Ernst Glasersfeld's First Scientific Paper

Commented by Paul Braffort ◇ ALAMO (France) <paul.braffort@noos.fr>

Purpose: At Silvio Ceccato's suggestion, I invited Ernst von Glasersfeld to the "Séminaire Leibniz" which took place in Brussels, in February 1961. The paper he delivered then, *Operational Semantics: Analysis of Meaning in Terms of Operations*, was included in a Euratom internal report and is published here for the first time.
Conclusion: These early works clearly show von Glasersfeld's methodological and philosophical coherence as well as his faithfulness to Ceccato's endeavour.
Key words: Linguistic, machine translation, Scuola Operativa Italiana.

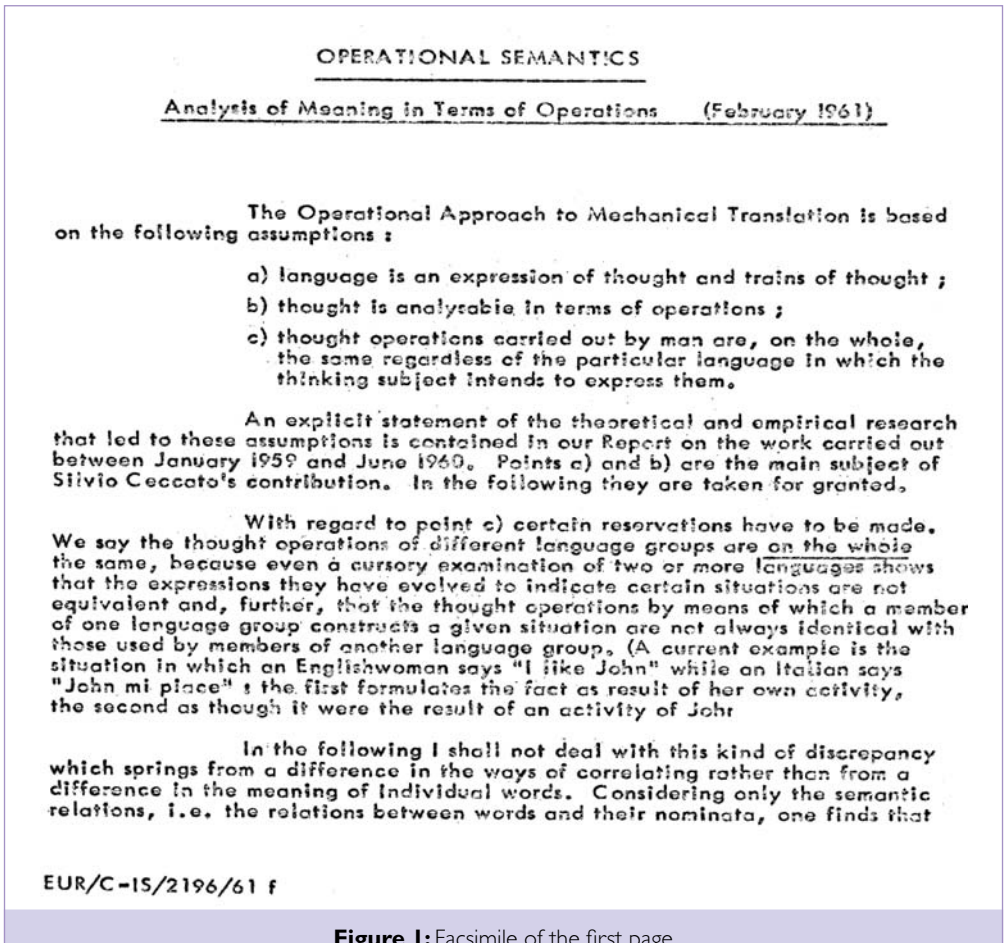
A historical note

The first published contribution by Ernst von Glasersfeld in the fields of linguistics and epistemology was his translation (from Italian to English) of Silvio Ceccato's *Il linguaggio con la Tabella di Ceccatieff*, published in 1951 by Hermann & Cie in Paris. He then joined Ceccato's "Scuola Operativa Italiana" and became deeply involved in their work which found financial support from Euratom, and the European Office of the U.S. Air Force (Air Research and Development Command). So he contributed to the Scuola's research on Linguistic Analysis and Mechanical Translation.

