Logico-Linguistic Papers

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Ger J. de Haan
Wim Zonneveld
editors

Richard M. Martin

Logico-Linguistic Papers

To the memory of
my parents

"Impensa monumenti supervacua est:
memoria nostra durabit, si vitâ meruimus."

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Truth and Denotation
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Events, Reference, and Logical Form
Semiotics and Linguistic Structure
Peirce's Logic of Relations and Other Studies
Pragmatics, Truth, and Language
Primordiality, and Value

Preface

The papers collected in this volume, all written within the last year or so, are devoted to various topics in logico-linguistics, a field in which the tools of modern logic are put to work on problems of interest to the linguist. But logic itself, like all science, is in a state of continual development. Different characterizations of it must be tried and their effectiveness in applications tested, especially in studying natural languages and the special languages of mathematics and natural science. Every paper in this volume is thus a kind of adventure of ideas, a fresh attempt to conquer recalcitrant mathematical, scientific, or linguistic material. Nonetheless there is also a common core of doctrine that figures as a *basso ostinato* throughout. This is essentially the logical theory of events sketched in previous publications. Its peroration and development is carried forward here as well as used as a basis of criticism for some other approaches.

More specifically the papers of this volume are as follows. In I there is a brief statement of the general kind of logical theory that seems most needed for linguistic purposes. This theory is thought to play the role in linguistics that set theory is often thought to play in mathematics, with of course some telling differences. In II the methods of I are put to work in the logical analysis of *similes* and *metaphors*. The result is perhaps the most extensive attempt yet made to handle metaphors in strictly logical terms. The papers III and IV are devoted to the work of *H.B. Curry* in its relation to natural language. In III the notion of an *epimathematics* is discussed in connection with a much more detailed hierarchy of different kinds of formal metalanguages than appears to have been described heretofore. The net effect of this is a kind of *calculus of systems* akin to that of Alfred Tarski. In IV Curry's distinction between $logic_1$ and $logic_2$ is sharpened and used as a basis for a critique of *William Craig*'s characterization of a Boolean logic of "collections," "properties," and "marks" as constituting a theory about the "everyday physical world."

In V there is a detailed discussion and critique of *Francesca Rivetti-Barbò*'s "dialogistic" approach to semantics and the philosophy of language. Of especial interest here is the analysis of perception sentences and their connection with denotation and meaning. VI is devoted to some

critical comments concerning *Henry Hiż*'s "aletheic," holistic approach to the problems of semantics, which is contrasted with that of I in various fundamental ways. In VII a logic of *fictional statements* is formulated on the basis of a suggestion due to Frege, which consists of a kind of "free" intensional semantics without assumptions of existence.

The sparsity of the logical methods used throughout is in marked contrast to those used by almost all other contemporary writers and is thought to be of especial importance. The only logic, strictly speaking, used is that of first order together with a first-order, inscriptional *semiotics*. No use is made of set theory in any way, and intensionality is construed in the most concrete way in terms of the Fregean *Art des Gegebenseins* or mode of linguistic representation. It is often thought that such restricted methods do not suffice for the study of natural language. An especially sensitive area in this respect is often thought to be in the handling of *abstract nouns*. In VIII therefore it is shown how the methods used here may in fact be used effectively in the logical analysis of such nouns. The restrictions imposed by the sparse logic presupposed are thought not to be an impediment on the road to inquiry, but rather an essential item and a positive aid. That such restrictions are desirable has been argued to some extent in previous publications. Here it is shown how the behavior of the *hidden predicates*, to say nothing of the *hidden variables*, usually used in semantics, may be fully brought to light.

Some recent work of *Zellig Harris* is discussed in IX in the light of the methods here, and some interesting points of contact brought out. In X *Donald Davidson's* approach to the analysis of action sentences is compared and contrasted with the treatment in terms of event logic. And in XI, *Hilary Putnam*'s philosophy of mathematics and methodology is discussed in some detail.

