

THE ACTIVATOR

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1. Introduction

The diffusion of the computer *paradigm* has brought with it not only innovations which we should be aware of, but also pressing demands for the simplification and reduction of data complexity — the sense and usefulness of which is open to question. Although it seems obvious that a detailed theory of the functions and working of language is necessary if we are to understand and analyse problems such as the automatic generation of language and its automatic translation into other languages, one finds that important studies on such automatic generation and translation have proceeded in blissful ignorance of these matters. Of course, the fault is entirely on my part. If numerous rigorous and authoritative scholars — teaching in prestigious universities, coordinating the work of teams of researchers and spending vast sums of public and private money — operate in this state of blissful ignorance without showing signs of doubt or perplexity, it is obvious that the fault lies with those who — by insisting on the obsolete convictions of the philosopher — argue that *the problem lies elsewhere*. There would be no point in talking about the problem if the efforts of these colleagues had been crowned with success.

However, it may be that the shortcomings of the results achieved so far are contingent. After some months or years they may have been remedied and the community of computer scientists will have further important successes to add to its already bulky portfolio. But it may also be the case that 'biting the bullet' is not enough and that it is instead necessary — for both practical *and* theoretical reasons — to make pro-

found changes to the research conducted in the last twenty or thirty years. If this is so, then even the opinion of a philosopher may not be entirely irrelevant.¹

2. The functions of language

Presumably the first step is to make sure that the right questions are asked. I do not know whether a computer capable of producing a text should do so in the same way as we produce a text. Ultimately, the issue is of little importance. When a machine has been built which is able to produce a language, or meaningful stretches of it,² then we will know whether this machine operates in the same way as humans, or whether it does not. Whatever the outcome may be, the problem of the automatic generation of language will be solved if what is generated is precisely that: language (or at least a relevant stretch of language).

We should begin by specifying what a language actually does. If whatever is generated performs the same functions as a language, then it *is* a language.

It is certainly not my brief here to propose a thoroughgoing theory of language. I shall merely indicate some of its aspects. In order to specify the functions of a language, I shall distinguish among three basic thematic areas: those of virtuality, communicative function, and the difference between a language and its sublanguages.

3. Virtuality

A language is a constantly evolving organism which never totally fulfils all its potential. That is to say, it is impossible to draw up a table which lists all the semantically correct expressions of a language on the one hand, and all its semantically incorrect ones on the other, simply because it is impossible to list *all* the expressions of a language. There are linguistic phenomena which by definition are never completely and exhaustively actualized. One need only consider the cases of metaphor

¹ The principal stimulus for the ideas set out in this article was the Bolzano International School on 'NLP and Multilingualism' (December 6-10, 1993), the speakers at which were M. Kay, E. Hovy, S. Nirenburg and R. Kittredge.

² Crucial here is understanding of the term 'language'. For the distinction between 'language' and 'sublanguage' see section 9.

and metonymy. A proposal to construct a list of all possible metaphors and all possible metonyms would be plainly nonsensical. For this reason I shall talk about the *virtuality* of language.

This intrinsic restriction on the phenomenon 'language' not only derives from the fact that language is a dynamic entity in constant evolution. If this were the case, a categorial apparatus able to investigate dynamic phenomena would probably suffice. As already said, the point is that the *problem lies elsewhere*.

An example may be of help. Consider the semantic structure of a lexicon. The two difficulties encountered by traditional theory are (i) the circularity of dictionary definitions (i.e. the non-existence of a specific set of primitive terms) and (ii) the irreducibility of the effects of metaphor and metonymy (i.e. the non-reducibility of all senses to proper senses).

These two obstacles evidence the basic fact — so well analysed by the structuralist tradition — that the global 'space' of the lexicon cannot be obtained simply by extending the range of local fields. In other words, a lexicon can be univocally reconstructed on the basis of primitive components only locally; it cannot be reconstructed as a global lexicon: *univocity is always local*. Even the univocity obtained by the putatively exhaustive listing and distinguishing of the meanings of a particular lexeme is purely local, and it functions, when it does function, only at the cost of regimenting metaphorical and metonymic uses.³ In these cases, it may be achieved the maximum possible extension of local fields, but it is never possible to encompass the language in its entirety.

