A Topos-Theoretic Approach to
Reference and Modality*

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Abstract   This paper presents an approach to modal logic based on the notion of *kind* or interpretation of a count noun as a prerequisite for reference. It gives a mathematical formalization of this notion in the context of a locally connected topos $\mathcal{E}$ (thought of as a universe of variable sets) over a topos $\mathcal{S}$ (thought of as a universe of constant sets). In this context, modal operators are intrinsically definable and the resulting formal system is described in some detail.

Introduction   This paper is an essay on reference and generality in natural languages (to borrow from the title of Geach [5]). More precisely, it is concerned with the semantics of pronouns, proper names, and count nouns.

It is a remarkable fact of natural languages that a proper name picks up its reference uniquely any time that it is uttered, whether or not its reference is present at the moment of utterance, whether or not we know the reference's whereabouts at that moment, whether or not we are able to recognize its reference, and whether or not we are referring to events that took place in the past or may take place in the future. My main concern will be with the following *problem*: What semantical structure should be postulated for this relation (between a name and its reference) to accomplish the formidable tasks just described? I shall propose an answer based on the notion of *kind* or *sortal* viewed as the semantical interpretation of count nouns.

The essay is divided into two parts. In the first, "Count nouns and kinds", taken from an unpublished paper in collaboration with Marie Reyes, I state and give arguments for a series of *theses on reference and generality* involving proper names, count nouns, and kinds. Although this medieval practice has long gone out of fashion, I believe it useful to understand the issues involved. Some of these

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*Dedicated to the memory of Isidro Suarez.