-Cl-Mo come-NEG-PST

However, as shown in (16), the second sentence is a total negation, meaning 'no one came.' Without setting a stipulation, we cannot eliminate the interpretation with the minimum number 'one', as long as *mo* is merely assumed as an existential quantifier.

A second problem concerns the pragmatic interpretation in (14c). If the particle scopes over the negation and also serves as large *mo*, presupposing (17b), the interpretation in (14c) results.

(17) a. Assertion for (14c): $\exists n[n \in \{m: \text{volumes}(m) \wedge \exists x[\text{student}(x) \wedge |x|=n \wedge \neg\text{come}(x)]]$

b. Presupposition of large *mo*

$\exists n \forall m \neq n$: that there are n-many students that did not come is less likely than that m-many students that did not come, in other words, n is a large number.

Note, however, that the discussion here leads us to predict a wrong pragmatic interpretation. Consider the case in which the particle serves as small *mo*, which introduce the presupposition (18).

(18) Presupposition of small *mo*

$\exists n \forall m \neq n$: that n-many students that did not come came is more likely than that m-many students that did not come, in other words, n is a small number.

If this is the case, we will logically obtain the following pragmatic interpretation:

(19) There are only such few people that did not come.

However, this interpretation is not in fact available. Unless we made a stipulation to block small *mo*, an implausible readings like (19) would be wrongly derived, though logically possible. This may not be a problem with Oda's analysis itself, but the lexical analysis adopted in her analysis cannot circumvent this problem.

I have argued against Oda's treatment of *mo* from the empirical domain. Finally, I would like to point out that it sounds theoretically awkward to assume that *mo* functions as an existential quantifier, in addition to the traditional universal quantifier. To make explicit the division of labors two types of *mo* bear, Oda defines the domain of existential *mo* and that of universal *mo* as complementary, as follows:

(20) Distribution of universal *mo* and existential *mo*

Mo is an existential quantifier when its sister denotes a set of scalar alternatives. Otherwise, it is a universal quantifier.

(Oda 2012:311)

Assuming two types of *mo* might be apparently feasible because each has its own distinct quantificational domain. However, since the existential force is theoretically assumed to be rather the labor of the Japanese *ka*, one cannot help but wonder if the particle *mo* could penetrate into the domain of *ka*. Cross-linguistically, the *mo*-type particles, including Hungarian *mind*, are said to build universal quantifier words and at the same time, serve as connectives, additives and scalar particles. On the other hand, the *ka*-type particle, like *vala* in Hungarian, derives existential and disjunction meanings. Put differently, assuming that *mo* builds an existential quantifier word would even break down the complementary boundary between the *ka*-family and the *mo*-family for their semantic contributions (see also Szabolcsi 2010 and Szabolcsi et.al. 2014). It would take further scrutiny and exploration before we justify the possibility of *mo* as inducing existential force.

4 Maximality-Based Approach

In this section, I attempt to prove that the maximality-based approach will give a more straightforward explanation to the indefinite numeral construction. As a maximality operator, the domain in which *mo* is applied consists of alternatives ordered with respect to semantic strength. If it is applied to a set of numbers, then the minimum domain whose elements are ordered in (21c) with ‘two’ being the maximal cardinal, which explains the fact that the minimum number *mo* picks out has to be larger than one.

(21) a. <..... 5, 4, 3, 2, 1>

b. <4, 3, 2, 1>

c. <2, 1> ■ the minimum domain over which *Mo* is applicable

This maximality-based approach would not create the reading in which the number of *gakusei* ‘student’ is one in contexts like (16) and the positive assertion (22) below:³

(22) *Gakusei-ga nan-nin-mo kita.*
 Student-NOMWhat-Cl-Mo came
 ‘A large number of students came.’

