Generalized Quantifiers and Ontological Commitments

Isidora Stojanovic
Institut Jean-Nicod (ENS-EHESS-CNRS)
ENS-Pavillon Jardin, 29 rue d'Ulm, 75005 Paris, France
isidora.stojanovic@ens.fr

Oliver Kutz
SFB/TR 8 Spatial Cognition, University of Bremen
Enrique-Schmidt Strasse 5, 28359 Bremen, Germany
okutz@informatik.uni-bremen.de

Abstract: In Generalized Quantifier Semantics for Natural Language, as developed by Montague, Barwise, Cooper and others, singular terms, such as names like "Tom Smith," or demonstrative phrases like 'this man,' are treated as (generalized) quantifiers. Thus a statement like "Tom Smith is clever" does not attribute cleverness to that person, Tom, notwithstanding intuition. Rather, it is to cleverness that such a statement will attribute a higher-order property, namely that of belonging among Tom's properties. In our paper, we raise the following problem for such semantic approaches, a problem that arises from ontological considerations. Singular terms such as names and demonstratives should only commit us to the existence of individuals, hence, given that generalized quantifiers commit us to the existence not only of properties of individuals (or sets, if you prefer), but also to the existence of properties of properties (or classes of sets), such accounts are ontologically questionable. In discussing possible replies, we also raise and address the more general issue of the relationship between semantics and ontology.

Keywords: generalized quantifiers, natural language semantics, ontology, existence, higher-order properties

Introduction

One of the most important insights of Richard Montague was that singular terms, such as the name "Richard Montague," or "Tom Smith," or the demonstrative phrase "this man," may all be treated as quantifiers. Common sense suggests that a statement like "Tom Smith is clever" attributes a certain property, cleverness, to the very individual Tom Smith. Montague, on the other hand, suggests that it is to the property of cleverness that a certain higher order property gets attributed, namely, the property of belonging among Tom Smith's qualities. The Montagovian approach raises a fairly straightforward objection that comes from ontological considerations. Roughly, the objection holds that singular terms should only commit us to the existence of individuals. Given that generalized quantifiers commit us to the existence not only of properties of individuals (or sets, if you prefer), but also to properties of properties (or classes of sets), such an approach should only be accepted if a case can be made for its heavy ontological commitments.

In Section 1, we set up the background for the discussion by distinguishing several variants of the theory of generalized quantifiers according to the ways in which they take Montague's insight into account. In Section 2, we take up the ontological objection and discuss possible ways of responding to it. In doing so, we also address the more general issue of the relationship between semantics and ontology. In Section 3, we defend one particular quantifier treatment of singular terms and we argue that, from the viewpoint of ontology, it is more promising than either the standard, directly referentialist treatment of singular terms (according to which the semantic value of a singular term is the individual referred to using the term) or the other generalized quantifier treatments.

1. Singular Terms in Generalized Quantifier Theory: the Landscape

Consider the example of the statement "Tom is clever." In providing semantics for a natural language like English, how should one formally analyze this statement? Here is a straightforward suggestion that uses the language of first order logic with individual constants (FOL, for short):

$$\text{(standard view):} \quad Sj \tag{1}$$

where 'S' is a 1-place predicate whose intended interpretation is the set of clever people, and 'j' is an individual constant whose intended interpretation is Tom.

In Natural Language Semantics, generalized quantifiers were introduced primarily in order to account for the meaning of determiner phrases such as 'all' and 'most' (cf. e.g. (Keenan & Westerstahl, 1997) for an overview). The introduction of generalized quantifiers does not, however, discard by itself 'Sj' as a possible rendering of "Tom is clever."[1] There exists, then, a conservative way of formalizing singular terms in the generalized quantifier theory, that is, the very way in which one does so in FOL.[2] But in their pioneering work on generalized quantifiers, Barwise and Cooper resist such a conservative treatment:

> To have our cake and eat it too (preserving the intuition that proper nouns denote individuals, rather than sets of sets) we will let the lexical item or word Harry denote an individual. However, the noun phrase containing just this word ... will denote the family of sets containing Harry. ((Barwise & Cooper, 1981), p. 166)