I met Silvio Ceccato for the first time in June 1956 in Namur (Belgium) where the First Cybernetics International Congress was taking place. Silvio's presentation was entitled *La machine qui pense et qui parle* (Ceccato 1958). We became friends and had fascinating discussions in Milan (with Enzo Morpurgo) and Vulcano (after a session in Messina with Giuseppe Vaccarino). Both were members of the Scuola Operativa Italiana.

When, in 1959, I was hired by Euratom for doing research in Automatic Documentation and Automatic Translation (GRISA, *Groupe de Recherches sur l'Information Scientifique Automatique*), I started an official cooperation with Ceccato's team and so met Glasersfeld. We succeeded in gathering a number of European experts and publishing contributions from them.

At Ceccato's suggestion, I invited Ernst von Glasersfeld to the "Séminaire Leibniz" which took place in Brussels, in February 1961. The paper he delivered then, *Operational Semantics: Analysis of Meaning in Terms of Operations*, was included in a Euratom internal report. Figure 1 shows a facsimile of its first page. Von Glasersfeld's short papers included in the Technical Report submitted to the Air Force are also mentioned here. He published three other papers during 1962–1963 but which are not readily available either. So I decided to make his first paper reader-friendly such that it can be published here for the first time.



OPERATIONAL SEMANTICS

Analysis of Meaning in Terms of Operations (February 1961)

The Operational Approach to Mechanical Translation is based on the following assumptions :

a) language is an expression of thought and trains of thought ;

b) thought is analysable in terms of operations ;

c) thought operations carried out by man are, on the whole, the same regardless of the particular language in which the thinking subject intends to express them.

An explicit statement of the theoretical and empirical research that led to these assumptions is contained in our Report on the work carried out between January 1959 and June 1960. Points c) and b) are the main subject of Silvio Ceccato's contribution. In the following they are taken for granted.

With regard to point c) certain reservations have to be made. We say the thought operations of different language groups are on the whole the same, because even a cursory examination of two or more languages shows that the expressions they have evolved to indicate certain situations are not equivalent and, further, that the thought operations by means of which a member of one language group constructs a given situation are not always identical with those used by members of another language group. (A current example is the situation in which an Englishwoman says "I like John" while an Italian says "John mi place" ; the first formulates the fact as result of her own activity, the second as though it were the result of an activity of John

In the following I shall not deal with this kind of discrepancy which springs from a difference in the ways of correlating rather than from a difference in the meaning of individual words. Considering only the semantic relations, i.e. the relations between words and their nominata, one finds that

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Figure 1: Facsimile of the first page.

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In the following I shall not deal with this kind of discrepancy which springs from a difference in the ways of correlating rather than from a difference in the meaning of individual words. Considering only the semantic relations, i.e., the relations between words and their nominata, one finds that languages differ considerably; that is to say, although the operational elements making up a train of thought may remain the same whether the thought be expressed in English or, say, in German, the arrangement or grouping of these elements in connection with the words expressing them will hardly ever be the same in both languages. Hence, any serious research aiming at M.T. must necessarily include thorough analysis of the semantic relations evolved by the language concerned.

The semantic analysis carried out up to the summer of 1960 has, on one hand, confirmed us in the opinion that of all the different kinds of words those expressing a developmental situation are the most complex in respect of the number of operational elements involved; on the other hand, if this preliminary work had not yet given us a definitive classification of elements (definitive both with regard to their number and to their final individuation), it had at least supplied us with precise ideas about how to carry out such analysis.

As a result of these considerations it was decided, at the start of the project's second stage, to concentrate analytical work on the most frequent expressions of developmental situations, because a classification of operational elements obtained in this way will presumably require few additions or modifications when being applied, subsequently, to other kind of expressions.

The direct expression of a developmental situation is usually called "verb"; the same situation, with an addition of another mental category can also be expressed by a noun (nomen actionis or nomen agentis).

In order to analyse a verb, we take stock of the operational elements necessary to make up the developmental situation expressed by it, and we try to push this analysis far enough to be able to distinguish the nominatum of the verb in question, by at least one operational element, from the nominata of all the other verbs that have been examined.