For clarification of the discussion here, I will spell out the core semantics of the particle *mo* when it applies to an NI construction like (22). Syntactically, *mo* needs to bind an indeterminate pronoun which denotes a set of numbers. Note incidentally that classifier languages including Japanese count on Cls to express quantities of nominals in general, so the indeterminate pronoun needs to be modified by the Cl, *nin* ‘person’ before it combines with *mo* as in (23a).⁴ The resultant expres-

³The analysis here derives a reading that allows the number of students to be two in the large reading in (22). In our system in which the maximal operator applies to a set of numerals that contains at least two elements, i.e., <two, one>, it could even pick ‘two’ as the maximal element. However, imagine a situation in which no one is expected to show up in a seminar. Under this situation, that two students came amounts to saying that as many as two students came. Probably the cardinal ‘two’ would be large enough to hold up in a setting like this. The same could hold true of negative statements.

⁴How a numeral word is combined with a classifier is not a critical issue in this paper, but I follow Kobuchi-Philip (2010) and some others, assuming that in classifier languages Cls are interpreted as a measuring unit to count the relevant objects. Though their logical representations vary among linguists, I assume tentatively that classifiers take a numeral and return a modifier (of <et,et>). Specifically, the classifier, *nin*, is interpreted as a measuring unit for expressing quantity of human objects and at the same time, takes a number word as its input and denotes a modifier to an associated nominal:

sion in (23a) proceeds to combine with other elements such as the head nominal *gakusei*, the covert existential determiner ϕ and finally the verbal predicate, to reach (23e).

- (23) a. *Nan-nin-mo*: $\lambda P \langle e, t \rangle . \lambda x . \text{Max}[m \in \text{Number}(n) \wedge \text{Card}_{\text{human}}(x) = m \wedge P(x)]$
 b. *Gakusei nan-nin-mo*: $\lambda x . \text{student}'(x) \wedge \text{Max}[m \in \text{Number}(n) \wedge \text{Card}_{\text{human}}(x) = m]$
 c. ϕ : $\lambda P \langle e, t \rangle . \lambda Q \langle e, t \rangle . \exists x [P(x) \wedge Q(x)]$
 d. ϕ *Gakusei nan-nin-mo*:
 $\lambda Q \exists x [\text{student}'(x) \wedge \text{Max}[m \in \text{Number}(n) \wedge \text{Card}_{\text{human}}(x) = m] \wedge Q(x)]$
 e. (22): $\exists x [\text{student}'(x) \wedge \text{Max}[m \in \text{Number}(n) \wedge \text{Card}_{\text{human}}(x) = m] \wedge \text{ran}'Q(x)]$

In the pragmatic component, too, *mo* contributes to the interpretations of the NI construction. In other words, *mo* serves as a scalar particle, introducing the presupposition in (24):

- (24) Presupposition of *mo*:
 a. The assertion *p* and all its alternatives are (partially) ordered on a scale about unexpectedness such that: $\forall q \in C[q \neq p \rightarrow \text{unexpected}(p) > \text{unexpected}(q)]$
 b. $\forall n [n \neq m \rightarrow \text{unexpected}(m\text{-many students came}) > \text{unexpected}(n\text{-many students came})]$

In this way, *mo* induces a scalar reading, asserting that it is most unexpected for the assertion to happen. Let us say for the sake of discussion that the maximum number is five. If five students coming is most unexpected, then that less than five students came is less unexpected, because the former entails the latter, but not vice versa. Among these alternatives, the asserted proposition contains the largest number, and as a consequence, it induces the ‘large’ reading.

Next, consider the negative statement (13) and its three pragmatic interpretations in (14), repeated below:

- (13) *Gakusei-ga nan-nin-mo ko-na-katta.*
 Student-NOMwh-CI-Mo come-NEG-PST
- (14) a. It is not the case that a large number of students came.
 b. It is not the case that only such few people came.
 c. There are a large number of students who did not come.

In my analysis, the interpretations of (14a) and (14b) are both assumed to share the same truth

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- (i) a. *nin* ‘CI_{person}’: $\lambda n \lambda P \langle e, t \rangle . \lambda x [P(x) \wedge \text{Card}_{\text{person}}(x) = n]$
 b. *san-nin* ‘3 persons’: $\lambda x [P(x) \wedge \text{Card}_{\text{person}}(x) = 3]$
 c. *gakusei san-nin* ‘three person-units of students’: $\lambda x [\text{student}'(x) \wedge \text{Card}_{\text{person}}(x) = 3]$

When it comes to the case with an indeterminate plus a classifier, like *nan-nin* ‘what-CI’, things become slightly more complicated. Along the lines proposed by Hamblin (1973), the indeterminate pronoun *nani* ‘what’ denotes a set of (contextually salient) objects, which can be equivalent to the denotation of non-human objects. According to Kobuchi-Philip (2010), when it combines with a classifier, its denotation do not range over a set of things, but over a set of numerals. Furthermore, she assumes that the denotation of the indeterminate and the classifier is a single unit, but not the one derived as a consequence of the composition of these two units.

