

## DEGENERATE PLURALS\*

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### Abstract

We argue that the *wh-mo* construction in Japanese should be analyzed as an *i-sum* denoting degenerate plural, distinct from group denoting true plurals and from universal quantifiers. Universal quantification-like behavior we derive from an optional distributive operator that can occur with plurals as well as with *wh-mo* expressions. The optionality of this operator makes it possible to account for quantificational variability in examples containing adverbs of quantification as well.

### 1 Introduction

Japanese has a quantification-like construction in which a *wh*-expression can be associated long-distance with the particle *mo*. This construction is illustrated in (1).

- (1) [DP[CP *Dono-gakusei-ga t<sub>j</sub> kai-ta*] ronbun<sub>j</sub>]-*mo<sub>i</sub>* *omoshiro-katta*  
which-student-NOM write-past paper-MO interesting-past  
'Whichever student wrote a paper, it was interesting'

As the gloss suggests, the interpretation associated with this construction is related to English expressions with *wh+ever*, though the connection is loose in several ways. For starters, while *mo* can be syntactically separated from the *wh* expression it associates with in Japanese, in English *wh* and *ever* form a single lexical item that cannot be split. The semantic interpretations associated with these expressions differ in important ways as a result of this morphological distinction. In English, the semantic scope of *ever* can extend to an NP argument of *wh+ever* and a relative clause, as in the expression *whatever student wrote a paper*. This can be seen in the fact that the referent of the expression is taken from among the set of students who wrote a paper, and not simply from the set of students. Corrective contexts aside, however, the scope of *ever* cannot easily extend to a higher DP. Thus the expression *the paper that whichever student wrote* can only be given a pragmatically unrealistic interpretation, presupposing that there is one jointly authored paper which any student you pick has contributed to and referring to that paper. The semantic scope of *ever* in this case is the set of students, and cannot be extended to

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the set of papers that the students wrote. The Japanese *wh-mo* expression *dono-gakusei-ga kaita ronbun-mo* in (1) has the exact opposite properties from its English counterpart. The Japanese DP can only be given an interpretation in which the semantic scope of *mo* is over the entire DP, typically giving rise to a distributive type of interpretation in which for every student *x* who wrote a paper reference is made to the paper that *x* wrote. It cannot be interpreted as referring to a single paper that is presupposed to be multiply authored by a group of students. That is, the semantic scope of *mo* cannot be restricted to the *wh*-expression *dono-gakusei* (which student), but rather must extend to the entire DP to which it is adjoined.

In this paper we are interested first in the question of how to generate the universal quantificational force typically associated with the *wh-mo* construction. Analyses of the construction by von Stechow (1996), Shimoyama (2001), Kratzer and Shimoyama (2002) and Tancredi and Yamashina (2002) all analyze *mo* as denoting a universal quantifier as part of its lexical semantic interpretation. However, such an analysis cannot make room for the fact that the universal force can be overridden by adverbs of quantification, a fact first noted in Nishigauchi (1986). We argue that the universal force should be seen as coming from the optional occurrence of a distributive plural operator. However, we show that *wh-mo* interpretation cannot be reduced to plural interpretation since *wh-mo* expressions fail to exhibit several typical plural behaviors. To account for the semi-plural character of the construction, we then propose that *wh-mo* expressions denote *i*-sums, but that plurals underlyingly denote groups.

We develop our analysis of the *wh-mo* construction based loosely on Shimoyama (2001). In section 2 we briefly review Shimoyama's analysis. Then in section 3 we show three basic problems that her analysis cannot handle and propose modifications to overcome them. In section 4 we then address the question of how to account for both the plural-like and the quantification-like behavior of *wh-mo* expressions while still distinguishing them both from true plurals and from quantifiers. Section 5 contains a conclusion, and section 6 an appendix in which the formal analysis argued for is spelled out in detail.

## 2 Shimoyama (2001)

Shimoyama (2001) analyzes *wh*-expressions as restricted variables. At LF, *wh*-expressions are assumed to be in an IP adjoined position and coindexed with an operator that occurs in the immediate scope of *mo*, as in (2) for example (1).

- (2) [[IP *Dono-gakusei<sub>i</sub>-ga* [IP *t<sub>i</sub> kai-ta*]] *ronbun Op<sub>i</sub>]-mo omoshiro-katta*

The operator forms a set of interpretations from its sister as follows. The *wh*-expression is analyzed as a restricted variable, with the restriction contributed by the internal argument of the *wh*-expression itself, i.e. *gakusei* (student). Formally this restriction is analyzed as the proposition that the referent assigned to a variable *x* has the property of being a student. This proposition is conjoined with that denoted by the IP, which itself serves as a separate restriction on the variable contributed by the trace of the *wh*-expression. The relative clause containing this IP modifies the head noun *ronbun* (paper), with the DP as a whole given an existential quantifier interpretation.<sup>1</sup> The operator

<sup>1</sup> The DP could also be definite, as noted by Shimoyama, though we gloss over this possibility here.

collects together all such existential quantifier interpretations that can be generated by substituting individuals in place of the original wh-variable. This set is universally quantified over by *mo* and the resulting quantification is applied to the main predicate of the sentence, here *omoshirokatta* (was interesting). The interpretations Shimoyama gives for Op and *mo* are given in (3) and (4) and their formal application is illustrated in (5) for the LF in (2).