Since any developmental situation involves a temporalisation – i.e., the insertion of several operational elements into a certain temporal sequence (cf. the German term "Zeitwort") – our analysis proceeds by splitting the "meaning" of the verb into at least two moments. If, for instance, we consider verbs like "to come," "to go," "to move," etc, (i.e., verbs that indicate a developmental situation involving a change of place) we find that all of them refer – apart from other things – to a common block of operations:

- at a moment M1 a thing X is localized in a place L1, and
- at a moment M2 a thing considered the same thing X is localized in a place L2.

(Note: here and in the following, "to localize" means that one attributes a particular place to a thing.)

In our notation we represent this as follows:

M1	M2
X	X
L1	L2

A simple structure such as this can derive from more than one kind of developmental situation. In fact, we find that two of the verbs mentioned above – all of which contain this structure – can also be applied to more than one situation; for instance "John goes to the bathroom" and "this pipe goes to the bathroom" – where John is moving, and the pipe is not.

At first sight it might seem that the reason for this ambivalence is that by localizing John in the bathroom one categorically excludes his being localized anywhere else at the same moment, whereas with the pipe this is not so. This would amount to saying: the nominatum of "pipe" includes the operational particle "extension," while the nominatum of "John" does not. The distinction would be very comfortable, but unfortunately it does not always hold. In fact, I can also find the element of extension in the nominatum of "John" whenever I want to (for instance, if I know that his other name is Gulliver, I can, at a pinch, refer to his extension by saying "he goes from the front door to the bathroom").

Actually, the ambivalence of the verb is much less controllable and we cannot establish any a priori rules. We distinguish the situations to which it refers by what we call the "Notional Sphere," i.e., a network of specific relations established between nominata in the course of our living experience. It is on this basis that we cope with ambiguous words and also with expressions like "its shadow goes across the field" – where we are inclined to see motion when we know that "it" stands for a plane, and extension when we know that "it" stands for a tree. That is to say, in order to decide the question of locomotion/extension we use indications obtained, not from the verb and often not even from the sentence, but from a wider context.

If we now ask in what way the situation indicated by the verbs "to come," "to go," and "to move" differ from each other, we realize that, besides the common block of operational elements, each of them contains further

operational elements that distinguish it from the others.

In order to say that something "comes," we have to have an operational element that specifies the motion or extension of the common block as motion or extension reaching a particular point, namely a point with which the speaker identifies himself in some way (how this "identification" is arrives at operationally is another question which, in this context, does not interest us). We can represent this more complete situation by the formula:

M1	M2	M3
X	X	X
L1	L2	L_{Sp}

In this kind of analysis it is important to keep verbs apart from the prepositions which may accompany them. If, for instance, we put "to Paris" after "to come," we not only add something to the structure indicated by the verb, but we also change it; the element L_{Sp} is replaced by the definite location "Paris" which no longer necessarily conveys the indication the X reaches a point with which the speaker identifies himself.

The developmental situation expressed by "to go" is, of course, the inverse of the one indicated by "to come," and we write its formula:

M1	M2	M3
X	X	X
L_{Sp}	L2	L3

Here, too, we find that specification of L3, for instance by the preposition "to," may cancel the indication L_{Sp}; and, further, when X is of a certain kind – i.e., an engine – the "change of place" need no longer be seen as locomotion or extension, but may also indicate "partial motion" or "functioning.")

The developmental situation indicated by "to move" differs in at least two respects from the nominata "to come" and "to go." Firstly, unlike these, it cannot be categorized as "extension," but exclusively as "motion"; secondly, the verb gives no indication whether the thing X, which in M1 and M2 is localized in different places, will – grammatically speaking – find expression as subject or as object.

With regard to the first point we can say that, whereas the operational element added to the basic block

M1	M2
X	X
L1	L2

in the case of "to come" and "to go" did not interfere with the possibility of applying either the category of "motion" or that of "extension," in the case of "to move" there must be an element which excludes this dual possibility. In fact, if we see a thing in one place and, at a subsequent moment, in another place, this is not yet enough to say "the thing moves"; in order to say "it moves" we must see X in L1, then L1 without X and, finally, X in L2. Hence, the explicit formula for "to move" should be:

M1	M2	M3
X	–	X
L1	L1	L2

(Note: in M2 of this structure there is a location, i.e., the result of localising a thing, but the thing is not present. This would be contradictory, if the location were not simply the *maintained* result of the localisation effected for X in M1.

