9. Transformational Generative Grammar and the Study of Language *

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The fundamental question defining the research program of Transformational Generative Grammar (TGG) is the following: 1 What insights into the formal properties of the mind/brain can the study of natural languages provide?

The behaviour that individuals exhibit when they speak or understand a natural language clearly involves an interaction of various systems such as grammatical knowledge, beliefs, expectations, etc. and the type of answers one will get to **this** question will very much depend on how the expression *study of natural languages* is understood.

The first methodological assumption that TGG makes is that one particular factor determining this complex behaviour, namely grammatical knowledge, can be studied independently from the others: TGG focuses on this factor, also termed grammatical *competence* (e.g. the knowledge that certain forms have certain meanings, etc.),and more precisely on the mentally represen-ted system (ultimately physically represented system2) that characterizes this knowledge, termed *grammar*.

In other words, the above question should be more adequately reformulated as: What insights into the formal properties of the mind/brain can the study of grammars provide? Grammars, as defined above, therefore constitute the basic objects of inquiry within this framework, and the study of grammars reduces in part to the construction of explicit models of such grammars.

One of the main empirical problems that the study of grammars faces, as soon as some explicit model of a grammar tries to account for very elementary properties of grammatical processes, is the fact that it appears that basic principles governing its organization cannot be inductively inferred from the kind of (even relevant) experience a language learner might have, nor do they appear to be taught in any way since they are for the most part unconscious, for the mature speaker (as is the case e.g. with the structure dependency of transformational rules).

How, then, does this knowledge develop? Since the principles governing the organization of grammars do not seem to mirror external structures in any obvious way either, it is reasonable to suppose that the language learner is equipped a priori with some analytic structure in the domain of language development which might be termed *Universal Grammar* (UG), and whose function is both to select relevant data from the environment and to map them into grammars, thus determining their basic character.

Given this body assumptions, it becomes clear how TGG tries to answer the above questions. Since, we assume, UG is a system available to each individual (by a straightforward assumption of uniformity of the species) prior to experience and therefore reflects some properties of the brain, some insights about mental structures can be gained through the explicit construction of models of UG.

This enterprise is guided by the following two boundary conditions: On the one hand, such models must be compatible with the range of existing (in fact, possible) grammars. On

the other hand, they must be sufficiently rich and structured to account for the fact that these grammars develop on the basis of limited and fragmentary evidence.

While the first condition simply states that a linguistic theory (i.e. a model of UG) must be empirically adequate, the second stems from the qualitative observation that the transition from UG to a particular grammar is vastly underdetermined by the evidence available and from the requirement that a linguistic theory must be in principle amenable to providing an answer to what has been called the *Projection Problem*3, i.e. how grammar is selected on the basis of linguistically relevant input.

Although much remains to be done in this last domain, the views recently put forth in Chomsky (1980) and elsewhere suggest a plausible and promising line of research; as Chomsky (op. cit.) puts it:

"... Universal Grammar provides a highly restricted system of 'Core Grammar' which represents in effect the 'unmarked case'. Fixing the parameters of core grammar and adding more marked constructions that make use of richer descriptive resources, the language learner develops a full grammar representing grammatical competence..."

Indeed, if UG consists of a system of principles with a sufficient degree of intricacy and deductive structure with parameters that can be fixed one way or another, given a relatively small amount of evidence, small charges in their values will lead to what appears to be radically different grammars. Adopting this picture, part of the projection problem reduces to the question of how available evidence determines the values of these parameters. Of course, in order not to undermine the content of the 'core principles', a theory of parameters must be developed, which would specify for example the types of principles that are parametrizable, the range of values and the accessibility (in terms of acquisition) of such and such a value for a given parameter... in effect a theory of markedness in the now traditional sense.

Illustrations of this conception of UG can be found in recent articles dealing with various principles that have been proposed to characterize the core system. For example:

a. The Empty Category Principle and Proper Governors (Chomsky (forth. a), Kayne (1979), Rizzi (1980), etc.).
b. The Subjacency Condition and Bounding Nodes (Rizzi (1978), etc.)
c. Case theory (Chomsky (1980), Vergnaud (1980), etc.)
d. Metrical phonology (Halle & Vergnaud (1979), etc.)
e. Markedness theory (Chomsky & Halle (1968), Kean (1975), van Riemsdijk (1978), etc.)

To be more specific, and also more technical, let us consider the following examples:

As a first example, let us consider a class of systematic differences between Italian on the one hand, and English and French on the other. We shall merely outline the logic of the approach, and we refer to Chomsky (forth a) and Rizzi (1980) for further details. Italian, in contrast with French and English, permits the following surface configurations:
a. Subjectless tensed clauses, e.g. *è partito* (compare with English **Has left*).
b. Free subject-verb inversion, e.g. *è partito Giovanni* (compare with English **Has left John*).
c. Apparent violations of the (*that*-t) filter (cf. Chomsky & Lasnik, 1977) e.g. *chi credi che è partito* (compare with English **Who do you think that left*).