$$(3) \quad \llbracket \text{XP Op}_{1,\dots,n} \rrbracket^g = \{ \llbracket \text{XP} \rrbracket^{g'} : g' \approx^{1,\dots,n} g \} = \{ z : \exists g' [g' \approx^{1,\dots,n} g \ \& \ z = \llbracket \text{XP} \rrbracket^{g'}] \}$$

$$(4) \quad \llbracket \text{mo} \rrbracket = \lambda P \lambda Q. \forall X [P(X) \rightarrow Q(X)], \text{ where } X \in D_{\tau} \text{ and } P, Q \in D_{\langle \tau, t \rangle}.$$

$$\begin{aligned} (5) \quad & \llbracket \llbracket [\text{IP Dono-gakusei}_i\text{-ga } [\text{IP } t_i \text{ kai-ta}]] \text{ ronbun Op}_i \rrbracket \rrbracket^g \\ &= \{ \lambda P. \exists x [\text{paper}(x) \ \& \ \text{student}(g'(z)) \ \& \ \text{wrote}(g'(z), x) \ \& \ P(x)] : g' \approx^1 g \} \\ &= \{ \lambda P. \exists x [\text{paper}(x) \ \& \ \text{student}(a) \ \& \ \text{wrote}(a, x) \ \& \ P(x)], \\ & \quad \lambda P. \exists x [\text{paper}(x) \ \& \ \text{student}(b) \ \& \ \text{wrote}(b, x) \ \& \ P(x)], \\ & \quad \lambda P. \exists x [\text{paper}(x) \ \& \ \text{student}(c) \ \& \ \text{wrote}(c, x) \ \& \ P(x)], \dots \} \\ &=: \mathbf{A} \\ & \llbracket \llbracket [\text{IP Dono-gakusei}_i\text{-ga } [\text{IP } t_i \text{ kai-ta}]] \text{ ronbun Op}_i \rrbracket \text{-mo omoshiro-katta} \rrbracket^g \\ &= \llbracket \text{mo} \rrbracket^g (\llbracket \llbracket [\text{IP Dono-gakusei}_i\text{-ga } [\text{IP } t_i \text{ kai-ta}]] \text{ ronbun Op}_i \rrbracket \rrbracket^g) \\ & \quad (\llbracket \text{omoshiro-katta} \rrbracket^g) \\ &= [\lambda P \lambda Q. \forall X [P(X) \rightarrow Q(X)]] (\mathbf{A}) (\llbracket \text{omoshiro-katta} \rrbracket^g) \\ &= \forall X [X \in \mathbf{A} \rightarrow X(\lambda x. \text{interesting}(x))]^2 \end{aligned}$$

The final formula in (5) says that every existential quantifier meaning in  $\mathbf{A}$  applies truthfully to the predicate  $(\lambda x. \text{interesting}(x))$ . The sentence is thus predicted to be true just in case *a* is a student and there is a paper that *a* wrote that was interesting, *b* is a student and there was a paper that *b* wrote that was interesting, etc., for all individuals *a*, *b*, ... in the universe of discourse.

### 3 Problems for Shimoyama

In this section we identify and propose solutions for three problems with Shimoyama's analysis. These problems derive from an incorrect analysis for the restriction of wh-variables, unexplainable blocking effects on the wh-*mo* association from strong quantifiers, and unexpected quantificational variability with adverbs of quantification.

#### 3.1 Restricting the Domain of Quantification

The first problem with Shimoyama's analysis lies in her treatment of restrictions on the wh-variable. Shimoyama treats these restrictions as part of the assertion, thus taking *student*(*g'(z)*) and *wrote*(*g'(z)*, *x*) in (5) to be assertions about the individual assigned by the variable assignment function *g'* to the variable *z*. For (1), however, this makes for truth conditions that are impossible to satisfy in any non-empty universe. For the first

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<sup>2</sup> Shimoyama is presumably assuming that the predicate  $\llbracket \text{omoshirokatta} \rrbracket$  is type-shifted into an  $\langle \langle \langle e, t \rangle, t \rangle, t \rangle$  type expression. We take the relevant interpretation to be  $\lambda \wp \wp \in D_{\langle \langle \langle e, t \rangle, t \rangle, t \rangle} . \wp (\lambda x. \text{interesting}(x))$ .

expression listed in the set produced by the operator to apply truthfully to the predicate  $(\lambda x.\text{interesting}(x))$ , it is necessary that  $a$  be a student, and that  $a$  wrote an interesting paper. This means that the universe will need to contain both  $a$  and an interesting paper written by  $a$ . Suppose that this paper is  $d$ . Then since  $d$  is also an individual in the universe of discourse, there will be some interpretation in  $A$  of the form  $\lambda P.\exists x[\text{paper}(x) \ \& \ \text{student}(d) \ \& \ \text{wrote}(d,x) \ \& \ P(x)]$ . This is so since *mo*, by quantifying over every variable assignment  $g'$  that differs at most from  $g$  in the values it assigns to variables contributed by *wh*-expressions, effectively quantifies over all individuals in the universe, and not only over students. However, since  $d$  is not a student, the existential quantifier interpretation just given cannot possibly apply truthfully to  $(\lambda x.\text{interesting}(x))$ .