Note the *structural* reasons for my argument so far. The search for a procedure which yields the global univocalization of language — which amounts to a search for the proper sense of linguistic expressions — is driven by the idea that there exists a 'base' semantic space which is simultaneously (i) global, (ii) has the structure of a local field, and (iii) is such that each 'figurative meaning' can extend itself into a local field situated 'above' it. On the contrary, the irreducibility of the effects of metaphor and metonymy and the non-existence of primitive terms signifies that this base semantic space only exists locally. A lexicon is only locally objective (i.e. codifiable, intersubjective).

In this situation, metaphors and metonyms operate as an open stock of virtual operators binding local fields together. Hence it follows that

³ Obtaining in such a way one of its sublanguages.

not only does the global 'space' of the lexicon not possess the structure of a local field, it does not even exist as such. There is no global base 'state' of the lexicon: its only global states are 'excited' states, and they are therefore the expression of a *subject producing* the utterance.⁴

4. Communicative function

Whatever the manifold activities of an utterance producing subject may be, it seems difficult to deny that one of its aims is to communicate (perhaps only with itself). However diversified and complex the process of communication, some of its aspects seem particularly salient. If we consider, for example, the role performed by the noun in the Indo-European languages, it is evident that it performs three functions, namely:

(i) designating something;

(ii) informing the listener that the speaker has a particular content in mind;

(iii) evoke in the listener a specific content of representation (ideally, that same content as the speaker has in mind).

The problem is understanding that the study of communication and therefore the analysis of language cannot be reduced to (i). It is equally clear that the problem is also one of finding a way to handle (ii) and (iii).

At minimum, we have established the following two points: the in-eradicable presence of (j) a subject producing (jj) linguistic signs which (jja) announce the presence of a certain content in the subject and (jjb) arouse a certain other content of representation in the listener.

The problem is linking (jja) with (jjb) and therefore of linking (jj) with (j). In other words, one must identify the mechanisms which give determinateness to the communication.

5. The principle of holonymy

⁴ J. Petitot, "Locale/globale", in *Enciclopedia Einaudi*, vol. VIII, Torino, Einaudi, 1979, pp. 429-490.

The analysis of texts readily shows their frequent vagueness. Unfortunately, however, it neither tells us nor reveals equally analytically the reasons why we nevertheless understand these texts, apparently without any particular effort.

In order to deal with this difficulty we must tackle the complex problem of the twofold opposition subjective/objective and objective/intersubjective. The crucial point is that the subject producing utterances generates them from a *mode* of representation of an *oriented* scene. The mode is the way in which the scene is analysed, while the orientation is given by the constitutive presence of a particular vantage point.

The point becomes clearer if we say that the scene is the representation of (i) something (ii) in a certain way (iii) from a certain point of view.

The objectivity of communication is ensured by the intervention of a principle of holonymy; that is, a law whereby different aspects (representations) of the same object depend on the different positions of the subject(s) facing the scene.

In formal terms one may proceed as follows. Given a phenomenon F , attempt to parametrize all the views of F by the set of virtual observers of F . This set of observers constitutes a regular space U . Associated with every position u of U is a second space $S(u)$. The observer in u has a view of the phenomenon F symbolized by a geometrical object $O(u)$. When the observer shifts from u to $u + du$, his view changes from $O(u)$ to $O(u) + dv$. The crucial point is that there is a law of connection (called law of holonymy) between the change in the observer (du) and the change in the object (dv). If the connection is not holonymous (as in quantum mechanics), or if there is no connection, objectivity becomes difficult to define.

For my purposes here it is not necessary to exploit all the mathematical potential of this model. One need only bear in mind that a linguistic expression is tied to a scene, and that this scene is a complex structure internally endowed with its own orientation (as other features which we will examine below).

