Plural Predicates and Quantifiers
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1. Introduction

Landman (1989a,b, 1996, 2000) has argued extensively for a semantic ambiguity in the interpretation of plurals. On one interpretation plurals denote i-sums, while on another they denote groups, analyzed formally as atoms formed from an i-sum. I adopt Landman’s approach to plurality for its explicitness, and will not attempt to justify this approach as superior to other approaches to plurality given in the literature such as those of Schein (1993), Schwarzchild (1996) or Brisson (2003). Rather I will focus on the question of how to formalize the semantics of plural predicates in such a way that their behavior can be explained. I will argue that two classes of inherently plural predicates need to be distinguished. What makes both classes inherently plural is that they enter groups into a basic thematic role in their event domain. The two classes differ, however, in their selectional properties. The larger class selects a group denoting argument, which gets entered into the basic thematic role unchanged. The other class, however, selects for either a group or an i-sum, and in the latter case enters the group formed from the i-sum into the basic thematic role. I will justify this claim by examining differences in the interaction of these two classes of plural predicates with numeral quantifier expressions in Japanese and with downward entailing plural quantifiers in English, and showing that these differences cannot be explained within Landman's framework otherwise.

2. Overview of Landman's event semantics

Landman (2000) constructs an intricate and highly detailed semantics for the interpretation of plurals. The core ideas upon which this semantics is based are the following:

(i) Plural NPs and existential QPs (e.g. numeral quantifiers) are ambiguous between a group interpretation and an i-sum interpretation;
(ii) Group interpretation gives rise to collective readings;
(iii) I-sum interpretation gives rise to distributive and cumulative readings.

These ideas are implemented in a Davidsonian event semantics, extending the basic ideas of Parsons (1990). The main extension to Davidson's original semantics lies in the admission of plural individuals (i-sums and groups) plural events (i-sums) and plural roles (i-sums).

Under Landman's analysis, all predicates are inherently plural. This is true even for a sentence without any plural arguments. Thus the example in (1a) below is given the interpretation in (b).

(1) a. John kissed Mary
     b. $\exists e \left( \ast \text{KISS} (e) \& \text{past} (e) \& \ast \text{Ag(e)=john} \& \ast \text{Pat(e)=mary} \right)$

What the interpretation in (b) says is that there is an i-sum of past kissing events e all of whose Agents sum to John and whose Patients sum to Mary. Since an atomic event also qualifies as an i-sum, the plurality in the representation in (1b) is in this case superfluous. (1b) will be satisfied just in case there is one past event of John kissing Mary. Now consider the minimally extended example in (2), with a plural object three girls in place of the singular object Mary above.

(2) John kissed three girls

On its most straightforward interpretation, this sentence entails that there were multiple kissing events – at least one for each of the girls. Landman gives two ways of generating this distributive interpretation: (i) distributing over three girls (analyzed as denoting an i-sum) by quantifying this expression into an effectively singular event domain similar to that in (1b) above, or (ii) directly entering an i-sum of three girls into a plural event domain. These two options are illustrated in (3), where $\ast \text{GIRL}$ is a function true of exactly those i-sums of individuals whose atomic elements are girls, $\ast \text{KISS}$ is a function true of exactly those i-sums of events whose atomic elements are kissings, and $\Pi$ is the atomic-part-of relation. (Tense information is suppressed here and throughout the remainder of this paper.)

(3) a. $[\exists X: \ast \text{GIRL}(X) \& |X|=3] \left[ \forall x: x \Pi X \right] (\exists e \left( \ast \text{KISS}(e) \& \ast \text{Ag(e)=john} \& \ast \text{Pat(e)=x} \right))$
     b. $\exists e \left( [\exists X: \ast \text{GIRL}(X) \& |X|=3] (\ast \text{KISS}(e) \& \ast \text{Ag(e)=john} \& \ast \text{Pat(e)=X}) \right)$
The option in (3a) involves universal quantification over the atomic parts of the girls, i.e. over the singular atomic individual girls. It is equivalent to what would be generated by attaching a distributive operator to a plural NP in an analysis like that of Heim, Lasnik and May (1991). Since for each value of x there is exactly one Agent and exactly one Patient, the plurality marking in *KISS is superfluous, just as in (1). This means that the sentence in (2) will be true under this interpretation iff for each atomic individual girl there is an atomic event of John kissing that girl. The option in (3b) differs from that in (3a) in that the pluralization of the Patient event role, and hence that of e itself, is non-trivial. *Pat(e)=X is true iff the i-sum gotten by adding up all the patients of the atomic events that make up e is equal to the i-sum denoted by X. Since X is constrained to being an i-sum of three girls, this means that collecting together all of the individual girls kissed in all of the atomic kissing events that make up e (for some e) yields an i-sum of three girls. Thus (3b) says that there is a plural kissing event e such that for some three girls X, the agents of the atomic kissing events that make up e all sum to John and the patients of these events all sum to X. This will be true iff John kissed each of the girls, and hence is equivalent to the distributive interpretation in (3a).