This problem can be avoided by analyzing the restrictions on the *wh*-variable as presuppositions rather than as parts of the assertion. We implement this idea by analyzing *wh*-expressions not as individual variables but as choice function variables applied to the internal (often implicit) argument of the *wh*-expression.<sup>3</sup> Applied to a given set, a choice function selects a member of that set. If the original set consists only of students, then the individual selected is guaranteed to be a student as well. However, the fact that the selected individual is a student does not thereby become part of the assertion. This analysis makes it possible to interpret *wh*-expressions either in the IP-adjoined position in which Shimoyama locates them or *in situ*. With this modification, the set generated by *Op* in (2) will be the following, with  $f_1$  a choice function variable:

$$(6) \quad \{ \lambda P.\exists x[\text{paper}(x) \ \& \ \text{wrote}(g'(f_1)(\text{student}),x) \ \& \ P(x)] : g' \approx^{1,\dots,n} g \}$$

As the reader can verify, the fact that there are individuals in the universe of discourse that are not students has no undesired consequences under this analysis.<sup>4</sup>

### 3.2 Blocking Effect of Strong Quantifiers

A second problem for Shimoyama's analysis is that it fails to distinguish strong quantifiers from weak quantifiers. As seen in (7), these two classes of quantifiers behave differently in *wh-mo* sentences.

- (7) a. [[ *Dono-gakusei-ga e<sub>i</sub> kai-ta*] *ronbun<sub>i</sub>]-mo omoshiro-katta*  
           which-student-NOM write-past paper-MO interesting-past  
           ‘Whichever student wrote a paper, it was interesting’  
   b. [[ *Dono-gakusei-ga e<sub>i</sub> kai-ta*] *mittu-no-ronbun<sub>i</sub>]-mo omoshiro-katta*  
           which-student-NOM write-past 3-GEN-paper-MO interesting-past  
           ‘For every  $x$  who wrote papers, 3 papers  $x$  wrote were interesting’

<sup>3</sup> A Hamblin semantics such as that used in Kratzer and Shimoyama (2002) would serve our purposes equally well here. Our choice to employ choice functions comes in part from our not yet seeing a clear argument in favor of one of the approaches to *wh* interpretation over the other.

<sup>4</sup> There will of course be choice functions which do not have the set of students in their domain and hence which will give an undefined result when applied to that set. We assume that in such cases no interpretation for the DP gets generated at all, making the existence of such choice functions innocuous.

- c. \*[[Dono-gakusei-ga  $e_i$  kai-ta] subete-no-ronbun <sub>$i$</sub> ]-mo omoshiro-katta  
 which-student-NOM write-past all-GEN-paper-MO interesting-past  
 ‘For every  $x$  who wrote papers, all papers  $x$  wrote were interesting’
- d. \*[[Dono-gakusei-ga  $e_i$  kai-ta] hotondo-no-ronbun <sub>$i$</sub> ]-mo omoshiro-katta  
 which-student-NOM write-past most-GEN-paper-MO interesting-past  
 ‘For every  $x$  who wrote papers, most papers  $x$  wrote were interesting’

Strong quantifiers like *subete* (all) or *hotondo* (most) block the association between a wh-expression and *mo*, while weak quantifiers like *mittu* (three) and the covert indefinite determiner do not. Under Shimoyama’s analysis, however, there is no reason to expect this difference in behavior. It could, of course, be stipulated that strong quantifiers make it impossible to copy the index of a wh-expression onto the operator below *mo*. However, such a stipulation would be *ad hoc*. Our solution to this problem is to add to *mo* the presupposition that the set it quantifies over must consist only of individuals.<sup>5</sup> This solution requires re-analyzing indefinites as referring expressions, an analysis worked out and defended in Tancredi and Yamashina (in preparation), and given in the form of the semantics for the indefinite determiner in (8).<sup>6</sup>

$$(8) \quad \llbracket D_{\text{indef.}} \rrbracket = \lambda P. f(P)(w)$$

The intensional choice function variable  $f$  in (8) is assumed to be bound by existential closure. With this change in place, the set generated by the operator for an example like (7a) will consist of papers written by students, one paper per student. (7b) will be similar, with the sole difference that there will be a plurality of three papers per student rather than only one. The examples in (7c,d) cannot be interpreted under this proposal, however, because there is no way of giving a referential analysis of the strong quantifiers, and hence no way of generating a set of individuals for *mo* to quantify over.

### 3.3 Over-riding the Universal Nature of *Mo*

The third problem for Shimoyama’s analysis is that it predicts that *mo* should always be associated with a universal quantification interpretation. However, when adverbs of quantification are added to a sentence like (1) they give rise to quantificational variability effects, a fact already noted in Nishigauchi (1986) and illustrated in (9).

- (9) Dono-gakusei <sub>$i$</sub> -ga kai-ta ronbun-mo taitei omoshiro-katta  
 which-student-NOM write-past paper-MO mostly interesting-past  
 ‘Papers that whichever student wrote were mostly interesting’

This sentence has one interpretation in which the wh-*mo* expression is given a universal quantificational interpretation. On this interpretation the sentence entails that for everyone who wrote papers, most of their papers are interesting. However, it also has

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<sup>5</sup> Essentially this same proposal was made in Kratzer and Shimoyama (2002) as well, though for reasons left unspecified.

<sup>6</sup> The variation comes from our using the Hamblin semantics framework of Kratzer and Shimoyama (2002) in that paper but not here.

another interpretation in which it entails that for most of the people who wrote a paper, a/the paper they wrote was interesting. This latter interpretation fails to have any universal quantification associated with *mo*. This behavior of *wh-mo* expressions differs strongly from that found with overt universal quantifiers as in (10) below, where the universal quantification disallows a quantificational variability interpretation induced by the adverb.

- (10) Subete-no ronbun-ga taitei omoshiro-katta  
 Every-GEN paper-NOM mostly interesting-past  
 ‘Every paper was mostly interesting’

As with its English interpretation, the sentence in (10) can only mean that each paper had the property of being mostly interesting, and not that most of the papers had the property of being interesting.