The second question – whether the X of the formula is to find expression in language as "subject" or "object" – is the age-old question of transitivity or intransitivity. From the operational point of view "subject," "object," and "development" are mental categories, that is to say, the results of a kind of operating different from that which yields, for instance, differentiata. We have already come across results of this purely mental kind of operating in the case of "locomotion"/"extension"; these, too, are mental categories. What interests us here, however, is not their intrinsic structure or the way in which they are made, but rather their application to a purely observational material and the expression of the resulting combinations of language. Thus we have found that the verbs "to come" and "to go" do not semantize the categorization of the situation as "locomotion" or "extension," but only the situation previous to the particular operational step of applying one of these categories. The verbs, however, require a certain part of the material (i.e., the part we have indicated by X) to be categorized as "subject" regardless of the situation in which they may occur. The verb "to move," on the other hand, leaves open the categorization of the corresponding piece, that is to say, it depends on the context whether X is to be categorized as "subject" or as "object." Hence the expression "John moves" is equally applicable to the situation where John, changes *his* place and to the situation where John changes the place of something else. The issue will be decided exclusively on the basis of other words figuring in the expression which may or may not indicate another thing categorized as "object." That is to say, in "John goes" or "John comes" X is necessarily regarded as the *agent* of the activity; in "John moves" this is not so, for "John" may indicate X, and in this case X and the agent will be one and the same thing; but if the expression contains the further indication of something categorized as "object" (e.g., "John moves a pawn") "John" merely indicates the agent, while the object "pawn" indicates the X of the development.

In this notation the agent is indicated by *a*, and it is given the place in the structure formula that best represents the role it plays in the developmental situation expressed by the particular verb.

In the case of verbs like "to come" and "to go," that is to say, verbs which conventionally take no direct object, the agent obviously coincides with that part of the development which we indicate by X; hence we write:

M1	M2	M3	
Xa	Xa	Xa	
L1	L1	L_{Sp}	for "to come," and

M1	M2	M3	
Xa	Xa	Xa	
L_{Sp}	L2	L3	for "to go."

In the case of verbs that represent a developmental situation that does not contain a part necessarily categorized as "subject," that is to say, a situation in which the agent can, but need not, coincide with X, because X can also be categorized as "object," we have two possible places for "a": one in coincidence with X, when the verb is used "intransitively" (Xa); and another, previous to the moment of the development concerning the object X, but that plays no other part in the moments of the development.

For "to move," therefore, we write:

	M1	M2	M3
a	X	–	X
	L1	L1	L2

and we add the notational rule that this formula implicitly comprises the alternative:

M1	M2	M3
Xa	–	Xa
L1	L1	L2

Which is indicated by the same verb whenever the linguistic expression of the developmental situation does not explicitly specify an object.

In the case of developmental situation that necessarily contain an object, we indicate this object by Y, while any other thing the development may bring into relation with X or Y is indicated by Z (or other letters).

As an illustration of how this method is applied I should like to take a group of comparatively simple and very common verbs, all of which concern some kind of contact between physical things:

to clap	to pat	to strike
to slap	to smack	to stroke
to slam	to knock	to beat
to tap	to hit	to smash

As in most groups of related verbs, two, three, or more of them may often apply to one and the same situation, but, on the other hand, there are situations which can be express only by one of the verbs. For instance, if one ship hits an iceberg and another strikes on iceberg, they are – in practice – doing much the same thing; but hitting a match and striking a match are two very different things; and this is so, not because the discrepancy between their meanings makes no appreciable difference in the one situation, whereas in the other the difference is of practical importance.

