Toward providing an input to Relational Grammar from Montague grammar: a preliminary sketch

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The title of this short paper is inappropriate, in a sense, for it reads and sounds at least to my ear, unnecessarily, awful and abominable, while the idea expressed and to be conveyed is actually very simple. What I wish to do is merely indicate how one may come up with a deep structure that provides a reasonable syntactic underlying structure for the operation of the rules of Relational Grammar (: henceforth RG)[1] while working within a more general framework of Montague Grammar (: henceforth MG)[2] and explain why the two can get along without any contradictions.

Rather than directly proceed to providing a mini-fragment that has the above characteristic, it is perhaps more appropriate here to spend a couple of paragraphs as to why I would regard such a combined R and M Grammar more preferable over other kinds of grammar, though preference, it might be well to remember, sometimes borders on the personal.

Being a linguist of transformational persuasion, I regard grammatical transformations indispensable in the overall description of any human language if one is to achieve linguistically significant generalizations about its syntax and semantics. When we turn to the intra- and cross- language generalizations a possible grammar might achieve, RG stands out par excellence above the rest in the way of providing them without any ad hocity; to name just a few, the universal characterization of several advancement rules, the notion of retirement, i.e., chômage and emeritus-hood, the dichotomy

into terms and non-terms, the NP accessibility hierarchy, etc. I know of no other theory of grammar that enables one to make so many predictions about the particulars and universals of the syntax of human languages with so few assumptions, one of which being that grammatical relations that NPs bear to a specified predicate is syntactically primitive and hence given from scratch[3].

Over and above these descriptive advantages of RG is my personal preference of it in the way it can provide a perfect parallel of my belief, albeit intuitively based, that, granted that an underlying structure is to receive a semantic interpretation, the order of arguments that appear in it must be considered superfluous to its interpretation simply because an idea that expresses a certain situation takes a variety of surface forms in a variety of languages (except perhaps some identifiable set of emotionally loaded interjections). Particularly salient is the great diversity of surface word orders realized in human languages. True that a surface sentence cannot be equated with its underlying structure order-wise, but to assume that an underlying structure has its arguments ordered entails that the surface word order is derivative from some such unique order of elements in the underlying structure. Nothing to my knowledge, however, indicates that this must be the case. Thus the most one can and is justified to assume as to the order of elements in the underlying structure of natural language sentences is that each constituent of it is unordered, being neutral to the wide variety of surface word orders of languages of the world: to require anything else of it would be tantamount to imposing restrictions on the shape of the underlying structure without any justification. In this connection I find the argument for $\widehat{\text{NP VP}}$ as against { NP, VP } in Chomsky (1965, Chapter 2, §4.4) (i.e., ordered vs. unordered) totally incomprehensible. To express the idea of John's killing Mary, Japanese has *John wa Mary o korosita, Mary o John wa korosita, John ga Mary o korosita, Mary wa John ni korosareta*, etc. while English requires

John killed Mary, Mary was killed by John, etc. What would then seem to be crucial in these examples from the viewpoint of human language universals is the constancy of underlying grammatical relations the argument NPs bear to the predicate rather than the word order they appear in on the surface. (Or it could be the deep case relations as in Fillmore (1968, 1977).) Thus there is every (personal!) reason to assume that the underlying structure is to be expressed in terms of RG primitives such as *subject-of* (1), *indirect-object-of* (3), etc. This means, instead of a string of linearly concatenated elements, we have, for an underlying structure of say *John killed Mary*, something like $\{killed, John_{sub}, Mary_{obj}\}$ or some representation having the same effect such as a relational dependency diagram as in Lakoff and Thompson (1975), while *Mary killed John* would be expressed as $\{killed, Mary_{sub}, John_{obj}\}$ or some such formally similar representation. English and Japanese for instance would then differ, at the level of their respective underlying structure, to the extent that each language has its own phonological underlying forms for the notions *John, Mary*, and *killed*. Otherwise the two languages should appear completely identical in RG.