In XII some aspects of Frege's critique of Hilbert's axiomatization of Euclidean geometry are reflected upon and developed. More particularly, this paper is an attempt to formulate a kind of *dynamics of logical systems* akin in some respects to the work of Joseph Sneed and Laszlo Tisza.

Some of these papers have appeared previously or were written for special occasions. I contains the substance of an invited address given at the VIth International Congress for Logic, Methodology, and Philosophy of Science at Hannover in September, 1979, and is included in the Proceedings thereof. II has appeared in the Polish journal *Studia Semioticzne*. III and IV were written in honor of Professor Curry on the occasion of his 80th birthday in September, 1980. IV has appeared in the series *Strumenti per una nuova conoscenza* (Milan) and XI in *Philosophy and Phenomenological Research*. VII was presented at the International Semiotics Symposium at Warsaw University in September, 1980. The author is grateful to the respective editors and publishers for their kind

permission to use these papers here. The remainder are presented for the first time.

All of the papers are virtually self-contained, and thus there is some inevitable slight overlap of material. Further, they may be read in any order, although X is more introductory and expository in character than the others. Even so, it has seemed best to present the various papers in essentially the order in which they were written.

Thanks are herewith expressed to Northwestern University, the University of Connecticut, and the Boston University Center for the Philosophy and History of Science for support, and also to Dr. James Scoggin for help in reading proof.

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CHAPTER I

On Logico-Linguistics:
Structure and Transformation

"Stat magni nominis umbra."

Linguists and philosophers on the whole have been slow to embrace the vast riches of modern mathematical logic as the *logica utens* for their work. The situation in linguistics is rather like that in mathematics seventy to a hundred years ago. In spite of the staggering achievements of Frege, Zermelo, and Whitehead and Russell, mathematicians as a whole were not convinced of the possibility of a logical unification and systematization of their subject even up into the 1940's. Perhaps more than anything else, it was the expository work of the Bourbaki group that convinced them such a systematization could be achieved. Similarly, enormous progress has been made in recent years in the study of logical form or linguistic structure that should prove to be helpful to the linguist. Let us dub the study of these, and their role in the study of language generally, 'logico-linguistics' for want of a better term. Just as modern logic has developed with the help of both mathematicians and philosophers, so, presumably, logico-linguists will develop fruitfully only with the cooperation of logicians and linguists. Such cooperation is an activity devoutly to be wished for in the years to come.

By the *structure* of a sentence let us mean simply its logical form, and by the structure of a text let us mean the sequence of logical forms of its constituent sentences taken in the same order. The sentences of a text "interanimate" each other in most intimate ways, as is well recognized, and this interanimation must be made explicit in the sequence of forms by suitable cross-referential devices. In Hiż's aletheism and in some of Harris's systems, for example, and in non-translational semantics generally, such devices are regarded as *sui generis* and are not made to rest upon some notion of direct reference independent of cross-reference.[1] However this may be, all manner of means for handling reference and cross-reference of whatever complexity must be at hand, if the study of logical form is really to get under way.

The question immediately arises as to just what logical forms are supposed to be. Several criteria have been suggested elsewhere.[2] There are many variant ways of characterizing them, but all workers are agreed that they must be incorporated in a *system* very much in the manner in which

some basic logic is always presupposed in the formalization of some area of mathematics or empirical science. It is very important to keep the system as simple as possible, both in linguistics and in the foundation of the sciences, lest complexities in the underlying logic be allowed to obfuscate rather than clarify. It is an extraordinary methodological fact that the simpler the logic is required to be, the more is made to depend upon bringing out into the open *all* the non-logical predicates and terms determinative of the given subject matter. There should be *no hidden predicates, no hidden variables or terms, no hidden quantifiers*, or the like. Complex logics — type theory, set theory, modal theory, model theory, and the like — at best serve as heuristics and are not ultimately acceptable in their own terms. They posit too many hypothetical elements not required for the given subject matter. As Einstein put it so beautifully: "If there are too many hypothetical elements one cannot believe one is on the right track. Thus [in the development of my work leading to the theory of general relativity] I came to *logical simplicity, a desperate man's way to get on the right track.*"[3]