In the formulas given below the following symbols are used:

M1, … Mn – moments of the development;
Xa, X, Y – the thing which executes or undergoes the development:
Xa – if it always finds expression as subject of the verb,
X – if it finds expression either as subject or as object of the verb,
Y – if it always finds expression as object of the verb;
a – the agent responsible for the development;
f – the agent employing relative force;
i – the conative agent (i.e., acting with intention);
Z – the thing with which X or Y are put in relation;
L1, L2, … Ln, Lm – different locations, i.e., result of localization;
L/1, L/2 … – any location different from L1, L2, etc…

		M1	M2
to clap	a	X	X–Z
		L1	L2

- Establishing contact and producing noise;
- X and Z may be covered by a plural (e.g., "hands");
- X and/or Z may remain implicit.

		M1	M2
to slap	Xf	pX	pX–Z
		L1	L2

- Establishing surface contact, relative force;
- pX (part of X) or Z may be soft;
- pX remains implicit.

		M1	M2	M3
to slam	af	X	X–Z	X–Z
		L1	L2	L3

- Establishing state in contact and producing noise, relative force;
- Z remains implicit.

		M1	M2	M3
to tap	Xa	pX	pX–Z	Y
		L1	L2	L1

- Establishing and terminating point contact;
- PX remains implicit;
- Z may remain implicit;
- (this does not include the 2nd meaning, i.e., "to tap a barrel").

		M1	M2	M3
to pat	Xi	Y	Y–Z	Y
		L1	L2	L1

- Establishing and terminating surface contact;
- X must be conative;
- Y remains implicit;
- Y or Z must be soft.

		M1	M2	M3
to smack	Xa	pX	pX–Z	pX
		L1	L2	L/1

- Establishing and terminating surface contact and producing noise;
- PX remains implicit.

		M1	M2	M3
to knock	a	X	X–Z	X
		L1	L2	Ln

- Establishing and terminating contact;
- X and Z may remain implicit;
- X and Z must be hard.

		M1	M2	M3
to hit	af	X	Z	X–Z
		L1	Ln	L2

- Establishing contact, relative force;
- X may remain implicit.

		M1	M2	M3
to strike	af	X	X–Z	X–Z
		L1	L2	Ln

- Establishing contact and state of motion in contact, relative force;
- X and/or Z may remain implicit;
- L2–Ln may be motion of X in contact with Z (surface of X moving along point of Z, or X moving along surface of Z).

		M1	M2
to stroke	Xi	pX–Z	pX–Z
		L1	L2

- Motion in contact with Z;
- Xi must be conative;
- PX remains implicit;
- L1–L2 = motion of pX and extension of Z.

		M1	M2	M3	M4
to beat	af	X	X–Z	X	X–Z
		L1	L2	L1	L2

- Repeatedly establishing and terminating contact, relative force;
- X may remain implicit.

		M1	M2	M3	M4
to smash	af	X	X–Z	p1	p2
		L1	L2	Ln	Lm

- Establishing and terminating contact, relative force, and change of relation whole/part;
- Z remains implicit;
- P1 and p2 are parts of X or of Z;
- Ln and Lm are unspecified locations, one of which must be different from L2.

If we have to translate sentences containing any one of these verbs into another language, we discover that each one "corresponds" to more than one verb in the output language and that the choice will depend on the situation with which the sentence is concerned. Taking only the most current uses and leaving aside all figurative, metaphorical, or idiomatic occurrences, we shall require roughly the following group in German:

klatschen	tippen	treffen
klappen	antippen	streichen
schlagen	stossen	streichln

klopfen	anstossen	prügeln
hauen	krachen	zertrümmern
pochen	prallen	zerschlagen

Analysing them in the same manner as we analysed the English verbs,a first examination has led to the following results:

		M1	M2
klatschen	a	X	X–Z
		L1	L2

- Establishing surface contact and producing noise;
- X and Z may remain implicit;
- (this does not include the 2nd meaning, i.e., "to gossip").

		M1	M2	M3	M4
klappen	a	X	pX	X	pX
		L1	L2	L1	L3

- Change of direction by circular motioin (partial)
- PX remain implicit.

		M1	M2	M3
schlagen	af	X	X–Z	X
		L1	L2	Ln

- Establishing and terminating contact, relative force;
- X may remain implicit.

		M1	M2	M3	M4
klopfen	a	X	X–Z	X	X–Z
		L1	L2	L1	L3

- Repeatedly establishing and terminating contact and producing noise;
- X and Z may remain implicit.