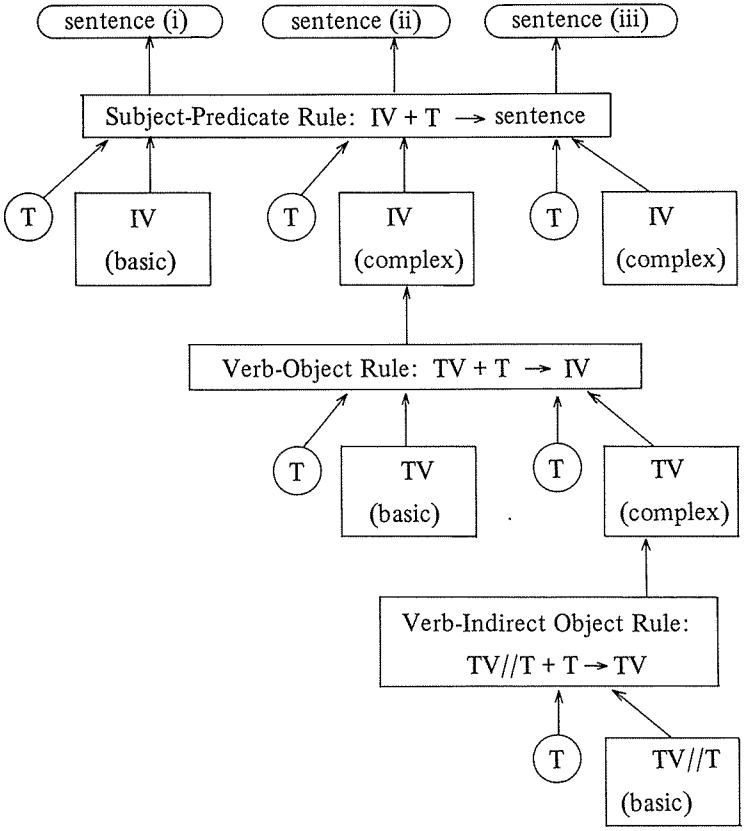
I have indicated that the RG underlying structure must be semantically interpreted. This is where RG and MG meet. Actually the notions like *subject-of, object-of*, etc. are already implicitly present in MG. This should become clear from the consideration of rules of syntax in MG. Thus, those terms that get combined with intransitive verbs or verb phrases (IV) are subjects, while those that combine with transitive verbs or verb phrases (TV) are direct objects. The extension to 3-place verbs or verb phrases is obvious enough, the terms that get combined with them being indirect objects. Dowty (1978[c], 113-4), reproduced below with minor simplification, is perhaps useful for grasping the idea.

T = noun phrases (or *terms*)

IV = intransitive verb (phrase) (corresponds to VP)

TV = transitive verb (phrase)

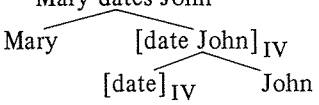
TV//T = three place verb (phrase)



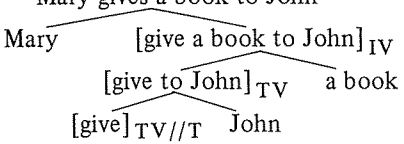
(i) Mary walks

Mary [walk]$_{IV}$

(ii) Mary dates John



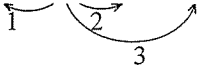
(iii) Mary gives a book to John



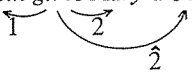
Should the need arise, we ought to be able to use, in principle at least, such implicitly present relational notions in our linguistic description.

Turning again to RG, we note that no semantically unique interpretation of any grammatical realtion as it is employed in the grammar is available; this is clear when we look at RG analyses of the following two sentences.

(1) a. *John gives a book to Mary*



b. *John gives Mary a book*



In (a) *a book* bears the 2-relation to the predicate *gives* while in (b) it is *Mary* that enters into that relation with respect to the predicate in question. Obviously these two terms each bear different semantic relations to the rest of the sentences; one is a direct object, the other is an indirect object. Nonetheless RG's claim is that *syntactically* they both have the 2-relation. It seems then, if we wish to have a unique interpretation of RG primitive grammatical relations, we must, as it were, distinguish between semantic and

syntactic grammatical relations (unless we are ready to maintain à la Dowty (1978[c]) that each occurrence of *gives* in (a) and (b) above is of a different syntactic category). Such distinction I think it is possible to maintain due to the generality afforded by MG. More specifically, there seems to be a place in MG where syntactic grammatical relations and semantic ones appear in one-to-one correspondence, namely, the MG syntactic rules that combine verbs or verb phrases with terms.

Let us now consider a mini-fragment of English (and *mutatis mutandis* Japanese) that generates, among others, the following sentences (: throughout the rest of the paper we ignore the problem of verb morphology since it is not germane to the present discussion; we also omit many well-understood details of other parts of MG grammar, there being no point in copying them all out here from works by other people).