The logical representations just considered generate logically equivalent interpretations, and as such would appear at first glance to be redundant. The justification for including both in the grammar comes from consideration of examples involving multiple plural arguments. As has been known at least since Scha (1981), such examples give rise to cumulative reading as well as to non-cumulative readings. These readings can be illustrated with the sentence in (4).

(4) Two boys kissed three girls.

On its cumulative interpretation, this sentence entails that by adding up all of the kissers in kissing events in which a boy kissed a girl you will come up with a total of 2 boys, and that by adding up all of the kissee of such events you will come up with a total of 3 girls, an analysis formalized in Schein (1993) and adopted by Landman. The sentence will be true under this interpretation, for example, if John kissed Mary, Sue and Nancy, Bill kissed Nancy, and no other kissings took place. On a multiply distributive interpretation, in contrast, a total of at least six kissings must take place for the sentence to be true. On one such interpretation, one in which the subject is given wide scope
over the object, the sentence entails that each of two boys kissed each of three girls, for
a total of 2 boys and up to 6 girls participating in atomic kissing events. Given that
each NP can be analyzed as either a distributed NP that gets quantified into an event
domain or as an i-sum that gets entered into a plural event role, and given the two
possible scope orderings of the NPs when they are both treated in the former way, then
even restricting the NPs to receiving an i-sum interpretation there are at least 5 distinct
semantic representations available for (4), given below.

(5) a. \([\exists X: *\text{BOY}(X) \land |X| = 2] [\forall x: x \Pi X] [\exists Y: *\text{GIRL}(Y) \land |Y| = 3] [\forall y: y \Pi Y]
    (e (*\text{KISS} (e) \land *\text{Ag}(e)=x \land *\text{Pat}(e)=y))

b. \([\exists Y: *\text{GIRL}(Y) \land |Y| = 3] [\forall y: y \Pi Y] [\exists X: *\text{BOY}(X) \land |X| = 2] [\forall x: x \Pi X]
    (e (*\text{KISS} (e) \land *\text{Ag}(e)=x \land *\text{Pat}(e)=y))

c. \([\exists X: *\text{BOY}(X) \land |X| = 2] [\forall x: x \Pi X] (e \exists Y: *\text{GIRL}(Y) \land |Y| = 3) (*\text{KISS}
    (e) \land *\text{Ag}(e)=x \land *\text{Pat}(e)=Y))

d. \([\exists Y: *\text{GIRL}(Y) \land |Y| = 3] [\forall y: y \Pi Y] (e) \exists X: *\text{BOY}(X) \land |X| = 2) (*\text{KISS}
    (e) \land *\text{Ag}(e)=X \land *\text{Pat}(e)=y))

e. \(e) [\exists X: *\text{BOY}(X) \land |X| = 2] [\exists Y: *\text{GIRL}(Y) \land |Y| = 3) (*\text{KISS} (e) \land
    *\text{Ag}(e)=X \land *\text{Pat}(e)=y))

Of these five representations, a and c are semantically equivalent, as are b and d. All
other pairs are non-equivalent. The cumulative interpretation comes from e, and the
scopal interpretation described above in the text can be derived from a or c. Of central
importance is the observation that the cumulative interpretation formalized in e cannot
be reduced to any of the scopal interpretations in a-d or vice versa. Since cumulativity
relies on pluralization of an event and entering i-sums into plural event roles, and since
scopal interaction requires that at least one of the NPs be quantified in to an event
domain, these two mechanisms are separately required to account for the full range of
interpreative options one finds with sentences containing multiple plural arguments.

While the addition of the plural examples considered above has already led to a
large number of semantic representations generated, the interpreative options presented
are not yet sufficient to deal with another aspect of plural interpretation, namely
collective interpretation. The need for more than what is provided by event
pluralization and distributive interpretation of NPs can be seen by considering the
following sentence.
(6) The boys touched the ceiling.
This sentence allows for a distributive interpretation like those we have already seen, in which it entails that each individual boy touched the ceiling. However, it is also true in a situation in which the boys worked together as a group, perhaps forming a pyramid so that only the topmost boy made physical contact with the ceiling. In such a situation, the sentence is false on a distributive reading since only one of the boys actually makes contact with the ceiling. The distributive reading can be generated by either of the options illustrated in (3) above. The collective interpretation, however, requires something more. For Landman, this something more is the possibility of interpreting plural expressions as denoting groups, where a group is an atomic individual constructed from an i-sum. If X is the i-sum $a \oplus b \ominus c$, for example, then $\uparrow(X)$ is the group $\uparrow(a \oplus b \ominus c)$ made from this i-sum. A group acts like an atomic individual. For Landman this means that unlike an i-sum, a group can be assigned a basic thematic role. Thus, if X is an i-sum, Ag(e)=X is never true, while Ag(e)=\uparrow(X) can be.

