Situated Groups

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Abstract

The referents of plural NP's denote groups, by their nature, but at the same time, we want to say that they denote atomic individuals in some cases. By analyzing such dual nature of plural Np's in Situation Semantics, we offer a straightforward and unified analysis which accounts not only for various readings of plural NP's but also for the so-called Committee and Judge/Hangman Puzzles.

1 Introduction

Treatments of the contribution of plural NP's are faced with a puzzle: in some cases we want to say that the referent of the NP is in some sense a group, composed of subparts, and yet must contribute an individual which acts as an atomic unit at the same time. The dual nature of plural NP's can be seen in examples like (1).

(1) Two boys annoyed Carol.

In its collective reading, the referent of the subject is in some sense a group composed of two boys, yet it acts as an atomic unit with respect to the phrase *annoyed Carol*. Similarly for the coordinate subject in (2).

(2) John and Mary annoyed Carol.

I propose that the situation semantics mechanisms[1] offer a convenient way of resolving the duality of plural NP's. I present such an analysis here and demonstrate that the very same analysis successfully accounts for the *Committee Puzzle* of [5] and the *Hangman/Judge Puzzle* of [6].

2 Preliminary Considerations

I distinguish (in)definite descriptions from generalized quantifiers (cf. [7], [8], [9]). Then, the denotation of the subject of (1), for example, is a term, that is, first order objects as opposed to higher order generalized quantifiers. The expression *two* is best viewed as an adjective (as noted in the literature), and it imposes a cardinality restriction on that term.[2]

Let X be the referent of the subject of (1). X is plural with respect to the property of boyhood, but in the collective reading, we observe in addition that

it is singular with respect to the property of annoying Carol. That is, X is two boys and a single annoyer of Carol at the same time. However, (3) shows that this relativity of singularity/plurality is only a result of memberships of a group.

(3) The guys and the girls married.

Let John and Tom be the guys and Mary and Alice be the girls. Let X be the referent of the subject. As the form of the subject suggests, with respect to sexuality, X's members are John$\oplus$Tom and Mary$\oplus$Alice.[3] On the other hand, with respect to marriage, the membership has to be something different (e.g. John$\oplus$Mary and Tom$\oplus$Alice).[4] X's cardinalities (=2 both with respect to sexuality and with respect to marriage) follow from these memberships, not the other way around.

Our strategy is to express the membership relativity in terms of situations. Fortunately, situation semantics already offers a good tool for this, i.e. the notion of *resource situation*.

3 The Basic Mechanism

We call a proposition of the form $s \models p$ a *sum proposition* if one (or more) of the constituent(s) of p is a *sum individual* in s; otherwise we call it an atomic proposition. Something is a sum individual in s if it consists of more than one thing in s; otherwise it is an *atomic individual*. A sum proposition is a lattice-theoretic *join* of a set of atomic propositions.

When $x_1, x_2, \ldots, x_n$ are the members of x in s, $y_1, y_2, \ldots, y_n$ are the members of y in s, etc., we say that the set of propositions:

$$\begin{array}{c} s_1 \models \ll P, \ldots, x_1, \ldots, y_1, \ldots \gg \\ s_2 \models \ll P, \ldots, x_2, \ldots, y_2, \ldots \gg \\ \vdots \\ s_n \models \ll P, \ldots, x_n, \ldots, y_n, \ldots \gg \end{array}$$

is a *resolution* of the sum proposition:

$$s \models \ll P, \ldots, x, \ldots, y, \ldots \gg$$

such that:

$$s = s_1 \oplus s_2 \oplus \cdots \oplus s_n$$

Note that nothing in principle prohibits e.g. $y_i = y_j$ or $s_i = s_j$, where $i \neq j$. A sum proposition has to be *justified* by being *resolved* to a set of atomic propositions.

