A Semantic Fact about Spanish Quantification

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Abstract

A notorious feature of plural universal quantification in Spanish is that the universal determiner demands a complex NP as argument. This syntactic complication, however, has no semantic consequences. For speakers of Spanish, modulo a restriction to distributive predicates, both types of quantification are indistinguishable. Taking as starting point a recursive definition of distributive predicates suggested by Van Benthem and adopted by Hoeksema, we simulate within the framework of the generalised quantifier view of quantification the the equivalence judgement just referred to.

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1 Introduction

While a sober language like Dutch gives speakers the space to express plural universal quantification in an economic way, the Spanish language, with the baroque abandon that fostered Gongora and Sor Juana, dictates its users an exuberant route. Consider, briefly, the following Dutch sentence:

(1) Alle mannen beminnen God

The most natural Spanish translation cancels the compositional simplicity of the input, thus giving:

(2) Todos los hombres aman a Dios

The word-for-word translation of the original is beyond repair:

(3) Todos hombres aman a Dios

God nor man can make decent Spanish of it because the Spanish plural determiner demands a non-bare plural as argument.

Nevertheless, speakers of Spanish are not condemned to the plural form in order to express universal quantification. Undoubtedly, this construction is a quite natural way of expressing universal quantification but it is not the only one. Even though some speakers would strongly prefer the plural form, a singular alternative is available to them:

(4) Todo hombre ama a Dios

Interestingly, the educated intuition of speakers of Spanish sanctions the equivalence of the plural and the singular sentences (2) and (4). The syntactic richness of the plural noun phrase does not have a significant semantic effect. Such is the fate of most baroque features. In this note we shall use some ideas due to Hoeksema ([1], [2]) to simulate the educated intuition just mentioned. Within Hoeksema's semantics for plurals, we prove the equivalence of plural and singular quantification as far as distributive predicates are concerned. An additional feature of Spanish quantification should be mentioned at this stage. The plural form seems to have a stronger existential import than the singular one. This implies that the equivalence we want to establish will hold only for non-empty arguments of determiners.

2 A Semantics of Plurality

The goal that Hoeksema tried to achieve with his treatment of plurality has nothing to do with the quirks and oddities of Spanish quantification. His concern was the semantics of conjoined noun phrases. But, of course, he was forced to give a general account of plural expressions. His starting point is the ontological division of the universe into two types of objects: groups and atomic individuals. Groups are seen as sets containing at least two elements. Those groups are generated from an initial set of atoms. Hoeksema preserved in a footnote a suggestion by Van Benthem, namely that it is possible to work with a Hoeksema universe D recursively defined:

Definition 1 (Universe)

1. $D_0 = E$
2. $D_{m+1} = D_m \cup \wp^2(D_m)$
3. $D = \cup D_i \ (0 \leq i)$

In this definition $\wp^2(\mathrm{D}_m)$ denotes the set $\{\mathrm{X} \in \wp(\mathrm{D}_m) : |\mathrm{X}| \geq 2\}$.

The denotation of plural nouns is the set of groups that we can form taking the denotation of the singular ones as starting point. This feature is reflected in the following definition:

Definition 2 (Nouns)

1. *The denotation of a singular substantive* S_{sg} *is a subset* E
2. *The denotation of a plural substantive* S_{pl} *is the set* $\{X : X \in \wp(S_{sg}) \wedge | X | \geq 2\}$

The denotation of predicates differs slightly from the denotation of nouns. In particular, while the denotation of a plural substantive does not contain any individual, the denotation of a plural predicate may contain them. Moreover, in the case of distributive predicates, individuals have to belong to this denotation.

Definition 3 (Predicates)

1. *The denotation of a singular predicate* P_{sg} *is a subset of* E*, this is* $\|P_{sg}\| \in \wp(E)$
2. *The denotation of a plural predicate* P_{pl} *is a subset of* D *that is not the denotation of a singular predicate:* $\|P_{pl}\| \in (\wp(D) - \wp(E)) \cup \{\emptyset\}$

In the cited papers, Hoeksema adopted the view on quantification developed within the generalised quantifier theory. Noun phrases are considered to denote generalised quantifiers. Given his interest in plurality, Hoeksema cannot but add to the semantic interpretation of the singular noun phrases special semantic characterisations of their plural counterparts. We adapt to Spanish Hoeksema's proposal:[1]

Definition 4 (Noun Phrases)

1. $\| \textit{los } S_{pl} \| = \{X \in D_{P_{pl}} : \cup \|S_{pl}\| \in X\}$
2. $\| \textit{Todos los } S_{pl} \| = \{X \in D_{P_{pl}} : \cap \|\textit{los } S_{pl}\| \subseteq X\}$
3. $\| \textit{Todo } S_{sg} \| = \{X \in D_{sg} : \| S_{sg} \| \subseteq X\}$

In the next paragraph we show that the first two noun phrases determine the same set.

Lemma 1 $\cup \|S_{pl}\| \in \cap \|\textit{los } S_{pl}\|$.

