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SCIENTIFIC LANGUAGE: INSTRUMENT AND OBSTACLE EXAMPLES FROM THE FIELD OF LINGUISTICS

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Through its lexicon, the inter-relationships within it and its syntactic categories and relationships, language obviously shapes our first awareness of the world and offers a systematic means of analysing it. Yet, on the other hand, any language is a system or ensemble of systems which belong to what the General Theory of Systems calls the "open" type: by means of a series of delicate mechanisms, it is able to modify itself to adapt more efficiently to its objectives. And one of these objectives is knowledge of the world. To this end, a series of modifications in a given language brings forth either a broadening of this knowledge or a modification of same.

In Greece, when what is commonly called Science or scientific knowledge was attained, a "scientific language" simultaneously came about, both by creating a new vocabulary and by re-interpretation of that which already existed. There was nothing radically new in this. But there was indeed a qualitative and quantitative difference; the process of readjustment of the language to a new phase of knowledge or reality now became more radical and showed itself to be more permanent. Scientific language had come into being with most of the fundamental features which were later to be considered characteristic of it.

However, a far more recent matter is our awareness that scientific language is radically different to natural language. It is above all as from the work of Russell and Carnap that a distinction has been made time and again between natural languages and scientific language as though the former were more imperfect and the latter more perfect as an instrument of knowledge.

Apart from a certain contempt for natural languages partially derived from an ignorance of their capacities, a series of confusions really lies at the heart of these ideas. As against natural language, three languages with certain coincidences but also with remarkable differences, are opposed in a block: formal mathematical language, based on purely quantitative and formal criteria and endowed with both very simple and quantifiable relationships; the language of Logistics and other related symbolic systems, in which basic units of an abstract nature and more complex relationships come into play; and scientific language in the commonest sense, which is really a marginal language: a lexicon anchored in a specific natural language, albeit with a tendency to become universal in a similar way to the signs of Logistics.

In a paper of mine published several years ago[1], I attempted to summarize certain differences between these different aspects or modalities of scientific language and place this latter within the general scope of language. I should here like to add a few more points, stressing the at times thorny problems among which scientific language in the commonest sense of the term moves, as also to give examples from a particular area of scientific language: that handled by Linguistics. This is an especially significant area for two reasons. In the first place, because language is in a highly specialised relation to vast sectors of reality, which are the substratum of its phonemes, its semantic contents, and the behaviour of its speakers and listeners. Secondly, because linguistic terminology is prototypic: it defines linguistic entities that are to a certain extent also translations of the world around us.

Leaving aside mathematical language, I should state that among the systems of signs of Logistics and scientific language (in the commonest sense of the term and hereinafter abbreviated to SL) there are in fact a series of common features. Their signs have a unique referent, their meaning has fixed and permanent definitions (and not relative ones) which are not sensitive to context. They are not polysemic, nor can they be neutralized neither (it is assumed) are they subject to evolution; whether effectively or potentially, they are considered universal, above the individual languages. Besides, many signs, when they are complex, tend to be motivated and may be analysed in inferior signs within systems of stable relationships.

Within this common stock of features, it is quite clear that the signs of Logistics are closer to attaining the proclaimed ideal of universality and a fixed, objective nature. They are certainly not the subject of this paper. I should not, however, like to miss out, before going on to my main subject, the fact that these signs, both those which refer to entities and those which refer to relationships, do at heart imply abstractions, with the problems that any abstraction poses with regard to the possibility of other alternative analyses and traditional "haul-overs". This may be seen clearly for the first time by observing what happens in linguistic theory. For it is well-known that in this case Generative or Transformational Linguistics represents accurately the application of the methods and principles of Symbolic Logic. However, under apparently neutral and symbolic labels - which could in hypothesis be applied to any language - there lie traditional and highly disputable methods of analysis. So much so, that critics from within the school have progressively modified the concept of deep structure until it has become definitely removed from

