



The Status of Thematic Relations in Linguistic Theory

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The Status of Thematic Relations in Linguistic Theory

1. Introduction

My interest in Gruber's (1965) notion of thematic relations was initially sparked by the realization that it provides the right sort of solution to certain problems of control, illustrated in (1)–(2).

- (1) a. John_i gave Sue_j orders PRO_j to leave.
b. John_i got from Sue_j orders PRO_i to leave.
- (2) a. John_i gave Sue_j a promise PRO_i to leave.
b. John_i got from Sue_j a promise PRO_j to leave.

The problem is that these are all structurally identical in the relevant respects, so there is no apparent syntactic condition that determines the antecedent of PRO.

However, the sentences differ in the positions of Source and Goal in an appropriate way to predict the results. Intuitively, it is part of the meaning of *order* that the recipient (or Goal) of an order is under obligation to perform the action described by the complement clause; it is part of the meaning of *promise* that the issuer (or Source) of a promise undertakes an obligation to perform the action described by the complement. This difference, crossed with the difference in thematic relations between *give* and *get*, correctly predicts the control properties of (1)–(2): the complement subject of *order* should be controlled by the goal of the speech-act, that is, the indirect object of *give* or the subject of *get*; the complement subject of *promise* should be controlled by the Source of the speech-act, that is, the subject of *give* and the oblique object of *get from*.

This solution was sketched in Jackendoff (1972) and elaborated in Jackendoff (1974). If it is correct, thematic relations play an important role alongside syntactic structure in regulating control, especially in nominals. Similar conclusions have since been reached by Cattell (1984) and Williams (1985).

In a review of Jackendoff (1972), Hust and Brame (1976) offered a single counter-

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example to the claim that thematic relations determine control, an example that so far as I know has not yet been adequately explained.

- (3) Bill was promised to be allowed to leave.

Here, the recipient of the promise controls the complement subject, contrary to the claim above. On these grounds, Hust and Brame dismiss the whole notion of thematic involvement in control. However, notice that control by the recipient of a promise is restricted to a very tiny, syntactically and semantically coherent class of complements.

- (4) a. Bill was promised to be permitted to leave.
 b. *Bill was promised to permit Harry to leave.
 c. *Bill was promised to get permission to leave.
 d. *Bill was promised to leave the room.
 e. *Bill was promised to be hit on the head.
 etc.

That is, the recipient of a promise seems to be able to control the complement subject only when (1) the complement is passive, (2) the complement subject is the recipient of permission from the Source of the promise, *and* (3) the Source of the promise is not overtly mentioned. This is clear in the nominal as well.

- (5) a. Harry_i's promise to Bill_j $\left\{ \begin{array}{l} ?\text{PRO}_i \\ *\text{PRO}_j \end{array} \right\}$ to be allowed to leave
 b. the promise to Bill to be allowed to leave

Thus, the solution to (3) seems inevitably to involve thematic relations again, though more subtly than in my original treatment of (1)–(2).¹

Oehrle (1975; forthcoming) has also suggested counterexamples to the strongest account of (1)–(2), namely, that thematic relations in a nominal are *always* determined by those in the matrix clause. In (6), for instance, *the director* can be either kicker or source of permission to kick; *the dancer* can be either kicker, “kickee,” or interested observer. Only one of these combinations could be predicted by the strongest account.

- (6) The director gave the dancer a kick.

Again, this requires a deeper account of (1)–(2), but it does not eliminate the role of thematic relations. In particular, in the reading of *kick* in which both the director and the dancer are characters involved in the action of kicking, the director must be understood as the kicker and the dancer as “kickee”; the reverse is impossible. By contrast,

¹ Růžicka (1983) offers a solution to (3) in terms of thematic relations, rejecting any purely syntactic solution. His solution—namely, that *promise* requires identity of thematic relations between matrix and complement subjects—is not restricted enough, in that it should allow **Bill was promised to receive the letter*, where both subjects are goals; at the same time it does not account for the evident object control in (5b). His study is nevertheless valuable for its illustration of the cross-linguistic variation in control conditions.

in the parallel reading of *kick* in (7), the roles of director and dancer are reversed, just as in (1)–(2).

(7) The director got a kick from the dancer.

Thus, the problem presented by Oehrle is really one of refining the conditions under which the thematic relations of the matrix verb affect those of the complement, not one of finding an altogether different theory.

All of this is by way of justifying the introduction of thematic relations as part of the account of control. The present article is concerned with laying the proper foundations for a more refined integration of thematic relations into linguistic theory. The notions of θ -role and θ -marking, originally based on thematic relations, are now central to Government-Binding Theory—though often with if anything weaker motivation for thematic analyses than provided in Gruber's work and mine—and parallel notions appear in other syntactic theories as well. Given the importance of these notions, it is crucial to find out what they really are, so that they have an independent life of their own. We must be sure we are not invoking them as a thinly disguised wild card to meet the exigencies of syntax.

Jackendoff (1976) sought to motivate thematic analyses on the grounds of lexical generality and the behavior of different thematic roles in generalized rules of inference. Jackendoff (1983) (henceforth *S&C*) places the study of thematic relations within a more general psychological inquiry into the structure of concepts and thought. The present article briefly describes the essence of the *S&C* theory of Conceptual Semantics and the status of thematic roles within that theory. After this introductory exposition, the article explores in more depth the relation between Conceptual Semantics and the theory of syntax. It then motivates two important enrichments in the theory of Conceptual Semantics itself, which in turn call for further consideration of the syntax-semantics relation, including the proper formulation of the problem of control.

Each step in this progressive deepening of the theory is based on fairly elementary problems in the description of lexical items. As lexical semantics often seems to be thought of as a fairly arcane and imprecise enterprise, I hope through this procedure to show by example how the framework of Conceptual Semantics permits issues of semantic description to be formulated and debated with some rigor.

The syntactic theory I presume throughout is closest in its specifics to Government-Binding (GB) Theory, with occasional sidelong glances at Lexical Functional Grammar (LFG). However, this is mostly a matter of convenience. The conclusions of this article with respect to syntax apply with equal force, I believe, to any syntactic theory that assumes the autonomy of syntax, in other words, any viable contemporary syntactic theory. The gist of these conclusions is that, as one explores in depth the form of a semantic theory that is adequate to the task of lexical description, many aspects of the theory of argument structure, θ -roles, control, and binding prove not to be as purely syntactic as often assumed. It should be emphasized, though, that the main issue treated

here is not “What is the form of syntactic theory?” Rather, it is “What is the form of *linguistic* theory, in particular the semantic portion and its interaction with syntax?” The repercussions for syntax are, for the purposes of this article, a relatively subsidiary issue, even if they assume considerable importance in the context of current trends in research.

2. The Organization of Grammar

The fundamental point, from which all else proceeds, is that *thematic relations are part of a level of semantic/conceptual structure, not part of syntax*. Following S&C, the organization of language includes three autonomous levels of structure: phonological, syntactic, and semantic/conceptual. Each of these has its own characteristic primitives and principles of combination, and its own organization into subcomponents (such as segmental phonology, intonation, and metrical grid in phonology; D-Structure, S-Structure, Phonetic Form (PF), and Logical Form (LF) or c-structure and f-structure in syntax). Each of the levels is described by a set of *formation rules* that generates the well-formed structures of the level.

The grammar also contains sets of *correspondence rules* that link the levels. The correspondence of phonological structure to syntactic structure is specified by one such set; this is, for instance, the locus of “readjustment rules” such as cliticization and the resegmentation of sentences like (8). Notice that the labels of categories in the syntactic structure are syntactic in character, whereas those in the phonological structure are phonological.

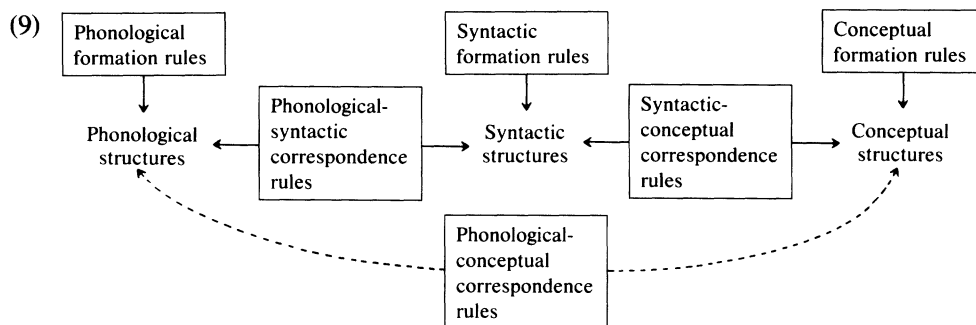
- (8) *Syntactic structure*
 [S This is [_{NP} the cat [S that ate [_{NP} the rat [S that ate the cheese]]]]]
 Phonological structure
 [_{IntPhr} This is the cat] [_{IntPhr} that ate the rat] [_{IntPhr} that ate the cheese]

An explicit theory of the syntax-phonology correspondence appears in Selkirk (1984).

The correspondence of syntactic and semantic/conceptual structures is specified by what used to be called “projection rules,” which determine the relation of syntactic structure to meaning. In addition, if there are aspects of meaning that are determined directly by phonological structure without syntactic intervention, these can be captured by a third set of correspondence rules. (A candidate for such a phenomenon is the interpretation of intonation, which is governed in English by phonological rather than syntactic domains.) The overall organization, then, is sketched in (9).

Notice that (9) contains no explicit lexical component. Where is the lexicon in this picture? Interpreting the standard view of the lexicon within this format, a lexical item can be seen as a small-scale correspondence between well-formed fragments of phonological, syntactic, and conceptual structure; that is, the lexicon is part of the correspondence rule component. Similarly, morphology in general has a phonological part (how an affix is pronounced, how it affects stress, and so on), a syntactic part (what

lexical category the affix attaches to and the lexical category of the resultant), and a conceptual part (what kinds of meanings the affix can be applied to and the meaning of the resultant). (Sproat (1985) develops in detail the separation of phonological and syntactic parts of word formation.)



Looking at (9) from a slightly different angle, we can regard the phonological component as divided into lexical principles (those that apply within words) and extralexical principles (those that apply beyond the word level); however, the basic alphabet of phonological primitives and principles of combination is shared by the two subcomponents. Similarly, Selkirk (1982) argues that the syntactic part of word formation consists essentially of an extension of the principles of X-bar syntax down below the word level, while retaining the characteristic syntactic primitives and principles of combination. In semantics, Gruber (1965), *S&C*, and indeed the generative semanticists (for whom the observation served as one important reason for assimilating semantics to syntactic principles) argued that the semantic primitives and principles of combination that can be expressed through syntactic phrases can in many cases also be incorporated into the internal structure of lexical items. For instance, to the extent that *twice* paraphrases *two times*, or *kill* paraphrases *cause to die*, or *smash* paraphrases *break violently*, or *sell* paraphrases *give away in return for money*, the extralexical semantic structures expressed by the paraphrases must be reproduced internal to unitary lexical items.² In other words, the division of the grammar into three independent levels linked by correspondence rules is cross-cut by a division in each component into lexical versus extralexical principles. Whereas extralexical principles are uniformly productive, lexical principles further divide into productive principles and idiosyncratic (lexically governed, exceptional) ones. (It is important to ask further whether there is a discontinuity in the form of principles in any component as one crosses from extralexical to lexical, or within lexical principles, from productive to idiosyncratic rules. Although I think this is a useful

² This point is explicitly disputed by Jerry Fodor in a number of publications such as Fodor (1975) and Fodor et al. (1980). Fodor claims that lexical meanings are indissoluble monads, innately specified. Besides implying that the concept expressed by the word *telephone* is innate—a conclusion that strains credulity but that Fodor embraces—this position makes it impossible to study lexical relations and argument structure. For replies to the arguments that lead Fodor to this curious position, see *S&C*, sections 5.2, 6.2, and 7.5.

way of couching certain current disputes in morphology, it is not to be an issue taken up here, except for a brief remark in section 11.)

One further remark on (9) might be in order. A last remnant of the Katz-Postal (1964) Hypothesis has survived into contemporary generative grammar: the idea that the creative capacity of the grammar is invested in the syntax, and that phonology and semantics are “interpretive” components that derive their respective structures from some level or another of syntactic structure. (This is seen clearly in GB Theory, for instance, where PF and LF are taken as derived from S-Structure and further components map these into phonology and “meaning,” respectively.) The organization proposed in (9), by contrast, eliminates such syntactocentrism. It treats the three levels as equally “creative”; none is derived from the others. Rather, they are autonomous structures that are placed in correspondence with each other by further independent rule components. This is clearly the correct approach to the syntax-phonology correspondence, given the form of modern phonological theory, replete with autonomous phonological trees, grids, tiers, and the like. The usual “interpretive” approach can be seen in this light as a historical relic of the SPE era, when phonological form looked much more like syntactic surface structure. I suggest that the same is true of the syntax-semantics correspondence, and that much unclarity in the formulation of the syntax-semantics interaction has come from the absence of an autonomous component that characterizes conceptual form.