The possibility of entering groups into basic thematic roles makes available an added interpretation for the sentence in (6) above, namely that derived from the following semantic representation, where $\sigma$ is a supremum operator, $\sigma X$: $\phi(X)$ denoting the maximal i-sum that $\phi$ holds of.
(7) $\exists e \left( \text{*TOUCH}(e) \land \text{Ag}(e)=(\sigma X: \text{*BOY}(X)) \land \text{Pat}(e)=(x: \text{CEILING}(x)) \right)$
Importantly, entering a group into a semantic representation in this way gives rise to collectivity implications. That is, whatever entailments follow for an atomic individual x when a thematic role applies to it follow for a group $\uparrow(X)$ as well when a thematic role applies to it. In the current case, this means that whatever the necessary and sufficient conditions are for an event to count as a touching of the ceiling by an atomic individual apply for an event to count as a touching of the ceiling by a group. In the individual case, what is required is for some part of the individual to make contact with the ceiling. This entails that for the group case, what is required is for some part of the group to make contact with the ceiling. Since this requirement can be satisfied by a group even if the part making contact is restricted to a single individual in
the group, it follows on this analysis and the sentence in (6) can be true under the interpretation in (7) in the pyramid scenario sketched earlier.

Groups enter interpretations for Landman through NP interpretations and quantifiers. In particular, Landman takes plural NPs to be ambiguous between a group interpretation and an i-sum interpretation. Quantifiers like three are similarly taken to be ambiguous, in particular between the following two interpretations.

\[
\begin{align*}
(8) \ a. \ & \lambda P \lambda Q. \ [\exists X: P(X) \land |X|=3] \ (Q(X)) \\
& \lambda P \lambda Q. \ [\exists X: P(X) \land |X|=3] \ (Q(\uparrow(X)))
\end{align*}
\]

In both cases the existential quantifier takes a variable X that is implicitly restricted to being an i-sum by the cardinality restriction present in the restrictive clause. In (8a), this variable is also introduced as an i-sum in the nuclear scope, while in (8b) it is only the group formed from this variable that is entered into the nuclear scope. This analysis makes it possible to generate both a distributed interpretation (using (8a)) and a group interpretation (using (8b)) for a sentence such as Three boys touched the ceiling.

3. Plural predicates

Numeral quantifiers in English can be used to demonstrate the plural nature of certain predicates. Predicates like gather, for example, are readily acceptable with numeral quantifier subjects provided that the subject is plural, as seen in (9).

\[
\begin{align*}
(9) \ a. \ & \text{Two / Ten students gathered} \\
& \text{#One student gathered}
\end{align*}
\]

Other predicates like touch the ceiling and form a circle allow for either singular or plural subjects, but can be true in two distinct situations when occurring with a plural subject. Thus, (10) can be true in a situation in which each of 3 students independently touched the ceiling or in a situation in which the 3 students worked together as a group in order for one or more of the students to be able to touch the ceiling, say by forming a pyramid. Similarly, (11) can be true if each of 10 rocks is circle shaped, or if none is circle shaped on its own but the 10 together are arranged into a circular configuration.

\[
\begin{align*}
(10) \ & \text{Three students touched the ceiling} \\
(11) \ & \text{Ten rocks formed a circle}
\end{align*}
\]

These exact same facts obtain for Japanese as well, as can be seen in (12) – (14).
(12) a. Futari-no / Ju-nin-no gakusei-ga atsumatta
   Two-people-GEN / Ten-people-GEN student-NOM gathered
   Two / Ten students gathered
b. #Hitori-no gakusei-ga atsumatta
   One-person-GEN student-NOM gathered
   One student gathered
(13) San-nin-no gakusei-ga tenjo-ni sawatta
   Three-people-GEN student-NOM ceiling-DAT touched
   Ten students touched the ceiling
(14) Ju-kko-no ishi-ga wa-ni natta
   Ten-counter-GEN stone-NOM circle-DAT became
   Ten stones formed a circle

In Landman's analysis, the ambiguity of sentences like (10), (11), (13) and (14) derives from a group / i-sum ambiguity in the interpretation of the plural subject. Taking (10) for illustration, if *three students* is given a group interpretation, i.e. if it is assigned an interpretation parallel to (8b), then the external thematic role of the VP is assigned to a group denoting variable constrained through existential binding to being composed of three students. All thematic implications are then taken to involve this group denoting variable as a singular entity. Of significance here, this means that responsibility is to be assigned to some three students as a group, and that contact with the ceiling must be made by some part of that three student group. Since this latter requirement does not entail that each individual member of such a group contact the ceiling, the analysis explains how the sentence can be true when only one individual student actually makes contact with the ceiling.