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[1] F.R. Adrados, "La Lengua en la Ciencia contemporánea y en la Filosofía actual", **Revista de la Sociedad Española de Lingüística**, 3, 1973, pp. 297-321 = **Estudios de Semántica y Sintaxis**, Barcelona 1975, pp. 43-67, German trans. in: F.R. Adrados, **Sprache und Bedeutung**, München 1977, pp. 172-192.

the reality of language. For example, the concepts of *NP* and *VP* or *subject* and *predicate* are, in today's general opinion, not nearly so clear or univocal as was thought and the result is their substitution by concepts such as *focus* and *presupposition* among diverse others (Lakoff, Fillmore, etc).

Generative Linguistics attempted to discover firm, stable ground in its underlying phrase markers, which were to be the exponents of a deep structure that, through a series of rules, would then be transformed into the surface structure. Somehow, this opposition is more or less similar to Saussure's distinction of **langue** and **parole** or to others such as that of system of language and text or code and message. But it turns out that this stable ground, organized in theoretically universal units and relationships, was no more than one among a myriad ways of analysing the units and relationships of language and one, precisely, which came from Graeco-Latin Linguistics. On the other hand, the method of analysis presupposed a surface structure which was no more than a transcription, like that of a code, of a deep structure which consisted of a series of symbolic formulae - something not too far removed from Hjelmslev's "algebra of language". It was also just as incapable as this latter of giving any description of the texts of a language in all their multiplicity. Hence the generativists' problems with Semantics.

The apparent asepsis of TG's system of symbols and markers therefore conceals an analysis which is just as conventional as diverse other possibilities. And it is not fair with the immense variety of reality. Neither is it successful when it substitutes traditional symbols for other more remote and abstract ones - those used in new versions of Deep Structure (see below) - for here indeed it becomes totally detached from the reality of language.

However, we shall now leave symbolic systems, that of TG among them, to go on to discuss what we have called Scientific Language or SL. This is no longer a system of universal symbols but operates within a specific language. In fact, it would be an exaggeration to speak of "scientific language"; rather, it is a sector of the vocabulary of a certain language. And a marginal sector at that: on the one hand, new words created *ad hoc*; on the other common or mongrel words, albeit defined in a special way. Their inter-relations take place within the common syntax of a given language. And when these are common words which are also scientific ones, it is the type of broader context that decides if they should be taken to be understood in one or another sense. That is, TG's pretensions to univocity, indifference to context, etc., are not totally respected and a certain margin of ambiguity is left.

Nevertheless, it is true that SL, although it is really a marginal area of any given language, does, from another angle approach the ideal of universal language. To a great extent, scientific vocabulary is made up of words taken from a foreign language (Greek, also Latin,

English, etc.), or else of words from the language itself using special types of affixation or derivation. Moreover, the whole of this vocabulary is common to cultured languages and even others with only slight adaptations.

The origins of scientific vocabulary include a series of dangers; precisely those which the expounders of the new symbolic systems tried to avoid. On the one hand, the words used in SL bear connotations deriving from the language of origin or of their original meaning in the same language. Certainly, the scientist may abstract these data and be aware when a word is used with the meaning pertaining to a certain branch of science. There is, however, the opposite risk: despite SL's pretensions to universality and atemporality, the truth is that so many words belonging to it have taken on as many meanings from the mouth of diverse schools of thought that the words have ended up by becoming mere labels which each attempts to define in his own way. They mean practically nothing through having been used in different senses.

To give examples from Linguistics as we intended at the beginning: the countless attempts to define what a sentence is should be recalled, or even a subject or a word, even far more recent concepts such as the phoneme. There is only a certain degree of consensus: to keep to these words, to acknowledge that they refer to a homogeneous reality and then to try and define them. But even when the unit of form is quite clear that of content no longer is so. However much effort has been spent, it is, for example, impossible to find a unitary meaning for the cases in those languages which have them: the accusative, for example. What can be said when one tries to find the same "accusative" for all languages with cases or certain verbal aspects which are thought also to be universal, to give a further example ? We are now at a point when, in order to keep a word or a label, we carry out purely aprioristic formal analyses and even ones of content.