3. Elementary Principles of Conceptual Structure

Let me give an idea of what this autonomous conceptual component is like, following the theory of Conceptual Semantics in *S&C*. *S&C* argues that conceptual structure is essentially the form in which thought is couched, the “Language of Thought” in the sense of Fodor (1975). Rules of inference and of pragmatics are stated as principles that map conceptual structures into new conceptual structures. Further sets of correspondence rules connect conceptual structure to levels of representation appropriate to non-linguistic modalities, for instance, Marr’s (1982) 3D model level in the visual system (see Jackendoff (1987) for elaboration). It is by virtue of these connections to other modalities that linguistic meaning can be coordinated with understanding of the perceived world.

This fundamental assumption—that meanings are mentally represented—distinguishes Conceptual Semantics from logic-based approaches in much the same way that generative linguistics is distinguished from nonpsychological and behaviorist theories of language. For instance, in model-theoretic semantics, meanings are taken to involve sets of individuals in possible worlds, a conception of meaning patently not squeezable into a finite mind. Situation Semantics (Barwise and Perry (1983)) purportedly takes into account the individual’s relation to the world, but the need for a theory of mental representation is explicitly denied, and a primitive version of the Gibsonian psychology of “attunement to regularities in the world” is put in its place. Given that there is no Gibsonian theory of syntax and phonology on the horizon, much less a Gibsonian theory of language learning, the prospects for integrating Situation Semantics with generative

grammar look dim. (See Jackendoff (1984) for somewhat more extended remarks on Situation Semantics.) By contrast, Conceptual Semantics is worked out according to first principles parallel to those that motivate generative syntax and phonology—the need for finite representability, the creative application of concepts in situations one has not encountered before, and above all the necessity that concepts be learnable from a sufficiently rich innate basis.

Following the S&C theory, the innate formation rules for conceptual structure include, among other things, a vocabulary of primitive conceptual categories or “semantic parts of speech.” These categories include such entities as Thing (or Object), Event, State, Action, Place, Path, Property, and Amount. Here are some of the formation rules for expanding such basic categories into more complex expressions:

- (10) a. $\text{PLACE} \rightarrow [\text{Place} \text{ PLACE-FUNCTION (THING)}]$
- b. $\text{PATH} \rightarrow \left[\begin{array}{c} \left\{ \begin{array}{c} \text{TO} \\ \text{FROM} \\ \text{TOWARD} \\ \text{AWAY-FROM} \\ \text{VIA} \end{array} \right\} \left(\left\{ \begin{array}{c} \text{THING} \\ \text{PLACE} \end{array} \right\} \right) \end{array} \right]_{\text{Path}}$
- c. $\text{EVENT} \rightarrow \left\{ \begin{array}{l} [\text{Event} \text{ GO (THING, PATH)}] \\ [\text{Event} \text{ STAY (THING, PLACE)}] \end{array} \right\}$
- d. $\text{STATE} \rightarrow \left\{ \begin{array}{l} [\text{State} \text{ BE (THING, PLACE)}] \\ [\text{State} \text{ ORIENT (THING, PATH)}] \end{array} \right\}$

(10a) says that a conceptual constituent of the basic category Place can be expanded into a Place-function plus an argument of the function that is of the category Thing. The argument serves as a spatial reference point, in terms of which the Place-function defines a region. For example, in the expression *under the table*, *the table* designates a reference object, and *under* expresses a Place-function that maps the table into the region beneath it. (10b) similarly expands a Path, or trajectory, into one of five functions that map a reference Thing or Place into a related trajectory. An example of a Path with a reference Thing is *to the house*; a Path with a reference Place is *from under the table*, where the trajectory begins at the Place “under the table.”

(10c) says that a constituent of the category Event can be expanded into either of the two Event-functions GO and STAY, each of which takes two arguments. The arguments of GO, which denotes motion along a path, are the Thing in motion and the Path it traverses. This structure appears most transparently in a sentence like *Bill went to New York*. The arguments of STAY, which denotes stasis over a period of time, are the Thing standing still and the Place where it is located, as seen in *Bill stayed in the kitchen*, for instance. (10d) gives two expansions of State; the first is used for specifying the location of objects (*The dog is in the park*), and the second for specifying the orientation of objects (*The sign points toward New York*). (See S&C, chapter 9, for more detailed discussion.)

Certain basic correspondence rules govern the relationship of conceptual constituents to syntactic constituents. The fundamental principle is that, in a sentence, every content-bearing major phrasal constituent (S, NP, AP, PP, and so on) corresponds to a conceptual constituent of some major conceptual category. (The stipulation "content-bearing" is intended to exclude elements like expletive *it* and *there*.) The converse is not the case, however. As will be seen directly, there are conceptual constituents in the meaning of a sentence that do not correspond to any syntactic constituent.

Within this primary correspondence rule, there are subsidiary principles, partly language-specific, concerning which syntactic category can express which conceptual category. NPs can express almost any conceptual category (*horse* = Thing, *earthquake* = Event, *redness* = Property, and so on). A PP can express a Place (*in the house*), a Path (*through the tunnel*), and in English, idiomatically, a Property (*in luck*, *out of your mind*). An S can express an Event or a State. There are in addition markedness relations: in the unmarked case, for example, NP expresses Thing, and S or VP expresses Action. (It has been suggested by various researchers, including Grimshaw (1981), Macnamara (1982), and Pinker (1984), that such markedness conditions are crucial in children's initial acquisition of syntactic categories.)

The relation of syntactic and conceptual constituent structure can be illustrated for a first approximation with an example like (11).

- (11) a. *Syntactic structure*
 [_S[_{NP} John] [_{VP} ran [_{PP} into [_{NP} the room]]]]
 b. *Conceptual structure*
 [_{Event} GO ([_{Thing} JOHN], [_{Path} TO ([_{Place} IN ([_{Thing} ROOM]))])]]]]]

The sentence corresponds to the entire Event in conceptual structure. The verb corresponds to the Event-function GO; in other words, this is a sentence expressing motion. The subject corresponds to the first argument of GO, and the PP corresponds to the second argument. This second argument is composite: the Path-function TO takes a Place as its argument, and the Place in turn decomposes into the Place-function IN and a Thing argument expressed by the object of the preposition.

In order to see how (11b) is put together from its parts, it is necessary to look at the lexical entries for the two items that have argument structure.

- (12) a.
$$\left[\begin{array}{l} \text{into} \\ [-N, -V] \\ \text{[--- NP}_j\text{]} \\ [\text{Path TO ([Place IN ([Thing } l_j\text{])}])] \end{array} \right]$$

 b.
$$\left[\begin{array}{l} \text{run} \\ [-N, +V] \\ \text{[--- (PP}_j\text{)]} \\ [\text{Event GO ([Thing } l_i\text{, [Path } l_j\text{])}] \end{array} \right]$$

Into requires an NP object, which is coindexed with the argument position in conceptual structure. *Run* is slightly more complicated. Semantically, it requires two arguments, the Thing in motion and the Path that specifies the trajectory of motion. The first is indexed *i*, which we will take by convention to indicate subject position. (Alternatively, it is the “external argument” in the sense of Williams (1984; 1985).) The second argument is filled in with the reading of the postverbal PP, with which it is coindexed in the subcategorization feature. If no PP is syntactically present, the Path is simply unspecified: *John ran* means in part ‘John traversed some (unspecified) trajectory’. In other words, the well-formedness conditions on conceptual structure require this argument to be present conceptually even if it is not expressed.

A similar conceptual structure can be expressed in different syntactic form, for example by a sentence like (13).

- (13) John entered the room.

Here *enter* is a transitive verb, with a lexical entry like (14).

- (14)
$$\left[\begin{array}{l} \text{enter} \\ [-N, +V] \\ \text{[] (NP}_j\text{)]} \\ \text{[Event GO ([Thing }]_i, [\text{Path TO ([Place IN ([Thing }]_j)\text{)])}] \end{array} \right]$$

This verb incorporates into its meaning the Path- and Place-functions expressed separately by the preposition *into* in (11a). Notice that the intransitive version, *John entered*, means not just ‘John traversed some path’ but ‘John went into something’. That is, the sense of *into* appears even when the second argument is unspecified.³

These examples show the elementary properties of the mapping between syntactic and conceptual structure. Words in general need not correspond to complete conceptual constituents—they correspond to constituents with open argument places. The argument places in turn may be embedded two or more functions down into the conceptual constituent, as seen in (12a) and (14); the only stipulation on arguments is that they themselves be full constituents. (This is codified as the “Lexical Variable Principle” in S&C, section 9.5.) For the moment I will assume that the link between argument positions and syntactic positions is stipulated by coindexing in the verb’s lexical entry; I will briefly mention the possibility of general linking principles in sections 6 and 8.

4. The Status of Thematic Relations

Given this elementary exposition of Conceptual Semantics, where do thematic relations fall out in the theory? Recall Gruber’s intuitive definition of Theme: the object in motion

³ This formalism is slightly different from that in S&C, where the indices for conceptual arguments are inside the brackets, for example, $[\text{Thing } i]$ for the first argument of *run* and *enter*. The change in notation has two advantages: first, it parallels the notated indexation in the syntactic structure, which is outside the NP; second, it facilitates the representation of selectional restrictions to be presented in section 6. It is otherwise of no significance.

or being located. This can be structurally defined as the first argument of the functions GO, STAY, BE, and ORIENT (and of a further small number of related functions that together form a coherent family). Source, “the object from which motion proceeds,” appears structurally as the argument of the Path-function FROM. Note that Source is *not* a direct argument of the Event-function but is embedded within a Path constituent.⁴ Similarly, Goal, “the object to which motion proceeds,” is the argument of the Path-function TO. Agent is the first argument of an Event-function [_{Event} CAUSE (*i*, *j*)], where *j* is the Event being caused. Experiencer presumably is an argument of an as yet unexplored State-function having to do with mental states. In other words, thematic relations are to be reduced to structural configurations in conceptual structure; the names for them are just convenient mnemonics for particularly prominent configurations.⁵

In support of this claim, notice that there are many kinds of arguments for which there is no traditional name. For example, consider the object of the verb *pass*, as in *John passed the house*. This means essentially ‘John passed *by* the house’. *By* is an elaboration of the Path-function VIA—roughly, VIA NEAR; this function is optionally incorporated into the verb *pass*, just as TO IN is (obligatorily) incorporated into *enter*. The direct object of transitive *pass* thus is understood as the argument of this Path-function; it is neither Source nor Goal nor Theme in the usual sense. (Section 7 treats the formalism responsible for such optional incorporation.)

Similarly for the direct objects of *jump* (*John jumped the gorge*), *approach* (*John approached Harry*), and *pierce* (*The arrow pierced the target*); these verbs incorporate OVER/ACROSS, TOWARD, and THROUGH (or VIA IN), respectively. Although there is no standard name for the thematic relations of these direct objects, their conceptual roles are perfectly well defined and fall out of the general account of Path-functions. Likewise, there is (oddly enough) no standard name for the second argument of CAUSE, the caused Event; perhaps Effect would be the most appropriate.

A slightly different case arises with the transitive use of the verb *climb*. In *John climbed the mountain*, it is not the mountain that is Goal, but the top of the mountain. That is, transitive *climb* embeds its NP argument in a structure something like [_{Path} TO ([_{Place} TOP OF ([_{Thing}]_{*j*}))]. There is a Goal, both intuitively and formally, but it is a location on the Thing denoted by the direct object, not the Thing itself. Again, we do not want to have to invent a new thematic role for the object of *climb*; treating thematic roles as structural positions in conceptual configurations eliminates any such need.

My claim, therefore, is that the terms *Theme*, *Agent*, and so on, are not primitives

⁴ This is a major difference between the S&C theory and the theories of Jackendoff (1972; 1976), where Source and Goal were direct arguments of the GO-function. The difficulty with the earlier formalism was that it could not express the semantic contribution of any prepositions other than *from* and *to*. The innovation of a Path constituent corresponding to PP permits all prepositions of Path to be handled uniformly, an important descriptive advance. Here, then, the change of notation is of theoretical significance, unlike the change mentioned in footnote 3.