According to their proposal, the statement "Tom is clever" receives this rendering:

$$\text{(Barwise \& Cooper view):} \quad \mathbf{the}(\hat{y}(y = j))S \tag{2}$$

It is worth noting that for Barwise & Cooper, generalized quantifiers do not bind any variables, but they compose with a "set term" to form a sentence. Thus S above is a set term (and so is any 1-place predicate), denoting the set of clever people. However, the FOL formula 'Sj' is also a formula of Barwise & Cooper's language of GQ. The truth conditions of statements with singular terms are derived from those associated with the definite article:

$$\begin{array}{rll} \text{`}\mathbf{the}(F)G\text{' is true} & \text{iff} & |F| = 1 \text{ and } F \text{ is a subset of } G; \text{ hence} \\ \text{`}\mathbf{the}(\hat{y}(y = j))G\text{' is true} & \text{iff} & |\{x : x = j\}| = 1 \text{ and } \{x : x = j\} \text{ is a subset } G, \\ & \text{iff} & j \text{ belongs to } G. \end{array}$$

Now, if one asked what the phrase $\mathbf{the}(\hat{y}(y = j))$ denotes, one would say, a function that maps sets to truth values, or equivalently, a class of sets (viz. those mapped to Truth).

In the later developments of the theory of generalized quantifiers, in particular Keenan & Westerstahl (1997), type $\langle 1 \rangle$ quantifiers are similarly functions from the powerset of the universe into $\mathbf{2}$ (the set of truth values). Keenan & Westerstahl distinguish type $\langle 1, 1 \rangle$ quantifiers, which are functions whose range is the powerset of the universe, but whose domain is the class of type $\langle 1 \rangle$ quantifiers. The determiner '$\mathbf{the}$', for instance, takes a set A and sends it to a type $\langle 1 \rangle$ quantifier, which in turn takes a set B and sends it to a truth value (namely, Truth iff A is a singleton and a subset of B).

Now, neither the standard view's formula in (1) nor the Barwise & Cooper formula in (2) are formulas of Keenan & Westerstahl's language of GQ, which contains neither variables nor constants. They use, though, individual constants in their metalanguage, since for every member b of the universe, they introduce a type $\langle 1 \rangle$ quantifier $\mathbf{I}_b$ whose truth conditions are:

[1] As we will shortly see, though, the account favored by Keenan & Westerstahl (1997) does not allow for this rendering: even though one-place predicates denote sets, those do not work as devices of predication.

[2] Indeed, (Larson & Segal, 1995), authors of one of the most important textbooks for NL semantics, use individual constants for singular terms within a generalized quantifier framework.

$$`\mathbf{I}_b(G)' \text{ is true} \quad \text{iff} \quad b \text{ is a member of } G.$$

Keenan & Westerstahl call such quantifiers 'individuals' and take them to be denoted by proper nouns (cf. p. 842). "Tom is clever," then, will be rendered as follows:

$$\text{(Keenan \& Westerstahl view):} \quad \mathbf{I}_{\mathsf{Tom}}(S) \tag{3}$$

Finally, there is another straightforward way of incorporating proper nouns into a generalized quantifier framework, one that, to our knowledge, has not been explicitly defended in GQ theories, but corresponds to what we would get by combining a descriptivist, or Russellian, treatment of proper names with a generalized quantifier account. In a nutshell, with every proper name, one would associate a one-place predicate, and would then view the noun phrase as the definite description formed with that predicate. "Tom is clever," on this proposal, will be rendered as follows:

$$\text{(descriptivist GQ view):} \quad \mathbf{the}(P_{\mathsf{Tom}})(S) \tag{4}$$

Note that this descriptivist proposal does not presuppose any individual constants, neither in the language of GQ nor in the metalanguage.