		M1	M2	M3	M4
hauen	afi	X	pX	X	pX–Z
		L1	L2	L1	L3

- Establishing contact, relative force, circular motion;
- PX remain implicit;
- X must be conative.

		M1	M2	M3	M4
pochen	a	X	X–Z	X	X–Z
		L1	L2	L1	L2

- Repeatedly establishing and terminating contact;
- X or Z is soft;
- X and/or Z may remain implicit.

		M1	M2	M3
tippen	Xi	pX	pX–Z	pX
		L1	L2	L1

- establishing and terminating point contact;
- pX remains implicit.

		M1	M2	M3
antippen	Xi	pX	pX–Z	pX
		L1	L2	Ln

- establishing and terminating point contact;
- pX remains implicit.

		M1	M2	M3
stossen	Xa	pX–Z	pX–Z	Z
		Li	L2	Ln

- Motion in contact, terminating contact;
- pX remains implicit;
- (the situation often also contains the establishing of contact, but the verb, I think, only implies this).

	M12	M2	M3
anstossen	Xa	Xa–Z	Xa
	L1	L2	Ln

- Establishing and terminating contact;
- Z remains implicit.

	M1	M2
krachen + prep.	Xf	Xf–Z
	L1	L2

- Establishing contact, relative force, and producing protracted noise;
- X and Z must be explicit.

	M1	M2	M3
prallen + an	Xf	Xf–Z	X–Z
	L1	L2	L/1

- Establishing and terminating contact, relative force;
- X and Z must be explicit.

		M1	M2	M3
treffen	a	X	Z	X–Z
		L1	L2	L/1

- Establishing contact;
- L1–L/1 = motion of X;
- Z may remain implicit.

		M1	M2
streichen	a	X–Z	X–z
		L1	L2

- Motion in contact;
- L1—L2 motion of X and extension of Z;
- Z may remain implicit.

		M1	M2	M3	M4
streicheln	Xi	pX–Z	pX–Z	pX–Z	pX–Z
		L1	L2	L1	L2

- Repeated motion in contact, relative force;
- L1–L2 = motion of pX and extension of Z;
- PX remains implicit; X must be conative.

		M1	M2	M3	M4
prügeln	Xfi	Y	Y–Z	Y	Y–Z
		L1	L2	L1	L2

- Repeated establishment and terminating contact, relative force;
- Y remains implicit; X must be conative.

		M1	M2	M3
zertrümmern	Xf	Y	pY1	pY2
		L1	pY12	pY2

- Changing relation whole/part, relative force;
- PY1, pY2 = parts of Y remaining implicit;
- Y must be explicit.

		M1	M2	M3	M4
zerschlagen	Xf	Y	Y–Z	p1	p2
		L1	L2	Ln	Lm

- Establishing contact, relative force, and changing relation whole/part;
- L1–L2 = motion of Y;
- p1, p2 = parts of Y or of Z;
- Y or Z remain implicit.

These analyses should be considered an illustration of method rather than final and definitive results. Above all I should like to stress once more that in each case the analysis has been pushed just so far as to enable us to discriminate the nominatum of the particular verb from those of the verbs under consideration. Obviously some of the pieces that are used here as "elements of meaning" are far from being elementary, nor are all of them as clear and unequivocal as they should be (e.g., the difference of attributing location to the one of two pieces in contact rather than the other). As our vocabulary increases, many of the formulas may have to be extended or corrected in order to discriminate the developmental situations represented by them from other similar ones, which, so far, have not been considered. In other words, the formulas given here, although representing more or less accurately some characteristics of the nominata of the respective verbs, are as yet certainly not exhaustive; they should however, be sufficiently advanced to show that an exhaustive analysis of the meaning of words can be achieved in this way.

Besides, they show a type of difficulty in translating (regardless of whether mechanised or not) which, hitherto, has certainly been underrated, if not altogether overlooked: the lack of precise correspondence between words of different languages that are often held to be "synonymous." This, of course, is not really a momentous discovery. In every bilingual dictionary one finds thousands of instances of this kind and human translators are so thoroughly used to them that they rarely register them consciously.