Looking "bottom-up," on the other hand, assume that $s_1, s_2, \ldots s_n$ are the sub-situations of s and that:

$$\begin{array}{c} s_1 \models \ll P, \ldots, x_1, \ldots \gg \\ s_2 \models \ll P, \ldots, x_2, \ldots \gg \\ \vdots \\ s_n \models \ll P, \ldots, x_n, \ldots \gg \end{array}$$

If, for each i, x_i is the j-th argument, then for all such j (including polarity), if $x_1, x_2, \ldots, x_n$ have a join, then s has to support the atomic *infon*:

$$\ll P, \ldots, x \ldots \gg$$

where $x = x_1 \oplus x_2 \oplus \cdots x_n$

With these mechanisms in hand, we analyze (1) as follows.[5]

(4) a. $r \models \ll \text{boy}, X; 1 \gg$

b. $\text{members}(\{x_1, x_2\}, X, r)$

c. $d \models \ll \text{annoyed}, X, \text{Carol}; 1 \gg$

The resource situation r is X's boy situation, and (4b) says that X has two members x_1 and x_2 in r. Thus, X is a *sum* individual in r. The only possible resolution is the set of atomic propositions in (5).

(5) a. $r_1 \models \ll \text{boy}, x_1; 1 \gg$

b. $r_2 \models \ll \text{boy}, x_2; 1 \gg$

Thus, both x_1 and x_2 are boys.

On the other hand, (4) itself does not tell whether X is a sum individual or an atomic individual in d. If it is atomic, then (4c) is already resolved, and hence, we get the *collective reading* (that is, X is plural as boys but singular as an annoyer; intuitively, X annoyed Carol not as individual persons but rather as a group). In contrast, if X is a sum individual in d, we get the *distributive reading*. By *structural constraints*, we know that (4a-b) can be the case only if (6a-b) are also the case, where p is X's individual person situation.

(6) a. $p \models \ll \text{person}, X \gg; 1$

b. $\text{members}(\{x_1, x_2\}, X, p)$

The distributive reading arises when p overlaps with d so that (7) is also the case.

(7) $\text{members}(\{x_1, x_2\}, X, d)$

In such a case, (4c) is a sum proposition, and its only possible resolution is the set of propositions in (8), and hence, the distributive reading arises.

(8) a. $d_1 \models \ll \text{annoyed}, x_1, \text{Carol}; 1 \gg$

b. $d_2 \models \ll \text{annoyed}, x_2, \text{Carol}; 1 \gg$

Intuitively, X annoyed Carol as individual persons.

4 How the Theory Works

4.1 More Complicated Cases

Generally speaking, there can be more than one possible resolution to a given sum proposition, and the resolutions with respect to resource situations and described situations do not have to coincide. Such is the case in (3), for example, which is analyzed as in (9).

(9) a. $\mathrm{members}(\{X_1, X_2\}, X, r)$

b. $d \models\!\ll \mathrm{married}, X; 1 \gg$

where r is X's sexuality situation with two sub-situations r_1 and r_2 such that:[6]

(10) a. $r_1 \models\!\ll \mathrm{guy}, X_1; 1 \gg$

b. $r_2 \models\!\ll \mathrm{girl}, X_2; 1 \gg$

If, as illustrated above, John and Tom are the guys in question and Mary and Alice are the girls in question, then the followings obtain in addition.

(11) a. $\mathrm{members}(\{\mathrm{John}, \mathrm{Tom}\}, X_1, r_1)$

b. $\mathrm{members}(\{\mathrm{Mary}, \mathrm{Alice}\}, X_2, r_2)$

However, nothing forces d to give the same membership to X. For example, in the case considered above, where John and Mary married and Tom and Alice married, the followings are the case in addition.

(12) a. $\mathrm{members}(\{Y_1, Y_2\}, X, d)$

b. $\mathrm{members}(\{\mathrm{John}, \mathrm{Mary}\}, Y_1, p)$

c. $\mathrm{members}(\{\mathrm{Tom}, \mathrm{Alice}\}, Y_2, p)$

d is X's marriage situation (and hence X's couple situation). p is their individual person situation (and hence not a sub-situation of d). Thus, (9b) has to be resolved to:

(13) a. $d_1 \models\!\ll \mathrm{married}, Y_1; 1 \gg$

b. $d_2 \models\!\ll \mathrm{married}, Y_2; 1 \gg$

However, Y_1 and Y_2 are atomic in d, and hence, we cannot infer from (13a) that John married, for example.

Note that this is an instance of *intermediate reading* (cf. [12]), in which a "distributive" inference is valid but not to the atomic level.

4.2 Cumulative Reading

Consider (14).

(14) Two students bought four books.