⁵ It should be mentioned that this position on thematic relations is implicit in Gruber (1965) and explicit in Jackendoff (1972): see especially pp. 37–41 of the latter, where it is compared in examples (2.56) and (2.58) with the view of thematic relations as diacritics.

of semantic theory. Rather, they are relational notions defined structurally over conceptual structure, with a status precisely comparable to that of the notions Subject and Object in many syntactic theories (for example, the Standard Theory, the Extended Standard Theory, and GB Theory, but not LFG and Relational Grammar). In particular, they are not marked as annotations to D-Structure (GB Theory) or to predicate argument structure (LFG; see Bresnan (1982c, 293)). Nor are they specified at a special level of representation such as Stowell's (1981) "θ-grid," Williams's (1984, 640) "argument structure," or Culicover and Wilkins's (1986) "R-structure."⁶

Why is this important? It has to do with the independent motivation of thematic analyses. If there is going to be any way to determine the thematic roles in a sentence, it has to begin with semantic intuitions like those that motivated Gruber. To deal with unclear cases, these intuitions must be regimented into a format that permits independent semantic constraints. An annotation of syntax or a list of θ-roles in the sentence permits no such independent constraints. By contrast, the *S&C* account embeds the theory of thematic roles in a rich system governed by its own combinatorial properties, such as those illustrated in (10).

In addition, an important way of differentiating thematic roles is to see how they behave in rules of inference. As shown in Jackendoff (1976), each kind of argument position plays a distinct role in rules of inference, which are stated over full conceptual structures, not over a list of θ-roles. For instance, (15) is a semiformalized version of an inference rule involving the functions GO and TO.

- (15) For an Event of the form
 [_{Event} GO (X, [_{Path} TO (Y)])],
 there is a point in time *t*, the termination of the Event. At *t*, the following holds:
 [_{State} BE (X, [_{Place} AT (Y)])];
 and for some interval of time leading up to but not including *t*,
 NOT [_{State} BE (X, [_{Place} AT (Y)])].

Informally, (15) says that at the end of an Event of going to some place, one is at that place, and before the end of the Event, one is not there. This inference depends on the total conceptual configuration; it does not hold if either of the functions in the Event is changed—for instance, if TO is changed to TOWARD, as in *Bill ran toward the room*, or if GO is changed to ORIENT, as in *Bill pointed to the house*.

Inference rule (15) is one of the pieces of evidence for the generalization of spatial semantics to other semantic fields, demonstrated by Gruber. For instance, as shown in

⁶ Some other theories contain a level of argument structure in which thematic roles are not even named. Higginbotham (1985, 555), for instance, speaks of the "thematic grid" of the lexical item *see* but gives it just the content ⟨1, 2, E⟩, that is, a first and second argument plus an "event argument." Such a level is devoid of semantic content; it is just an indexing device. The theory of thematic relations presented here thus does not, strictly speaking, have any bearing on its existence. Section 10 will show, however, that such a level is unnecessary—that it is simply an abbreviation for certain aspects of a verb's conceptual structure.

Jackendoff (1976) (for a slightly different form of the rule), (15) licenses inferences from (16a) to (16b) in the Possessional field, from (17a) to (17b) in the Identificational field, and from (18a) to (18b) in the Circumstantial field.

- (16) a. Bill gave the book to Harry.
- b. (At the appropriate time *t*,) Harry had the book.
- (17) a. The light changed from red to green.
- b. (At the appropriate time *t*,) the light was green.
- (18) a. Bill forced Harry to shut up.
- b. (At the appropriate time *t*,) Harry shut up.

An important test of a putative generalization of θ -roles to a new case, then, is to see whether the rules of inference generalize properly. In the present context, the point is that one cannot state inference rules over a mere list of θ -roles in a sentence, since a list of θ -roles does not express an assertion. On the other hand, if θ -roles are regarded as structural relations in conceptual structure, as proposed here, the inferential possibilities grow directly out of the structure in which the θ -role-bearing NPs are embedded.

It might turn out, still, that only limited aspects of conceptual argument structure interact with syntax—for example, to determine control in cases like (1)–(2). This might be seen as motivation for an independent level of θ -Structure that encodes only a subset of conceptual information. But if indeed such limitations exist, there is an alternative account that requires no extra level of representation: one can incorporate the constraints directly into the correspondence rule component. For example, various syntactic processes make use of the singular/plural distinction, but none so far as I know ever make use of the red/orange distinction. One could account for this either by claiming that there is a level of argument structure that encodes number but not color, or else by claiming that the correspondence rules between semantics and syntax can refer only to number but not color. As far as I can see without detailed examples, the constraints on the theory and the need for stipulation are exactly the same in either case, and the latter treatment makes do with one fewer level of representation. (Not that I am generally against extra levels, as will be seen in sections 8 and 9, but here it seems superfluous.)

To sum up, thematic relations are *not* like case-markers, that is, a system of diacritics. Rather, they are a system of structural relations. The constraints on their number and type follow from whatever constraints exist on the range of conceptual functions necessary to express the meanings of verbs.

Three quick consequences follow from this conclusion. First, there is no θ -role of *subject* (as appears in Baker (1985), for example, and as alluded to, perhaps in a moment of terminological inattention, by Chomsky (1981, 148, note 113)). *Subject* is a syntactic relation, not a conceptual one, and syntactic subjects can hold a variety of different θ -roles.

Second, not only NPs receive θ -roles. For instance, *green* is a Goal in (17a), and *PRO to shut up* is a Goal in (18a). From the latter case we see that *proposition* is not

the θ -role for a subordinate clause, as suggested by Bresnan (1982c, 293). *Proposition* may be a conceptual category like Thing and Event, expressed most frequently by an S. But if there is such a conceptual category, it can occur in various thematic roles, just as Things can.

Third, there cannot be a “default” thematic relation in the sense that there is a “default” or “neutral” case Objective in Fillmore’s (1968) Case Theory—a thematic relation that an NP is assigned when it has nothing else. Rather, an NP must correspond to a specific argument position in conceptual structure and therefore must have a specific thematic role. Some have taken Theme or Patient to be such a default role: if one can’t think of anything else to call an NP, call it Theme or Patient (and some have treated the two terms as interchangeable). However, Theme has a specific structural definition, following Gruber, and Patient (traditionally the “object affected by the action”) is not a role in Gruber’s system. Thus, neither can serve as a default case in any event. I will take up a possible treatment of Patients in section 8; meanwhile, I want to maintain that every putative θ -role assignment must be justified on the grounds of its place in conceptual structure. The notion of a default conceptual role is incoherent.

5. The Status of the θ -Criterion

Given this theory of thematic relations, let us examine the θ -Criterion, which says, in our terms, (1) that each subcategorized NP (plus the subject) corresponds to exactly one argument position in conceptual structure, and (2) that each argument position (or *open* argument position) is expressed by exactly one NP.⁷ Here is a variety of examples that collectively suggest that this statement of the θ -Criterion must be weakened.

5.1. Cases Where an NP Has More Than One θ -Role

In sentences with transaction verbs such as *buy*, *sell*, *exchange*, and *trade*, two actions are going on at once. For instance, *buy* involves at least the components (19a) and (19b).

- (19) X buy Y from Z
 - a. Y changes possession (from Z) to X
 - b. money changes possession from X to Z

Thus, X and Z have two semantic roles apiece. We cannot save the θ -Criterion by just saying that the roles in the countertransfer (19b) do not count: it is precisely the presence

⁷ This is the θ -Criterion as generally understood. It is stated in essentially this form on page 36 of Chomsky (1981) and repeated in various places throughout the book (for example, page 112) and in Chomsky (1982, 6). However, Chomsky’s initial statement of the θ -Criterion is immediately hedged by note 14, page 139, where he refers to exactly the sorts of examples we are about to examine, citing the discussion in Jackendoff (1972). As Chomsky’s footnote makes clear, the objective of the θ -Criterion is to make sure that NPs do not acquire additional θ -roles in the course of a derivation. Chomsky’s formal statement of the θ -Criterion (1981, 335) makes this insight explicit but otherwise little resembles the original statement. On the other hand, subsequent literature has often made use of the θ -Criterion as though its primary insight is biuniqueness between θ -roles and NPs in argument positions; it is this aspect of the θ -Criterion I shall be addressing, not the one that Chomsky regards as most significant for GB Theory.

of the countertransfer that distinguishes *buy* from *obtain*. Moreover, the countertransfer does play a role in syntax. Notice what happens when we append *for \$5* to both *buy* and *obtain*.

- (20) a. X bought Y from Z for \$5.
b. X obtained Y from Z for \$5.

Both of these sentences express a countertransfer. That is, *obtain* permits a countertransfer to be indicated by a *for*-phrase, and X and Z take on the requisite extra roles. *Buy*, however, always requires a countertransfer in the semantics, which *may* be expressed in part by the *for*-phrase. So the possibility of a countertransfer does have syntactic reflexes.

Another verb with multiple θ -roles on each NP is *chase*. For an action to count as chasing, at least three conditions must be satisfied.

- (21) X chase Y
a. Y in motion
b. X moves toward (or in path of) Y
c. X intends to go to (or catch) Y

If Y is standing still, X isn't chasing Y (we don't have a verb for only (21b,c), I don't think). Similarly, if X isn't moving toward Y, X isn't chasing Y, whatever Y's motions and X's intentions; and if X doesn't intend to go to (or catch) Y, X is at best *following* Y, not chasing Y. X therefore has two essential roles and Y three. Is there any reason to call one of these *the* θ -role of X or Y? Perhaps, but it requires some motivation.

5.2. Cases Where Multiple NPs Hold a Single θ -Role

On the flip side of these cases are others where two NPs in the sentence seem to have the same θ -role. Here are three (pointed out by Gruber (1965, section 7.3) and by Dick Carter in talks at MIT, fall 1984).

- (22) a. The box has books in it (*self).
b. Bill brought/carried some books with him (*self).
c. The list includes my name on it (*self).

In (22a) *the box* and *it* do not appear to have distinct θ -roles; notice the apparent synonymy with *There are books in the box*, where this participant in the state is expressed only once. Notice also the impossibility of questioning the object of the preposition (**What does the box have books in?*), befitting its status as necessarily coreferential to the subject. This NP position is also curious in that a reflexive is impossible, even though for all the usual structural reasons there ought to be one; I am not familiar with any attempts in the literature to explain this difference.

Similar considerations apply to (22b,c), where *with him* and *on it* do not seem to add any information. They can be omitted without loss, and they cannot be questioned

(**Who did Bill bring some books with?*, **What does the list include my name on?*). No other NP can be substituted in (22b) (**Bill brought some books with Harry*), and only NPs that express some location within the list can be substituted in (22c) (*The list includes my name on its/the first page*). Again the reflexive is unaccountably ruled out.

In each of these cases, then, two different NPs in the sentence appear to satisfy the same θ -role. We thus have counterexamples to both parts of the θ -Criterion.

Why is this important? The θ -Criterion is normally based on the view of θ -roles as annotations to syntactic structure (that is, many linguists write of θ -marking and case-marking as though these are comparable phenomena). My purpose in presenting (19)–(22) is to show that the θ -Criterion as generally understood is not so obviously correct and that the view of θ -roles that it presupposes is itself problematic. The correspondence between syntax and θ -roles must be stated in somewhat less rigid terms, in particular admitting the real richness of thematic roles. Section 10 will recast in more adequate terms the insight that the θ -Criterion attempts to express.

6. Argument Substitution and Selectional Restrictions

Having laid out the basic position of Conceptual Semantics on the status of thematic relations, I want to explore some of the consequences for encoding lexical entries of verbs. To do this, I must first be more specific about the combinatorial rules that develop conceptual structure for a sentence from its parts. Let us consider again how the lexical entries in (12) are used to build up the conceptual structure (11b). For a first approximation, the general principle involved might be (23).

(23) *Argument Substitution I*

For each indexed position in the reading of the verb or preposition, substitute the reading of the syntactic constituent in the sentence that satisfies the coindexed position in the verb's subcategorization feature. For the position indexed *i* in the reading of the verb, substitute the reading of the subject.

(23) would apply in (11a) three times: to substitute the reading of *the room* into the variable in the reading of *into*, to substitute the reading of *into the room* into the Path-variable in the reading of *run*, and to substitute the reading of *John* into the Thing-variable in the reading of *run*.

Two immediate remarks. First, (23) assumes that all correspondences of argument positions and syntactic positions are stipulated in the verb's (or preposition's) lexical entry. Yet clearly there are regularities, such as the fact that agents invariably appear in subject position. There are various ways to express such regularities and thus to leave predictable indices out of lexical entries. One would be to effect predictable correspondences by special cases within (23), for instance, "For the first argument of CAUSE, substitute the reading of the subject." Another alternative is to preserve the form of (23) but fill in predictable coindexing within lexical entries by redundancy rules, for instance,

“Assign to the first argument of CAUSE the index *i*.” I will leave this issue open, since it makes little difference for present purposes; for now, the indices will be left as is.