A related problem shows up with examples like (11), where once again a universal quantificational interpretation would appear to be inappropriate.<sup>7</sup>

- (11) [[[ *t<sub>j</sub>* Dono-kyoku-o<sub>i</sub> hiita] sorisuto<sub>j</sub>]-mo<sub>i</sub>] (ensoukai-no ato-de) atsumatta.  
 what-piece-ACC played soloist-MO recital-GEN after gathered  
 ‘Soloists who played whatever piece gathered (after the recital)’

Under Shimoyama’s analysis, the verb *atsumatta* (gathered) should be required to apply separately to interpretations of the form [the *x*: soloist(*x*) & played(*x*,*a*)], with different such interpretations generated by substituting different musical pieces in place of *a*. Thus in an appropriate context, the sentence is predicted to imply that the people who played Chopin’s first ballade gathered, the people who played Liszt’s Spanish Rhapsody gathered, and the people who Bach’s Italian Concerto gathered, for a total of three separate gatherings. While such an interpretation is available, there is also another interpretation in which (11) is true if all soloists gathered together in a single gathering regardless of what piece they played. This is clearest in a situation in which each piece under consideration was played by exactly one person, as in a typical recital. In such a circumstance, the reading produced by Shimoyama would be predicted to be infelicitous, since it would entail that each person who played a piece gathered, and one person cannot gather. The sentence is still acceptable in this circumstance, however, suggesting that it is possible to interpret this sentence in such a way that *mo* does not introduce a universal quantifier into the interpretation.

The easiest way around the above two problems is to adopt a suggestion of Nishigauchi’s (1986) and assume that *mo* is not itself a universal quantifier but is rather associated by default with a covert universal quantifier. Implementing this change directly within Shimoyama’s analysis would leave *mo* vacuous. However, if *mo* is reanalyzed as taking over the function that *Op* has in her analysis, this problem is at least partially resolved.

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<sup>7</sup> More accurately, a *non-plural* universal quantificational interpretation is inappropriate. See example (20) below and the surrounding discussion. Technically, this example leaves open the possibility of analyzing *wh-mo* expressions as plural universal quantifiers. However, since *subete-no N* also falls into this category of plural quantifier and yet contrasts with *wh-mo* expressions with respect to quantificational variability, this alternative is unable to solve all of the problems examined in the present paper.

Our third modification to Shimoyama's analysis is thus to analyze *mo* as taking over the function of Shimoyama's set forming operator, and combining *mo*-phrases with a covert universally quantifying operator. Nishigauchi proposed that the operator in question is a covert adverb of quantification. In the next section, we will suggest instead that it is the covert distributive operator that can occur with plural expressions.

Summarizing at this intermediate point, we have argued for the following changes to Shimoyama's original proposal: (i) *mo* has the functions of Shimoyama's set forming operator; (ii) the universal quantification associated with *mo* comes from a covert operator and can only operate over individuals, not over quantifier meanings; and (iii) in generating individuals from a DP, *wh*-expressions introduce individuals presupposed to satisfy the lexical restrictions of the *wh*-expression, these presuppositions deriving from a choice function analysis of the *wh*-expressions.

#### 4 Wh-*mo* and Plurals

The analysis we have come to through revisions to Shimoyama (2001) is in many respects adequate as it stands. However, the analysis does not yet fully address the question of how to relate *wh-mo* interpretations to the interpretations of plurals and quantifiers. In this section we argue that *wh-mo* interpretation should be both connected to and distinguished from full-fledged plurality. We saw in section 3.3 two types of examples in which a *wh-mo* expression does not have an obvious universal quantificational interpretation. In the first example the quantificational force associated with the *mo*-phrase was determined by an adverb of quantification. In the second, the *mo*-phrase combined with the verb *atsumaru* (gather) without any apparent quantification. Both of these behaviors are found also with simple plural expressions, hence forming the intuitive basis for a connection between *wh-mo* expressions and plurals. We thus begin by examining the hypothesis that *wh-mo* interpretation is identical to plural interpretation.

##### 4.1 The Wh-*mo* = Plural Hypothesis

A plural analysis of *wh-mo* expressions receives some support from the observation that just like *wh-mo* expressions, plurals give rise to quantificational variability effects with adverbs of quantification and can co-occur with predicates like *atsumaru* (gather), as seen in (12) and (13) below.

- (12) Korera-no ronbun-wa taitei omoshiro-katta  
 These-GEN paper-TOP usually interesting-past  
 These papers were usually interesting  
 ('Each of these paper was mostly interesting' OR  
 'Most of these papers were interesting')
- (13) Sorisuto-tachi-ga (ensoukai-no ato-de) atsumatta.  
 Soloist-pl.-NOM recital-GEN after gathered  
 '(The) Soloists gathered (after the recital)'

However, *wh-mo* expressions lack cumulative readings (14), *Scha* readings (15) and group responsibility readings (16) available for standard plurals. (14a), with true plurals, has a reading according to which the total number of companies involved in computer making is three and the total number of computers made is 6000. The sentence is true on this reading if each of three companies made 2000 computers. The availability of such a reading is a hallmark of plural interpretation (cf. Scha 1981, Link 1983). (14b), containing a *wh-mo* expression in place of the first plural, is false in this same situation, however. (14b) can only be true if each of the companies that someone visited made 6000 computers.