(14) has a variety of readings. The most simple one is that a group of two students bought a group of four books together (and hence co-ownership of the books). Somewhat more complicated ones arise when either one of the subject or the object is read collectively and the other is read distributively. These readings are analyzed in exactly the same ways illustrated above. The third kind of reading arises when both the subject and the object are read distributively. Here, there are two cases. Either the total number of the students (or books) in question exceeds two (or four) (quantificational readings),[7] or the total number of the students in question is exactly two and that of the books is four (*cumulative readings*; [13]).

Remember that nothing in our definition of *resolution* forces there to be a unique resolution nor require the arguments of an atomic proposition in the resolution to be distinct from their corresponding arguments of another atomic proposition in the resolution. It only requires that the joins of the arguments of the atomic propositions in the resolution be the arguments of the sum proposition respectively. Then, given that (14) is analyzed as (15),[8] and given that the distributive memberships in (15b) and (15d) obtain with respect to d too,

(15) a. $r_{sbj} \models\ll \text{student}, X; 1 \gg$

b. $\text{members}(\{x_1, x_2\}, X, r_{sbj})$

c. $r_{obj} \models\ll \text{book}, Y; 1 \gg$

d. $\text{members}(\{y_1, y_2, y_3, y_4\}, Y, r_{obj})$

e. $d \models\ll \text{bought}, X, Y; 1 \gg$

one can resolve (15e) to x_1's buying y_1 and x_2's buying y_2, y_3 and y_4, or to x_1's buying y_1 and y_2 and x_2's buying y_3 and y_4, etc. Thus, we do not need such a thing as *branching quantification* in order to analyze cumulative readings.[9]

4.3 Coordination

Our analysis contrasts with Link's [5] in that the collective/distributive ambiguity is not analyzed in terms of an ontological distinction between a set of individuals and a group in ours. Now, sentences like (16),[10] in which the subject is read collectively with respect to one predicate and distributively with respect to another, pose a problem for Link's approach, as Landman [6] correctly points out.

(16) The boys met at school and were wearing golden earrings.

This poses a problem for Link's approach, as Landman [6] correctly points out, for Link would not be able to decide which ontological entity the subject should denote.

Let X be the referent of the subject. In our analysis, (16) describes two situations. The first is X's meeting situation, described by the first conjunct VP,

in which X is atomic. In the second one, which is X's earring-wearing situation described by the second conjunct VP, X's is a sum individual. Membership is relative to each situation, and hence, such sentences pose no problem for our analysis.

5 The Committee and Judge/Hangman Puzzles

Link [5] used the following "puzzle" to motivate his ontological distinction mentioned above. That is, we cannot conclude (17b) from (17a) if the visits are as the official ones as the committees, even if Committee A necessarily consists of the same members as Committee B (e.g. by law).

(17) a. Committee A paid an official visit to South Africa.

b. Committee B paid an official visit to South Africa.

However, as Landman [6] correctly points out, this "puzzle" arises even in the case of singular nouns. For example, (18c) does not follow from (18a-b) if the strikes in (18a) and (18c) are as a judge and as a hangman, respectively.

(18) a. The judge is on strike.

b. The judge is the hangman.

c. The hangman is the judge.

Let John be the judge/hangman. Note that, in order to be on strike, you have to have some occupation. Being on strike while having no occupation simply does not make sense, so we assume that if a situation supports someone's being on strike, then it has to be his or her occupation situation (or one of his or her occupation situations, if he or she has more than one occupation). Then, the described situation of (18a), j, under the intended reading, is John's judge situation (i.e. the resource situation coincides with the described situation). Thus,

(19) a. $j \mid\!=\!\ll \text{judge}, \text{John}; 1 \gg$

b. $j \mid\!=\!\ll \text{on-strike}, \text{John}; 1 \gg$

However, it does not follow from this that John is on strike also in his hangman situation h, which is the described situation of (18c) under the intended reading. Similarly for (17). Of course, the inferences in question fail only under the intended readings; for example, if (18c) is uttered as a description of the judge situation, our analysis correctly predicts that (18c) follows from the intended reading of (18a) and (18c).[11]

On the other hand, (20c) always follows from (20a) and (20b).

(20) a. The judge has a big nose.

b. The judge is the hangman.

c. The hangman has a big nose.