There is one consequence to be deduced from the foregoing: as all natural languages are subject to evolution, then any scientific language, despite its mottos of objectivity and permanence, will also evolve. New analyses of reality require new concepts and these latter need new words. Except that scientific vocabulary is conservative and it is hard to oust. It involves roundabout analyses. Or, should we disregard these analyses, it becomes a series of empty labels which become a nuisance at a certain point. However, if we dispense with these latter, there then comes about the chaotic renovation of the vocabulary at the hands of new schools and there is a loss in universality and understanding.

Whilst language is an instrument of knowledge, man is capable of leaping over language to reach new knowledge and then to renew language itself. Language, which was once an aid thus becomes an obstacle, and as it is something "in the way" (Weisgerber) but almost

transparent, it is the worst obstacle. And above all if it is considered as scientific language, that is, as an indispensable scientific instrument. For we cannot analyse reality without words and these sometimes cover up prejudices which prejudge the analysis.

What is remarkable is that, on the strength of successive partial analyses, often poorly backed by the scientific vocabulary available, or often expressed too late in a new vocabulary, Science and knowledge have managed, despite this, to progress. Concepts such as those of matter and energy, space and time may be simple abstractions, analytical procedures among other possible ones which are surpassed at certain levels; yet, the perspectives and laws derived from them are valid and operative. Operativity is the key to success in certain sciences, even though they cannot be backed by satisfactory conceptual and linguistic analyses (which are equivalent of each other). The important thing is that the experiment should give a result, that certain causes should produce certain effects (a chemical reaction, a biological process). In these cases, Science sometimes consists of mere interpretation of events with the aid of networks of conceptual units and relationships between same. There may be several different analyses with the same result.

In a certain sense - only in a certain sense - language is likewise a system of signs related to human conduct that produce certain effects. In any phrase I utter, I pass on a certain type of knowledge or feeling, I change sommebody's way of thinking or I make him act in a certain way, naturally with a margin of uncertainty. Here, too, we could put forward several analyses of how the mechanism works or simply of how fragmentary knowledge and analyses are organized within the system of the language or within the text uttered. Sometimes, the differences between diverse analyses lie in the fact that, among the various cuts or units we can suggest within reality, one or the other is preferred. This is for several reasons: simplicity, applicability to a maximum of texts and even languages, coherence with other classifications, etc.

For example, Structural, Generative and Tagmemic Linguistics all analyse the same texts under criteria that are to a great extent quite different and which are based on quite different classifications. Yet, the results are coherent in good measure and one method may explore aporias put forward by another and vice-versa.

Language which, at the hands of diverse schools had long been interpreted as a sort of dressing out of reality, came at a given moment to be considered as the very centre of research into reality. In an above-mentioned paper, I quoted phrases from Urban, Wittgenstein and Carnap according to which language was considered the most profound philosophical problem (Urban), Philosophy was really language criticism (Wittgenstein) and language research (Carnap). So much for the philosophers. Meanwhile, researchers into myth, social sciences, etc., took over the methods of Linguistics as their models. Perhaps

the time has come to be a little more modest and say how far these statements exaggerate.