- (ii) *nan-nin* { *hito-ri, futa-ri, san-nin, yo-nin, go-nin, ...* }
 What-CI_{person} 1-CI 2-CI 3-CI 4-CI 5-CI (Kobuchi-Philip 2010: 5)

Aside from the discussion of whether her analysis is on the right track, I tentatively present a denotation of *nani* as in (ii), where *nin* ‘CI_{person}’ is a measure expression that provides a counting unit for expressing quantity of persons, namely, $\text{Card}_{\text{person}}$, whose sortal restriction is presupposed.

- (iii) For *Nani* $\subseteq D_{\text{Card}}$
Nan-nin: $\lambda n . \lambda P \langle e, t \rangle . \lambda x . [n \in \text{Number}(n) \wedge \text{Card}_{\text{human}}(x) = n] \wedge P(x)]$

conditions in (25) in which the negation scopes over \exists .

(25) Assertion for (14a) and (14b)

$$\neg\exists x[\text{student}'(x) \wedge \text{Max}[m \in \text{Number}(n) \wedge \text{Card}_{\text{human}}(x)=m] \wedge \text{ran}'(x)]$$

The variations of the large/small readings stem from the scope effects of *mo* based on its structural position. The large reading is assumed to be derived from the scope interaction of $\neg > mo > \exists$, as shown in (26):

(26) a. $\neg > mo > \exists$ (14a: Large Reading)

b. $\forall n \neq m$: that m-many students came is more unexpected than that n-many students came. In other words, m is a large number.

Since *mo* stays below the negation, the domain it is applied over is the set of the positive proposition and its alternatives. Since *mo* induces the reading in which the assertion is the most unexpected, i.e., the strongest proposition, it can be calculated against the entailed alternatives. In other words, the calculated alternatives are a set of propositions with a 'smaller' number of students than the given maximal number. The assertion contains the largest number among its alternatives, and as a consequence, we obtain the unexpected and, at the same time, large reading.

When it comes to the small reading in (14b), it is derived when *mo* takes scope over the negation and introduces the presupposition in (27b).

(27) a. $mo > \neg > \exists$ (14b: Small Reading)

b. $\forall n \neq m$: that it is not the case that m-many students came is more unexpected than that it is not the case that n-many students came. In other words, m is a smaller number.

Since negative statements reverse the entailment relation, the calculated alternatives are a set of propositions with 'smaller' numbers than the number in the assertion. More specifically, if the maximal number in the assertion is five, then, that it is not the case that five students came is more unexpected than it is not the case that more than five students came, because the latter entails the former. Thus, among these alternatives, the assertion is the most unexpected and also contains the smallest number. As a result, it gives rise to a small reading.

Finally, I will consider the large reading in (14c) that has been left unresolved in Oda's mechanism. Recall that in her analysis that adopts the lexical analysis of *mo*, an unnecessary reading was wrongly predicted, namely, that there are only such few people that did not come. In the analysis here, this 'small' reading could be circumvented successfully. The story is simple and straightforward. I assume first that the assertion is truth-conditionally represented as in (28) where \exists scopes over the negation.

(28) $\exists x[\text{student}'(x) \wedge \text{Max}[m \in \text{Number}(n) \wedge \text{Card}_{\text{human}}(x)=m] \wedge \neg \text{ran}'(x)]$

There are some students that did not come, whose cardinality is maximal (in a subset of numbers).'

Further, if the scalar *mo* scopes over those scope elements, introducing the presupposition in (29b) below, only the desirable large reading obtains.