[1] Remember that the empty set is excluded as denotation of the arguments of the determiners. Given Hoeksema's definition of plural universal quantification, the exclusion of the empty set is most desirable.

Proof
The question is that for each property of groups P holds: $P \in \|\text{los } S_{pl}\|$ iff $\cup \|S_{pl}\| \in P$. This means that each member of $\|\text{los } S_{pl}\|$ contains $\cup \|S_{pl}\|$.

Proposition 2 $\|$ *los* S_{pl} $\| = \|$ *todos los* S_{pl} $\|$

Proof

i Suppose $P \in \|\text{los } S_{pl}\|$. Then, $\cap \|\text{los } S_{pl}\| \subseteq P$. Hence $P \in \|\text{todos los } S_{pl}\|$.

ii Suppose that $P \in \|\text{todos los } S_{pl}\|$. This means that $\cap \|\text{los } S_{pl}\| \subseteq P$. But we have just established that $\cup \|S_{pl}\| \in \cap \|\text{los } S_{pl}\|$. Therefore, $\cup \|S_{pl}\| \in P$. And so, by definition, $P \in \|\text{los } S_{pl}\|$.

The identity just established simulates the semantic judgement of speakers of Spanish when they judge the next sentences to be equivalent:

(5) a. Todos los hombres se reunen

b. Los hombres se reunen

3 Distributive Predicates

Of course the previous equivalence is not insensitive to the predicates used. The next sentences, that adapt an earlier remark of Ladusaw, are not equivalent. The first one suggest the existence of unanimity. The second one does not.

(6) a. Todos los senadores absolvieron a Clinton

b. Los senadores absolvieron a Clinton

Moreover, the equivalence between the singular and the plural universal quantification is also sensitive to the nature of the predicates involved. The equivalence makes sense only with regard to distributive predicates. As we see the matters in semantics, distributive predicates are those which being true of a group are also true of the individuals making up that group. Let us then consider the equivalence we are interested in within the realm of the distributive predicates.

Definition 5 (Distributive Predicates)
A predicate P_{pl} *is called distributive iff its denotation is determined in the following way:*

i $P_0 = \|P_{sg}\|$ $(\subseteq E)$

ii $P_{m+1} = P_m \cup \wp^2(P_m)$

iii $\|P_{pl}\| = \cup P_i$ $[0 \leq i]$

Remember that we want to show the equivalence between a plural and a singular sentence. So, an important step will be the proof that the content of singular predicates are retrievable from their plural surroundings. A nice feature that helps us in that proof is given by the following:

Lemma 3 *For any natural number* m *it holds that* $\|P_{sg}\| = P_m \cap E$

Proof

i Given that $P_0 \subseteq E$ it follows that $\|P_{sg}\| = P_0 \cap E$

ii Assume now $\|P_{sg}\| = P_m \cap E$. Consider P_{m+1}. Then,

$$\begin{array}{lcl} P_{m+1} & = & P_m \cup \wp^2(P_m) \\ P_{m+1} \cap E & = & (P_m \cup \wp^2(P_m)) \cap E \\ & = & (P_m \cap E) \cup (\wp^2(P_m) \cap E) \\ & = & (P_m \cap E) \cup \emptyset \\ & = & P_m \cap E \\ & = & \|P_{sg}\| \end{array}$$

On the basis of this lemma we can show that it is possible to retrieve the denotation of a singular predicate from its plural form.

Corollary 4 $\|P_{sg}\| = \|P_{pl}\| \cap E$

Proof

$$\begin{array}{lcl} \|P_{pl}\| \cap E & = & \cup P_i \cap E \\ & = & \cup(P_i \cap E) \\ & = & \cup \|P_{sg}\| \\ & = & \|P_{sg}\| \end{array}$$

It is clear that this lemma allows us to assert that if a plural distributive predicate is true of a group of individuals then its corresponding singular form will be true of each of the members of the group.[2] An essential element in the remaining discussion is the following lemma:

Lemma 5 *For every set* S *and every natural number* m *holds that if* $S \in P_m$ *then* $S \subseteq P_m$

i It holds vacuously that if $S \in P_0$ then $S \subseteq P_0$

ii Assume the hypothesis for P_m. Consider $S \in P_{m+1}$. By definition, $S \in P_m \cup \wp^2(P_m)$. Now, if $S \in \wp^2(P_m)$, then $S \subseteq P_m$. If, for whatever reason, $S \notin \wp^2(P_m)$ then $S \in P_m$. So, by hypothesis, $S \subseteq P_m$. In both cases, $S \subseteq P_m$. But this means that $S \subseteq P_{m+1}$

A result of this lemma is the following:

Corollary 6 *If* $S \in \|P_{pl}\|$ *then* $S \subseteq \|P_{pl}\|$

Proof

Suppose $S \in \|P_{pl}\|$. Then, $S \in \cup P_i$ $(0 \leq i)$. There is then a set P_m $(m \leq i)$ such that $S \in P_m$. But we already know that in this case $S \subseteq P_m$. Given that $P_m \subseteq \cup P_i$ we conclude $S \subseteq \cup P_i$, that is, $S \subseteq \|P_{pl}\|$.