Second, (23) does not stipulate that the coindexing is biunique. That is, there is nothing to prevent two indexed positions in conceptual structure from bearing the same index and hence being filled with the same information from the syntax. This is of course a way for a single NP to receive multiple θ -roles, as in (19) and (21). Similarly, there is nothing to prevent two syntactic positions from bearing the same index and hence being mapped into the same θ -role. This is presumably what is happening in cases like (22) (though a formal account is not without problems). I will deal with some refinement of this situation in section 10.

The issue I want to take up in this section, though, concerns the adequacy of the term *substitute* in (23). As stated, (23) permits the reading of any NP in an argument position to be substituted for the coindexed variable in the verb’s reading. So, for example, it would apply to (24a) to give a reading (24b).

- (24) a. Sincerity entered the room.
 b. [Event GO ([Property SINCERITY], [Path TO ([Place IN ([Thing ROOM])]])])]

Among other things, what is wrong with (24) is that the Theme is of an incorrect conceptual category: a Property cannot be the Theme of spatial motion. This restriction is already present in the lexical entry (14) for *enter*, where the position indexed *i* is specified as a Thing. (23), however, does not attend to such specification: it just dumbly substitutes the reading of the subject, whatever its category, into the requisite position.

An immediate remedy would be to revise (23) to (25) (changes marked in italics).

(25) *Argument Substitution II*

For each indexed position in the reading of the verb or preposition, substitute the reading of the syntactic constituent in the sentence that satisfies the coindexed position in the verb’s subcategorization feature, *if its conceptual category matches that of the indexed position*. For the position indexed *i* in the reading of the verb, substitute the reading of the subject *if its conceptual category matches that of the position indexed i*.

Given this extra condition, the subject of (24a) would fail to be substituted into the appropriate argument position and hence the sentence could not receive a well-formed reading.

However, the problem with (24) is symptomatic of a broader problem, that of how to stipulate selectional restrictions, that is, semantic restrictions on arguments that go into more detail than merely the conceptual category. Three typical examples are the object of *drink*, which must be a liquid, the direct object of *pay*, which must be an amount of money, and the subject of German *fressen* ‘eat’, which is predicated only of animals. In each of these cases the selectional restriction is part of the verb’s lexical entry but does not follow in any obvious way from the action predicated by the verb. One can

pour a powder down one's throat, but one cannot *drink* a powder; one can give someone five cats in exchange for a book, but one cannot *pay* someone five cats for a book; and although a girl can eat, *Das Mädchen frißt* can only be meant facetiously.

Selectional restrictions evidently are constructed out of a subvocabulary of conceptual structures. That is, the set of possible selectional restrictions is chosen from primitives and principles of combination present in conceptual structure, including not only major conceptual category but also distinctions such as solid versus liquid, human versus animal, and so on. Thus, the appropriate linguistic level for stating them is conceptual structure and not syntax or a putative level of argument structure.

Chomsky (1965, 110–111) suggests that selectional restrictions be formally treated as conditions on lexical insertion—essentially, that a verb cannot be inserted into a sentence if its arguments violate its selectional restrictions. Rule (25) is stated in this spirit. However, if we are interested in accounting for the interpretations of sentences as well as their grammaticality, Chomsky's formalization is not enough. For instance, it tells us only that the sentences in (26) are grammatical; it does not tell us that *it* in (26a) is understood to be a liquid, that *a lot* in (26b) is understood to be a lot of money, or that *sie* 'she' in (26c) is understood to be a female animal.

- (26) a. Harry drank it.
- b. Bill paid Harry a lot.
- c. Sie frißt.

This fact is noticed by Katz (1972, 107), who points out that the anomalies of selectional restriction violations and the construal of proforms in the context of selectional restrictions ought to be recognized as reflections of the same phenomenon.

The proper treatment of selectional restrictions is suggested by further cases, where an argument is not even syntactically expressed.

- (27) a. Harry drank (again).
- b. Bill paid.

Here Harry is still understood to have ingested a liquid and Bill to have given away some amount of money. From this we see that *selectional restrictions are essentially explicit information that the verb supplies about its arguments*. If an argument is unexpressed, the information is supplied entirely by the verb. If an argument is expressed by an NP, the verb supplements the NP's reading with material of its own. If the NP argument is a proform, the verb's selectional features are added to the interpretation of the proform; if the NP is content-bearing, the selectional features are still added, though in some cases they will be redundant. (They are not always redundant: in *Hans frißt*, we know that Hans is an animal.) Finally, a selectional restriction violation occurs if the features supplied by the verb conflict with those of the NP argument.

In short, a selectional restriction should not be regarded as a contextual condition on the insertion of a verb. Rather, it is part of the verb's meaning and should be fully integrated into the verb's argument structure.

To capture this theoretical intuition in the present framework, we can treat a selectional restriction simply as ordinary semantic structure that happens to occur within an indexed conceptual constituent. So, for example, *drink* will have a lexical entry like (28). (I will assume it means ‘cause a liquid to go into one’s mouth’, obviously an oversimplification, but sufficient for the present point.)

- (28)
$$\left[\begin{array}{l} \text{drink} \\ [-N, +V] \\ \text{— (NP)}_j \\ [\text{Event CAUSE } ([\text{Thing }]_i, [\text{Event GO } ([\text{Thing LIQUID}]_j, \\ [\text{Path TO } ([\text{Place IN } ([\text{Thing MOUTH OF } ([\text{Thing }]_i)])])])])]) \end{array} \right]$$

In this entry the selectional restriction on the direct object appears as the semantic marker LIQUID within the constituent indexed *j*.

In order to make use of this marker, we cannot simply substitute the reading of the direct object NP for the constituent indexed *j*. Rather, it is evidently necessary to regard the reading of an NP argument as somehow fused or merged with the semantic markers already present in the constituent. I will not try to characterize such an operation of fusion formally,⁸ but intuitively its effect is clear: a conceptual constituent *C* resulting from the fusion of constituents *C*₁ and *C*₂ contains all the markers of *C*₁ and *C*₂, and redundant markers are deleted. If *C*₁ and *C*₂ contain markers that are incompatible, the fusion of *C*₁ and *C*₂ is ill-formed. This will occur, for example, if the offending markers are sisters in a taxonomy of mutually exclusive possibilities, such as Thing/Property/Place/Event or solid/liquid/gas.

We can now replace Argument Substitution with a rule of Argument Fusion.

(29) *Argument Fusion*

Into each indexed constituent in the reading of the verb or preposition, fuse the reading of the syntactic constituent in the sentence that satisfies the co-indexed position in the verb’s subcategorization feature. Into the position indexed *i* in the reading of the verb, fuse the reading of the subject.

In *Harry drank the wine*, Argument Fusion combines the reading of *wine* with the constituent [_{Thing} LIQUID]_j; the redundant marker LIQUID is deleted. In *Harry drank it*, the result of merger is the reading ‘contextually specific liquid’, the former part coming from the pronoun and the latter from the verb. In *Harry drank*, there is no NP to be merged with the *j*-indexed constituent, so the reading is merely ‘liquid’ and otherwise unspecified. In *Harry drank the powder*, fusion cannot apply because *powder*, with the marker SOLID, clashes with LIQUID. In *Harry drank sincerity*, the clash is on the major category feature: the verb supplies the feature Thing, but *sincerity* supplies the feature Property. Thus, Argument Fusion deals with all the observed phenomena con-

⁸ Something formally similar to fusion appears in Kaplan and Bresnan’s (1982, 274) “Merge” operator, which fuses f-structures instead of conceptual structures. Fusion appears to be a variety of the “unification” operation developed in Shieber (1986).

cerning selectional restrictions, including the use of selectional restrictions to make sure that the major conceptual category of an argument matches that stipulated by the verb.

According to this account, selectional restrictions on arguments are of exactly the same form as stipulation of totally incorporated arguments such as the Theme in (30a) and the goal in (30b).

- (30) a. Harry buttered the bread.
b. Joe bottled the wine.

The verbs in (30) have the conceptual structures in (31).

- (31) a. [_{Event} CAUSE ([_{Thing} _i, [_{Event} GO ([_{Thing} BUTTER],
[_{Path} TO ([_{Place} ON ([_{Thing} _j)])))]))]
b. [_{Event} CAUSE ([_{Thing} _i, [_{Event} GO ([_{Thing} _j,
[_{Path} TO ([_{Place} IN ([_{Thing} BOTTLE)])))])))]

In (31a) the Theme bears no index and thus is not to be connected to a subcategorized position. As a result, this argument is totally filled in with information from the verb and understood as ‘nonspecific butter’. In (31b), by contrast, it is the Goal that bears no index and hence receives its interpretation (‘nonspecific bottle(s)’) entirely from the verb.

Comparing (31a) with (28), we notice that the similarities and differences between *butter* and *drink* fall out directly from the notation adopted here. There is no need to interpose a level of argument structure to encode them. Both are verbs that mean ‘cause something to go someplace’. They differ semantically in what further information they stipulate about the Theme and the Path; they differ syntactically only in that *butter* is obligatorily transitive and *drink* is optionally transitive. But their most striking difference from the present point of view is in the syntactic-semantic correspondence they stipulate. The direct object of *butter* is the Goal, and the Theme is completely specified by the verb. By contrast, the direct object of *drink* is the Theme, and the Path is (almost) completely specified by the verb.

The point of this comparison is that the specification of semantic structure in arguments of the verb—part of the verb’s meaning—can be regarded as in large part orthogonal to the positions of indices on arguments—the way the verb connects to syntactic structure. If a constituent of the verb’s meaning is indexed, its semantic features appear as a selectional restriction; if a constituent is unindexed, its features appear as the content of an ‘implicit argument.’ Thus, the notion of selectional restriction can be dropped from linguistic theory except as a convenient name for the effects of Argument Fusion.⁹

⁹ Katz (1972, 107) arrives at a similar conclusion, and he nearly states an equivalent of Argument Fusion. However, he keeps separate the use of selectional restrictions to predict anomalies from their use to fill in readings of proforms; the latter is his rule (3.77).

Since this article went to press, it has come to my attention that a more general formulation, actually closer to the one advocated here, appears under the term ‘transfer features’ in Uriel Weinreich’s ‘Explorations in Semantic Theory’ (1966). Weinreich’s paper is criticized at length by Katz in a 1967 article in *Foundations of Language* but is not mentioned in the present context in Katz (1972).

7. Multiple Argument Structures

An important problem for the theory of the lexicon is how to unify the various sub-categorization frames of a lexical item into a single entry. There has been considerable discussion of relatively productive changes in argument structure such as passive, middle, and causative constructions (references too numerous to cite). Here, however, I would like to pay attention to some cases of variability in argument structure that are specific to individual lexical items and therefore are not to be formulated as general lexical rules of the language.

Consider the verb *climb*.¹⁰ It appears in three syntactic contexts: with a null complement, with a direct object, and with a PP.

- (32) a. Joe climbed (for hours).
 b. Joe climbed the mountain.
 c. Joe climbed $\left\{ \begin{array}{l} \text{down the rope} \\ \text{along the ridge} \\ \text{through the tunnel} \\ \text{etc.} \end{array} \right\}$.

As observed in section 4, the conceptual structure for the transitive case (abstracting away from various complications) is (33).

- (33) [Event GO ([Thing i], [Path TO ([Place TOP OF ([Thing j)]])]]]

However, the PP complement does not require the subject to reach the top of anything—it specifies only that the subject is traversing some Path described by the PP (in a clambering manner). The null complement leaves the Path totally unspecified. In particular, it too does not imply that the subject got to the top of anything (compare to intransitive *enter*, which implies that the subject went into something).

Jackendoff (1985a) develops an abbreviatory convention that permits these structures to be collapsed into a single lexical entry. Essentially, the index for the postverbal argument appears in two different positions in the verb's conceptual structure, but the two positions are marked as mutually exclusive by enclosing them in curly brackets. Using this notation, the lexical entry for *climb* looks like (34).¹¹

- (34) $\left[\begin{array}{l} \text{climb} \\ [-N, +V] \\ \text{— (XP}_j\text{)} \\ [\text{Event GO ([Thing } i, [\text{Path } \{\text{TO ([Place TOP OF ([Thing } j\text{])}}\}_{\{j\}}]]}] \end{array} \right]$

¹⁰ This verb is discussed in much greater detail in Jackendoff (1985a), and I ignore here considerations that are irrelevant to its argument structure. Some of the observations that led to this analysis appear in Gruber (1965, section 2.1). I am grateful to Larry Horn for pointing out (personal communication) that some of my further observations appeared, unbeknownst to me, in Fillmore (1982); I apologize to Fillmore for this oversight.