6. The general scheme of linguistic production

I can now present some features of the structure which governs a linguistic expression. I shall use at least three basic modules — which I

shall call module (1) of linguistic competence, module (2) of representative competence, and module (3) of the activator. Each of these modules is a complex entity which may contain other modules. For example, the linguistic competence module certainly contains the modules of lexical and grammatical competence.⁵ Despite the fact that the subject of the present analysis is language, the linguistic competence module is the one which, at the present stage of scientific research, is the *least important*. In effect, the most important point, and the one most difficult to grasp, is this: what makes effective communication possible is not fully contained in language and is not only a dimension of language. Precise analysis of language therefore requires careful analysis of the modules of the activator's representative competence.

7. Representative competence

The representative competence module contains the world-view implemented in the mechanism producing the linguistic expression.

A world-view comprises information derived from the sensory interface with the world and information arising from the beliefs that, for various reasons, the subject adopts. Accordingly, there is no basis for the argument that a world-view is a complete and consistent depiction of the world or of that which is thinkable. Much more plausible is the hypothesis that a world-view presents areas, more or less sharply delimited, of consistency.

Of the information contained in this module there are certain items which result from the application of categorization procedures which find a particularly interesting correlation in the linguistic competence module.

Some of the most striking cases arise in the classification of qualities. Consider the well-known case of colours. These are perceptively representable on the basis of an underlying continuum, the segmentation of which gives rise to basic colour terms. Evidently, different results are

⁵ L. Talmy, "The Relation of Grammar to Cognition", in B. Ruszka-Ostyn (ed.), *Topics in Cognitive Linguistics*, Amsterdam-Philadelphia, John Benjamins Publishing Co., 1988, pp. 165-207 specify them as follows: "the grammatical and lexical subsystems in a sentence seem generally to specify different portions of a CR [cognitive representation]. Together, the grammatical elements of a sentence determine the majority of the *structure* of the CR, while the lexical elements together contribute the majority of its *content*" (p. 165).

obtained if the underlying continuum is divided into a different number of parts. The important aspect here is that whenever the underlying continuum is divided in the same ways, comparable segmentations are obtained. By operating in this manner, it is possible to clarify the mechanism adopted by different languages in segmenting the colour spectrum. Different languages can have distinct sets of names for colours if they segment the perceptive continuum differently.

A more systematic theory of perceptive continua would require analysis of numerous and complex questions which cannot be broached here.⁶ The foregoing discussion, however, suffices to highlight my essential point that a procedural (or cognitive) schema intervenes to govern the discretization of the perceptive continuum.

8. The activator

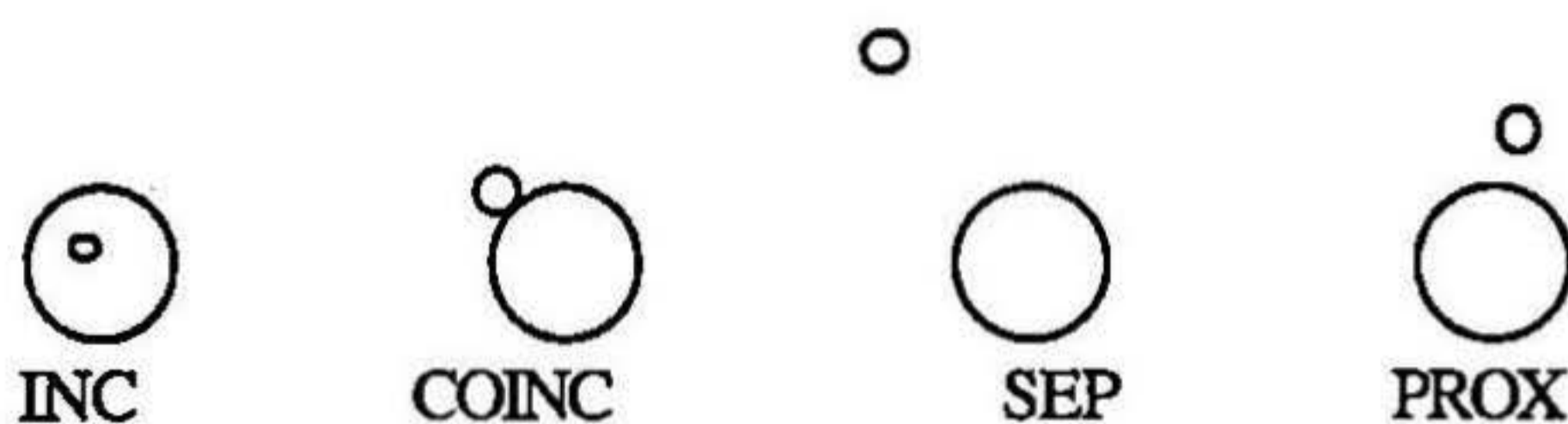
The activator module is the key element in my enquiry. As far as I know, the most advanced analysis of it conducted so far are by Langacker and Talmy, to whom I shall make explicit reference. What I call 'activator' constitutes the point of view and the mode in which a fragment of world-view is considered.