(29) a. $mo > \exists > \neg$ (13c: Small Reading)

b. $\forall n[n \neq m \rightarrow \text{unexpected}(\text{There are } m\text{-many students who did not come})$
 $> \text{unexpected}(\text{There are } n\text{-many students who did not come})]$

The assertive meaning involves the maximal number **m**. Of course, that there are m-many students who did not come entails all the propositions in which a smaller number of students are involved, but not vice versa. Given the scope relation and the presupposition in (29b), the large reading comes out naturally.

In this section we have so far discussed the wh-Cl-*mo* construction in terms of maximality.

The maximality binder *mo* is applied to an ordered subset of cardinals and picks the greatest cardinal **m**, and on the other hand *mo* serves as a scalar particle, whose application conveys the implicit meaning that the assertion is the most unexpected among the relevant alternatives. The assertion with the maximal **m** derives the highest value on the scale of unexpectedness among its alternatives and at the same time, **m** is the largest number among a (sub)set of its alternatives. Note also that given this analysis, the unobserved interpretation that was wrongly predicted in Oda, namely that the fewest cardinal *one* is involved, would never come out. In the maximality-based analysis, *mo* is defined on the presupposition that it should be applied to an ‘ordered set’ of numbers. Thus, the case in which the maximal number is the minimum ‘one’ would never be derived; otherwise it would give rise to a presupposition failure. On the other hand, we have appealed to the necessity of Oda’s basic stance, claiming that *mo* plays two roles. However, what substantially differs from Oda (2012) is that we consistently have defined *mo* as a maximal operator, not as an existential quantifier. Further, note also that the discussion here suggests that the scope analysis of *mo* should be more appropriate than the lexical analysis (Nakanishi 2008, 2010).

5 Conclusion

This paper has discussed the scalar readings induced by the constructions with an indeterminate numeral plus the Japanese suffix *mo*. Basically I have supported Oda’s (2012) claim that *mo* serves as a binder over a set of alternatives to the denotation of the indeterminate and at the same time, as a scalar particle. However, on the other hand, I have clarified that the functions are both derived from a core semantic property of *mo*, namely, maximality. Specifically, *mo* serves as the iota-as-maximality operator (cf. Giannakidou and Cheng 2006) and likewise as a scalar particle. These functions work individually, but the component of maximality is placed in the center of the semantics of both usages.

As briefly touched upon early in this paper, the particle *mo* occurs in various semantic environments: universal quantification, NPI, minimizer NPI, additivity, and conjunction. I cannot explore into each of those cases here, but they seem to bear the same core meaning as well. In many languages the particles that build quantifier words also serve as connectives, additives, scalar particles, questions markers, etc. It seems to me that the most insightful and cross-linguistic studies are a series of works by Szabolcsi (2010) and Szabolcsi et al. (2014). The *mo*-type particle, including say, *mind(en)* in Hungarian, is said to derive universal and conjunction meanings, which are both represented in terms of set-theoretic intersections (Gil 2008). On the other hand, the *ka*-type particle, like *vala/vagy* in Hungarian, derives existential and disjunction meanings, which are both treated as special cases of the join operation of lattice theory that finds the least upper bound of two appropriate things. In the series of her analyses, each type of particle has to do with join \cup and meet \cap , respectively, and further, they impose the same requirement. It is reasonable to treat both particles in parallel fashions, and if either one is characterized independently, we might miss the whole picture and fails to obtain parallel insight for the other particle’s role (Szabolcsi p.c.). In fact, if it is assumed that *ka* is a meaningful particle, say, as a choice-function variable, as proposed by Yatsushiro (2009), it does not offer any parallel insight for *mo*’s role. This criticism, of course, holds true of the maximality-based analysis developed in this paper. This is a methodological question with respect to which Szabolcsi has raised our awareness in studies of this sort. The characterization of *mo* should be expected to fit into a bigger picture that could also accommodate that of the other particle. Further, it should also be expected to explain similarities and differences in the distribution of its Chinese and Hungarian counterparts in the framework of a model-theoretic semantics. Hopefully, the analysis here will lead to a bigger picture, which I would like to draw by presenting their compositional analyses in future work.

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