In the case in which *three students* is given an i-sum interpretation, i.e. an interpretation parallel to (8a), a distributive interpretation is derived either via a pluralization of the predicate or by scopal quantifying in. The sentence is true in the former case if and only if there is a plural event $e$ made up of individual touch-the-ceiling events such that the agents of all of the atomic parts of $e$ sum to three students. It is true in the latter case just in case there is a three student i-sum of students such that each atomic student in the i-sum touched the ceiling. On both of these latter
interpretations the sentence will be true just in case each of three students individually touches the ceiling. The group interpretation and the two distributive interpretations are summarized below.

(15)a. \(\exists e \ (\exists x: \ {\text{STUDENT}}(x) \land |x|=3) \ (\{\text{TOUCH}(e) \land \text{Ag}(e)=\uparrow(x) \land \text{Pat}(e)=\text{the-ceiling}\})\)

b. \(\exists (\exists x: \ {\text{STUDENT}}(x) \land |x|=3) \ (\{\text{TOUCH}(e) \land \text{Ag}(e)=x \land \text{Pat}(e)=\text{the-ceiling}\})\)

c. \(\exists (\exists x: \ {\text{STUDENT}}(x) \land |x|=3) \ (\forall x: x \in X \ (\exists e (\{\text{TOUCH}(e) \land \text{Ag}(e)=x \land \text{Pat}(e)=\text{the-ceiling}\})\))\)

The case of gather / atsumaru differs from that of the other predicates considered above in at least two ways. First, gather / atsumaru exhibit plural-like selectional behavior in that they do not combine readily with expressions denoting or quantifying over atomic singular individuals but do combine readily with expressions denoting or quantifying over plural individuals. Thus we see a clear contrast in the following:

(16)a. *Each / *No / *Some / *One / *The boy / *John gathered

b. Few / Most / No / Some / Three / The boys / John and Mary gathered

(17)a. *Hitori-no \ {\text{gakusei}}-ga / John-ga \ atsumatta
one-GEN student-NOM John-NOM gathered

One student / John gathered

b. Futari-no \ {\text{gakusei}}-ga / John-to Bill-ga \ atsumatta
two-GEN student-NOM John-and Bill-NOM gathered

Two students / John and Bill gathered

Second, the availability of strictly plural interpretations for the two sets of predicates differs, as can be seen below.

(18)a. Fewer than three students ever touched the ceiling (distributive only)

b. Fewer than three students ever gathered (single gathering possible)

(19)a. \{\text{gakusei}}-ga \ san-nin \ tenjo-ni \ sawatta
students-NOM 3-people ceiling-DAT touched

Three students touched the ceiling (distributive only)

b. \{\text{gakusei}}-ga \ san-nin \ atsumatta
students-NOM 3-people gathered
Three students gathered (single gathering possible)

The sentence in (18a) quantifies obligatorily over the individual students who made physical contact with the ceiling, claiming that the number of such students is fewer than three. The sentence is thus true even if the students who made contact with the ceiling invariably did so as part of a group effort involving a six-person pyramid, provided that no more than three students ever got to be the one at the top making contact. In other words, this sentence lacks a group interpretation. (18b), in contrast, easily allows an interpretation according to which the largest number of students ever to gather in a single gathering is two. Analyzed closely, this interpretation seems to have distributional aspects as well as group aspects to it. In order for a number of individuals to gather, each must do something that results in the individuals coming together into a group. I will call this interpretation a group-based interpretation, in order to highlight both its dependency on a group interpretation and its independence from the pure group reading of (18a). A similar contrast to that seen between (18a) and (18b) is observed in the Japanese examples in (19) as well, containing subjects associated with floating quantifiers. (19a) only allows a distributed interpretation in this case – a collective reading is unavailable. (19b), in contrast, readily allows a group-based reading according to which some group of three students gathered.

The contrast above is problematic for Landman. Any of the individual examples can be explained straightforwardly within Landman's framework by adding suitable assumptions. For example, the lack of a distributive reading in (18a) and (19a) could easily be explained by assuming that downward entailing quantifiers in English and floated numeral quantifiers in Japanese give rise exclusively to i-sum variables, never to group variables. However, such an assumption would make the availability of a group interpretation in (18b) and (19b) entirely mysterious, since application of a predicate to an i-sum denoting subject can only give rise to a distributive interpretation in Landman's framework. Alternatively, the availability of a group interpretation for (18b) and (19b) could be explained by assuming that downward entailing quantifiers in English and floated numeral quantifiers in Japanese can introduce a group denoting variable. However, such an assumption would leave it mysterious why the examples in (18a) and

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1 See section 4 for a more detailed discussion of the semantics of *gather / atsumaru*. 
(19a) fail to have a group interpretation.