What is probably the simplest known system of forms runs somewhat as follows. The usual *first-order logic* with identity is presupposed, with *virtual classes* and *relations*, extended to include a suitable version of Leśniewski's *mereology* or theory of the part-whole relation between individuals. In addition, a theory of *events, states, acts, processes*, and the like, may be provided by the introduction of variables for them and of special *event-descriptive predicates.*

The explicit need for linguistic purposes of variables for events was perhaps first noted by C.S. Peirce, in his classic analysis of human acts of giving gifts. "For instance," he wrote,[4] "A gives B to C may be represented by saying A is the first party [agent] in the [some?] transaction D, B is the subject [object] of D, C is the second party [patient] of D, [and] D is a giving by the first party of the subject to the second party." The event-descriptive predicate here may be taken as

(1)   '⟨ A, G, B, C ⟩'

in the context

(2)   '⟨ A, G, B, C ⟩ D',

which expresses that D is an-A's-giving-B-to-C transaction (or act or event). The expressions (1) and (2), however, contain hidden predicates that should be brought into the open, more particularly, predicates for the relations of being an *agent-of*, of being the *object-of*, and of being the *patient-of*.

Let '*e*', with or without primes or numerical subscripts, be variables hereafter for events, and let '*p* Agent *e*', '*p* Patient *e*', and '*x* Object *e*' express respectively that person *p* is the — or a — agent of *e*, *p* is the patient of *e*, and that the individual *x* is the object of *e*. And let '⟨G⟩ *e*' express that *e* is an act of giving. (2) may then be given the more explicit form

(3)   '(E*e*) (A Agent *e* . ⟨ G ⟩ *e* . B Object *e* . C Patient *e*)' .

Such a form contains no hidden material other than what is needed for the analysis of the constituent predicates.

In citing logical forms, it is customary to take the non-logical predicates and names at face value, and this practice will be followed here. Ultimately, of course, certain such predicates (and perhaps names) are to be taken as primitives, and thus characterized axiomatically, with the others then suitably defined. The whole array of predicates needed for a full natural language will of course turn out to be very extensive indeed, but not beyond human power to determine.

(3) is still far from adequate. An additional clause is needed to provide the appropriate *tense*. Also the handling of the preposition 'to' in 'A gives B to C' is left unaccounted for. Two obvious notions needed for tense are some deictic expression '*now*' for the speaker's present moment and a temporal *before-than* relation, say Before$_{Time}$. Many (perhaps all) locutions involving tense, and also *aspect*, may be defined with these together with a part–whole relation between events. Mereology is thus needed in the theory of events as well as in that of individuals, and seems fundamental for the theory of aspect. An action is completed, for example — in many instances anyhow — just where all parts of it bear the relation Before$_{Time}$ to *now*. Suppose '*e* During *now*' expresses that *e* takes place during the *now* of the speaker. A conjunct in (3) may then be inserted to provide that the giving takes place *now*, thus providing for the present tense 'gives'. (3) is of course in the Fregean tense of timelessness; in fact, all of its conjuncts are.

The preposition 'to' in 'A gives B to C' seems best handled by the to-relation of patiency. Let 'To$_{Patient}$' symbolize this were '*e* To$_{Patient}$ *p*' expresses that *e* is an action taking place with *p* is patient. The full logical form for 'A gives B to C' then becomes

(4)   ' (E*e*) (A Agent *e* . ⟨ G ⟩ *e*. *e* During *now* . B Object *e* .
         e To$_{Patient}$ C) '.

Here of course the English 'give' is "represented" by 'G', the final 's' in 'gives' by the deictic '*now*', and the English 'to' by 'To$_{Patient}$'. The whole then represents — in Peirce's meaning of the word, notice — the tensed

English sentence 'A gives B to C', where 'A', 'B', and 'C' are taken as proper names [say 'Adam', *'Belchamber'* (by Howard Sturgis), and 'Cathy'].

