

## PLURAL PREDICATION

### INTRODUCTION

The codification, interpretation and development of first-order logic constitute one of the great intellectual achievements of the last 150 years. However, the standard formalization of that language does not provide adequate resources for properly representing many ordinary things that we say.<sup>1</sup> For example, any of these predicates might be true of some people without being true of any one of them:

They are shipmates (classmates, fraternity brothers)

They are meeting together

They lifted a piano

They are surrounding a building

They come from many different countries

They weigh over 500 pounds

Such predications are a routine part of ordinary language use, yet standard systems of first-order logic provide no place for such non-distributive predication.

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<sup>1</sup> Gerald Massey's exposition (Massey 1976) of these problems is probably the best known. George Boolos explored related themes (Boolos 1984, 1985) in his discussion of plural quantification as an alternative to a set-theoretic understanding of second order logic. Landman 2000 is the most extensive systematic development of the semantics of plurals in English. Many who have approached this topic have succumbed to the *singularist* bias, assuming that the semantics for plurals must make reference to single entities: groups, sets or mereological sums. (See Chapter 2.) Notably, Boolos has avoided this singularist bias, and, in recent work, so have Hossack, Yi, Rayo, and Oliver and Smiley. Yi 1999, 2002, and 2005, and Oliver and Smiley 2001 argue against singularism in ways that overlap significantly with considerations to be developed in this work.

Work on plurals and non-distributive predication has led me to the conclusion that we should extend first-order logic to allow for the representation of non-distributive plural predication. Philosophers often employ first-order logic as a basis for regimenting claims, assessing inferences, and developing their thoughts. Enriching first-order logic with a clear semantics for non-distributive plurals can provide us with a better tool with a wider range of applicability in philosophy and other disciplines.

The use of non-distributive plurals in metaphysics has become common in the discussions of when some things compose a single things, for example. Also, when a metaphysician proposes to say "Everything is identical with itself," she often refuses to concede that this can be said only of some restricted domain, less than everything. Timothy Williamson has formulated a very general version of Russell's paradox and argued that the metaphysician must adopt second-order logic in order to support such a universalist position. I argue (in Chapter 6) that a plural first-order approach can do as well in defusing the paradox and allowing us to speak of everything.

Linguists have already done much towards the difficult task of accounting systematically for the expression of non-distributive predication and plural quantification in natural language.<sup>2</sup> Linguists who might wish to explore questions about natural language in

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<sup>2</sup> Landman 2000 is an especially rich source, both for the account it develops of the semantics for English and for its exposition of earlier work. Several linguists and philosophers exploring plurality, including Landman, do so within the context of a semantics that follows Davidson and Parsons in taking events as fundamental to semantics. I believe that the core phenomena of non-distributive predication and plural quantification are independent of that aspect of the semantics. By exploring these phenomena without giving a fundamental role to events, I think that this work will make a case for that independence. However, this should not be taken as an argument that events are not important to semantics. The consideration of adverbs provides strong arguments for an

a formal language with a clear semantics and without singularist assumptions will still find this discussion to be a valuable resource. I think that the simplicity of the semantics and some success in accounting for the semantics of many difficult examples from natural language should help to make a case that using a plural, first-order, non-singularist metalanguage might make our semantic theories simpler. We will also see some considerations in favor of the conclusion that such a metalanguage provides a more accurate semantics by allowing us to assign semantic roles to the correct individuals rather than to set-theoretic surrogates. I also argue more specifically (Chapter 10) that we do not need to introduce events in order to give a successful semantic account of the core phenomena of plurality (even if there are other reasons to introduce events into semantics).

There is also potential value for mathematicians and philosophers studying the foundations of mathematics, since the language of plurals provides some of the expressive power of set theory but is not subject to the paradoxes that we find in naïve set theory or the coping mechanisms that we find in non-naïve set theory. It also has the fundamental expressive power of monadic second-order logic, though it is first-order --- predication and quantification involve the individuals of the domain and nothing else. Results concerning monadic second-order logic transfer to a first-order plural logic.

Chapter 1 presents some preliminary considerations in favor of taking non-distributive predication seriously, introduces key concepts, and indicates some of the issues that need to be worked out in order to have a successful treatment of non-distributive predication, plural quantification with a full range of quantifiers, and compound plural terms.

Chapter 2 presents a fuller set of arguments against singularist (set-theoretic and mereological) approaches to the semantics of plurals and non-distributive predication.

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event-based semantics. (See Landman 2000, especially pp. 1-25, and Parsons 1990, especially 3-19 and Davidson 1967.) See Chapter 10 for further discussion of this issue.

Chapter 3 codifies a formal language of plurals and presents a full semantics. The language allows non-distributive predication and a full range of quantifier concepts.

Chapter 4 connects the formal language more explicitly with some problems in the formal representation of English sentences. This should enable readers to get a better understanding of the formal apparatus, and it also indicates the direction of some applications in the semantics of natural language. Using quantifiers as the basis for representing distributive predication is a central development here.

Chapter 5 indicates how to develop the semantics within a set-theoretic context. Although I hope that Chapters 1 - 3 will have made the case that a set-theoretic semantics is not needed, some readers will probably find this more familiar approach to be useful, and having it may facilitate comparison with some other work. It also provides a base for reconsidering limitations of the set-theoretic approach.

Chapter 6 explores the fundamental semantic concept *among* and discusses the relationship of the work here to set theory, to mereology and to second-order logic. Axioms for the concept make some of these relationships especially clear. This chapter is suggestive concerning the role that a logic with non-distributive predication might play in the foundations of mathematics. With the formal apparatus in place, we can also present the plural, first-order alternative to Williamson's second-order language for speaking of everything.

Chapter 7 develops a formal treatment of definite descriptions indicating how the singular and plural descriptions are related and exactly how they differ from (and are analogous to) mass descriptions. The formal theory is applied to produce a natural solution to a puzzle about plurals due to Philip Bricker.

Chapter 8 considers the significance of the context sensitivity of definite descriptions (singular and plural) and suggests some ways of understanding it.

Chapter 9 indicates what significance the account of descriptions has for the development of a theory of English pronouns, especially E-type pronouns.

Chapter 10 shows how to use the material developed here to deal with some of the principal puzzles that have led people to the conclusion that the introduction of events into the semantics of English is important to understanding plurals. While events may be important to the semantics of English for other reasons, we can deal with the core issues involving plurals without giving a central role to events.

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