In the philosophy of language, there has been a long-lasting debate as to how one should best construe a predicate like P_{Tom}. Of course, one could always understand in as "being identical with the individual Tom," but that would make the descriptivist view collapse into a view like Barwise and Coopers. Among the various descriptivist proposals, the most promising ones are the so-called metalinguistic proposals, on which a predicate like P_{Tom} is to be understood as "being a bearer of the name 'Tom'." To be sure, such predicates need not always be interpreted by singletons, as there may be more than one bearer of the same proper name. But what allows us to make true statements is that the universe will typically be contextually narrowed to some subset whose intersection with the set P_{Tom} will be a singleton. It is beyond the scope of the present paper to discuss in greater detail the motivations for such a metalinguistic approach and its rebuttals of the criticisms coming from Saul Kripke and other direct reference theorists; for discussion, see e.g. (Geurts, 1997) or (Stojanovic, 2010).

2. The Ontological Costs of Generalized Quantifiers

The most straightforward objection against the quantifier treatment of singular terms goes roughly as follows. Generalized quantifiers presuppose the existence not only of individuals and sets, but also of classes of sets, that is, properties of sets and relations between sets. Any proposal that considers singular terms as generalized quantifiers is therefore problematic, for at least two reasons. First, one may want to work with an ontology in which individuals and, perhaps, sets as well as properties exist, but in which there is no "further stuff" beyond that. Second, even if one were to accept that classes of sets and other higher-order properties exist, the assumption of their existence should not be imposed on us by the mere presence of singular terms in our language, which only commit us to the existence of individuals.

It is to be noted that neither Barwise & Cooper nor Keenan & Westerstahl deem such ontological matters worth discussing. In general, Natural Language Semantics is seldom concerned with ontological costs. Our own stance on this question is that this attitude is essentially correct, and that the choice of one's semantic framework does not impose any specific ontology—or, at least, ontology in the sense of what there really is out there. But, rather than simply ignore the concerns coming from ontology, we shall try to offer something of a justification as to why semanticists may safely be ignorant and sloppy about ontology.

Let us begin by pointing out that the theory of generalized quantifiers does not square well with Quine's famous dictum according to which ”to be is to be the value of a variable” (Quine, 1953). For Quine, what exists is what lies in the range of the (first order) existential quantifier. But as we have seen, generalized quantifiers do not bind variables, hence it is hard to say what exactly they range over. In FOL, 'Something is F' is true iff there is an element in the range of the existential quantifier which belongs to the extension of F. In GQ theory, 'Something is F' is true iff the extension of F is not empty. To be sure, the two truth conditions are in an important respect equivalent. However, the latter puts a condition directly on the denotation of F, while the former does so by the intermediary of a particular element of the universe. At any rate, the point is that Quine's criterion of what there is can hardly be even understood if the relevant notion of a quantifier is that of a generalized quantifier, let alone be applied.

Now, it is notoriously difficult to rest arguments about what there is on any solid grounds. One might think that the way we talk reveals what sorts of things exist, but again, it is very difficult to decide whether a given expression presupposes the existence of a given entity. To give an example, consider the sentence "Every boy danced with a different girl." At first blush, one would think that all that needs to exist for this sentence to be meaningful are individuals like boys and girls, and perhaps events of dancing. But when we try to provide the truth conditions for this sentence, we would naturally require that there should be a one-one correspondence between the set of all boys and some subset of the set of all girls, and then the sentence will be true if every member of the first danced only with his 'image' in the second. Does this mean that our prima facie innocent sentence commits us to the existence of groups or one-one correspondences? Some would say yes, others no. It is difficult, however, to see on which grounds one could adjudicate between the parties in such a dispute. Regarding the similar Geach-Kaplan sentence "Some critics admire only one another," (Boolos, 1975) held that it only commits us to the existence of critics. (Resnik, 1988), on the other hand, replied that he was "inclined to understand it as saying: 'There is a nonempty collection of critics each member of which admires no one but another member.' " (p. 77)