¹¹ This looks slightly different from the version in Jackendoff (1985a), because of the change in notation for indices described in footnote 3. The present notation is somewhat more perspicuous for the cases to follow.

The Path constituent in (34) abbreviates the two possibilities in (35).

- (35) a. [Path TO ([Place TOP OF ([Thing l_j)])]
 b. [Path l_j]

To see how (34) works, consider how Argument Fusion applies to the sentences in (32). Start with the transitive case (32b). *The mountain* is of the conceptual category Thing. Since Argument Fusion must combine it with an indexed constituent of category Thing, only the realization of the Path given in (35a) is possible. Thus, (32b) says that Joe went to the top of the mountain. On the other hand, a PP complement as in (32c) is of the conceptual category Path and therefore must be fused with realization (35b) of the Path. Hence, there is no implication of reaching the top of anything. Finally, in the case of a null complement, neither choice of j can be satisfied, so the Path is indeterminate.

The subcategorization feature in (34) stipulates merely an optional postverbal phrase of arbitrary major phrasal category. This simplification is possible because of the selectional restrictions of the verb: only an NP or a PP can correspond to a conceptual constituent of the proper category. Things must always be expressed in English by NPs; Paths in the unmarked case are expressed by PPs.

However, there is a further, marked possibility: a small class of nouns such as *way* and *route* map into Paths instead of Things. Notice what happens when these nouns head the direct object of *climb*.

- (36) We can get down there by climbing this $\left\{ \begin{array}{l} \text{route} \\ \text{way} \end{array} \right\}$.

(36) shows that, in these cases, unlike with other direct objects, climbing need not imply getting to the top of anything. The reason is that the NP *this route/way* expresses a Path; hence, it must fuse with realization (35b) of the Path constituent, which does not contain TO TOP OF. In other words, *this route/way* behaves semantically like a PP, even though its syntax is clearly that of an NP. The interpretation of *climb this route* is therefore predicted by lexical entry (34), without further ado. There is, for example, no need to advert to an idiosyncratic rule of preposition deletion or an empty preposition in order to account for the interpretation.

Another verb that works much like *climb* is *jump*. To *jump a fence* or *jump a gorge* means roughly 'jump over NP'; that is, the Path-function VIA OVER is incorporated. But with a PP complement, any path is possible: *jump toward Bill*, *jump around the corner*, *jump through the hoop*. Moreover, *jump right this way* (where *right* excludes the irrelevant manner reading 'in this fashion') does *not* incorporate *over*. Thus, the treatment of *climb* generalizes to this verb as well.

A subtly different combination of multiple arguments appears in the verb *pass*. Syntactically, it looks the same as *climb*.

- (37) a. The train passed.
 b. The train passed the station.
 c. The train passed $\left\{ \begin{array}{l} \text{through the tunnel} \\ \text{under the bridge} \\ \text{etc.} \end{array} \right\}$.

The conceptual structure for the transitive case, like that of *climb*, incorporates Path- and Place-functions; it means roughly 'go via near':

- (38) [Event GO ([Thing i], [Path VIA ([Place NEAR ([Thing j])]])]

However, the PP complement differs from that of *climb* in that it is subject to a selectional restriction: Source, Goal, and Direction expressions are ungrammatical.

- (39) *The train passed $\left\{ \begin{array}{l} \text{(away) from the station} \\ \text{to the station} \\ \text{toward the station} \\ \text{northward} \end{array} \right\}$.

With a few possibly idiomatic exceptions such as *pass from sight*, the PP complements of *pass* are restricted to Routes—essentially Paths whose Path-function is VIA.

This combination of argument structures can be expressed by placing curly brackets slightly differently than in (34).

- (40) $\left[\begin{array}{l} \text{pass} \\ [-N, +V] \\ \text{— (XP}_j\text{)} \\ [\text{Event GO ([Thing } i\text{], [Path VIA ([Place \{NEAR ([Thing } j\text{])})\}])}] \end{array} \right]$

The Path constituent here abbreviates the two possibilities in (41).

- (41) a. [Path VIA ([Place NEAR ([Thing j])])]
 b. [Path VIA ([Place j])] _{j}

The difference from *climb* appears in (41b). Whereas in (35b) the variable j is stipulated only as a Path, in (41b) it is stipulated as a Path whose Path-function is VIA. This further stipulation makes it impossible to fuse this constituent with the interpretation of PPs such as those in (39), which have different Path-functions.

This verb illustrates an important advantage of the approach to selectional restrictions proposed in the previous section. The very same marker, VIA, plays two apparently different roles in the verb *pass*. In realization (41a) it appears as an incorporated Path-function, altogether parallel to the incorporated functions TO IN in *enter*. But in realization (41b) it plays the role of a selectional restriction on the PP complement. In the present approach this falls out naturally. When VIA is outside the indexed constituent, as in (41a), it is information supplied solely by the verb—which is what is meant by an incorporated function. When VIA is inside the indexed constituent, as in (41b), it in-

teracts with the information supplied by the PP complement—which is what is meant by a selectional restriction. No further distinctions need to be invoked.

Moreover, the difference between *pass* and *climb* is expressed simply by the placement of the inner curly brackets. Because those in *climb* include the Path-function TO, TO drops out if the outer *j* is chosen. By contrast, the Path-function VIA in *pass* is not within the inner curly brackets, so it remains as a selectional restriction if the outer *j* is chosen.

A case similar to *pass* is *cross*. *Cross NP_j* means roughly ‘go over NP_j to other side of NP_j’; the rather complex Path-function ‘across’ has been incorporated. *Cross PP_j* puts a corresponding selectional restriction on PP_j that permits *cross over the river* and *cross to the other side* but not **cross toward the house*, **cross around the car*, or **cross up the stairs*. (Other possibilities such as *cross between the signs* describe the overall location of the event of crossing and are not relevant.) Evidently this verb’s possibilities are formalized much like those of *pass*. In fact, the Path-function incorporated in transitive *cross* is similar enough to that in transitive *jump* that the two verbs constitute a near-minimal pair in the behavior of their PP complements: *jump* imposes no selectional restriction, but *cross* does. This difference is nicely expressed in the present formalism.

Yet another case is the verb *put*, everyone’s standard example of a verb that subcategorizes an obligatory PP. What has not been so widely remarked is this verb’s curious selectional restriction on the PP argument.¹² It appears that this argument must express either a Place or else a Path whose function is TO. Examples of the former case are given in (42a),¹³ of the latter in (42b).

- (42) a. George put the book $\left\{ \begin{array}{l} \text{at the corner of the bed} \\ \text{with the telephone} \end{array} \right\}$.
- b. Martha put the book $\left\{ \begin{array}{l} \text{into the drawer} \\ \text{onto the counter} \end{array} \right\}$.

On the other hand, expressions of Source (43a), Direction (43b), and Route (43c) are impossible—and, oddly enough, so is the preposition *to* itself (43d).

- (43) a. *Groucho put the book from the shelf.
 b. ?*Harpo put the book toward the bed.
 c. ?*Chico put the book through the tunnel.
 d. *Gummo put the book to the floor.¹⁴

¹² I am grateful to Dick Carter (personal communication) for making me aware of this problem.

¹³ The case is clouded by the numerous prepositions such as *under* and *between* that can express either (1) a Place-function, or (2) the Path-function TO plus a Place-function, or (3) the Path-function VIA plus a Place-function (see S&C, section 9.1, for details). The PPs in (42a), however, seem never to be expressions of Path. If one *runs at the corner of the bed*, one is presumably running more or less in place, not traversing a path. If one *runs with the telephone*, one is carrying the telephone, not approaching it, leaving it, or traversing its extent.

¹⁴ *Put a gun to his head* and *put his ear to the telephone* are acceptable. However, these *to*’s may be a different preposition *to*, since they can be paraphrased by *against*. The usual *to* of Goal cannot: *John ran to the wall* does not equal *John ran against the wall*.

The notations developed here permit a relatively straightforward account of this selectional restriction. (44) is the entry for *put*; (45) spells out the options for the Path abbreviated by the curly brackets.

- (44)
$$\left[\begin{array}{l} \text{put} \\ [-N, +V] \\ \text{--- NP}_j \text{ PP}_k \\ [\text{Event CAUSE } ([\text{Thing }]_i, [\text{Event GO } ([\text{Thing }]_j, \\ [\text{Path TO } ([\text{Place }]_{\{k\}})]_{\{k\}})])] \end{array} \right]$$
- (45) a. $[\text{Path TO } ([\text{Place }]_k)]$
 b. $[\text{Path TO } ([\text{Place }])]_k$

In realization (45a) the verb means ‘cause to go to a place’. The PP argument is coindexed with the Place constituent and therefore must itself express a Place. This is the case illustrated in (42a). In realization (45b), on the other hand, the PP argument is fused with the whole Path constituent. In order for the result of fusion to be well-formed, the PP must express a Path (1) whose Path-function is TO and (2) whose argument is a Place. The first of these requirements is sufficient to rule out (43a,b,c), whose Path-functions are FROM, TOWARD, and VIA, respectively. (43d) is ruled out by the second requirement, since the structure of its PP is (46).

- (46) $[\text{Path TO } ([\text{Thing FLOOR}])]$

On the other hand, the PPs in (42b) have the requisite structure to satisfy (45b).¹⁵

- (47) a. $[\text{Path TO } ([\text{Place IN } ([\text{Thing DRAWER}])])]$
 b. $[\text{Path TO } ([\text{Place ON } ([\text{Thing COUNTER}])])]$

Similarly, to the extent that (43c) is acceptable (and *Chico put his head through the window* is certainly all right), it is with the “completive” reading of *through*: ‘to the other side of NP via its interior’. This has a subpart that satisfies the selectional restriction in (45b).

The upshot of this analysis is that the disjunctive selectional restriction on the PP of *put* follows from a disjunctive argument structure. Unlike the previous cases, this disjunction does not show itself in the syntax, since both Places and Paths are expressed by PPs. Nevertheless, it is a genuine, if subtle, case of multiple argument structures, and its properties follow from the present account of selectional restrictions and the curly bracket notation. In particular, we see again that a marker, in this case TO, functions in one realization as an incorporated function and in the other as a selectional restriction, just because of where the alternative choices of index happen to fall in the verb’s semantic structure.

These verbs are, I believe, representative of the kinds of idiosyncratic alternations

¹⁵ One would, however, expect **Joe put the book to its place* to be acceptable if, as seems reasonable, *place* is a noun that expresses a Place. I have no solution at the moment; perhaps a division of Places into finer classes is involved.

of argument structure that appear in the lexicon. Lexical theory must have enough expressive power to capture and differentiate the range of possibilities. For example, it is not enough to say that *climb*, *jump*, *pass*, and *cross* all undergo a lexical process that changes an oblique argument into a direct object: as we have seen, there are differences both in the character of their oblique arguments and in the functions they incorporate in the transitive case. Likewise, a theory that treats lexical argument structure as a list of primitive θ -roles cannot account for the relation between the realizations of *pass* and *cross*. For instance, in transitive *pass*, VIA serves as a determinant of the NP argument's θ -role—perhaps the NP would receive the primitive θ -role "Landmark." However, when *pass* takes a PP complement, VIA serves as a selectional restriction on the argument—an aspect of the verb's representation totally outside the system of θ -roles. In the present approach, where θ -marking amounts to coindexation with positions in conceptual structure, the generalization between these two cases falls out naturally. Finally, the distinction between the argument structures of *put* makes no difference at all in the syntax, only in the selectional restrictions on the PP. We have seen, though, that it is otherwise quite like the alternation in the verbs *pass* and *cross* and should therefore be represented similarly. The present theory assimilates the two cases; it is hard to see how they would be related in a separate level of argument structure.

To close this section, I want to return briefly to the more productive lexical processes that have often been treated in terms of alternations in argument structure. In the present theory such alternations can be expressed in terms of manipulations on the indices in the verb's conceptual structure.

For example, consider the lexical rule that forms passive participles from verbs. The essential modification that this rule performs on the conceptual structure of the verb is to delete *i*, the index that marks the subject argument. By virtue of this deletion, the "logical subject" becomes an implicit argument, precisely parallel to all other lexically specified implicit arguments: all that we know about this individual is what is specified in the verb's selectional restriction.¹⁶ In GB Theory this is all that needs to be said: the absence of *i* means that the subject is not a θ -position, and the independent alterations of the participle's case-marking properties will trigger movement of the object into subject position. In a theory such as LFG, where the passive is purely lexical, one of the other indices in the verb's conceptual structure must be changed to *i* so that the argument in question will appear in subject position. The point is that there is no need for a separate level on which to perform these manipulations on indices. They can be carried out directly on conceptual structure. Thus, both idiosyncratic and productive alternations in argument structure can be formulated in the present framework without loss of generality.