(2) a. *Cynthia runs.*
b. *Cynthia kisses Ed.*
c. *Cynthia gives a book to Ed.*

Basic expressions[5]:

$B_{IV} = \{\{runs\}\}$
$B_{CN} = \{\{book\}\}$
$B_{T} = \{\{Cynthia\}, \{Ed\}\}$ $(B_T = \text{df. } B_{T/IV})$
$B_{TV} = \{\{kisses\}\}$ $(B_{TV} = \text{df. } B_{IV/T})$
$B_{TTV} = \{\{gives\}\}$ $(B_{TTV} = \text{df. } B_{TV/T})$
$B_{Det} = \{\{a\}\}$ $(B_{Det} = \text{df. } B_{T/CN})$

Rules of Syntax (S) and Translation (T)

TO. *Cynthia* translates into $\lambda P\ [P\ \{c\}]$
Ed translates into $\lambda P\ [P\ \{e\}]$
a translates into $\lambda P\ \lambda Q\ \vee x\ [P\ \{x\} \& Q\ \{x\}]$

S1. $\{\alpha\} \in P_{Det}$, $\{\beta\} \in P_{CN}$, then $F_1(\alpha, \beta) \in P_T$,
where $F_1(\alpha, \beta) = \{\{\alpha, \beta\}\}$

T1. $\alpha'(\hat{}\ \beta')$

S2. $\{\delta\} \in P_{IV}$, $\{\alpha\} \in P_T$, then $F_2(\delta, \alpha) \in P_t$,
where $F_2(\delta, \alpha) = \{\delta, <1, \alpha>\}$

T2. $\alpha'(\hat{}\ \delta')$

S3. $\{\delta\} \in P_{TV}$, $\{\alpha\} \in P_T$, then $F_3(\delta, \alpha) \in P_{IV}$,
where $F_3(\delta, \alpha) = \{\delta, <2, \alpha>\}$

T3. $\delta'(\hat{}\ \alpha')$

S4. $\{\delta\} \in P_{TTV}$, $\{\alpha\} \in P_T$, then $F_4(\delta, \alpha) \in P_{TV}$,
where $F_4(\delta, \alpha) = \{\delta, <3, \alpha>\}$

T4. $\delta'(\hat{}\ \alpha')$

The analysis trees for the sentences (2a,b,c) are:

(3) a. $\{runs, <1, Cynthia>\}, 2$

$\{runs\}$ $\{Cynthia\}$

b. $\{kisses, <2, Ed>, <1, Cynthia>\}$, 2

$\{kisses, <2, Ed>\}$, 3 $\{Cynthia\}$

$\{kisses\}$ $\{Ed\}$

c. $\{gives, <3, Ed>, <2, \{a, book\}>, <1, Cynthia>\}, 2$

$\{gives, <3, Ed\}, <2, \{a, book\}>\}, 3 \quad \{Cynthia\}$

$\{gives, <3, Ed>\}, 4 \quad \{\{a, book\}\}, 1$

$\{gives\} \quad \{Ed\} \quad \{a\} \quad \{book\}$

Thus the above mini-fragment generates an appropriate underlying structure upon which grammatical rules of RG, i.e., relation changing rules and linearization rules, may operate, but some comments on the fragment may be in order here since there are a couple of innovations introduced in the above presentation. I will below first touch upon what I feel is central to the present proposal, i.e., S2 – S4. Then I will say a few words on S1 and the basic expressions in the mini-fragment.

As I have indicated and illustrated from Dowty (1978[c]), the notion of grammatical relations are implicitly present in MG rules of syntax that combine verbs or verb phrases and terms. The rules S2 – S4 utilize this fact and make it appear more explicitly and overtly in the grammar. The structural operations $F_{n\in\{2,3,4,\}}$ (and also F_1) are now, unlike the ususal MG structural operations that operate upon strings, operations upon members of sets, forming new sets thereof. Each F_n creates a set wherein a term appears as a right member of an ordered pair, which is itself a member of the set formed by the operation of F_n. The number entered as a left member of such an ordered pair is syntactically primitive, being introduced there once and for all. The number itself never gets translated and hence never semantically interpreted although of course the corresponding term to the right is translated and semantically combined in a special and unique way with the translation of the verb or verb phrase as indicated in the rules of translation. Figuratively speaking, the number reflects the manner of such semantic

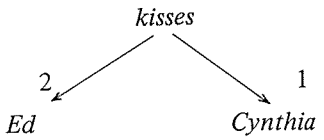
combination (: but of course this is partly true; recall the comment made with respect to (1) above).