For natural language, the wealth of possibilities of which on the other hand often slips by the scientists, and then the different types of scientific language do no more than achieve successive approximations to reality. However, they are sometimes an obstacle, precisely to reach through to reality. Moreover, although it might seem paradoxical, scientific language is the worst offender for it is the one with the best alibi, we might say the one which most boasts of its own innocence. It was created precisely to avoid ambiguities, to give secure bases. Thus, whoever uses it backs his arguments with it regardless of the risks which this entails: traditional analyses which are partial and surpassable; the totally unwitting pre-judgement that there is exactly "one" thing or one concept behind each word and that, if this does not seem clear, that is because true light has not been shed upon it because it needs further research. The idolising of language, and particularly of scientific language, is a danger along the path of knowledge. Without language, without any prior analysis, although this might be insufficient, knowledge would be impossible. But language, although it is an aid, is also an obstacle. Scientific language can, of course, be altered. But the reform itself would entail dangers and would not solve the crux of the problem for us: what is questionable is any form of language.

Thus it happens that in certain Sciences - perhaps in all - in the same way as it is true that diverse analyses reveal diverse aspects of truth which are more complementary than contradictory, it is also true that the struggles between schools sometimes become very logomachies through a lack of attention to what words and concepts really mean: at the best, partial and provisional analyses among many possible ones.

To return to Linguistics, I should like to mention the inexhaustible discussion in the field of Generative Linguistics on the role of Semantics and Syntax. Which belongs to deep structure, the former or the latter ? There are answers to please all tastes. Or is the Semantics of a word made up of a series of universal semes in a certain syntactic relationship ? These, however, are no more than constructions of the linguists and not of language itself, and the same goes for attempts to set up fixed, unremovable barriers between Semantics and Syntax, which concern basically identical data although they may seem to have certain gradations and be differently expressed[2]. The linguist analyses and classifies, for the human mind can only function like this and can only understand thus. The features which are obviously in the subject of his study are organized coherently in order to make them understandable. Nevertheless, I would stress the

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[2] On this point, cf. F.R. Adrados, "Reflexiones sobre Semántica, Sintaxis y Estructura Profunda" in **Revista de la Sociedad Española de Lingüística** 6, 1976, pp. 4-25.

fact that these are rather classifications thought up by our capacity for abstraction with the aims of comprehension or explanation.

I think that linguists have a great need of more humbleness and a wider knowledge of objectivity and subjectivity. Even of the sum of subjectivities of men of past generations and our own, which to a great extent make up what we call Science. Yet not only linguists, but also men of Science in general should learn this. Something concerning scientific language and the content of abstractions in the supposedly well-defined, permanent and objective words in which it is expressed.

This does not mean preaching scepticism, but merely realism. And, I would stress that I acknowledge the fact that analyses carried out with provisional and deficient instruments like words can either mean an advance (at least at times), or a new perspective on the discovery of reality, the object of our study. In some sciences, the criterion of truth is certainly clearer than in others. The action of an anti-biotic on certain viruses is proved by both statistics and obvious data. Very often in the humanities the only "proof" is majority consensus among scholars - and this, of course, is no irrefutable proof as history has so often shown us. Neither are the criteria of simplicity or economy decisive. Sometimes, however, the truth of a new interpretation, although this truth may be merely complementary to others, may break through by means of this simplicity, the new connexions established and the new things explained with its aid.

Of course, all this would lead us to a discussion which we are not prepared to go into here: What is Science ? On the other hand, this would be a discussion which would make us incur the defect we are criticising: the attempt to find a unitary meaning in a word as if it covered a pre-existent reality, as if, in Plato's image, we chopped up a chicken at its natural joints. Is Science the quantifiable ? The predictable ? What gives results ? Or simply what reveals the structure of things ?

However this may be, the domain of the humanities is somewhat different and apart. Occasionally, with the aid of a scientific language, or one that is presumably so (for all scientific language at a certain moment becomes anti-scientific, or a road-block), one comes to results which have nothing scientific about them and which merely respond to a desire or plan of ethical origin, the results of which are not always ethical. I shall explain this further.