¹⁶ As is now generally accepted, the *by*-phrase in the passive is not an argument of the passive participle. In the present theory this means it is not coindexed with the verb's conceptual structure. It receives its interpretation by means of one of a class of "Adjunct Fusion rules," whose function is to integrate the interpretation of adjuncts into *nonindexed* arguments of the verb. See Jackendoff (in preparation).

8. The Role Patient; The Action Tier

The last two sections have dealt with modifications and enrichments of the correspondence rule component—the rules that map between syntactic structure and conceptual structure. However, the organization of conceptual structure has been left intact; we have stayed essentially within the outlines sketched in section 3. The next two sections present further alternations in argument structure that suggest that the *S&C* theory of conceptual structure is if anything not rich enough. The enrichments to be proposed will be highly speculative and incomplete, but I think they are indicative of the directions in which research should proceed.

Our focal example will be the verb *hit*. Consider the thematic roles in (48).

- (48) a. Sue hit Fred.
 b. The car hit the tree.
 c. Pete hit the ball into center field.

In (48a) *Sue* is evidently the Agent. But what is *Fred*? I have seen it said that *Fred* is the Theme, because it is the thing affected. But that is not the definition of Theme, “thing in motion or being located.” Such an analysis derives, I think, from the notion of Theme as the default case-marker, like Fillmore’s (1968) Objective case; as pointed out in section 4, such a notion makes no sense within the theory of thematic relations as originally conceived and as pursued here.

The proper analysis comes from (48b), where *the car* is clearly what is in motion and *the tree* is the endpoint of motion, hence the Goal. By analogy, *Fred* is Goal in (48a) and the Theme is *Sue* (or, more precisely, Sue’s hand). However, this analysis fails to generalize properly with (48c), where *the ball* is clearly in motion and therefore ought to be Theme. So how do we express the relationship among these three uses of *hit*?

A notion missing from the theory of thematic relations in *S&C* and earlier sources (back to Gruber) is that of “object affected”—the traditional notion of Patient. A rough-and-ready test for the Patient role is the ability of an NP to appear in the frame (49).

- (49) $\left\{ \begin{array}{l} \text{What happened} \\ \text{What Y did} \end{array} \right\}$ to NP was . . .

Using this test, we can see that the direct objects in all the examples in (48) are Patients.

- (50) a. What happened to Fred was Sue hit him.
 b. What happened to the tree was the car hit it.
 c. What happened to the ball was Pete hit it into center field.

Notice that not all Goals are Patients (51a); nor are all Patients Goals, since *the ball* in (51b) is Theme.

- (51) a. *What Bill did to the room was enter it.
 *What Pete did to center field was hit the ball into it.
 b. What Pete did to the ball was throw it.

The distribution of Patients vis-à-vis other thematic relations is reminiscent of the distribution of Agents: an Agent can be Source (52a), Theme (52b), or Goal (52c).

- (52) a. Bill gave a pretzel to the monkey.
 b. Bill ran down the hill.
 c. Bill took a pretzel from the monkey's hand.

This correlation of roles has a flavor not unlike that of recent phonological theory, in which representations are organized into independent tiers. Following suggestions of Culicover and Wilkins (1986) and Talmy (1985), semantic roles would fall into two tiers: a *thematic tier* dealing with motion and location, and an *action tier* dealing with Agent-Patient relations. Staying for the moment with a description in terms of informal annotation, we might find analyses like those in (53).

- (53) a. Sue hit Fred.
 (Theme) Goal
 Agent Patient
 b. The car hit the tree.
 Theme Goal
 Patient
 c. Pete threw the ball.
 Source Theme
 Agent Patient
 d. Bill entered the room.
 Theme Goal
 Agent
 e. Bill received a letter.
 Goal Theme
 f. Bill pushed on the wall.
 Agent Patient

We see in these examples different combinations of thematic and actional roles. In particular, *receive* assigns no actional roles (see (54)); *push on*, which unlike transitive *push* describes no motion, assigns only actional roles and no thematic roles.

- (54) a. *What Bill did was receive a letter.
 b. ?*What happened to Bill was he received a letter.
 (OK only with surrounding context in which the letter in turn has some
 unfortunate effect)
 c. *What happened to the letter was Bill received it.

This is all well and good for a first approximation, but as seen above, mere annotation of syntactic structure is inadequate. What we really need is a *functional* representation that has Agent and Patient as argument positions, parallel to the motion and location representations for thematic relations. Let us introduce a function ACT ($X, \langle Y \rangle$) ('X

acts (on Y)') that takes as its arguments an Actor X and an optional Patient Y. (Since normal parentheses in this context already designate arguments of a function, angle brackets are used to indicate optionality.) The Actor is the character that performs the action; this role is picked out by the test (55).

(55) What NP did was . . .

In particular, we can say *What the car did was hit the tree*, so *the car* is an Actor in (48b).

As shown in S&C, section 9.4, and Jackendoff (1985b), the role Agent amounts to 'volitional Actor': it is just when an NP has the Actor role that volitionality becomes an issue. For example, the well-known ambiguity of *Bill rolled down the hill* reduces to whether the Actor *Bill* is a volitional Actor (Agent) or not. Generally, it appears that any Actor, if animate, is subject to this ambiguity, unless the verb specifically selects for a volitional Agent, as do, for instance, *buy* and *look*. Given the action tier, we do not have to represent this systematic ambiguity as the rather clumsy alternation in (56), which requires an optional CAUSE function in the lexical entry of every action verb. (This is the proposal in Jackendoff (1972).) Rather, the difference between volitional and nonvolitional intransitive *roll* is simply the presence or absence of a feature VOL on the ACT function, as in (57). (Here and henceforth I omit for convenience many self-evident parentheses, brackets, and category labels.)

(56) a. Volitional
[CAUSE ([BILL], [GO ([BILL], [DOWN HILL])])]

b. Nonvolitional
[GO ([BILL], [DOWN HILL])]

(57) a. Volitional
[GO ([BILL], [DOWN HILL])
[[ACT
[VOL]] ([BILL])]]

b. Nonvolitional
[GO ([BILL], [DOWN HILL])
[ACT ([BILL])]]

This now enables us to limit the role of the function CAUSE in the thematic tier to cases where there is an extrinsic instigator of the Theme's motion. For instance, transitive *roll* is genuinely causative, since the Theme's motion is instigated by the subject. (58) shows volitional and nonvolitional structure with transitive *roll*. The fact that volition is not necessary here either shows that (56a) is in any event the wrong analysis for volitional intransitive *roll*.

(58) a. Bill rolled the ball down the hill.

[CAUSE ([BILL], [GO ([BALL], [DOWN ([HILL])])])]
[[ACT
[VOL]] ([BILL], [BALL])]]

- b. The wind rolled the ball down the hill.

$$\left[\begin{array}{l} \text{CAUSE ([WIND], [GO ([BALL], [DOWN ([HILL])])])} \\ \text{ACT ([WIND], [BALL])} \end{array} \right]$$

Thus, the standard role of Agent breaks into three semiautonomous parts: Actor (first argument of ACT), volitional Actor (first argument of $\left[\begin{array}{l} \text{ACT} \\ \text{VOL} \end{array} \right]$), and extrinsic Instigator of Event (first argument of CAUSE).

Given the ACT function, we can represent the action tiers of (53a–f) as (59a–f), respectively.

- (59) a. $\left[\left[\begin{array}{l} \text{ACT} \\ \text{VOL} \end{array} \right] (\text{SUE, FRED}) \right]$
 b. $[\text{ACT} (\text{CAR, TREE})]$
 c. $\left[\left[\begin{array}{l} \text{ACT} \\ \text{VOL} \end{array} \right] (\text{PETE, BALL}) \right]$
 d. $\left[\left[\begin{array}{l} \text{ACT} \\ \langle \text{VOL} \rangle \end{array} \right] (\text{BILL}) \right]$
 e. (empty action tier)
 f. $[\text{ACT} (\text{BILL, WALL})]$

Section 6 mentioned the possibility of a general linking rule that correlates agentivity with subject position. Which of the three notions of agent is involved in this rule? In English action sentences the subject is invariably Actor on the action tier; on the thematic tier the subject is Instigator if there is one, and otherwise usually Theme, as seen in (57)–(58). Thus, the constancy of association goes specifically with the Actor role. On the other hand, when no Actor is specified (for instance, in *Bill received a letter*), the choice of subject is freer (in this case Goal). Similarly, neither case of the well-known doublet *X likes Y* versus *Y pleases X* has an Actor, so the choice of subject is lexically specified rather than determined by a general convention.

There is also evidence that the role Patient tends to be (but is not inevitably) associated with direct object position in English. Some of the relevant facts are presented by Anderson (1977) (who unfortunately uses the term *Theme* rather than *Patient* for “object affected,” perpetrating a certain amount of confusion that has persisted in the literature). If we compare the two syntactic frames of verbs like *load* and *smear*, we find differences in which argument is understood as Patient.

- (60) a. What Bill did to the books was load them on the truck.
 What Bill did to the paint was smear it on the wall.
 b. ??What Bill did to the truck was load the books onto it.
 ?What Bill did to the wall was smear paint on it.
 (61) a. *What Bill did to the books was load the truck with them.
 ?*What Bill did to the paint was smear the wall with it.

- b. What Bill did to the truck was load it with books.
 What Bill did to the wall was smear it with paint.

The thematic relations in each case are the same: the books go onto the truck, the paint goes onto the wall. The change is in which entity is viewed as most directly “affected” by Bill’s action, and the direct object has a stronger claim on the role in either case. Thus, the action tier not only plays a strong part in determining subjects but evidently also plays some part in determining objects.

If there is an action tier, it had better contain a larger vocabulary of functions than just ACT. Another possibility might be a function EXP(X,Y) (“X experiences Y”), whose first argument is Experiencer and whose second is something like Percept. This tier might also express preliminary steps toward acting such as intending and trying. But I leave these questions for future research.

9. The Temporal Tier; The Role Instrument

Adding the action tier enables us to partially unify the direct objects of *hit* in the three cases in (48): they are all Patients. But it still does not deal with the fact that the direct object is clearly Goal in *The car hit the tree* and Theme in *Pete hit the ball into center field*. To pursue this further, consider the contrast between (62a) and (62b).

- (62) a. Bill dragged the car down the road.
 b. Bill threw the ball into center field.

In (62a) Bill’s dragging is temporally coextensive with the motion of the car; by contrast, in (62b) Bill’s throwing only initiates the ball’s motion. (See Talmy (1985) for a range of such distinctions.)

To express these relationships, among other things, let us introduce a third tier of conceptual structure, the *temporal tier*. Like the segmental CV skeleton of phonology, this is the temporal framework around which the parts of an event are organized. This tier has two primitives: P, a point in time, and R, a region in time. The well-formedness constraint on this tier is that Ps and Rs must alternate; that is, two Ps must be separated by a region, and two Rs can be adjoined only by designating a point in time that ends one and begins the next.

Different kinds of events, with different aspectual properties, will be associated with different structures in the temporal tier. A *point-event*, such as *The light flashed* or *Bill sneezed*, will be associated with P. An *achievement*, such as *Bill arrived*, is associated with a region R bounded at the end by a point P that picks out the time of arrival: its temporal tier is R P. Conversely, an *inceptive event*, such as *Bill left*, is associated with P R, the time of leaving followed by an indefinite region of time during which Bill travels away from the origin. Finally, *processes*, such as *Bill ran around*, are associated with a region R.

Unlike the CV skeleton in phonology—and unlike the usual conception of a time-

line—the temporal tier permits hierarchical elaboration. (63) gives two rules of expansion.

- (63) a. $R \rightarrow R P R$
 b. $P \rightarrow P R P$

(63a) has the effect of picking out a designated point within a region of time and “taking a snapshot” of that moment. One might see the progressive aspect as making use of this temporal expansion. For instance, if *Bill ran around* is associated with a region R, *Bill was running around* can be associated with a P somewhere within R, derived in the temporal tier by expansion (63a). (Rule (63a) might also be seen as the foundation principle for the formation of *metrical grids* in phonology: the subdivision of an interval between two points (beats) and the designation of the division point as a subsidiary beat.)

Rule (63b) is perhaps less obvious. It is based on a suggestion of Talmy (1978). The idea behind this rule is that one can take an event conceptualized at a point in time and “zoom in on it” to reveal its inner structure. From this closer perspective the event appears to occupy not a point but a bounded interval of time, notated here as P R P. For instance, *It took Bill three hours to die* and *The light flashed (on) for 10 milliseconds* spread normally punctual events over a period of time. These special cases will make use of expansion (63b) in the temporal tier.

We can now use the temporal tier to correlate subevents in the thematic and action tiers. (64) gives some sample analyses. (The association lines are to be understood as connecting a P or an R to an entire Event.)