Because of the presence of 'to' in the English 'A gives B to C' let us no longer write just '$\langle$ A, G, B, C$\rangle$ e' as above, but instead

(5)   '$\langle$ A, G, B, To, C $\rangle$ e', regarded now as short for
       ' (A Agent e . $\langle$ G $\rangle$ e . B Object e . e To$_{\text{Patient}}$ C) '.

Note that the definiens here, and hence of course the definiendum, is tenseless, tense and aspect being provided by additional clauses. This definition is already in effect a rule of transformation, of which we shall speak in a moment.

Provision should also be made, in the system of logical forms, for *semiotical* items in the form of a systematic, inscriptional *syntax, semantics* (both extensional and intensional), and *pragmatics*. The presence of these is needed, not only to handle sentences that are at first blush metalinguistic, but also to bring to light referential and other features of sentences that at first blush are not. Thus there is no clear line of demarcation between object-language and metalinguistic sentences, and hence it is of little interest to separate off two parts of the system, one dealing with one kind, the other with the other. More important is the *unification* of the two. Every natural language contains its own hierarchy of metalanguages, each metalanguage in turn being a sublanguage of its metalanguage. No interest attaches to a language at any one level more than at any other, and a logical form may end up being located at any level depending upon its internal features. Some level higher than the lowest is usually needed for the handling of a text, with cross-references between items in its various sentences. Especially simple examples are of pronouns used referentially or cross-referentially (either anaphorically or epiphorically).

Consider next the text

'Adam gives *Belchamber* to Cathy. He loves her.'

The 'he' and 'her' here are of course used cross-referentially by the speaker to 'Adam' and 'Cathy' respectively. The form for 'He loves her' will thus not only contain deictic expressions *'he'* and *'her'* but also a clause to the effect that the speaker takes these words in the context to have the desired cross-referentiality to the respective words as occurring in the preceding sentence. The full spelling out of the logic of cross-reference is a much more complicated matter than at first appears.[5] It is the sort of matter we know all about until asked for an explicit formulation. In particular, it must presuppose a full theory of *inscriptions* or sign-events, in terms of

which deictic expressions in general may be handled. Logicians tend not to like the complexities of inscriptions and of the semantics and pragmatics based on them. Their role in language seems so very basic, however, as to be unavoidable. They constitute the very bedrock of language, all of our linguistic activity consisting of writing them, uttering them, questioning them, doubting them, and so on and on. There would thus seem to be no adequate way at all of avoiding the explicit introduction of inscriptions as values for the expressional variables. On the contrary, they should be welcomed with open arms.

Note that the logical form (4) is a conjunction, each conjunct of which brings out some basic structural feature of the English original. One is the feature of agency, as noted, one concerns the nature of the act or event, one the tense, one the object, and one the patiency. More complex sentences will of course need more conjuncts, and further kinds of sentences will need further kinds of conjuncts. The first task of logico-linguistics, as conceived here, is to provide the full array of structural relations needed for logical forms of sentences and of full texts of any complexity. Of course "representations" of the non-logical (non-semiotical, non-grammatical) words occurring are assumed available. The logical form then consists of these representations occurring in the very order in which their originals occur in the original sentence, interspersed, prefixed, or suffixed with suitable logical and structural material. The interspersed material spells out in full detail the structural roles, so to speak, of the representatives in the given context.

The logical form is thus the "meaning" of the original, its semantic or pragmatic structure, if you will.[16] All structural ambiguities are assumed to be disambiguated. If an English word is itself ambiguous, it will have as many distinct representatives as are required. Ultimately each and every unambiguous word of the natural language must be provided its appropriate "logic." Perhaps some can be listed as primitives, the others then being definable, with suitable meaning postulates given for the primitives, as already suggested.