The activator comprises a number of further modules. Two of the activator's main modules concern (i) reasoning and (ii) construction of the scene. Here I shall consider only the latter. It contains several sub-modules, which I now briefly describe.

1. Profiling the figure-ground opposition (the standing-out of shape against the background). If Langacker's analysis is correct, the four 'situations' of (i) inclusion, (ii) coincidence, (iii) separation and (iv) proximity seem sufficient to describe the various patterns of profiling.⁷ In graphic terms, these four situations can be depicted as follows:

⁶ Such as the problem of the dimensions of the continuum and of the specific features which distinguish certain continua from others. For example, the intervals of fifths and fourths are structurally inscribed in the sound continuum.

⁷ R.W. Langacker, *Concept, Image, and Symbol*, Berlin-New York, Mouton De Gruyter, 1990, p. 21.



Each of the four situations has a profile (figure) and a base (ground). By 'profile' is meant the entity designated, while 'base' denotes that part of the scene required to characterize the profile. Two cognitive strategies are available for each pattern: (i) use the *interconnections* between a set of indices as the base and *profile the region* that derives from them; (ii) use a *set* of indices as the base and *profile the interconnections* among them.⁸

One feature of the base is its level of specificity or granularity: different levels of granularity yield different reconstructions of a situation, until one obtains different schematic substructures one within the other (e.g. thing — tree — eucalyptus).

2. Summative or sequential scanning. Scanning involves the cognitive analysis of a number of patterns which typically appear in the case of movement. Instead of base and profile, we can speak of actans (or trajectors, in Langacker's own terminology) and points of reference (or landmarks).

The set of patterns can be read in two ways. A *sequential* reading follows the progressive transformation of one pattern into the next (as in 'falling'). An *additive* reading instead considers all the patterns as co-existent and simultaneously available (as in 'fall').⁹

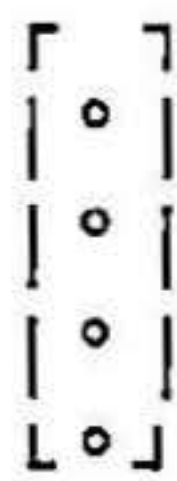
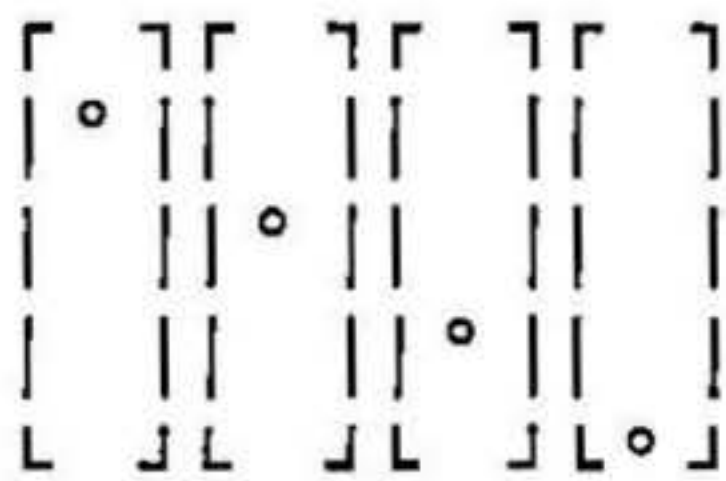
Application of these two forms of scanning to movement is not restricted to physical movement. It can be generalized to all the forms assumed by *dynamics in a conceptual space*.