- (64) a. Bill dragged the car down the road.

[CAUSE (BILL, GO (CAR, DOWN ROAD))]

|
R

|
ACT (BILL, CAR)

- b. Bill threw the ball into center field.

[CAUSE (BILL, GO (BALL, [FROM BILL
TO IN CENTER FIELD])))]

|
P R P

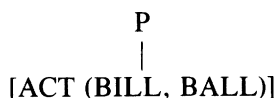
|
[ACT (BILL, BALL)]

- c. Bill pushed on the ball.

{ R }
{ P }

|
[ACT (BILL, BALL)]

- d. Bill gave the ball a push.



The association lines between the tiers express directly the temporal difference between (62a) = (64a) and (62b) = (64b). In (64a) Bill's acting on the car extends throughout the region of time in which the car moves. In (64b), though, Bill's acting on the ball occurs only at the initial point in time during which the ball moves. (64c) is nonspecific about whether the pushing is a single act or continuous; the nominal form (64d) restricts it to a point in time.

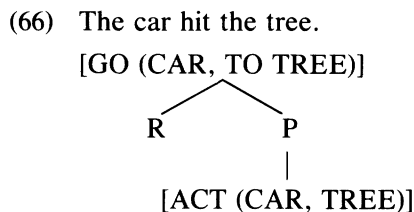
In this framework it is easy to see how temporal adverbs work: they refer directly to the temporal tier. For instance, *at 6:00* identifies a P; *for six hours* attaches a measurement to an R; in *X took place until Y*, X is associated with an R whose end-bounding P is identified by Y (or the onset of Y). And so forth.

Moreover, the temporal tier permits more complete formalizations of the temporal part of inference rules. For instance, inference rule (15) can be restated in part as (65): the notion of "termination" in (15) is formalized as the final point P_1 in the temporal tier.

$$\begin{array}{ccc}
 (65) & [\text{Event GO (X, [Path TO (Y)])}] & \Rightarrow & [\text{State BE (X, [Place AT (Y)])}] \\
 & \begin{array}{c} \diagup \quad \diagdown \\ (P) \quad R \quad P_1 \end{array} & & \begin{array}{c} | \\ P_1 \end{array}
 \end{array}$$

Again, the details of the temporal tier must be left for future research, but it can be seen that the formalism is not gratuitously introduced just to deal with examples like (62).

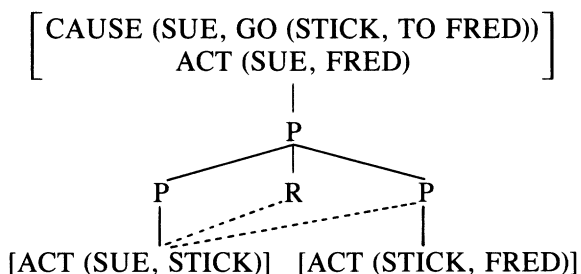
Now let us go back to *hit*. The simplest case, *The car hit the tree*, comes out as (66).



That is, by virtue of the car's motion to the tree over an interval of time, it comes to act on the tree at the termination of its motion.

Next consider (67), which invokes an expansion of P into P R P. Here a punctual event of which Sue is Actor and Fred Patient decomposes into parts on the action tier: Sue acts on the stick, and the stick in turn acts on Fred at the termination of its motion. The association of [ACT (SUE, STICK)] with the temporal tier is indicated in part with dashed lines because it is indeterminate whether, for example, Sue threw the stick (association with initial P only) or held it in her hand throughout its motion (association with P R P).

(67) Sue hit Fred with the stick.



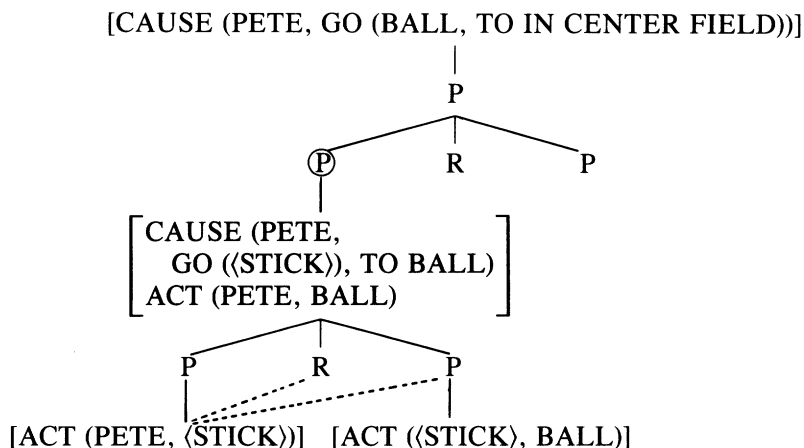
Notice the relation between the senses of *hit* in these two examples. The basic conceptualization, that of an object moving to and coming to act on another object, is all there is in (66); it appears as a subpart of (67). The direct object plays the same role in both sentences. The “instrument” in (67) plays the same role as the Theme in (66), but in addition it is the Patient of an action carried out by the Instigator. Thus, the role Instrument is not a new primitive role but an intermediary between Actor and Patient in the decomposition of an action.

This analysis intuitively fits the traditional notion of Instrument; it also explains nicely how a Theme can get “demoted” to Instrument in changing from (66) to (67)—its conceptual roles are not altered but rather augmented. The only “demotion” is in the correspondence to syntax: since the Instigator is the most superordinate Actor in (67), it has a stronger claim on subject position.

Next let us omit the explicit instrument from (67), giving us (48a), *Sue hit Fred*. The object in motion is now Sue’s hand; this is an incorporated instrument that serves as default if nothing else is named. The structure is otherwise identical to (67).

Finally, here is the most complex case, (48c).

(68) Pete hit the ball into center field (with a stick).



This elaborates (67) by adding the motion of the ball after it is hit. The part of the structure dominated by the circled P is identical to (67). If the instrumental is expressed, it plays

the same role in the structure as it did in (67); if left out, some instrument is still implied (though this time it is not the hand in the default case).

The core of the verb *hit*, then, is structure (66): an object striking with impact on another object. The further senses add extra characters and actions to this core: a character operating the missile, and a subsequent trajectory for the object struck. These elaborations must be in part lexically specified. For example, the verb *strike* can be substituted for *hit* in (66) and (67) without changing the sense appreciably, but it cannot be substituted into (68).

- (69) a. The car struck the tree.
 b. Sue struck Fred with the stick.
 c. *Pete struck the ball into center field (with a stick).

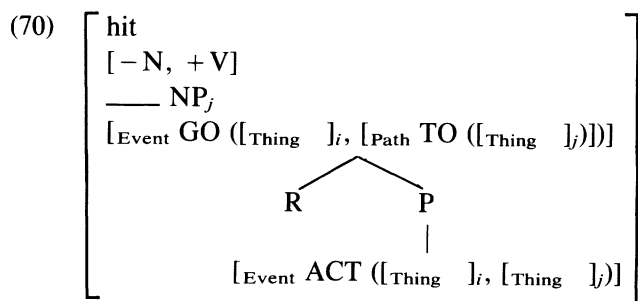
Thus, *hit* and *strike* must be differentiated in the lexicon according to whether the superordinate elaboration in (68) is possible.

These elaborations of *hit* explain the superficially strange behavior of the thematic relations of *hit*. *The ball* in (68) is a Goal, just like the direct objects in (66) and (67), preserving the generality of the analysis. But in addition a superordinate Event has been erected in which it is the Theme. Thus, we are dealing not with a change from Goal to Theme but with the creation of a further layer of θ -roles.

Structures like (68) make it impossible to regiment θ -roles into any kind of list form. There are two Themes and two Goals; *Pete* is Instigator of two Events and Actor of two (and not the same two); *the ball* is Theme of one Event, Goal of another, and Patient in two positions; *a stick* appears in three positions. However, the present theory of θ -roles extends without stress to hierarchical conceptual structures; each argument in (68) has a distinct θ -role, defined purely by its position in the structure as a whole.

10. Argument Binding; The θ -Criterion Again

For each of the structures (66)–(68), the verb *hit* must provide a realization in its lexical entry. (70) gives the simplest of these, the one responsible for (66).



The other realizations are correspondingly more complex, and I will not trouble the typographer with them. Once the three realizations are laid out, it is further necessary

to develop appropriately explanatory abbreviatory conventions in order to express the fact that these three uses of *hit* are related. Again, I will not pursue this here, although it is clearly an important issue for the future development of lexical theory.

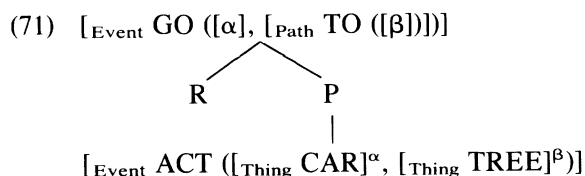
A different problem arises, though, from the proliferation of indexed positions in such lexical entries—two *i*'s and two *j*'s in (70), mounting up to four *i*'s, four *j*'s, and three indices to the instrumental phrase in the realization responsible for (68). There are two difficulties, one morphological and one conceptual.

The morphological difficulty is simply stated. Suppose, for instance, that we wish to treat the passive in the manner described at the end of section 7: the conceptual change wrought by passive morphology is the deletion of the index *i* and possibly the changing of some other index to *i*. With *i*'s and *j*'s scattered all over the verb's conceptual structure, such changes will be formally rather complex.

The conceptual problem follows directly from the morphological one. Suppose that, in forming a passive, a number of *i*'s are deleted from a lexical entry, leaving implicit arguments. Then there is no information to the effect that all these implicit arguments represent the very same unmentioned character—which they do. For instance, in *The ball was hit into center field with a stick*, the character that causes the ball to move is understood to be the same character that manipulates the stick.

Similarly, if the instrumental phrase is omitted from (68), the instrument of *hit* remains as an implicit argument of three different functions. Yet there is nothing to say that these three implicit arguments are necessarily the same character. For instance, if *stick* is omitted, the lowest line of (68) might consist of Pete acting on one thing followed by something else acting on the ball. But this would obviously violate the meaning of *hit*.

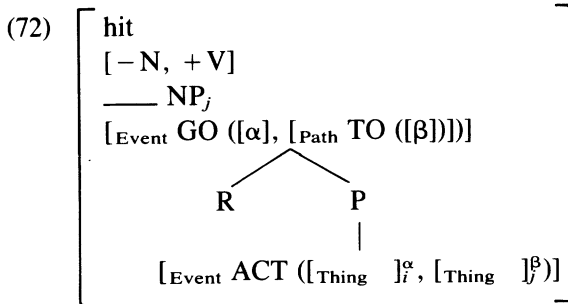
The solution to both these problems is to devise a way of stipulating coreferentiality among arguments. There are many possible notations (not necessarily equally adaptable to the concomitant problem of collapsing the entries for *hit*); here is one. Let us define an asymmetrical relation of *argument binding*, which obtains between a *binding argument* (or *binder*) and one or more *bound arguments* (or *bindees*). Essentially, a bound argument carries no semantic properties except its position in conceptual structure; it must inherit the rest of its properties, including reference, from the binding argument to which it is bound. A binding argument will be notated by a Greek superscript; its bindees will be notated by a Greek letter within the square brackets. Using this notation, (66) might be rewritten as (71).



This avoids the repetition of the conceptual material represented by CAR and TREE,

and at the same time explicitly represents the coreferentiality of the characters in the thematic and action tiers. Similar binding can be applied to (67) and (68).

This relation of argument binding can be incorporated into the lexical entry of *hit*. Instead of (70), then, we will have (72).



The conventions on the notation in (72) must be strictly observed. Roman alphabet subscripts stipulate correspondence between syntactic and conceptual positions; Greek letters stipulate binding between conceptual positions. After Argument Fusion has taken place, the Roman letters are gone from the conceptual structure; the binding structures remain, as shown in (71).

Notice how argument binding in (72) solves both the previous problems. There is now only one *i* and one *j* in the lexical entry; the other roles of these characters are just bound arguments. Thus, the passive has only to delete a single *i* (and change a single *j* to *i* if the theory demands it). Moreover, if *i* is deleted, the Theme is still bound to the Actor; that is, the two positions are understood as coreferential even if the character in question is not named. Parallel considerations will apply to the instrumental in (68).

Adopting this independently motivated enrichment of conceptual structure enables us to formulate almost trivially a more adequate version of what the θ -Criterion is intended to express. In essence, each index linking syntactic and conceptual structure in a lexical entry now appears only once in the conceptual structure. All other θ -roles that the coindexed NP holds will be expressed by arguments bound to the indexed conceptual constituent.¹⁷ This has the formal effect desired for the sake of the syntax, without violating the theory of thematic roles and argument structure.