To account for the contrast in (18) and (19), I assume first that gather / atsumaru, unlike touch the ceiling / tenjo-ni sawaru, can apply either to a non-trivial i-sum or to a group formed from such an i-sum. This accounts for the plural-like requirement on the subject imposed by gather / atsumaru. Making this analysis work requires a minimal extension to Landman's framework. In particular, if nothing else is said, such an analysis would be expected to generate unattested distributive interpretations for gather / atsumaru. To avoid this consequence, I propose that these predicates are special in that they select (at least optionally) for an i-sum, but enter a group formed from such an i-sum into their event domain. In particular, I adopt the following translation for gather / atsumaru.

(20) tr(gather / atsumaru) = \lambda X: |\downarrow (\uparrow (X))| > 1. \lambda e. *GATHER(e) & *Ag(e)=\uparrow (X)

According to this translation, the subject of gather / atsumaru is presupposed to be either an i-sum with more than one atomic part or a group made out of such an i-sum. Regardless of which type of subject it receives, it takes the group formed from its subject interpretation and enters it into the Agent role in its event domain. For this analysis to work, we assume following Schwarzschild (1996) that \uparrow (\uparrow (X)) = \uparrow (X) for any X, i.e. that groups do not self-embed. The presupposition in (20) will thus require that the i-sum out of which the group formed from X is constituted have a cardinality greater than one, and the Agent will always be a group.

The analysis of gather / atsumaru just presented makes it possible to generate the interpretation in (21a) for the sentence in (19b). In particular, this is the interpretation that results from combining (20) with the i-sum interpretation of three boys in (8a).

(21a)  \exists e [\exists X: *BOY(X) & |X|=3] (*GATHER(e) & *Ag(e)=\uparrow (X))

b.  \exists e [\exists X: *BOY(X) & |X|=3] (*TOUCH(e) & *Ag(e)=\uparrow (X) & *Pat(e)=the-ceiling)

Recall, however, that we need to not only generate the proper reading for (19b) as we have just done but also to block the unavailable reading for (19a) given in (21b). There are two ways in which (21b) could potentially be generated. The first would be by analyzing touch the ceiling / tenjo-ni sawaru as parallel to gather / atsumaru. The second would be by adopting an analysis for touch the ceiling / tenjo-ni sawaru compatible with all of Landman's assumptions and combining this with the group
interpretation of *three boys* in (8b). Since the reading in (21a) is unavailable for (19b), it follows that both of these analyses must be prohibited.

To block the former option, I simply stipulate a lexical difference between the relevant predicates with respect to how they incorporate their subject into their event domain, analyzing *touch / sawaru* as in (22).

(22) \( \text{tr(tenjo-ni sawaru)} = \lambda X \lambda e. \ *\text{TOUCH}(e) \land *\text{Ag}(e)=X \land *\text{Pat}(e)=\text{the-ceiling} \)

Unlike *gather / atsumaru*, these predicates directly enter their semantic subject argument directly into the Agent role, without altering its status as a group or i-sum. Some such difference will need to be acknowledged in any theory that aims to explain the differences in semantic behavior of *gather*-type predicates and *touch*-type predicates, and so relying on such a stipulation does not detract from the analysis presented. Blocking the latter option requires eliminating the possibility of giving a group analysis to *Gakusei-ga san-nin* (students-NOM 3-people), such as that given for *three students* in (8b). In this case, however, a simple stipulation would be highly unsatisfying since other related expressions lacking quantifier float, specifically *Gakusei san-nin-ga* and *San-nin-no gakusei-ga*, allow for the group reading missing in the floated quantifier version. Fortunately, we can do better.

The trick to giving an explanatory analysis of the difference between floated and non-floated numeral expressions is to separate existential quantificational force from the numeral and place the former squarely within the DP. This can be accomplished by analyzing the DP as headed by a covert indefinite determiner which is given an existential interpretation. Giving this determiner a tripartite structure, it will combine first with a restrictive clause and then with its nuclear scope. With existential import contributed by a covert determiner, the natural analysis of the numeral expression is as a simple cardinality predicate. The obligatory distributive interpretation of the floating quantifier case in (19a) will then follow if we take the numeral expression to be part of the nuclear scope when floated outside the case particle but part of the restrictive clause otherwise. To implement this idea, I adopt minimal variants of Landman’s interpretations of *three* in (8) as the interpretations of the covert indefinite determiner given below.