⁸ R.W. Langacker, *op. cit.*, pp. 74-5.

⁹ R.W. Langacker, *Foundations of Cognitive Grammar*, vol. I, *Theoretical Prerequisites*, Stanford, Stanford University Press, 1987, p. 145.

falling

fall



t₁ t₂ t₃ t₄

t₁₋₄

The above two modules together form what Talmy calls 'structural schematization'. It "comprises all the forms of conceptual delineation that can be ascribed to a quantity, or to the pattern in which two or more quantities are interrelated". Dimension, plexity, state of boundedness, state of dividedness, degree of extension, pattern of distribution, axially, scene division property, partitioning of space or time specified by such deictics as this and that, spatial or temporal geometric schematization, are all categories pertaining to this module.¹⁰

3. Deployment of perspective or point of view. "Given a structurally schematized scene, this system pertains to how one places one's 'mental eyes' to look out upon that scene".¹¹ One component of the scene is the vantage point from which the scene itself is viewed. Each vantage point imposes a specific pattern on the difference between background and shape. A second component of the point of view associated with the vantage point is the correlated position of the subject (orientation). Observing a scene in the normal upright position is different from observing it when adopting another posture.¹² A third component is the directional axis along which the scene itself is oriented. Here the difference between horizontal and vertical direction intervenes.¹³ The fourth component involves the objective-subjective opposition in construction of the scene. We may say that a scene displays a subjective construc-

¹⁰ L. Talmy, *op. cit.*, p. 194. "'Plexity' is a quantity's state of articulation into equivalent elements. Where the quantity consists of only one such element, it is 'uniplex', and where it consists of more than one, it is 'multiplex'". *Ibidem*, p. 176.

¹¹ L. Talmy, *op. cit.*, p. 194.

¹² R.W. Langacker, *op. cit.*, p. 123.

¹³ R.W. Langacker, *op. cit.*, pp. 262-7.

tion if the subject structuring it is explicitly involved as a component of the scene itself (as in 'we').¹⁴ A further component is the degree of extension of the perspective.

4. The fourth submodule concerns the modalities of considering the scene, what Talmy calls 'distribution of attention': "Given a schematized scene and a vantage from which to regard it, this system pertains to the allocation of attention that one can direct differentially over the aspects of the scene".¹⁵ Level of synthesis, level of exemplarity, global vs local scope of attention, figure/ground distinctions, reference object, focus, topic, comments, given, new, are all categories pertaining to this module.

5. The last module is force dynamics: "given a structured scene, involves the forces that the elements of the scene exert on each other. Comprehended here are the notions of force exerted by one quantity on another, as well as notions of resistance to such force, the overcoming of such resistance, blockage to the exertion of force and removal of such blockage".¹⁶

The stabilized patterns or templates of the various modules can be called 'purposes'. In these cases, according to the vantage point assumed, the activator tries to arrange the other modules appropriately. Obviously, the templates can be adjusted according to the results that it yields.

A world-view and an activator together determine a scene. From what has been said it is obvious that a scene is something intrinsically oriented. It is something '*seen*', by someone, in a certain way.

The activator can be plausibly viewed as a (mainly) syntactic structure which articulates the contents of the world-view relevant to the ends pursued.

Once the scene has been obtained, the box of linguistic competence can be activated to generate a verbal description of the active scene.

¹⁴ R.W. Langacker, *op. cit.*, pp. 128-32.

¹⁵ L. Talmy, *op. cit.*, p. 195.

¹⁶ *Ibidem*. For a detailed analysis of 'force dynamics', see L. Talmy, "Force Dynamics in Language and Cognition", in *Cognitive Science* 12, 1988, pp. 49-100.