This account of the syntax-semantics correspondence gives a principled account of the level of "argument structure" found in various versions of GB and LFG (see representative citations in section 4)—a level of linguistic representation that lists the arguments of a verb, with or without their θ -roles. Such a list can now be simply constructed from the set of indices in the conceptual structure of the verb, and there is one index per syntactically expressed argument; in theories such as Williams's that divide argu-

¹⁷ It may or may not be possible to further constrain an index from appearing more than once in the syntactic structure. This depends on the disposition of the examples given in section 5.2 such as *The box has books in it*.

ments into internal and external arguments, *i* is the external argument. In short, “argument structure” can be thought of as an abbreviation for the part of conceptual structure that is “visible” to the syntax. (Note, however, that argument structure, so conceived, cannot be identified as a list of *the unique* θ -roles of NPs, so the constraints on correspondence are best *not* called a “ θ -Criterion.”)

There remains the issue of which of a set of coreferential θ -roles is the unique indexed constituent and binder, and which are the bound arguments. In (72) I have somewhat arbitrarily put the indexed constituents in the action tier, though formally they could reside equally well in the thematic tier. My reason for the choice is based on the discussion of general linking conditions at the end of section 8. There we saw that the general principle linking agents to subjects is localized in the Actor role, that is, the first argument of ACT. This principle would be most easily stated if the Actor-to-Subject link were direct rather than mediated through bound argument positions. Similar considerations apply to the Patient-to-Object link. However, other exigencies of the theory might force an indirect solution, and I have no further proposals on the matter at the moment.

11. On So-Called Syntactic Binding

Coreference between NPs is customarily notated by subscripts in syntactic structure, as was done in (1)–(2). In GB Theory these subscripts are taken to be part of syntactic structure: they are marked by the binding theory, which applies at LF. Argument binding is tantamount to a duplication of this descriptive machinery, but entirely within conceptual structure. However, I have made a point of the need for argument binding in exactly the cases where there is no NP to express the roles in question. Since such cases cannot be assimilated to syntactic binding, the issue arises of whether argument binding can be adapted to take over the work traditionally ascribed to syntactic binding.¹⁸

A good illustration of the interplay between argument binding and syntactic binding is provided by the verb *dress*. This verb appears in four subcategorization frames, with both direct object and PP complement optional.

(73) Bill dressed (Harry) (in a new suit).

What is of interest here is the effect of omitting the direct object. In previous cases—for example, *drink* and *enter*—the conceptual constituent indexed *j* became an implicit argument, with reading ‘nonspecific liquid’ and ‘nonspecific enclosure’, respectively. But intransitive *dress* does not mean ‘dress someone’—it means ‘dress oneself’; that is, the character being dressed becomes a bound argument instead of an implicit argument.

¹⁸ I couch the discussion in this section in terms of the GB formulation of control. However, it applies equally to the “control equations” of LFG (Kaplan and Bresnan (1982)), where the arrow from an anaphoric element in f-structure to a fully specified element is considered a part of syntax, just as the binding relation is in GB. A full translation into LFG terms is left to the interested reader.

(74) expresses this alternation formally.¹⁹

$$(74) \left[\begin{array}{l} \text{dress} \\ [-N, +V] \\ \text{---} (NP_j)(PP_k) \\ \left[\begin{array}{l} \text{CAUSE } ([\alpha], [\text{Event GO } ([\beta], \\ [\text{Path TO } ([\text{Place IN } ([\text{Thing CLOTHING}]))]_k)]) \\ [\text{Event ACT } ([\text{Thing }]_i^\alpha, [\text{Thing } \{\alpha\}]_j^\beta)] \end{array} \right] \end{array} \right]$$

The crucial constituent here is the Patient (the second argument of ACT). Following the conventions of the curly bracket notation introduced in section 7, this constituent has two mutually exclusive possibilities: either it is coindexed to the direct object, or else it is bound to the Actor. This is exactly the desired alternation of interpretations.

Note, incidentally, that in either case the Patient binds the Theme. This is a reason to keep the formal treatments of binder and bindee distinct: we want to be able to hold this binding relation constant while varying that between Actor and Patient. The notation adopted in the previous section makes this clear, since the Patient's role as a binder is notated as a superscript and its role as a bindee is notated within the constituent.

Note also that the alternation in the Patient constituent is lexically specific. The verb *clothe* is minimally different from *dress* in requiring the presence of the direct object.

- (75) a. Bill clothed Harry (in a new suit).
b. *Bill clothed in a new suit.

Thus, one cannot appeal to any obvious general convention to account for the behavior of *dress*.

Now consider the conceptual structure of *Bill dressed himself*. This is for all intents and purposes synonymous with *Bill dressed*. Suppose that the conceptual structure of *himself* is $[\xi]$, that is, a variable that must be filled by a binding index. Since *himself* is in the direct object, Argument Fusion will substitute this variable into the position indexed j in (74), yielding structure (76).

$$(76) \left[\begin{array}{l} \text{CAUSE } ([\alpha], [\text{Event GO } ([\beta], \\ [\text{Path TO } ([\text{Place IN } ([\text{Thing CLOTHING}]))]_k)]) \\ [\text{Event ACT } ([\text{Thing BILL}]^\alpha, [\text{Thing } \xi]^\beta)] \end{array} \right]$$

¹⁹ Some notes on this representation beyond those immediately relevant here: I assume the verb means 'put someone into clothing'. An alternative possibility, 'put clothing onto someone', does not mesh properly with the PP complement.

The PP complement is coindexed with the Place constituent, which carries a selectional restriction that the Place be of the form IN CLOTHING. When the PP is absent, IN CLOTHING acts as an implicit argument as usual. The index k is on the Place rather than the Path so as to rule out **Bill dressed Harry into a new suit*, where the PP is clearly a Path.

The indices in the conceptual structure of (74) are not marked consistently in a single tier. Following the reasoning at the end of the previous section, i and j should be in the action tier. But the PP complement does not have a role in the action tier, so it must be coindexed to the thematic tier. On the other hand, consistent coindexing to the thematic tier would make it more difficult to state the Actor-to-Subject linking rule. I leave the issue open.

What is missing in this representation, of course, is the assignment of a value to ξ , in particular the value α . A rule is necessary to establish this assignment. The general form of the rule will be (77).

- (77) Bind a conceptual constituent consisting of a variable ξ to a conceptual constituent superscripted α under the following conditions:

The application of rule (77) to (74) will change ξ to α , resulting in a representation identical to that of *Bill dressed*.

The conditions on (77) will be the present theory's counterpart to the binding theory in GB. More specifically, the relation between an anaphor and its antecedent is not expressed as a coindexation in syntactic structure. Rather, the anaphor corresponds to a bound argument in conceptual structure, and its antecedent corresponds to its binder. The standard notation (78a) can be considered an abbreviation for the formal treatment (78b).

- (78) a. *GB notation*

$$\text{NP}_i \text{ binds } \left[\begin{array}{c} \text{NP} \\ \text{anaphor} \end{array} \right]_i$$

- b. *Conceptual Semantics*

$$\begin{array}{ccc} \text{NP}_i & & \left[\begin{array}{c} \text{NP} \\ \text{anaphor} \end{array} \right]_j \\ | & & | \\ [\text{Thing}]_i^\alpha \text{ binds} & & [\text{Thing } \alpha]_j \end{array}$$

Since the configuration in (78b) includes both syntactic and semantic structure, it may be expected that the conditions in (77) may involve structural configurations in both. It is not implausible, for instance, that (79a) is acceptable (as in *Bill dressed himself*) but (79b) is not.

- (79) a. ACT ([] $^\alpha$, [α])

- b. ACT ([α], [] $^\alpha$)

Such a condition would account for the impossibility of **Bill was dressed by himself*: the reflexive here is mapped into Actor position, creating the impossible binding configuration (79b). **Himself was dressed by Bill*, on the other hand, has the correct conceptual configuration but violates the syntactic condition of c-command. An approach of this sort begins to make more sense of the "Thematic Hierarchy Condition" on reflexives in Jackendoff (1972), which seemed like a rather arbitrary stipulation. Here the thematic conditions may emerge as configurational, just like the syntactic conditions.

On the other hand, the conceptual conditions on (77) may apply even in the absence of syntactic structure. Relevant examples have been discussed by Schachter (1976) and by Williams (1985), who proposes a reinterpretation of binding theory not unlike (77). For instance, in *those promises PRO to leave*, PRO is bound by the promiser, even

though the determiner occupies the position where one would have to locate the controlling NP. (The frequently discussed example *The boat was sunk PRO to collect the insurance* may also fall in this class, although Williams (1985) offers an alternative analysis of some appeal.) In the present theory the implicit argument is *explicit* in conceptual structure and serves as the binder for PRO. Conversely, Williams observes that in *John submitted Harry to Sue's scrutiny*, *Harry* serves as binder for the Patient of *scrutiny*—*Harry* is necessarily understood as the person Sue is scrutinizing. Yet there is no evidence for the presence of a PRO within the nominal (*Sue's scrutiny of PRO*), and in fact such a PRO would violate the GB binding theory. Within the present account the binding takes place purely in conceptual structure, where all arguments must be present in order to express the meaning.

The treatment of *dress* proposed here reflects on an issue mentioned in section 2: the homogeneity of lexical and extralexical principles of grammar. Reflexivization in English is obviously an extralexical principle, a subcase of rule (77). But the structure that results from applying (77) to (76)—the binding of the variable ξ to the subject—is identical to the structure of *Bill dressed*, in which the binding comes as part of the lexical entry of the verb. A case intermediate between these two is presented by Romance reflexive clitics, which, following Grimshaw (1982), are not free morphemes like English reflexives. Rather, the rule of reflexivization in Romance languages is a morphological rule that alters the form of lexical entries: it adds a reflexive clitic to the verb in the phonology and deletes an NP from the subcategorization frame in the syntax. In conceptual structure (in our terms), the rule deletes the index corresponding to the NP deleted in the syntax and substitutes into that argument an α bound to the subject—in short, it performs just the alternation that appears in the lexical entry of English *dress*, (74). Thus, in this case a productive lexical rule has as output the same form of structure as the English extralexical rule. In a sense, it is this common effect that licenses calling both of them rules of reflexivization.

Recasting the binding theory in terms of argument binding need not necessarily affect any of the syntactic content of the theory. At the same time, (1) it permits semantic content to enter into the conditions on reflexives and control, as section 1 showed necessary; and (2) it permits a homogeneous treatment of binding in cases where either binder or bindee or both is an implicit argument, a serious problem for a purely syntactic binding theory. Thus, the thematic effects on control and reflexivization will be, not some curious intrusion of semantics into syntax, but a natural concomitant of the way rules work in the correspondence rule component. As promised at the outset, I leave it for future research to determine the precise nature of these effects.

12. Final Remarks

This article has compared a fine-grained theory of argument structure, where thematic roles appear as positions in a detailed conceptual representation, with a coarse-grained theory, where argument structure appears as a list annotated with thematic roles, or as

a set of diacritics marked on syntactic structure. In order for a sentence to be understood, of course, the fine-grained representation must exist in any event, so the issue is whether the coarse-grained argument structure is necessary as well. I have shown that it is unnecessary for the statement of the syntax-semantics correspondence and for the statement of productive lexical rules, and moreover impossible to specify for only slightly complex lexical entries. Further, it obscures relations among multiple argument structures of lexical entries—relations that emerge naturally in the fine-grained representation.

One of the virtues of the fine-grained approach is that it provides an explication of various important theoretical terms. *θ*-role is now a term for an argument position in conceptual structure; the particular *θ*-roles such as Agent and Theme now are particular structural positions, with conceptual content. *θ*-marking now amounts to establishing a correspondence between syntactic and conceptual arguments of a verb, as formalized by the coindexing and binding conventions. *Selectional restrictions* are now formalized as conceptual information a verb supplies within an indexed conceptual constituent. *Argument structure* consists of the set of indices that relate the syntactic and conceptual arguments of a verb. An *implicit argument* is a conceptual argument that is neither expressed syntactically nor bound to an argument that is expressed syntactically. Through the device of argument binding, binding and control involving implicit arguments generalize with ordinary binding and control.

One reason that people have adopted coarse-grained approaches to argument structure, I suspect, is that, in the absence of a full-blown theory of conceptual structure, one still needs *some* expression of *θ*-roles. But adopting a coarse-grained theory as a temporary shortcut and adopting it as a codification of a level of mental representation are two different matters. I have shown here that the latter approach is untenable, even if the former is for the moment often unavoidable. At the same time the theory of Conceptual Semantics begins to provide some hope that a fine-grained theory of some generality and rigor can be formulated.

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