The total vocabulary required for the theory of logical form may be summarized then roughly as follows: representatives of non-logical predicates and names; some specific logico-grammatical predicates for agency, patiency, objectuality, and so on; suitable primitives for syntax, semantics, and pragmatics; 'P' for the part–whole relation between individuals and between events; 'Before$_{\text{Time}}$' for the temporal before-than relation; deictic expressions such as *'now'*, *'here'*, the demonstratives *'that'*, *'he'*, *'she'*, and so on; a suitable notation for handling events, states, acts, and so on; variables for individuals, events, persons, and inscriptions with quantifiers upon them; and a notation for handling virtual classes and relations of or between or among all these various kinds of entities. Concerning all the

primitives, of course, suitable axioms or meaning postulates are to be laid down.

A good deal is made in this present treatment of the theory of *gerundives*, which seem not to have been given an exact logical characterization. The half-diamond braces in '⟨ G ⟩' have the effect of an operator on G or 'G' yielding the gerundive 'G-ing'. Where 'G' represents 'give', '⟨ G ⟩' represents 'giving', so that

> 'Giving e' may be defined as '⟨ G ⟩ e'.

All manner of complex gerundive constructions may be handled by this notation. Thus,

(6)   'John's phoning leading to his going led to Adam's giving
         Belchamber to Cathy'

may be given the approximative form

(6')   '$(Ee_1)(Ee_2)(Ee_3)(Ee_4)(Ee_5)(⟨ J, Ph ⟩ e_1 . ⟨ e_1, L, e_2 ⟩ e_3.$
         $⟨ J, Go ⟩ e_2 . ⟨ e_3, L, e_4 ⟩ e_5 . e_5 \text{ Before}_{\text{Time}} \text{ now}.$
         $⟨ A, G, B, To, C ⟩ e_4)$',

with the obvious symbolization. And this is readily distinguishable from

(7)   'John's phoning led to his going's leading to Adam's giving
         Belchamber to Cathy',

with the approximative form

(7')   '$(Ee_1) \ldots (Ee_5)(⟨ J, Ph ⟩ e_1 . ⟨ e_1, L, e_5 ⟩ e_3 . e_3 B \text{ now}.$
         $⟨ J, Go ⟩ e_2 . ⟨ e_2, L, e_4 ⟩ e_5 . ⟨ A, G, \text{Before}_{\text{Time}}, To, C ⟩ e_4)$'.[7]

In both of these forms the presence of 'his' as cross-referential to 'John' in the original is left unaccounted for. Also complex event-descriptive predicates are used that are further reducible. Thus

> '⟨ J, Ph ⟩ e_1' may be regarded as short for '(⟨ Ph ⟩ e_1 . J Agent e_1)'.

Thus to say that e_1 is a John's-phoning act or event is to say that e_1 is a phoning of which John is the agent or doer. Note that the apostrophe and final 's' in 'John's' in this context is a suffix for agency — and thus definable in terms of the by-relation of agency — and not for possession or ownership. 'John's' in this sense contrasts of course with the use of 'John's'

in 'John's necktie', which utilizes the apostrophe -'s' suffix, definable in terms of the of-relation possession. The full spelling out of the cross-referentiality of 'his' to 'John' is of course somewhat complicated.[8]

Note that the forms (6') and (7') enable us to see in a very simple way the *logical consequences* of the original sentences. Its logical consequences are of course of primary importance to the structure or meaning of a sentence or text. The conjunctive forms, covered by existential quantifiers, lead in a very direct way to many of the logical consequences that must be provided for, in view of the general quantificational principle that

$$\vdash \ulcorner (Ee_1) \ldots (Ee_m)(A_1 \cdot \ldots \cdot A_k) \supset (Ee_{n_1}) \ldots (Ee_{n_j})$$
$$(A_{k_1} \cdot \ldots \cdot A_{k_m}) \urcorner, \text{ where each of } A_{k_1}, \ldots, A_{k_m} \text{ is one of}$$
$$A_1, \ldots, A_k \text{ and each of } e_{n_1}, \ldots, e_{n_j} \text{ is one of } e_1, \ldots, e_n.$$