- (14) a. San-sha-no kaisha-ga 6000-dai-no konpyuta-o tukutta  
 three-count-GEN company-NOM 6000-count-GEN computer-ACC made  
 ‘Three companies made 6000 computers’  
 b. #Dare-ga tazuneta kaisha-mo 6000-dai-no konpyuta-o tukutta  
 who-NOM visited company-mo 6000-count-GEN computer-ACC made  
 ‘The company that whoever visited made 6000 computers’

Another place where plurals exhibit unique behavior is in examples like (15a), based on similar examples in Scha (1981). The sentence is easily judged to be true of the figures drawn below when demonstratively referring to all four sides of each figure, despite the fact that not every side of figure A is parallel with every side of figure B. It suffices that every side of figure A is parallel with some side of figure B and vice versa. For the sentence in (15b) in which the plurals from (15a) are replaced by *wh-mo* expressions, however, similar facts do not obtain. Assuming for example that each side of the two figures was drawn by a different person, (15b) is false of the two figures in question. It would only be true in a situation in which all sides of the one figure were parallel to all sides of the other (and hence also parallel to one another).

- (15) a. Zu-A-no korera-no hen-wa zu-B-no korera-no hen-to  
 figure-A-GEN these-GEN side-TOP figure-B-GEN these-GEN side-with  
 heikou de-arau  
 parallel COP  
 ‘These sides of figure A are parallel with these sides of figure B’  
 b. #Zu-A-no dare-ga kaita hen-mo zu-B-no korera-no  
 figure-A-GEN who-NOM drew side-MO figure-B-GEN these-GEN  
 hen-to heikou de-arau  
 side-with parallel COP  
 ‘The sides of figure A that whoever drew are parallel with these sides of figure B’



Figure A

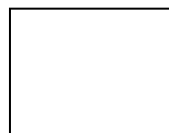


Figure B

Finally, in (16a) we see a type of case from Landman (1996) in which a thematic relation appears to apply to a group rather than to individuals within the group, which once again is a hallmark of plural interpretation. The sentence is judged to be true if the students act



together to reach the ceiling, e.g. by making a human pyramid so the top person can make physical contact with the ceiling. Such a situation can be understood as one in which the group of students as a whole touches the ceiling, hence as one in which the subject thematic role of the predicate applies to the group and not to the individuals within it. Once again we find that the *wh-mo* example is false in this same situation and hence cannot be interpreted as a plural. For the sentence in (16b) to be true, each individual student needs to make physical contact with the ceiling separately.

- (16) a.      *Gakusei-tachi-ga tenjo-ni sawat-ta.*  
               Student-pl.-NOM ceiling-DAT touch-past  
               ‘The students touched the ceiling’  
       b.      *#Nani-o yatte-ita gakusei-mo tenjo-ni sawat-ta.*  
               What-ACC doing-were student-mo ceiling-DAT touch-past  
               ‘The student(s) who had been doing whatever touched the ceiling’

Further indication that *wh-mo* expressions are not true plurals comes from a contrast in their behavior with different inherently plural predicates. While *atsumaru* is clearly a candidate for an inherently plural predicate, we find that not all such candidates behave alike with respect to *wh-mo* expressions. In particular, while predicates composed with the adverb *issho-ni* (together) pattern with *atsumaru* in taking either a true plural or a *wh-mo* expression as seen in (17), on its most prominent reading<sup>8</sup> the subject of *wa-ni naru* (form a circle) can only be a plural, and not a *wh-mo* expression, as seen in (18).

- (17) a.      *Korera-no kyaku-ga issho-ni suwatta*  
               These-GEN guest-NOM together-DAT sat  
               ‘These guests sat together.’  
       b.      *Nani-o tabeta kyaku-mo issho-ni suwatta*  
               what-ACC ate guest-MO together-DAT sat  
               ‘The guests that ate whatever sat together’  
       (18) a.      *Korera-no ishi-ga wa-ni nat-ta*  
               these-GEN stone-NOM circle-DAT become-past  
               ‘These stones formed a circle’  
       b.      *#Dare-ga nageta ishi-mo wa-ni natta*  
               who-NOM threw stone-mo circle-DAT become-past  
               ‘The stone that whoever threw formed a circle’

In (17a) the subject is a plural and in (17b) it is a *wh-mo* expression, but both are equally acceptable and can be given parallel interpretations. The sentences in (18) are to be considered in a situation in which 10 people threw one stone each, and the 10 stones that they threw happened to land in a circular formation. (18a) is an acceptable way of describing this situation, using *korera-no ishi* (these stones) to refer to the 10 stones thrown. (18b), in contrast, cannot be used to describe this situation. The use of a *wh-mo*

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<sup>8</sup> Like its English counterpart, the predicate *wa-ni naru* (form a circle) can marginally apply to an atomic individual, as in the sentence *Kono ishi-wa wa-ni natta* (This rock formed a circle). The sentence is true if and only if the single rock referred to somehow came to be in the shape of a circle. We ignore such an interpretation here as irrelevant to our present concerns.

expression in this case imposes an obligatorily distributive interpretation, leading only to an unnatural interpretation according to which each individual stone is claimed to have formed a circle on its own. These examples once again show clearly that *wh-mo* expressions must not be analyzed as plurals, since such an analysis would make these contrasts in behavior between *wh-mo* expressions and true plurals unexplainable.

#### 4.2 Wh-mo Expressions as Degenerate Plurals

We saw in section 3.3 that *wh-mo* expressions cannot be analyzed as inherently quantificational. In section 4.1 we also saw that they cannot be analyzed as plurals. However, they clearly share some properties both of quantified expressions and of plurals. For instance, in the absence of an adverb of quantification and when co-occurring with a singular predicate, they typically give rise to distributive readings, like both universal quantifiers and plurals. Furthermore they combine with at least some predicates that could be argued to select plural arguments, just not with them all. To account for this behavior, we make the following proposal: (i) *wh-mo* expressions denote i-sums, but never form groups; (ii) the distributive operator applies exclusively to i-sums, universally distributing over the atomic parts thereof; (iii) plurals have a group interpretation as their basic interpretation; and (iv) the grammar allows free application of Landman's (1996) de-grouping operator  $\downarrow$ . This proposal is summarized in a slightly different form below.