This is because (20a) and (20c) both describe the judge/hangman's facial feature situation. The difference between (18) and (20) comes from the fact that, while one can have only one face (facial feature situation), and hence there is only one candidate for the described situations of (20a) and (20c), he or she can have more than one occupation (occupation situation), and hence there are more than one candidate for the described situations of (18a) and (18c).

Thus, our analysis of plural NP's accommodates the Committee and Judge /Hangman Puzzles too.

Finally, we illustrate how our lattice-theoretic assumption and our account of the Judge/Hangman Puzzle interact. First, note that sentences like (18a) can be "disambiguated" by adding an *as*-phrase (as correctly observed in [6]). For example, if we add *as a judge*, then (18a) is about John's judge situation, but if we add *as a hangman*, then it's about his hangman situation. Then, according to our analysis, such *as*-phrases are to be understood as restriction on the described situations. Now consider (21) (again, taken from [6]).

(21) a. As a judge, John earns (exactly) \$50,000.

b. As a janitor, John earns (exactly) \$10,000.

c. As a judge and a janitor, John earns (exactly) \$60,000.

(21c) follows from (21a-b). Let s_1 and s_2 be John's judge situation and his janitor situation, respectively. Then, (21a-b) are analyzed (roughly) as in (22a-b), respectively.

(22) a. $s_1 \models\ll \text{earn}, \text{John}, \$50,000; 1 \gg$

b. $s_2 \models\ll \text{earn}, \text{John}, \$10,000; 1 \gg$

Let s_1 and s_2 be the sub-situations of s. Then, our "bottom-up" definition dictates that s should support a sum proposition whose resolution is (22). Note that John$\oplus$John=John and \$50,000$\oplus$\$10,000=\$60,000. Then, we predict that (23) is the case.

(23) $s \models\ll \text{earn}, \text{John}, \$60,000; 1 \gg$

This is exactly the analysis we want for (21c).

6 Conclusion

Thus, our analysis straightforwardly accounts for the *collective*, *distributive* and *intermediate readings* as well as *cumulative reading*. It also explains the Committee and Judge/Hangman Puzzles with the same mechanism. All of these issues become a matter of what situation is being described. I take our results as arguments for the situation semantic notions of *situatedness* and *resource situation*, which are the key ingredients of our analysis.[12]

Notes

*This research was conducted while I was a Fulbright scholar at the University of California, Santa Cruz. I would like to thank Bill Ladusaw as well as the audience of the joint conference. The usual disclaimer applies.

[1][1], [2], [3], [4], among others.

[2]By absorbing such a term, our mechanism can yield a "quantificational" reading" of *Two boys lifted a piano*, where the two boys lifted different pianos, but we do not focus on such readings in this paper. For *absorption*, see [3].

[3]We assume a lattice-theoretic ontology of individuals (cf. [5]). We also assume a lattice-theoretic ontology of situations, as will be seen below.

[4]Where heterosexual marriage is assumed.

[5]For expository reasons, we ignore the issues on *reference* dealt with in [10,11] here and assume the standard, model-theoretic interpretation of terms.

[6]The "bottom-up" assumption dictates nothing about r, so r might or might not support the infons in (10).

[7]As mentioned above, these readings can be obtained by absorbing either the subject or object parameter.

[8]When no absorption is involved.

[9]Essentially, our analysis of *cumulative reading* is the same as Krifka's ([14]). What is new with our analysis is the unified treatment of the range of issues covered in this paper (note that, situations not only give the lattice-theoretic structures of individuals but also play the role that *NU* plays in Krifka's theory, roughly speaking; however, we do not address the issues of aspect and negation in this paper).

On the other hand, note that branching-quantifier analyses (e.g. [13]) significantly complicate the syntax (since the subject and the object of (14) would have to form a syntactico-semantic constituent), but there is no obvious independent syntactic motivation for such complication.

[10]Taken from [6] (p.598) with slight simplification.

[11]If John is on strike as a judge but not on strike as a hangman, then:

(i) $j \models\ll \text{on-strike}, \text{John}; 1 \gg$

(ii) $h \models\ll \text{on-strike}, \text{John}; 0 \gg$

Then, should the situation $j \oplus h$ support John's being on strike or his being not on strike? Our "bottom-up" definition says nothing in such a case, since the "second" arguments, the polarities, of (i)-(ii) are incompatible with each other and hence fail to have a join.