We now want to show that if a distributive plural predicate is true of a set of individuals, then its singular version is true of the individuals themselves:

[2] In the rest of the discussion, we shall assume that P_{pl} is a distributive predicate.

Lemma 7 *If* $S \in \|P_{pl}\|$ *then* $S \subseteq \|P_{sg}\|$

Proof
According to Corollary (6), if $\mathrm{S} \in \|\mathrm{P}_{pl}\|$ then $\mathrm{S} \subseteq \|\mathrm{P}_{pl}\|$. Since S is a set of individuals, it holds that $\mathrm{S} \subseteq \mathrm{E}$. Therefore, $\mathrm{S} \subseteq \|\mathrm{P}_{pl}\| \cap \mathrm{E}$. But Corollary (4) characterises this set as $\|\mathrm{P}_{sg}\|$. Therefore, $\mathrm{S} \subseteq \|\mathrm{P}_{sg}\|$.

The usefulness of this result will be apparent in a moment. At this stage we only want to point out that it captures one of the most robust intuitions we have with regard to the behaviour of distributive predicates. A important step to the conclusion of our argument is the following:

Lemma 8 $\cup \|S_{pl}\| = \|S_{sg}\|$

Proof
Remember that $\|\mathrm{S}_{pl}\|$ is the set of sets of $\|\mathrm{S}_{sg}\|$ that contain at least two elements. It follows from this that if the plural is meaningful, then $\|\mathrm{S}_{sg}\| \in\|\mathrm{S}_{pl}\|$. Therefore, $\|\mathrm{S}_{sg}\|\subseteq \cup\|\mathrm{S}_{pl}\|$. On the other hand, each element X of $\|\mathrm{S}_{pl}\|$ is a subset of $\|\mathrm{S}_{sg}\|$. So, $\cup \|\mathrm{S}_{pl} \|\subseteq \|\mathrm{S}_{sg} \|$.

4 The Equivalence

We are finally in the position to conclude our simulation of the Spanish semantic judgement we started with. We need to assume that the plural noun phrase *todos los* S_{pl} is meanigful. This implies the non-emptiness of S_{pl}. This means, of course, that the denotation of S_{pl} has to contain at least two elements.

Theorem 9 $P_{pl} \in \|$*todos los* $S_{pl}\|$ *iff* $P_{sg} \in \|$*todo* $S_{sg}\|$

Proof

- i Suppose $\|\mathrm{P}_{pl}\| \in \|$todos los $\mathrm{S}_{pl}\|$. Then, $\cap\|$los $\mathrm{S}_{pl}\|\subseteq \|\mathrm{P}_{pl}\|$. According to Lemma (1) we have to accept that $\cup\|\mathrm{S}_{pl}\| \in \cap\|$los $\mathrm{S}_{pl}\|$ and, on this account, $\cup\|\mathrm{S}_{pl}\| \in \|\mathrm{P}_{pl}\|$. But then, by Lemma (7) we can conclude $\cup\|\mathrm{S}_{pl}\| \subseteq \|\mathrm{P}_{sg}\|$. Moreover, Lemma (8) enforces $\|\mathrm{S}_{sg}\| \subseteq \|\mathrm{P}_{sg}\|$. This means, of course, $\|\mathrm{P}_{sg}\| \in \|$todo $\mathrm{S}_{sg}\|$.
- ii Suppose now that $\|\mathrm{P}_{sg}\|\in \|$todo $\mathrm{S}_{sg}\|$. Then $\|\mathrm{S}_{sg}\| \subseteq \|\mathrm{P}_{sg}\|$. And therefore $\|\mathrm{S}_{sg}\| \in \|\mathrm{P}_{pl}\|$ thanks to the construction of $\|\mathrm{P}_{pl}\|$. But as we have already know, $\|\mathrm{S}_{sg}\| = \cup\|\mathrm{S}_{pl}\|$. Therefore $\|\mathrm{P}_{pl} \| \in \|$los $\mathrm{S}_{pl}\|$. Hence, $\cap\|$los $\mathrm{S}_{pl}\|\subseteq \|\mathrm{P}_{pl}\|$. This all leads us to the desired conclusion: $\|\mathrm{P}_{pl}\|\in \|$todos los $\mathrm{S}_{pl}\|$.

5 Final Words

We have now reached the end of our argumentation. We have shown how to use insights from the theory of plurality and the generalised quantifiers perspective to simulate in a semantic framework one of the most notorious features of quantification in Spanish. In spite of their different syntactic realizations, in many cases the singular and plural quantification are considered to be equivalent. We have argued that the syntactic peculiarity of the Spanish plural form is neutralised at the level of the semantics. Most of the definitions used in the course of this argumentation are taken from work of J. Hoeksema. The recursive definition of the universe and the distributive predicates is due to Johan van Benthem.

References

[1] J. Hoeksema. Plurality and conjunction. In Alice G. B. ter Meulen, editor, *Studies in Modeltheoretic Semantics*, pages 63–83. Foris Publications, 1983.

[2] J. Hoeksema. On the structure of english partitives. University of Groningen, 1984.