Here is another controversial case. Consider the statement "Tom might call." Intuitively, only Tom's existence is required for this statement to be meaningful. But, regardless of how we ought to treat proper nouns, when we inquire into the semantics of modalities, we see that "might" has an existential force, and to capture it, we ask that there should be some possible state of affairs in which "Tom has called" holds, for the modal statement to be true. Does this mean that the modalities commit us to the existence of possible states of affairs, possibilities, or other "creatures of darkness," as Quine would put it? We think not. Indeed, we believe that one's recourse to quantification over possible worlds or states of affairs in providing a semantics for modal expressions is, first and foremost, a modeling device. The burden of argument would be on those who want to claim that ontological commitments are forced upon us by the semantic frameworks within which we have chosen to work. But, to our knowledge, no such argument has been forcefully put forward. Rather, what we observe is a mere confrontation of positions, between those who take semantics to be ontologically committal, so to speak, and those who don't. Thus, among the former, for instance, someone like Alston held that the mere fact that "Tom might call" may be rephrased as "There is a possibility that Tom will call" already implies that by using the simple modal 'might', "we would be asserting that there is a possibility (committing ourselves to the existence of a possibility)" (p. 47).

To drive the point home, we have argued that the primary aim of semantics is to provide a conceptual analysis of how we can express things and communicate using language, and may therefore avail itself of conceptual tools such as meanings, possible states of affairs, various tools of classifying things, such as sets, functions, one-one correspondences, and the like. By having recourse to such tools, semantics does not ipso facto erect these theoretical entities into the world's first-class citizens. Returning to the case of a generalized quantifier treatment of singular terms, the issue was whether such a treatment had an unacceptable impact on ontology. We argued that it didn't. What is more, note that it is always possible to rephrase sentences with proper names and other singular terms in such a way as to sneak in ontologically heavy terms. Thus, suppose that someone was to write a recommendation letter for Tom, and finding it not very elegant just to say "Tom is clever," wrote "There are many qualities that Tom has. Cleverness is one of them." On the assumption that this statements is roughly equivalent to saying "Tom is clever and many other things," someone like Alston might want to claim that already by saying "Tom is clever," we are quantifying over Tom's qualities and attributing to cleverness the higher-order property of belonging among Tom's qualities. However, once again, the burden of argument is on those who, like Alston, take semantic modeling to be ontologically committal. Our own view is that neither this equivalence among the paraphrases one of which explicitly mentions ontologically problematic entities like possibilities and qualities, nor the use of sets or collections of sets in the generalized quantifier theory, constrain in any way our view about what there is. For if ontology were really so dependent upon language, it would have made sense for some ontological puritans among Tom's committee members to discard his recommendation letter because of its too weighty ontological assumptions but that would be sheer non-sense!

3. In Defense of a Quantifier Treatment of Singular Terms: the Case of Empty Names

We have tried to answer the most immediate objection to the quantifier treatment of singular terms, motivated by certain ontological concerns. We now want to close by arguing that *if* ontological concerns are to be taken seriously in devising NL semantics, then they actually offer more support to the descriptivist view, as in (4), than to any other view.

Our argument is as much a semantic argument as an ontological one. The case in point is that of empty names. Empty names, such as "Pegasus," "Sherlock Holmes," or "this tree" when no tree is available for reference (as in the case of hallucination), are generally acknowledged as belonging among singular terms. Only, they have a feature that most singular terms lack, namely, they fail to pick out anything in the real world as their referent.[3] Far from being a marginal issue, empty names have been the object of a lot of discussion. And, as it turns out, they provide a strong case for the quantifier treatment of singular terms. Consider the standard view, as in (1). Since all singular terms are treated as individual constants, defenders of such views will do so with empty terms, too. And yet, they cannot do so, since a constant must denote some individual in the universe, while there is just no such thing in the case of an empty name.

It takes little to realize that empty names present a case against, rather than for the Barwise & Cooper view, which employs a constant in the generalized quantifier denoted by the noun phrase. Yet, no constant is available if the noun phrase is an empty name. Note that the Keenan & Westerstahl view seems to be even worse off, since it requires not a constant, but a genuine individual, in order for the 'individual' quantifier to be defined. The only quantifier treatment really supported by the case of empty names is the descriptivist or Russellian view, outlined in

[3]We are not suggesting that empty names actually refer to something outside the real world. But since some might want to say something along those lines, as Meinong did, we don't want to bar this option at the outset by saying that empty names do not refer to anything *anywhere*.