Personally, I'm inclined to assume that $j \oplus h$ supports no "on-strike" infon, rather than to assume that it supports "on-strike" infons with an increased arity (cf. [2]), but I do not have an argument for this assumption.

[12]One thing that remains unaccounted for is *number agreement*. In the case of examples like (i)-(ii), we could simply say that the number agreement information has to be satisfied in the resource situations, since the referents of the subjects are sum individuals only in the resource situations (they are atomic in the described situations).

(i) John and Mary are/*is a nice couple.

(ii) John and Mary are/*is carrying the piano upstairs (together).

However, there are some problems concerning agreement that I have not solved. First, we also observe that, for example, (iii) allows singular agreement.

(iii) John and Mary are/is a nice group.

I do not know the source of the difference between (i) and (iii) yet. The second, and closely related to the first, problem comes from examples like (iv) (taken from [15,16]).

(iv) Doing phonology problems and drinking vodka make/makes me sick.

With the plural agreement, this is ambiguous depending on whether the subject is read collectively or distributively. However, with the singular agreement, it only has the collective reading. I do not yet have a satisfactory account to offer for this.

References

[1] J. Barwise & J. Perry. *Situations and Attitudes*. Cambridge, MA: MIT Press, 1983.

[2] J. Barwise. *Situation in Logic*. Stanford: CSLI, 1989.

[3] J. M. Gawron & S. Peters. *Anaphora and Quantification in Situation Semantics*. Stanford: CSLI, 1990.

[4] K. Devlin. *Logic and Information*. Cambridge, UK: Cambridge University Press, 1991.

[5] G. Link. "The Logical Analysis of Plurals and Mass Terms: A Lattice-Theoretic Approach." In Rainer et al. (eds.) *Meaning, Use, and Interpretation of Language*, 302–323, Berlin: Walter de Gruyter, 1983.

[6] F. Landman. "Groups." *Linguistics and Philosophy* **12**: 559–605, 723–744, 1989.

[7] H. Kamp. "A Theory of Truth and Semantic Representation." In J. Groenendijk, T. M. V. Janssen and M. Stokhof (eds.) *Truth, Interpretation and Information,* 1–41, Dordrecht: Foris, 1984(1981).

[8] H. Kamp & U. Reyle. *From Discourse to Logic. Introduction to Modeltheoretic Semantics of Natural Language, Formal Logic and Discourse Representation Theory*. Dordrecht: Kluwer, 1993.

[9] I. Heim. *The Semantics of Definite and Indefinite Noun Phrases.* Ph.D. dissertation, University of Massachusetts, Amherst, 1982.

[10] K. Ishikawa. "Individuation and Reasoning." in E. Engdahl, J. Etchmendy, J. Seligman, H. Sirai and D. Westerståhl (eds.) *Logic, Language and Computation: The 1994 Moraga Proceedings*. Stanford: CSLI, In press.

[11] K. Ishikawa. *A Network Theory of Reference* (working title). Ph.D. dissertation to be submitted to University of Tokyo.

[12] B. S. Gillon. "Plural Noun Phrases and Their Readings: A Reply to Lasersohn." *Linguistics and Philosophy* **13**: 477–485, 1990.

[13] R. J. H. Scha. "Distributive, Collective and Cumulative Quantification." In J. Groenendijk, T. M. V. Janssen and M. Stokhof (eds.) *Truth, Interpretation and Information*, 131–158, Dordrecht: Foris, 1984.

[14] M. Krifka. "Nominal Reference, Temporal Constitution, and Quantification in Event Semantics." In R. Bartsch, J. v. Benthem and P. v. E. Boas (eds.) *Semantics and Contextual Expression*, 75–115, Dordrecht: Foris,1989.

[15] C. Pollard & I. A. Sag. "An Information-Based Theory of Agreement." In *The Proceedings of the Parasession on Agreement in Grammatical Theory*, Chicago: Chicago Linguistics Society, 1988. (Also Report No. CSLI-88-132, Stanford: CSLI).

[16] C. Pollard & I. A. Sag. *Head-driven Phrase Structure Grammar*. Chicago: University of Chicago Press, 1994.