(23a) \( \lambda P \lambda Q. [\exists X: P(X)] (Q(X)) \)
b. $\lambda P \lambda Q. [\exists X \colon P(X)] (Q(\uparrow(X)))$

The only difference between (23) and (8) is that the cardinality information $|X|=3$ contained in (8) is eliminated in (23). This cardinality information is assumed to be contributed separately by the numeral *san* (three) and to enter the computation through the $P$ argument in non-floating cases or through the $Q$ argument in floating cases.

Assuming with Landman that cardinality in numeral expressions is a measure of the number of atomic parts in an $i$-sum, this analysis gives us an explanation of why numeral floating in (19a) only gives rise to a distributive interpretation. With *san-nin* (three-people) entering the computation through the $Q$ argument of the determiner, the two variations of the determiner in (23) will give rise to the following three potential interpretations for (19a), parallel to the collective and distributive interpretations given earlier in (15).

(24)a. $\exists e ([\exists X \colon *\text{STUDENT}(X)] (*\text{TOUCH}(e) \& *\text{Ag}(e)=\uparrow(X) \& *\text{Pat}(e)=\text{the-ceiling} \& |X|=3))$

b. $\exists e ([\exists X \colon *\text{STUDENT}(X)] (*\text{TOUCH}(e) \& *\text{Ag}(e)=X \& *\text{Pat}(e)=\text{the-ceiling} \& |X|=3))$

c. $[\exists X \colon *\text{STUDENT}(X)] [\forall x \colon \Pi X] (\exists e (*\text{TOUCH}(e) \& *\text{Ag}(e)=x \& *\text{Pat}(e)=\text{the-ceiling} \& |x|=3))$

The representations in (24a) and (24c), however, are internally inconsistent. For (24a) to be true, a group would need to have a cardinality of 3, as indicated by the bold part of the representation. For (24c) to be true, an atomic individual would need to have a cardinality of 3. Since both groups and atomic individuals are by definition atomic, they cannot have a cardinality of anything but 1. This means that employing either of these interpretations would make the sentence not only false but necessarily so independent of the context of utterance. It is reasonable to assume that speakers and hearers systematically exclude such necessarily false interpretations when there is another option available. In the present case, the other option is (24b). This interpretation, however, is a distributive one, just like its counterpart in (15b). Since this is the only remaining option, we derive as a conclusion that the floated numeral in (19a) gives an obligatorily distributive interpretation, as desired.

It should be noted at this point that the assumptions that went into deriving a
distributive interpretation for (19a) do not interfere with the group interpretation derived earlier for (19b). The difference in the predicate makes it possible in that example to generate a group interpretation from an analysis parallel to (24b). This is because when applied to an i-sum denoting expression, atsumaru, unlike tenjo-ni sawaru, enters the group formed from this i-sum into the Agent role in the event domain. As a lexical property of the predicate, however, it does not affect the predication internal to san-nin. Thus the interpretation derived for (19b) will be that in (25) below, where the underlined material in the event domain is contributed by atsumaru, and the bold-faced material by san-nin.

$$\exists e \left( \exists X : \text{STUDENT}(X) \right) \ ( \text{GATHER}(e) \land \text{Ag}(e) \land \left| X \right| = 3 )$$

The most important conclusion to draw from the above analysis is that Landman’s implicit assumptions about the syntax – semantics interface cannot be adopted. Landman implicitly assumes that if a predicate P applies semantically to an argument a, then a gets entered into a thematic role inside the event domain of P as is. Though this assumption is plausible, and surely represents the default assumption barring negative empirical consequences, we have seen that it cannot be maintained together with the rest of the assumptions that constitute Landman’s framework. In particular, in order to account for the interaction of atsumaru and tenjo-ni sawaru with floating quantifiers, it is necessary to analyze the former as applying to an i-sum denoting argument a and yet entering the group formed by this i-sum, i.e. $$\uparrow(a)$$, into its thematic role.

A parallel argument for a mismatch between the form of a semantic argument of a predicate and what gets entered into the thematic role of that predicate can be made from the English examples with downward entailing plural quantifiers. I will spell out such an argument using the quantifier few, which gives rise to the relevant contrast as seen below.

$$\text{(26a)} \quad \text{Few boys (ever) touched the ceiling} \quad \text{(distributive only)}$$

$$\text{b. Few boys (ever) gathered}$$

Within generalized quantifier theory, few A B is true iff $$\left| A \right| >> \left| A \cap B \right|$$, i.e. if the set of As is much bigger than the intersection between the set of As and the set of Bs. This analysis assumes that A and B are sets of atomic individuals. However, we saw above that we need to take the plurality marking in the restriction of plural quantifiers
seriously, since failure to do so will make it impossible to account for the contrast between *No boys gathered*, for example, and *No boy gathered*. This means that we need to give a modified semantics for *few*, one that operates over the denotation of plural expressions. For this I propose the following:

\[(27) \text{tr}(\text{few}) = \lambda P \lambda Q. \lambda X: P(X) |\gg \lambda X: P(X) \land Q(X) |\]

The plural semantics in (27) states that the number of atoms that are part of the maximal individual to which \( P \) applies is much greater than the number of atoms that are part of the maximal individual to which both \( P \) and \( Q \) apply.