Individuals:	$j, b, s$	(names, singular DPs)
I-sums:	$j \oplus b, j \oplus s, b \oplus s, j \oplus b \oplus s$	( <i>mo</i> -phrases, $\downarrow$ -shifted plurals)
Groups:	$\uparrow(j \oplus b), \uparrow(j \oplus s), \uparrow(b \oplus s), \uparrow(j \oplus b \oplus s)$	(plurals)
$\llbracket XP \text{ mo}_{1,\dots,n} \rrbracket^g$	$= \Sigma(\{\llbracket XP \rrbracket^{g'} : g' \approx_{1,\dots,n} g\})^9$	
$\llbracket Op_{\text{dist}} \rrbracket$	$= \lambda x \lambda P. [\forall x' \Pi x] (P(x'))$	

The proposal makes it possible in principle to explain all of the data considered so far. True plural behavior like that seen in (14) through (16) can be analyzed as requiring group interpretation, thus excluding *mo*-phrases. Furthermore, the analysis allows for two distinct classes of plural-taking predicates – one that applies to i-sums, including *atsumaru* (gather) and *issho-ni* (together) predicates, and one that applies to groups, including *wa-ni naru* (form a circle). Since plurals can be de-grouped for free, it follows that both classes of predicates can apply to true plurals. If we assume that there is no free application of a group forming operator in the semantics, we furthermore account for the fact that only the former group of predicates can apply to *wh-mo* expressions. Finally, if we assume that adverbs of quantification can minimally quantify over i-sums, we predict their behavior as well, namely that they can operate over *wh-mo* expressions (9) and plurals (13), but not over independently quantified expressions (10).

While the analysis proposed shares an i-sum / group distinction with Landman (1996), it should be noted that we put this distinction to a very different use, allowing plurals to denote either kind of expression but restricting *wh-mo* expressions to the former. Furthermore, while Landman takes the i-sum interpretation of plurals to be basic and optionally generates a group interpretation from it, we take the group interpretation of

<sup>9</sup>  $1, \dots, n$  are the indices on the unbound *wh*-expressions in *XP*, and  $\Sigma$  is an i-sum forming operator.

plurals to be basic. This makes it possible to differentiate full fledged plurals, i.e. those that can denote either groups or i-sums, from degenerate plurals, i.e. expressions like *wh-mo* expressions that can only denote i-sums.

### 4.3 Extensions

In this section we examine two extensions for the analysis presented above. The first extension is motivated by the fact that predicates like *atsumaru* (gather) can occur with a quantificational subject as seen in (19), something that is not expected if these predicates select for i-sums.

- (19) Subete-no / Hotondo-no sorisuto-ga (ensoukai-no ato-de) atsumatta  
 All-GEN / Most-GEN soloist-NOM recital-GEN after gathered  
 ‘All / Most soloists gathered (after the recital)’

While it is tempting to take such facts to indicate that *atsumaru* (gather) can select a quantifier, such a conclusion would be hasty given that the quantifiers *kaku* (each), distributive *sore-zore* (each) and *dochira ... mo* (both) cannot occur with these predicates, as seen in (20) below.

- (20) a. #Kaku sorisuto-ga atsumatta  
         each soloist-NOM gathered  
         ‘Each soloist gathered’  
       b. #Sorisuto-ga sorezore atsumatta  
         soloist-NOM each gathered  
         ‘The soloists each gathered’  
       c. #Dochira-no sorisuto-mo atsumatta  
         which-of-2-GEN soloist-MO gathered  
         ‘Both soloists gathered’

This suggests that what makes the examples in (19) acceptable is that they involve plural quantification. Support for this view comes from parallel observations in English where the singular / plural nature of the quantification is overtly marked on the noun. While the examples in (21) involving plural quantification are perfectly acceptable, those in (22) involving singular quantification are degraded.

- (21) Most / Few / All / Some / No / Two or more men gathered

- (22) \*No / \*Some / ??Every / ??More than one man gathered

Within the context of our current analysis, these facts suggest that plural quantification should be analyzed as involving true plurality. *Most men*  $\phi$  on such an approach could be

seen as asserting the existence of a group constructed from an i-sum consisting of more than half of the men as atomic parts to which  $\phi$  truthfully applies.<sup>10</sup>

The second extension needed to the analysis proposed above is to account for cover readings for *wh-mo* sentences. Consider once again the sentence in (11), repeated here with minor variation.

- (11') [[[t<sub>j</sub> Dono-kyoku-o<sub>i</sub> hiita] sorisuto<sub>j</sub>]-mo<sub>i</sub>]atsumatta  
 what-piece-ACC played soloist-MO gathered  
 ‘Soloists who played whatever piece gathered’

Under the recital scenario originally presented, the most natural way of understanding this sentence is as having one soloist per piece played. We noted that under this interpretation it is possible for the sentence to be true in the event that all soloists gathered in a single gathering. However, the sentence is also true in the event where the soloists split up into multiple gatherings and never gathered together into one large group. This is what Schwarzschild (1996) refers to as a cover reading, and it is clearly available here with singular *sorisuto*. To account for it, we assume that a cover reading is generated from application of an i-sum selecting predicate to an i-sum.<sup>11</sup>

Now consider a variation of (11) in which *sorisuto* is taken to be plural rather than singular. Such a reading can be gotten from (11) itself or from (23) in which the plural marking is made explicit.