In all the above Italian examples, grammatical theory requires that the 'absent' subject be abstractly represented at some level of syntax by an empty noun phrase ($[_{NP}$ e]). Furthermore, the distribution of these empty elements is governed (at some syntactic level)

by the so-called *Empty Category Principle*, which requires that they be 'locally controlled' (properly governed, in the technical sense).

It can be shown that, within a model in which the Empty Category Principle, the Binding Theory (cf. Chomsky, forth a), and Abstract Case theory interact properly, the differences in a-c above are on a par and reduce to a single difference in the structure of the inflectional element. This difference determines whether the inflectional element can act as a 'local controller' **(**proper governor) and/or as a Case assigner. The choice between the latter two possibilities defines one of the parameters of core grammar.

Similar examples can be found in other components of the grammar as well, e.g. phonology. As a second example, consider the stress patterns of naturel languages. They can be characterized, within an overall theory of the stress component, in terms of a small number of binary parameters.

Omitting details4 , we may describe the stress component of natural languages as constituted by a class of trees in the following manner:

a. Each tree in this class is a three layered structure, where each layer is a sequence of unidirectional trees (i.e. right or left branching); the bottom layer is the rhyme layer, where the rhyme is a subconstituent of the syllable, the intermediate layer is the foot layer and the top layer is the word tree.

b. A set of universal conventions determine the positions of primary, secondary, etc... stresses. For example: Primary stress falls on the rhyme which is only dominated by Strong nodes (cf. below P1).

c. A given stress component is specified by fixing the values of the following parameters:

P1. The labelling convention: a right (resp. left) node is labelled Strong if and only if it branches. A sister node to a strong node is labelled Weak.

P2. The word tree is right or left branching.

P3. The feet are right or left branching.

P4. The feet are bounded or unbounded.

This minimal model characterizes in a perspicuous way the similarities and the differences between the various stress systems of naturel languages. Each of these two cases constitute paradigmatic examples of how a linguistic theory abides by the boundary conditions mentioned earlier: fixing parameters one way or another implies a variety of consequences that lead to what appears to be formally unrelated phenomena. We should emphasize at this point that the investigation of the projection problem suggested by this view of UG, and in particular the approach illustrated above are logically distinct from the study of acquisition, although there obviously exist connections between the two areas. It does not seem illegitimate to compare the distinction just made with the now traditional dichotomy Competence/Performance (cf. Chomsky, 1965) . For example, a realistic model of language acquisition would take into account the order in which primary linguistic data are used by the child and the effects of preliminary grammars developed in the earlier stages of 'learning' on the interpretation of new, often more complex data. Thus, the projection mapping can be viewed as an idealized model of 'learning' that abstracts away from the specific circumstances just hinted at. However, one might conjecture that the kind of analyses illustrated here could provide plausible acquisition scenarios.

In conclusion, the particular research program that we have presented here for the domain of language will have to be judged by its long term effectiveness as compared with alternatives that might be imagined. We are certainly not claiming that our views are superior to other approaches to the study of language, but we may point out that, in spite of the fact

that this program has been initiated only a short while ego, it has already significantly deepened our understanding of the language faculty.

Footnotes

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1. Fuller discussion of all the issues and assumptions that are presented here can be found in Chomsky (1965, 1975, 1980, 1980a, forth a, forth c,b).

2. The issue implicitly raised here is that of the relation between a field like TGG and'say, neurophysiology. The following quote from Marr & Nishi-hara (1978) will clarify this issue: "Modern neurophysiology has learned much about the operation of the individual nerve cell, but unpleasantly little about the meaning of the circuits they compose in the brain. The reason for this can be attribu-ted, at least in part, to a failure to recognize what it means to under- stand a complex information-processing system (such as speech production and understanding- YA & DS); for a complex system cannot be understood as a simple extrapolation from the properties of its elementary components. One does not, for example, formulate a description of thermo-dynamical effects using a large set of equations, one for each of the particles involved. One describes such effects at their own level, that of an enormous collection of particles, and tries to show that in principle, the microscopic and macroscopic descriptions are consistent with one another. The core of the problem is that a system as complex as a nervous system or a developing embryo must be analyzed and understood at several different levers. Indeed, in a system that solves an information pro-cessing problem, we may distinguish four important levers of description. At the lowest, there is basic component and circuit analysis - how do transistors (or neurons), diodes (or synapses) work? The second level is the study of particular mechanisme: adders, multipliers, and memories, these being assemblies made from basic components. The third level is that of the algorithm, the scheme for a computation, and the top level contains the theory of the computation. Now each of the four levers will have its place in the eventual understanding of perceptual information processing, and of course, there are logical and causal relationships between them" The categorization above applies in particular to the description of languages: Linguistic Theory would correspond to the top level and neurophysiology to the first one.

3. cf. Peters (1972).

4. cf. Halle & Vergnaud (1979) for details.

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