Take the top line of the analysis tree (3b) above, which is repeated here:

$\{kisses, <2, Ed>, <1, Cynthia>\}$,2

From F_2 (in S2) (:this is what the right-most number means), this set is a member of the set P_t; it is, in other words, a sentence. Furthermore, each element *kisses*, <2, *Ed*>, <1, *Cynthia*> is unordered with respect to each other. Thus, generally speaking, each set that is a member of P_t has the form {x, <n,y>, <n−1, w> ...}. The single occurrence of the unordered member x in the set is to be designated as the predicate or the relational pivot of the set (or the sentence).[5a] Each ordered pair <n,α> then is to be interpreted as being a relation of "n-relation which α bears to the relational pivot of the set of which<n,α>is a member". The notion "n-relation which α bears to the relationsl pivot of the set of which <n,α> is a member" is considered to be syntactically primitive; hence "n-relation ..." and say "(n-1)-relation..." are regarded syntactically different in an undefined way. What is related to the predicate or the relational pivot is then not the lexical element per se but the relation that holds between a number and a lexcial element. I regard this artifact inherent in the above proposal as formally equivalent to the dependency found between predicates and terms in the RG dependency diagram of the usual sort. The following two representations are therefore formally equivalent:

{ *kisses*, <2, *Ed*>, <1, *Cynthia*> }

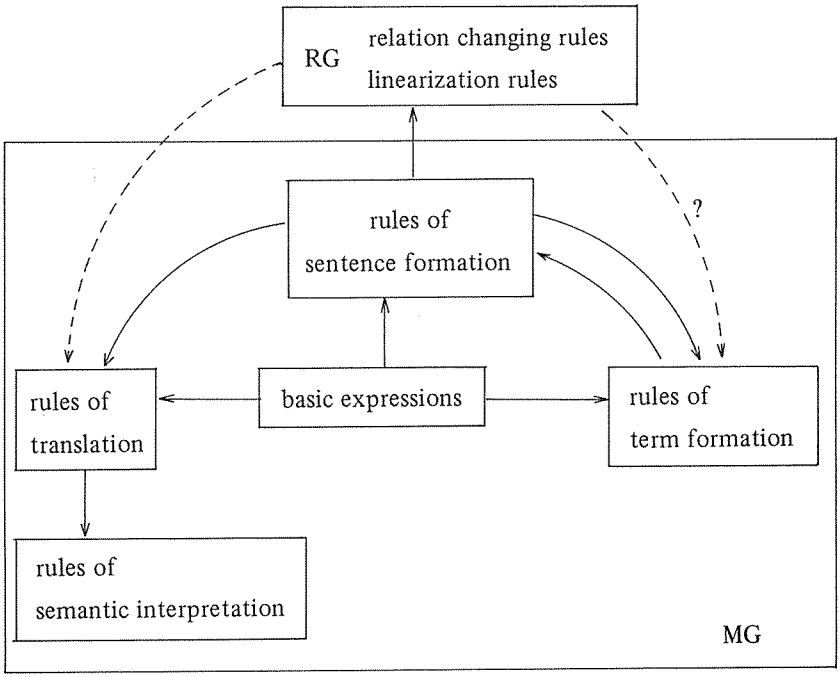


Now I turn to the rule S1. Here too the structural operation F_1 operates on members of a set and forms a new set from them. Recall that S1 is different from S2-4 in a very special way in that while S2 – S4 all have to do with grammatical relations in the sense made clear above, S1 is rather a term (both in RG and MG senses) creating operation. Since a grammatical term (as well as its semantic interpretation via a translation) always behaves as a unit[6] until the application of very superficial rules like *Extraposition from NP* that derives, for instance, *the girl hit the curb who was pregnant* from *the girl who was pregnant hit the curb*, S1 is so formulated that it forms a set out of say *a* and *book* in such a way that the set {*a, book*}acts on a par with basic terms like {*Ed*}or {*cynthia*}. That is why we have as a value of F_1 (α,β) in S1 a set of a set $\{\{\alpha,\beta\}\}$. Clearly syntactic rules of derived term formation have to be worked out in more detail; this means more specifically 1) we have to formulate rules that derive oblique terms together with their relational labels, and 2) we have to elaborate the rules that account for the so-called pre- and post- article structures. (1) and (2) are both conspicuously absent in the currently circulated version of RG. (The rules that would account for the post-article structures are, dubbed in MG terms, those that derive expressions of the CN category; one such rule of course is the relative clause formation). These are extremely challenging tasks for anyone working on a language like Japanese, for many of its syntactic terms have very often the surface appearance of English bare plurals, lacking any overt sign of articles, which serve in many languages to signal the termhood of the elements they bind[7].