- (23) [[[t<sub>j</sub> Nani-o<sub>i</sub> hiita] sorisuto-tachi<sub>j</sub>]-mo<sub>i</sub>] (konkuru-no ato-de)atsumatta  
 what-ACC played soloist-pl.-MO competition-GEN after gathered  
 ‘Soloists who played whatever gathered (after the competition)’

To make such a change in interpretation pragmatically plausible, consider the context of a competition in which for each piece performed there are several soloists who played it. Observationally, the sentences both have a cover reading available in these circumstances. In particular, they can be true if there were several gatherings of groups of soloists, adding up to all of the soloists who played any piece in the recital but not necessarily including all of them in any single gathering. Importantly, under such a cover reading, for any piece played, the soloists who played that piece have to have all been part of the same gatherings. Thus if there were 5 pieces played and the soloists who played pieces 1 and 2 gathered together as did the soloists who played pieces 3, 4 and 5, then the sentence is true. If, however, the two gatherings each consisted of half of the soloists who played each of the pieces, then the sentence is false. That is, the cover can

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<sup>10</sup> The downward entailing quantifier *few men* would have to be analyzed as denying the existence of a group consisting of many men to which  $\phi$  truthfully applies on such an approach. We leave full working out of the details of this approach for a later date.

<sup>11</sup> For our present concerns, any analysis of cover readings that can be spelled out using i-sums will suffice.

extend down to the level of groups, but not down to the level of individuals inside the groups.<sup>12</sup>

Assuming that i-sum selecting predicates can generate cover readings from their i-sum denoting arguments, the analysis developed above easily generates appropriate cover readings. However, without further change it is also capable of generating an unwanted global cover reading. This can be done by degrouping the DP *dono-kyoku-o hiita sorisuto* (the soloist(s) who played which piece) prior to sum formation by *mo*. *Mo* will then form a large i-sum out of a set of smaller i-sums, and the individuals within the larger i-sum will no longer be differentiated according to the pieces that they played. Under such an interpretation, any grouping of soloists into separate gatherings is expected to make the sentences true, contrary to what was observed. We can easily account for the absence of global cover readings, however, by analyzing *mo* as generating i-sums from atomic individuals, including normal individuals and groups, but not from i-sums. If *mo* cannot apply to an i-sum denoting expression, application of de-grouping prior to i-sum formation will be blocked by the semantics. Without de-grouping, however, *mo* applied to a plural DP will generate an i-sum whose atomic parts are groups. On the plausible assumption that cover readings can be generated from an i-sum but cannot look inside the atoms from which the i-sum is constructed, the observations made regarding the interpretation of (11) and (23) are then just what is expected.

## 5 Conclusion

In this paper, we have shown that *wh-mo* expressions in Japanese cannot be analyzed either as universal quantifiers or as plurals. We have argued instead for a degenerate plural analysis, in which *wh-mo* expressions denote i-sums and standard plurals underlyingly denote groups. Such an analysis was motivated by the need to distinguish *wh-mo* expressions both from universal quantifiers and from plurals while at the same time accounting for the similarities among these expressions. The analysis provided makes it possible to distinguish two types of plural predication, that exhibited by *atsumaru* (gather) and *issho-ni* (together) predicates on the one hand and by *wa-ni naru* (form a circle) on the other. It also allows for a straightforward analysis of ambiguities stemming from the interaction of *wh-mo* expressions with adverbs of quantification. Finally, it makes it possible to analyze universal interpretations as involving the distributive operator employed in plural interpretation by analyzing this operator itself as operating over i-sums.

## 6 Appendix

In this appendix, we provide a formalization of the analysis developed in the preceding sections, and illustrate how the analysis accounts for ambiguities found in two *wh-mo* sentences.

### Lexical Entries:

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<sup>12</sup> This behavior is unexpected under Schwarzschild's analysis of cover readings since Schwarzschild does not make a group / non-group distinction. We take this behavior, thus, to argue for a group / non-group distinction in plural interpretation.

- (24)  $\llbracket \text{dare}_i \rrbracket^g = [g(i)](\{x: \text{person}(x)\}) [g(i) \text{ a choice function}]$   
 (abbreviated as:  $\text{person}_{g(i)}$ )  
 (similarly for other simple wh-words)  
 $\llbracket \text{the} \rrbracket = \lambda P \lambda Q. \sigma (\{x: \text{AT}(x) \& P(x) \& Q(x)\})$  [AT(x) iff x is an atom]  
 $\llbracket \text{the}^\uparrow \rrbracket = \lambda P \lambda Q. \uparrow \sigma (\{x: P(x) \& Q(x)\})$  [ $\sigma$  a supremum operator]  
 $\llbracket X \text{ mo}_{1..n} \rrbracket^g = \Sigma(\{\llbracket X \rrbracket^{g'}: g' \approx_{1..n} g\})$  [ $\Sigma$  an i-sum forming operator]  
 $\llbracket \text{Op}_{\text{dist}} \rrbracket = \lambda x \lambda P. [\forall x' \Pi x] (P(x'))$   
 $\llbracket \text{taitei} \rrbracket = \lambda P \lambda x. [\text{most } x' \Pi x] (P(x'))$

### Sample Semantic Calculations:

Example (11) was seen to be ambiguous between a single gathering reading in which all soloists gathered and a multiple gathering reading in which soloists gathered into groups according to the piece that they played. We analyze this distinction as arising from optionality of the distributive operator. We give derivations for a non-distributed interpretation with a singular DP, and for a distributed interpretation with a plural DP.