While the semantics in (27) represents an independently needed modification to general quantifier theory, it does not by itself give an explanatory account of the difference in interpretation between the two examples in (26). Indeed, if we follow Landman and assume that the argument of a predicate must be entered into a thematic role of that predicate unaltered, then we would have no way of making the required distinction. The distributive reading of (26a) follows directly under Landman’s analysis combined with the plural analysis of *few* in (27). This example will be interpreted as in (28) below.

\[(28) \lambda X: *\text{BOY}(X) |\gg \lambda X: *\text{BOY}(X) \land \exists e (*\text{TOUCH}(e) \land *\text{Ag}(e)=X \land *\text{Pat}(e)=\text{the-ceiling}) |\]

This interpretation will be true just in case the largest plurality of boys is much greater than the largest plurality of boys each of whom touched the ceiling. The distributivity in this case comes from the fact that an i-sum denoting variable \( X \) is entered into a plural thematic role of *touch* as *Ag(e)=X*. This gives rise to a requirement that the agents of the various atomic parts of e sum to \( X \), with each part of \( e \) being an atomic touch-the-ceiling event. What works for *touch the ceiling*, however, fails miserably for *gather* in (26b). The same type of analysis applied to this example would yield the following as an interpretation.

\[(29) \lambda X: *\text{BOY}(X) |\gg \lambda X: *\text{BOY}(X) \land \exists e (*\text{GATHER}(e) \land *\text{Ag}(e)=X) |\]

However, this is just as distributive as (28). The difference between the two examples in (26) is thus left unaccounted for. Note that analyzing *gather* as applying exclusively to groups is of little help. In order for such an analysis to be possible, it would be necessary for *few* to introduce a group in its interpretation along the following lines:
\(\text{(30) tr}\langle\text{few} \rangle = \lambda P \lambda Q. \, \text{lo}X: P(X) \rangle >> \text{lo}X: P(X) \& Q(\uparrow(X))\rangle\)

Such an analysis would make it possible to correctly generate the interpretation in (31).

\(\text{(31) lo}X: \, ^*\text{BOY}(X) \rangle >> \text{lo}X: \, ^*\text{BOY}(X) \& \exists \epsilon (\, ^*\text{GATHER}(\epsilon) \& ^*\text{Ag}(\epsilon)=\uparrow(X))\rangle\)

However, this would come at the expense of the explanation for the obligatory distributivity of (26a). By allowing \textit{few} to introduce a group in its interpretation, the only way of accounting for the absence of a group interpretation for (26a) would then be by stipulating that the group version of \textit{few} cannot combine with \textit{touch the ceiling} and similar predicates. Aside from the difficulty involved in even formulating such a stipulation, it would be an \textit{ad hoc} solution to a problem screaming for a principled analysis.

As we have seen, trying to maintain the assumption that predicate application to an argument \(a\) invariably enters \(a\) into a thematic role of the predicate unaltered is not possible within Landman’s framework of assumptions. The problem arising with downward entailing plural quantifiers in English is very similar to what was encountered with the Japanese case examined earlier: no uniform analysis can be given to the predicates and to the quantifiers they interact with that generates all and only the readings encountered. Abandoning our initial assumption, however, immediately solves our problems. All we need do in order to account for the difference in interpretation between the two examples in (26) is to extend the analysis of \textit{atsumaru} and \textit{tenjo-ni sawaru} in Japanese to their English counterparts \textit{gather} and \textit{touch the ceiling} in English. With such an extension, it becomes possible to maintain (27) as the only interpretation of \textit{few} and yet still generate the desired interpretations in (28) and (31). The analysis of (28) remains just as it was given above. (31), however, can be generated under this analysis by combining (27) with (20) (and with Landman’s interpretation of \textit{boys}). In particular, a group-introducing version of the quantifier \textit{few} becomes unnecessary and can thus be eliminated, taking with it the unwanted overgeneration of readings for (26a). Thus we see that the interaction of downward entailing plural quantifiers with \textit{gather} and \textit{touch the ceiling} provides us with an independent argument in a historically unrelated language for the same conclusion: predicates like \textit{gather} can apply to an i-sum denoting argument and enter a group formed from that i-sum into a thematic role in their event domain.
4. **Inside Gather / Atsumaru**