A more sophisticated account holds that the three modules of linguistic competence, representative competence and the activator *operate jointly*. In this case, linguistic competence may also intervene while the scene is being constructed. "Perhaps the principal overarching function of the structuring common across cognitive domains is that of providing conceptual *coherence*, that is, acting as a means for integrating and unifying a body of otherwise disparate conceptual material".¹⁷

9. The difference between language and sublanguage

One notes with interest that one of the most interesting and fertile categorial specifications of the nature of the expressive means analysed here cannot be properly expressed in English. Using the prefix 'sub-', the opposition 'language/ sublanguage' suggests a connection between the whole and some of its parts that blurs the categorial difference between them.

What are the principal differences between the two concepts?¹⁸

A language is an inherently universal product: it manifests the entire range of the communicator's intentions (points of view), it employs all the expressive modules, it covers the entire spectrum of expressible contents. A sublanguage, in the sense for example of a machine language, by contrast, is characterized by certain specific restrictions imposed on the extreme generality of language. This latter type of language is created according to a specific intention (point of view) and uses only certain expressive modules (or literary genera). The possession or otherwise of a limited domain of reference is not a factor usable to distinguish a language from a sublanguage.

Correct specification of the difference between language and sublanguage is important if we are to avoid grievous error. First of all, it enables us to distinguish between the *partial* use of a language and the use of a sublanguage. For example, it enables us to distinguish between the lin-

¹⁷ L. Talmy, "The Relation of Grammar to Cognition", *cit.*, p. 195. "In language and ... in vision, this fundamental function has three main global forms of realization: coherence across a conceptual inventory, coherence within a scene, and coherence through time".

¹⁸ The distinction between language and sublanguages was first introduced by F. Mauthner, *Die drei Bilder der Welt*, Erlangen, 1925. For a critical analysis see L. Albertazzi, *Fritz Mauthner. La critica della lingua*, Lanciano, Carabba, 1986, chs. 9 and 10.

guistic expression of a child and that of a scientist (who is speaking as such). In the former case we have the use of a genuine language (albeit only a fraction of it, but nevertheless a language). In the latter case, what we have is presumably the use of a specific sublanguage.

As said and despite conventional belief, the principal characteristic of a sublanguage is not that it possesses a specific and often restricted domain of reference. On the contrary, this domain is a matter of little importance and may even coincide with the entire universe. One need only consider such examples as scientific sublanguages or that of expressive sublanguage *par excellence*, namely poetry. In our classification, poetry and scientific sublanguages are cases of sublanguages, not of languages, precisely because they only employ a restricted, although not necessarily predetermined, set of expressive modules.

Some, although not all, sublanguages differ from languages because they can be realized to their fullest extent; that is, they can be used in a manner that entirely fulfils their potential. These are those sublanguages which rely exclusively on a particular and predetermined set of tropes, which do not use metaphors or metonyms. In other words, they are descriptive, totally 'explicit' sublanguages equipped with a stable lexicon. It is in regard to these sublanguages that I now address the problem of their automatic generation.¹⁹

These languages have several other properties which are often not possessed by other languages or by sublanguages. These properties are the following:

- (i) a restricted lexicon;
- (ii) a restricted sentence syntax
- (iii) a restricted text grammar
- (iv) restricted co-occurrence patterns;
- (v) use of constructions or words which do not appear in the language.²⁰

¹⁹ These sublanguages too have their own dynamic, but it is a much 'slower' dynamic than that of a language, and in this sense they can be considered sufficiently stable.

²⁰ From R. Kittredge's lectures on Bolzano.

With reference to sublanguages of lesser complexity than a language, we may distinguish between the generation of a sublanguage and the generation of a language. The generation of a sublanguage differs from the other type of generation in that the activator module only operates to a limited extent, exploiting only some of its potential. More specifically, the activator of a sublanguage uses only some intentional structures and therefore only some of the possible expressive modules. Note that this restriction *concerns the activator, not the size of the reference universe.*

10. Generation and automatic translation of a linguistic expression

At this point in my enquiry I advance the hypothesis that the problem of the automatic generation of a linguistic expression may be more efficiently handled if we explicitly introduce not only the linguistic competence modules but the activator module as well. The way in which an oriented scene is represented contains, in fact, that non-linguistic information which permits correct selection of the appropriate grammatical and lexical items. If this is the case, then we can explain the reasons for the substantial failure, except for a small number of cases, of the automatic translation programmes so far developed.