Let me now briefly turn to the basic expressions B_A. Here each member (εB_A) is a unit set. Should one be bothered by this, it could be done away with though we would then have to rewrite each S rule so that the provision of the category membership in the antecedent clause would now be stated separately for B_A and P_A. For instance, instead of "$\{\alpha\}\varepsilon P_{IV}$, $\{\alpha\}\varepsilon P_T$" in

S2, we would now have " $\alpha \in B_{IV}$ or $\{\alpha\} \in P_{IV}$, $\alpha \in B_T$ or $\{\alpha\} \in P_T$ ".

While there are surely other relevant issues I must touch upon, I hope I have partly succeeded in presenting points that would shed some light on what I started out to indicate and explain in this paper. The overall picture of the kind of grammar that emerges from the above discussion may perhaps be represented in the following flow chart though, as usual with an illustration of this kind, other important issues are omitted from it like quantification, conjunction, negation, etc.



In this grammar then MG provides a syntactic deep structure (together with its semtantic interpretation) that serves as the initial underlying structure for

RG. The RG rules then maps the unordered set of several elements that form a sentence onto a linearly ordered surface sentence[8], changing on the way the grammatical relations wherever necessary[9].

Notes

1. See among others Perlmutter and Postal (1974; in press), Johnson (1974) and Cole and Sadock (eds.) (1977) for exposition of RG.
2. Cf. Montague (1974), especially Chapter 8. For an excellent introduction to MG now available, see Dowty (1978b). Partee (ed.) (1976) contains articles that extend the original Montague fragment as well as those that aim to revise it.
3. Perlmutter and Postal (in press, p. 3) give the following RG primitives:
   a. Primitive linguistic elements
   b. Primitive grammatical relations
   c. Linguistic levels

   "Primitive grammatical relations hold between primitive linguistic elements (ibid)." Throughout this paper I would like to ignore (c) above and concern myself with (a) and (b), focusing on how MG can assign primitive grammatical relations (b) to primitive linguistic elements (a).
4. The "accent circonflexe (ˆ)" is placed over a chômeur, i.e., a downgraded term.
5. Following Bennett (1974) I would also like to consider IV and CN as basic syntactic categories (rather than define them as t/e and t//e respectively) despite the fact that such a move, as it would stand, will not eable us to treat those cases where the subject of a sentence enters into an intensional construction.

5a. We are equating here a singleton with its member.

6. Needless to say, this remark is not meant to apply to those formulas that are logically equivalent by virtue of rules of inference, notational convention and meaning postulates in MG. Thus while *a book* translates into $\lambda P \lambda Q \forall x [P \{x\} \& Q \{x\}] (\hat{}book')$, which is clearly a single semantic unit, *Ed kisses a book*, for instance, would have as one of its logically equivalent formulas $\forall x [book'(x) \& kiss'_{*}(e,x)]$, where there is no "constituent" that corresponds to *a book*.
7. For treatment of English bare plurals within MG framework, see particularly Carlson (1977). Milsark (1974) also contains interesting observations on this construction from the viewpoint of the syntax of existential sentences.
8. For useful hints and suggestions on the issue of linearization, see for instance Lakoff

and Thompson (1975), Pullum (1977), etc.

9. For an approach that is completely different from mine with respect to grammatical transformations, see Dowty (1978[a], 1978[c]). I have not said anything on the two dotted arcs in the flow chart although it is obvious that the relations between the parts connected by them have to be specified. The nature of the arc that goes from RG to rules of translation box is to a certain extent clear and transparent while I am still in a quandry as to what exactly is involved in the specification of the arc that goes from RG to the box of rules of term formation – hence the query. Hopefully this arc may ultimately turn out to be unnecessary when we have worked out rules like conjunction and quantification in the proposed framework.

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