I have argued above that *gather / atsumaru* enter a group into the agent role in their event domain. However, I also mentioned in discussion of (18b) that *gather* has both a distribution-like part to its interpretation and a group-like part. In order for an atomic event to be a gathering, it needs to involve multiple individuals coming to a common location one by one to form a group. This raises a question of how to specify the lexical semantics of *gather* in a way that will yield appropriate results when combined with its compositional semantics. There are many potential approaches that could be taken to this problem, and I will make no attempt here to either spell them all out or to argue for one of them over the others. Rather, I will sketch one plausible analysis to show that the dual nature of this predicates is perfectly compatible with Landman's semantic framework once the compositional feature argued for is incorporated.

Entering an i-sum into the thematic role of *gather / atsumaru* would generate a purely distributional interpretation. Such an analysis could capture the first half of the interpretation of *gather / atsumaru* – the coming together one by one part – but would miss the second half. A pure group analysis parallel to that for (18a) would account for the second half – the forming a group part – but miss the first half. An adequate analysis thus needs access both to the group of individuals formed and to the individual parts that go into forming the group. Furthermore, since both halves of the interpretation go toward characterizing a single atomic event, both the resulting group and its atomic parts need to be made available to such an event. Landman's framework gives us three options for what to enter into the thematic role of the predicate: an atomic individual, a group, or an i-sum. Entering a group into the thematic role will make the individual members of the group recoverable, and so constitutes a viable options. However, entering either an atomic individual or an i-sum into the thematic role is inadequate. Either option would require analyzing a gathering event as an i-sum of atomic events, each with an atomic individual Agent. The atomic events themselves, however, would then fail to include all of the gatherers, and hence could not be used to generate the group. Only the collection of such atomic events as a whole could provide all of the individuals needed, but this collection would be an i-sum of
events, not an atomic event. While one could fathom turning this i-sum into a group event, this is a move that would constitute a fundamental change to Landman's basic framework, one with far-reaching consequences and for which strong independent motivation would thus be required. Landman himself finds no motivation for making such an extension to the framework, and in this I follow him. I assume, then, that only a group gets entered into the thematic role of gather / atsumaru through semantic composition.

What remains is to give a plausible lexical semantics to gather / atsumaru. Recall that in the event semantics that Landman employs, a given verbal predicate makes two different contributions to interpretation. First, it provides thematic roles to be filled through semantic composition, and second it provides a predicate of events, in this case the predicate *GATHER. Since the thematic roles are taken to be general, and hence shared by all sorts of predicates, what is special about the lexical semantics of gather / atsumaru will have to be located in the event predicate *GATHER and in how this predicate relates an event to the arguments in the event domain. For this, the following informal description will suffice:

(32) An event $e$ is a *GATHER event iff the parts constituting the Agent of $e$ separately move to a single location, thereby forming the group denoted by the Agent of $e$ at that location.

Put in a slightly more formal notation, this can be rewritten as:

(33) *GATHER($e$) iff $[\exists l: \text{location}(l)] \ [\forall x: x \subseteq \text{Ag}(e)] \ (\text{move}(x,l))$

& result-in (Ag(e),l)

The indispensable role that the group plays in the lexical semantics of the predicate helps to make gather the inherently plural predicate that it is. This property of the predicate is adequately captured by the lexical semantics of *GATHER in (33). The difference between gather / atsumaru on the one hand and touch the ceiling / tenjo-ni sawaru on the other is also captured, since in the former case the action of moving to a single location, attributed to the individuals making up the group, is separated from the result of this action, the formation of the group. In the case of the latter predicates there is no such separation, and the action of touching is attributed to the group as a whole. Since the action is attributed to the group, it is the group as a whole that bears
the responsibility for this action. With a gathering, in contrast, responsibility goes to the individuals.

5. Summary

In this paper I have shown that Landman's (2000) analysis of plurals, unmodified, is inadequate to account for the interaction between plural predicates and plural quantifiers in English, and between plural predicates and floated numeral quantifiers in Japanese. A simple modification to Landman's analysis, however, was shown to be sufficient to overcome the problems encountered. The innovation needed was to introduce a flexibility into the syntax/semantics mapping, allowing a predicate such as gather / atsumaru to take an i-sum denoting argument and yet at the same time enter a group formed from this argument into the thematic role associated with that argument. While the innovation is significant, it should be noted that it does not argue against the bulk of Landman's framework. Indeed, the analysis developed in this paper is consistent with the most important of Landman's semantic claims, particularly the claim that only an atom, i.e. to an atomic individual or a group, can be entered into a basic (non-pluralized) thematic role, never an i-sum. It adds only to the manner in which the semantic interpretations are compositionally derived from the syntax.

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