If the basic problem of linguistic production is the representation of an oriented scene, then the basic problem of automatic translation is discovering how to construct, on the basis of a certain linguistic string, the oriented scene of which that string is the linguistic expression. This, therefore, is the *reverse* problem to the one considered previously: then we had to move from a scene to its corresponding linguistic description, now we must proceed from a linguistic description to its corresponding scene. Once we have obtained the scene, the generation of the new language requires the appropriate linguistic competence module to be activated.

There are two major problems raised by the introduction of the activator module. The first concerns a phenomenon which can be intuitively expressed by saying that 'in German things are said more precisely' (or that the language of courtship is French, but let us keep to German). However difficult it may be to convert an 'impression' into a scientific proposition, this observation finds justification as soon as we admit that the components constituting the templates which govern the

generation of scenes may be differently calibrated. Thus it is not difficult to predict, for example, that a generation schema may systematically or preferentially accentuate the analytical aspect of its descriptions, while another schema may systematically or preferentially accentuate their synthetic aspect. Accordingly, the 'intuitive' observation that descriptions formulated in German seem 'more precise' may be explained by an accentuation of the analytical components of the relative templates. The generation of a linguistic string in a particular language therefore requires both the construction of the activator module and its appropriate 'adjustment'. Hence it follows that the problem of automatic translation is complicated by the introduction of a new element. It is no longer enough to extrapolate the scene from the initial linguistic string, one must also 'translate' the calibration of the template valid for the first language into the calibration valid for the second one.

The second problem arises when we no longer have a case of the differing calibration of the activated templates, as in the previous case, but of a systematic difference in the construction of the templates. An example may help. It is common knowledge that one of the principal difficulties for a Westerner learning Japanese is its courtesy expressions. My proposal could enable us to understand why. The generation of the oriented scenes which govern the linguistic expressions of the main Indo-European languages does not envisage the systematic use of a component which represents the social difference between addresser and addressee. In Japanese, however, every linguistic expression seems to be governed by this component. Thus, expressions are used which reveal the social relationship between I-speaker and you-listener. From the viewpoint of the production of the oriented scene, a new component must be inserted which activates the relevant information. Note that this information may be and *usually is extraneous* to the domain of competence explicitly considered by the linguistic string.

If the argument is valid, a number of consequences derive from it. First we have obvious confirmation of the fallaciousness of a theory of translation as carbon-copy translation. The matter is obvious and does not require further elaboration.

Much more important is another consequence stemming directly from our hypothesis. If the proposal is correct — if, that is, translation is essentially a problem of the connection between different cognitive templates — then one of the most tenaciously held assumptions (and hopes) of recent years collapses: the assumption-myth of interlingua

which maintains that translation from language A to language B must be intermediated by a third language-like structure underlying A and B. The point is that despite all the research effort devoted to the endeavour, construction of this inter-language is proceeding with such suspicious slowness that one is induced to believe that the project has proved impossible because a 'deep' language common to all the languages of the world does not exist.

My hypothesis explains why. The feature which every language shares with every other is the fact that it is the product of the activity of a subject endowed with intentionality. For this reason, what is needed is not a new artificial language-like structure but a procedure which enables articulation of the cognitive procedures underlying language performance. The presence of common procedures also explains the illusion of the interlingua. The problem is that this common nucleus underlying linguistic performance is cognitive in nature. In other words, and I would stress this again, it is not linguistic and it is not a linguistic phenomenon.

With the introduction of an activator the problems of generation and translation often considered to be linguistic in nature thus become problems to do with the construction of suitable scenes. In order to obtain the efficient generation or the efficient translation of linguistic expressions it is therefore necessary to achieve the efficient generation and calibration of the oriented schemes which sustain these linguistic expressions.

At this point we know the reason that forced me to claim that *the problem lies elsewhere*. In one sentence: to solve the problem of the automatic generation and translation of language without a detailed knowledge of the cognitive activities of the intentional subjects is simply impossible. In one word, we cannot hope in a successful solution of the automatic generation and translation problems without (*at least*) a detailed knowledge of what is called *intentionality*.

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