Thus it is a consequence of (6') that John phoned, that John went (somewhere), that Adam gave *Belchamber* to Cathy, and so on. Still further consequences are provided for, of course, by taking into account the meaning postulates governing the non-logical predicates. It then follows also from (6') that John did something, for example, in view of the meaning postulate that

$$\vdash (e)(\langle Ph \rangle e \supset \langle Do \rangle e),$$

that every phoning is a doing. The importance of the notion of logical consequence in the study of logical form and meaning cannot be overemphasized, as has frequently been pointed out.

As further examples of meaning postulates concerning 'G' — assuming it to be a primitive — we would have a limitation law, that

$$\vdash (e)(\langle G \rangle e \supset (Ep)(Ex)(Eq)(p \text{ Agent } e . x \text{ Object } e . q \text{ Patient } e)),$$

as well as that

$$\vdash (e)(\langle G \rangle e \supset \langle Do \rangle e).$$

The converse of this does not obtain. Not all doings are givings. Likewise the converse of the limitation law does not obtain. For example, acts or states of *owing* are such as to have an agent, an object, and a patient but are not therewith acts of giving. Many meaning postulates will be such as to incorporate a doctrine of *semantical categories* or of intersignificance. Only certain kinds of individuals are suitable to be objects of acts of giving, for example. One cannot give the moon to anyone, except perhaps metaphorically.

Nothing has been said thus far about intentional — or intensional — contexts. The method used here for handling these is an adaptation of Frege's *Art des Gegebenseins*, or mode of linguistic description.[9] We could let '*e* Under *a*' express primitively that *e* is taken under the predicate-description *a*, i.e., that *e* is regarded as having the predicate *a* apply to it. A better form, however, would be the pragmatized one,

'*p* Under *e, a*',

to the effect that person (speaker or hearer) *p* takes *e* under *a*. The form

'⟨ *p*, Under, *e, a* ⟩ *e*'

then enables us to express that *e* is an *act* of *p*'s taking *e* under *a*. A still more useful intentional relation, for some purposes, is the relation *That* in contexts of indirect discourse. Suppose *e'* is an act of believing and that *a* is the sentence giving the *content* of what is said to be believed. The relation here between *e'* and *a* may be symbolized by 'That$_{Content}$', standing for the that-relation of content. Consider, by way of an example,

'John believes that Adam gave *Belchamber* to Cathy'.

A form for this is forthcoming as follows.

'(E*e*) (E*a*) (J Agent *e* . ⟨ Blv ⟩ *e* . *e* During *now* . *e* That$_{Content}$ *a* . '(E*e'*) (A Agent *e'* . ⟨ G ⟩ *e'* . *e'* Before$_{Time}$ *now* . B Object *e'* . *e'* To$_{Patient}$ C)' *a*)'.

Note that, '*a*' here being a variable for inscriptions, the clause " — — —' *a*' states merely that *a* is an inscription of the appropriate shape '— — —'.

Given a natural-language sentence or text, how do we arrive at a logical form for it? Any attempt to answer this question leads at once to the topic of rules of transformation. Given the parent English sentence

(8)   'Adam gives *Belchamber* to Cathy',

how do we arrive at (4), other than by what has been called 'mysterious translation'? And conversely, given (4), how can we make good English sense of it by arriving at (8)? Let us consider these questions one by one.

Let us consider first (4) and the steps required to enable us to gain (8), its English original. From (4), by means of the definition (5) we gain

(4.1)   '(E*e*) (⟨ A, G, B, To, C ⟩ *e* . *e* During *now*)'.

The use of the definition (5) may be referred to as the *Rule of Compound-Predicate Introduction* and *Elimination*. Replacement of definiens by definiendum is clearly the introduction of a compound predicate, and replacement of definiendum by definiens, its elimination.