The verb "to hit" – to take one from our selection – occurring in the sentence "the car hits the wall," could be translated in German as "prallen," "stossen," "krachen," plus a suitable preposition; in the sentence "Mary hits John" it would be rendered by "schlagen" or "hauen" without a preposition (unless there is some previous indication to the effect that Mary is flying through the air or involved with some other kind of relatively fast locomotion); in the sentence "he hits the target" the German verb would have to be "treffen," and there are other uses of "to hit" which, in translation, would require some further German verbs. And the verb "to hit" is by no means an exception in this respect. Nearly all the verbs used in everyday language require multiple output in another language, because the output language hardly ever contains an exact operational replica of the original verb to be translated.

Hence, when we translate – i.e., when we reconstruct the correlational net indicated by a particular input text and then express that correlational net in another language – the actual meaning of the input verb is only one of the factors that we use in the procedure. The other factor is the complex of indications that we glean from the context of the particular occurrence and, in a wider sense, from all we know as a result of previous experience and learning with regard to the kind of situation referred to by the input text. This complex of indications is accumulated in what we call the Notional Sphere.

It is important to realise that reference to the Notional Sphere is instrumental not only in the process of translation, but already in the much more usual and elementary process of understanding a given text. If "to understand" does in fact mean to reconstruct a situation, the elements of which are conveyed by the text, it is clear that we have to refer to the Notional Sphere in order to understand sentences such as "John hits Mary," "John hits the target," and "John hits the bottom of the lift shaft" because it is only on the basis of some previous knowledge about things like Mary, target, or lift shaft that we can establish the exact part John plays in the situation generically conveyed by "to hit."

Since translating presupposes understanding the text that is to be translated, there would seem to be no possibility of bypassing the problem. On the other hand, however, the research on translation has helped a great deal to show the real extent of the problem and suggest ways and means towards its final solution. We now know for certain that the quality of translation will always be proportional to the exactness of the semantic analyses and the comprehensiveness of the network of associations contained in the Notional Sphere, and that both factors can be indefinitely refined and improved. [EUR/C-IS/2196/61 f]

A continuing effort in research and development

Research by Ceccato and his team was carried out at the *Centro di Cibernetica e di Attività Linguistiche* (Università di Milano). Financing came from two major contracts running simultaneously: one with Euratom (my initiative), and one with the Air Research and Development Command (contract AF 61 (052)-212). A comprehensive report of their first achievements was issued on the 4th June 1960 (RADC-TR-60-18), cf. also Ceccato (1961). It included, after a major contribution by Ceccato, Ernst's second paper: *Some notes on Inter-Language Correspondence* (pp. 117–129 of the report). This report also contained a smaller, more technical contribution by him: *Notes concerning output matrices* (pp. 170–174 of the report).

As is well known, after the initial years of enthusiasm, sponsors became more and more reluctant to contribute any further. I left Euratom in 1963; IDAMI (Italian Institute of Engineering Information) took over the contract with the U.S. Air Force Office of Scientific Research. In 1965 a final report was issued. It included a paper by Ernst von Glasersfeld and Paolo Terzi (1965) on automatic sentence analysis. Finally Ernst joined the Georgia Institute for Research, and later the University of Massachusetts.

From Ernst's first papers onwards, Ceccato's influence is evident. And maybe Operational Semantics could be considered – even today – as a good introduction to the Scuola Operativa Italiana's concepts and methods.

Ceccato died in 1997, but in 1987 a follow-up of the Scuola had been founded by Felice Accame: *La Società di Cultura Metodologico-Operativa,* publishing *Quaderni di Methodologia* including Ernst's *Il costructivismo radicale* in 1998, and including with veterans such as Vittorio Somenzi, Giuseppe Vaccarino and Ernst von Glasersfeld: a lifelong faithfulness!

ABOUT THE COMMENTOR

Born in Paris in 1923, Paul Braffort graduated at the Sorbonne in both Philosophy and Mathematics. He worked with the French Atomic Energy Commisssion, then for Euratom and the European Space Agency. Later he joined The University of Paris 11 (Orsay), the University of Chicago and the "Collège International de Philosophie." He is a member of the OuLiPo (Ouvroir de Littérature potentielle) founded by Raymond Queneau (a Ceccato's friend) and François Le Lionnais (who was one of the organisers of the Namur's International Congress of Cybernetics.

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