- (11") Nani-o hiita sorisuto-mo atsumatta  
 what-ACC played soloist-MO gathered  
 ‘The soloists who played whatever gathered’

### Single gathering reading (with singular *the*):

- (25) a.  $[_{\text{CP1}}[_{\text{moP}}[_{\text{DP}}[_{\text{CP2}}[_{\text{IP}} \text{ t}_k \text{ Nani}_i\text{-o hiita}] \text{ Op}_k] [_{\text{D}}[_{\text{NPsorisuto}}] \text{ the }]] \text{ mo}_i] \text{ atsumatta}]$   
 b.  $\llbracket \text{IP} \rrbracket^g = \lambda e. \text{played}(x_k, \text{thing}_{g'(i)}, e)$   
 $\llbracket \text{CP2} \rrbracket^{g'} = \lambda x_k. \exists e \text{ played}(x_k, \text{thing}_{g'(i)}, e)$   
 $\llbracket \text{DP} \rrbracket^g = \sigma (\{x: \text{AT}(x) \& \text{soloist}(x) \& \exists e \text{ played}(x, \text{thing}_{g'(i)}, e)\})$   
 $\llbracket \text{moP} \rrbracket^g = \Sigma(\{\sigma(\{x: \text{AT}(x) \& \text{soloist}(x) \& \exists e \text{ played}(x, \text{thing}_{g'(i)}, e)\}): g' \approx_i g\})$   
 $\llbracket \text{CP1} \rrbracket^g = \exists e''. \text{gathered}(\Sigma(\{\sigma(\{x: \text{AT}(x) \& \text{soloist}(x) \& \exists e \text{ played}(x, \text{thing}_{g'(i)}, e)\}): g' \approx_i g\}), e'')$

### Multiple gathering reading (with plural *the*<sup>↑</sup>):

- (26) a.  $[_{\text{CP}}[_{\text{moP}}[_{\text{DP}} \text{ Nani}_i\text{-o hiita sorisuto } \text{the}^\uparrow] \text{ mo}_i] \text{ Op}_{\text{dist}} \text{ atsumatta}]$   
 b.  $\llbracket \text{DP} \rrbracket^g = \uparrow \sigma (\{x: \text{soloist}(x) \& \exists e \text{ played}(x, \text{thing}_{g'(i)}, e)\})$   
 $\llbracket \text{CP} \rrbracket^g = [\forall x \Pi \Sigma(\{\uparrow \sigma(\{x: \text{soloist}(x) \& \exists e \text{ played}(x, \text{thing}_{g'(i)}, e)\}): g' \approx_i g\}) \exists e' (\text{gathered}(\downarrow x, e'))]$

(9), we saw, was also ambiguous. On one interpretation the *wh-mo* expression is given a universal quantificational interpretation and takes wide scope over the adverb of quantification *taitei* (usually). On the other, there is no universal quantification at all associated with the *wh-mo* expression, the only quantificational force coming from the adverb. Derivations generating these two readings are given below for a slightly simplified variation of the sentence.

- (9')  $[_{\text{DP}}[_{\text{CP}} \text{ Dare-ga kai-ta}] \text{ ronbun}] \text{-mo taitei omoshiro-katta}$   
 who-NOM write-past paper-mo usually interesting-past  
 ‘The papers that whoever wrote were usually interesting’

**Every (person) > Most (papers)**

- (27) a.  $[[[_{moP}[_{DP}[\text{Dare}_i\text{-ga } t_j \text{ kai-ta } \text{ronbun}_j \text{ the}^\uparrow]\text{-mo}_i] \text{Op}_{dist} [_{IP} \text{taitei omoshiro-katta}]]]$   
 b.  $[[DP]]^g = \uparrow\sigma (\{x: \text{paper}(x) \ \& \ \exists e' \text{ wrote}(\text{person}_{g'(i)}, x, e')\})$   
 $[[moP \text{Op}_{dist}]]^g = \lambda P. [\forall x \Pi \Sigma(\{\uparrow\sigma (\{x: \text{paper}(x) \ \& \ \exists e' \text{ wrote}(\text{person}_{g'(i)}, x, e')\}): g' \approx_i g\})] (P(x))$   
 $[[IP]]^g = \lambda x. [\text{most } x' \Pi x] \exists e (\text{interesting}(x', e))$   
 $[[a)]^g = [\forall x \Pi \Sigma(\{\uparrow\sigma (\{x: \text{paper}(x) \ \& \ \exists e' \text{ wrote}(\text{person}_{g'(i)}, x, e')\}): g' \approx_i g\})] ([\text{most } x' \Pi x] \exists e (\text{interesting}(x', e)))$

**Most (people) > The (papers)**

- (28) a.  $[[[_{moP}[\text{Dare}_i\text{-ga } t_j \text{ kai-ta } \text{ronbun}_j \text{ the}^\uparrow]\text{-mo}_i] [\text{taitei omoshiro-katta}]]]$   
 b.  $[[moP]]^g = \Sigma(\{\uparrow\sigma (\{x: \text{paper}(x) \ \& \ \exists e' \text{ wrote}(\text{person}_{g'(i)}, x, e')\}): g' \approx_i g\})$   
 $[[a)]^g = [\text{most } x' \Pi \Sigma(\{\uparrow\sigma (\{x: \text{paper}(x) \ \& \ \exists e' \text{ wrote}(\text{person}_{g'(i)}, x, e')\}): g' \approx_i g\})] \exists e (\text{interesting}(x', e))$

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