Next we replace the predicate 'G' in (4.1) by the tenseless English 'give' (taken in the appropriate meaning) of which it is the representative. This is justified by the *Rule of Representation for Predicates*. The results of this transformation, going either way, are regarded as logically equivalent. Thus we gain

(4.2)　'(Ee) (⟨ A, give, B, To, Cathy ⟩ e . e During *now*)'

from (4.1).

Strictly we should write 'To$_{\text{patient}}$' throughout for 'To'. Not to do so is legitimized, however, by a *Rule of Subscript Introduction (Elimination)* for such subscripts, such subscripts normally being dropped in ordinary language.

We need now a logical *Abstraction Principle* as follows. Let $\{p'x'Qq' \ni$ $---p'-x'-Q-q'---\}$ be a pentadic virtual relation among persons p', individuals x', dyadic virtual relations Q (and G or give), and persons q' such that $----p'-x'-Q-q'---$, where '$---p'-x'-Q-q'---$' is a suitable sentential form. The principle now needed is that

$$\vdash p\{p'x'Qq' \ni (Ee) (\langle p', G, x', Q, q' \rangle e . e \text{ During } now)\}$$
$$x, \text{To}, q \equiv (Ee) (\langle p, G, x, \text{To}, q \rangle e . e \text{ During } now).$$

This is a familiar enough kind of logical principle in the theory of virtual relations.

A definition of 'gives' in the present tense is needed in terms of the timeless 'give'. But clearly

(9)　'gives' may now abbreviate '$\{ p'x'Qq' \ni (Ee) (\langle p', \text{give}, x', Q, q' \rangle$ $e . e$ During *now*)$\}$'.

This definition is *Present-Tense Introduction* (and *Elimination*). By means of this definition and the Abstraction Principle just given, we gain

(4.3)　'A gives B To C'

from (4.2). But clearly the relational predicate 'To' is the representative of the English 'to'. Hence by the Rule of Representation for Predicates, we gain

(4.4)　'A gives B to C' .

And finally, by a *Rule of Representation for Names*, we gain (8) itself. Thus (8) is gained by derivation from (4).

Note that the Rules are such as to allow also the converse derivation, of (4) from (8). Note also that the Rules are suitably restricted so as not to allow deviant derivation of either an incorrect logical form, on the one hand, or English gibberish, on the other. In particular the Rule of Compound-Predicate Introduction and Elimination, legitimizing the use of definition (5), is highly restricted. The Abstraction Principle used is merely an instance of a much more general principle, and incorporates some features of what is essentially Reichenbach's "event splitting."[10] The definition (9), Present-Tense Introduction and Elimination, is restricted to just the predicate 'give' and to "subjects" in the third-person singular, so to speak. Note also the "naturalness" of these rules; they are either more or less standard rules in the kind of logical framework presupposed, or are natural extensions of it to provide for the inclusion of words of natural language in the normal ways in which they are allowed to occur.[11]

There are no doubt many predicates in English other than 'give' for which essentially the same derivations can be given *mutatis mutandis*.

'G' for 'give' is a triadic relation. Sentences related to (4.3) are of course

'A gives (to) C B'
'B is (being) given by A to C'
'B is (being) given to C by A'
'C is (being) given, by A, B'

and

'C is (being) given B by A'.

There are just these five, triadic relations having just five converses. Logical forms for all of these sentences may readily be supplied, and derivations for them given. The problem then remains of showing precisely how logical forms for these sentences are interrelated, all conceivable differences of nuance being taken into account.

Let us now have a closer look at (6), and perhaps at (7) also. (6') was said to give an approximate form for (6). In (6') there are existential quantifiers for the separate acts of John's phoning, of his going, and of Adam's giving *Belchamber* to Cathy. Actually, however, these acts are clearly intended to be unique. It is some one and only one act of John's phoning, of John's going, and of Adam's giving *Belchamber* to Cathy that are under discussion. Hence they should be handled by definite Russellian descriptions, some additional information being presupposed sufficient to render them unique.