A series of physical or biological sciences, and others, study dynamic systems unrelated to ethics or human conduct in general. These are sciences which result, for example, in atomic fission or in certain biological reactions. A first phase reveals how these reactions function and under what conditions; a second phase, in a science which is no longer purely cognoscitive but applied, may set off these reactions by bringing about the suitable circumstances. However, it is scientifically right, for example, to bring on these reactions, regardless of the concepts which explain them, regardless of whether

they bring sickness or health, progress or an atomic holocaust; of course, there will be an ethical problem for the scientist, but not for Science itself. But in certain humanities (including a sector of Linguistics, for it is concerned with propaganda and indoctrination techniques), these reactions operate differently. Thus, in Sociology, Pedagogy, Economics, Politics.

Those who apply them do so according to a programme, although this is based on a analysis of reality which they consider to be scientific. They attempt to create a certain type of society or type of man, for example. They carry out potentially dangerous social, political, pedagogical or religious experiments - at times, as may be seen from experience, annihilating or at least impoverishing. Successive attempts for the reform of man and social planning have only too often ended up as systems of oppression and artificial limitation of the individual. This is because those who advocated them started out with an analysis of man's situation in society from the point of view of an ideal which on the other hand may perhaps have been felt and shared by many.

What relation does this bear to language and particularly to scientific language ? Analyses intended for some system of human conduct or social structure, whether or not they are guided by a conscious or subconscious pure desire for knowledge itself, or entail a desire for reform, are based on networks of words and concepts which display many of the characteristics of scientific language. The language of action and proselytism is to a great extent very close to scientific language. It seeks to isolate words from context, to define them once and for all, to organize them in coherent systems which cross frontiers and ages. There is the subtle difference that the language of action tends (subreptitiously, for it apparently offers no more than objective classifications), to introduce positive and negative judgements related to precise conceptions of good and evil.

In any case, these doctrinal words of action and proselytism are specialized vocabularies, and marginal ones, too, which are built up partly of common words, partly of common words with new, distorted meanings and partly of neologisms. They belong to the sector of the followers or supporters of a certain doctrine. And, if the scientific vocabulary represents only a provisional analysis of reality, this doctrinal analysis will at times be one-sided and distorted. It is dangerous because its words may become weapons or arms for combat, and because, after all, they are in some way scientific words and thus respond to an analysis of social reality which usually has some true aspects. Yet, far more than the words of Science, which as I have said may turn into a factor of stagnation as from a given moment, these latter are attached to subjectivisms and voluntarisms which cut off the path of criticism and merely seek objectives implicit in prior analyses far away from true criticism.

There is no action without the vocabulary of action; neither is

there Science without scientific vocabulary and both one and the other entail risks.

Scientific vocabulary is not all, but it is important. There is a need for research in depth not only into its origin and evolution, but also into its very essence: into how to use it and not let oneself be used by it. We have to live with it, applying and modifying it as a human instrument that is just as indispensable as it is insufficient. And we should not be caught prisoners in its web by believing that, once defined, it must of necessity reveal truths, nor by believing that Science can only operate by using it, for results are sometimes obtained without it and Science comes first and then the vocabulary and the concepts.

However, one should not go so far as to build up such a distant and remote system of words and concepts that we are unable to grasp reality. This is what certain new analyses of Deep Structure in Linguistics have done, and are still doing. This is equivalent to substituting the problems of scientific vocabulary by practical rupture with it, or so to speak, by a lexical suicide. If the units and relationships of language - of one specific language in specific texts - have to be explained on the strength of a few vague concepts far removed from the reality of that language, this in practice means that one shirks any explanation of them.

Thus, the problems of scientific language are not those of such and such scientific language or such and such situation, neither do they stand only in relation to historical facts or to adherences of natural language, in spite of all. They cannot be reformed by radical solutions like symbolic languages or by taking off to planes far removed from reality. They are essential problems of this vocabulary, as part of vocabulary in general and of language in general and, in fact, of the problem of knowledge. They are problems which have no definite solution. The only viable one is to flee from both scepticism and idolization, to work for approximations with one's mind ever open to the advantages and limitations of the instrument - among other instruments - at our disposal.