(4), which associates a description (or a one-place predicate) to the name, and feeds it as an argument into the determiner $\mathbf{the}$. Thus, if you think of the meaning of "Pegasus" as something like "to be a bearer of the name 'Pegasus'," then "Pegasus is asleep" is rendered as:

$$\mathbf{the}(P_{\textsf{Pegasus}})(\textbf{asleep})$$

But given that there is no individual called 'Pegasus' (for, it is an empty name), $P_{\textsf{Pegasus}}$ denotes an empty set, hence $|P_{\textsf{Pegasus}}|$ is 0, and not 1, hence the sentence comes out false.

Now, one might ask, what if you have called my dog 'Pegasus', and if your dog is asleep? Isn't then the sentence true? The reply is that, sure, the sentence will be true if one contextually restricts the universe down to a subset that contains your dog and no one else called 'Pegasus.' But if we are talking of the empty name 'Pegasus,' meant for the non-existent mythical horse, then the domain of discourse is typically going to be a subset of the universe whose intersection with $P_{\textsf{Pegasus}}$ is empty.

To be sure, our discussion of the case of empty names does not address any of the subtleties that have been accumulated in the discussion in the literature, concerning e.g. fictional names (of which 'Pegasus' is arguably an example). But our main point in this final section was to show that if ontological considerations are taken into account, then they actually provide support to the idea of treating singular terms on a par with (other) generalized quantifiers.

Acknowledgments

Isidora Stojanovic acknowledges participation and partial funding from the project "Perspectival Thoughts and Facts" (PETAF), European Community's Seventh Framework Programme (FP7/ 2007-2013), grant no. 229 441CCC. Oliver Kutz acknowledges the support of the DFG-funded Research Center on Spatial Cognition (SFB/TR 8), project I1-[OntoSpace].

References

Alston, W. (1958). Ontological Commitments. *Philosophical Studies*, *9*(1–2), 8–17.

Barwise, J., & Cooper, R. (1981). Generalized Quantifiers and Natural Language. *Linguistics and Philosophy*, *4*(2), 159–219.

Boolos, G. (1975). On Second-Order Logic. *Journal of Philosophy*, *72*(16), 509–527.

Geurts, B. (1997). Good News About the Description Theory of Names. *Journal of Semantics*, *14*(4), 319–348.

Keenan, E. (1997). The Semantics of Determiners. In S. Lappin (Ed.), *Handbook of Contemporary Semantic Theory* (pp. 41–63). Oxford: Blackwell Publishers.

Keenan, E., & Westerstahl, D. (1997). Generalized Quantifiers in Logic and Language. In J. van Benthem & A. ter Meulen (Eds.), *Handbook of Logic and Language*. Cambridge, Massachusetts: MIT Press.

Larson, R., & Segal, G. (1995). *Knowledge of Meaning: an Introduction to Semantic Theory*. Cambridge, Massachusetts: MIT Press.

Montague, R. (1973). The Proper Treatment of Quantification in Ordinary English. In J. Hintikka, J. Moravcsik, & P. Suppes (Eds.), *Approaches to Natural Language: Proceedings of the 1970 Stanford Workshop on Grammar and Semantics* (pp. 221–242). Dordrecht: Reidel. (Reprinted in *Formal Philosophy: selected papers of Richard Montague*, ed. H. Thomason, Yale University Press, 1974)

Quine, W. V. O. (1953). *From a Logical Point of View*. Harvard University Press.

Resnik, M. (1988). Second-Order Logic Still Wild. *The Journal of Philosophy*, *85*(2), 75–87.

Stojanovic, I. (2010). Referring with Proper Names: Towards a Pragmatic Account. In L. Baptista & E. Rast (Eds.), *Meaning and Context*. Berlin: Peter Lang.