

2. The Logical Type of Thematic Roles

Because this paper uses model-theoretic semantics as its main investigative tool, we should begin our semantic investigation by asking what *logical type* thematic roles must be given in a formal semantic theory, in order for our theory to model the properties linguists have traditionally attributed to them. As Dowty (1989) is devoted to that question, I summarize here only very briefly the results of that paper and refer the reader to it for further details.

From the semantic point of view, the most general notion of thematic role (type) is *a set of entailments of a group of predicates with respect to one of the arguments of each*. (Thus a thematic role type is a kind of second-order property, a property of multi-placed predicates indexed by their argument-positions.)

For example, consider the subject argument of the two-place predicates *x murders y*, *x nominates y*, *x interrogates y*: entailments they all share include that *x* does a volitional act, that *x* moreover intends this to be the kind of act named by the verb, that *x* causes some event to take place involving *y* (*y* dies, *y* acquires a nomination, *y* answers questions--or at least hears them), that *x* moves or changes externally (i.e. not just mentally). The first entailment is not shared by *kills* (traffic accidents also kill), the second not by *convinces* (one can convince, or kill, inadvertently but cannot murder inadvertently), the third not by *looks at*, the last not by *understands*. By *entailment*, I mean the standard logical sense: one formula entails another if in every possible situation (in every model) in which the first is true, the second is true also. Since we are discussing entailments of "non-logical" predicates, I take this to be the same as an *analytic* implications (for which I also use the term *lexical entailment*: the implication follows from the meaning of the predicate in question alone). That is, a role-type like "Agent" is defined semantically as whatever entailments of verbs about NP referents are shared by the verbal argument-positions we label with the term "Agent" (and excludes whatever is entailed for those arguments that differs from one verb to the next); this sidesteps the question of whether "Agent" has a more "atomic" meaning underlying it, but it is precisely the point here to have an exact way of semantically characterizing roles that avoids such a presupposition, that can describe a possibly "arbitrary" as well as a "natural" role type, so that we can investigate and compare theories which do and don't involve the traditional notions.

Some of the lexical entailments that will be under discussion are perhaps also correctly described as presuppositions (in which case they correspond to the *selectional restrictions* of Chomsky (1965), but I assume it is now uncontroversial that these are correctly analyzed as semantic properties, not syntactic properties, of words). But the difference between presupposition and lexical entailments will not be important for our purposes.

This definition has the advantage that it is compatible with a theory, like Jackendoff's (1972, 1987) or Foley and van Valin's (1984), in which thematic role-types are defined by certain configurations of the (explicitly or implicitly interpreted) logical structures into which natural language predicates are translated¹; with a theory, like Zaenen's (1988) or Rozwadowska's (1988), in which thematic roles are sets of semantic features (as long as we can fix a definite set of entailments, within some formal semantic framework, to correspond to each such feature of those accounts), as well as a theory in which there is no internal "structure" to lexical meanings and in which entailments of lexical meanings are all listed independently (e.g. by meaning postulates) and do not completely "cross-classify" by semantic primitives in any neat way as structuralist semantic theories assume lexical meaning does. It is also neutral as to whether thematic roles are argument-indexing or not.² Yet the definition allows us to be as precise as possible in describing the substantive semantic *content* of thematic roles: as precise or more so, I believe, than any kind of current semantic theory does. When "entailments" are mentioned below, the reader should keep in mind that this notion is neutral among these various theoretical views.

¹ See Dowty (1979) for a demonstration of how English predicates can be interpreted (compositionally within a sentence) by translating them into a "logical form" or "semantic representation" where they are decomposed into elements such as CAUSE and BECOME, these translations then being part of a formal model-theoretic interpretation of English.

² Dowty (1989) also points out that if there is a set of effectively argument-indexing thematic role types for all predicates of a language, then an expressively equivalent language is one in which n-place predicates are represented in the "neo-Davidsonian" way with such predicates and their arguments replaced by event-predicates with thematic roles as relations between events and participants, e.g. in which "Mary kissed John yesterday" is represented by (ii) rather than (i):

- (i) yesterday[kiss(Mary, John)]
- (ii) Ee[kissing(e) & Agent-of(John,e) & Patient-of(Mary,e) & yesterday(e)]

(but of course this conversion is not possible if thematic roles are not effectively indexing). However, it is not clear what kind of conceptual or computational advantage, if any, (ii) achieves, once lexical entailments are also taken account of (Dowty 1989). The view of thematic roles as second-order properties of relations indexed by argument is equally adequate whether thematic roles are indexing are not.