THE 'TIME CATEGORY' IN NATURAL LANGUAGES AND ITS SEMANTIC INTERPRETATION

1. The approach outlined below is to be understood as a component of a more general method of semantic interpretation of natural languages,

Roughly speaking this method (developped in my forthcoming Elements of a Semantic Theory of Natural Languages) might be characterized as follows:

1°. A semantic system S in a very general form (like that of Carnap's 'Language A' or 'Language B' - cf. Carnap, Introduction to Symbolic Logic and Its Applications, 1958) is constructed. this system contains:

- A lexicon (specifying the signs used)
- Rules of designation (cf. Carnap, Meaning and Necessity, 1960, p. 4)
- Truth conditions
- Transformation rules.

2°. Rules of translation from a natural language, L_λ, into such a semantic system are established.

3°. System S_i is required to fulfil some explicit conditions in order to make each kernel sentence from L_λ translatable in S.

4°. A new system, S_i, is constructed, which actually fulfils the imposed conditions on translability in S. S_i, in its general form, becomes an extension of S; when S_i is put into correspondence with a concrete language, the 'meanings' (i.e. designata) assigned by these rules to different descriptive signs of S_i become more definite. Under such conditions, every sign from S_i which is a translation of a sign from L_λ has the same denotatum as the corresponding sign from L_λ.

5°. Under condition 3°, if G_i is a translation in S_i of a sentence P_i from L_i, every characterization which holds for G_i holds for the corresponding P_i too.

2. Let us assume that, in agreement with the translation rules, each kernel sentence of the simplest form (that means sentences with no adverbials determiners)

(1) N ⌢ Art ⌢ V

(2) N ⌢ Art ⌢ V ⌢ N ⌢ Art

.....

can be translated in S by an individual description (of course, only when the article has the function of individualization).

In agreement with this assumption, if L_i would be English, a sentence like

(3) the horse is running

would have as its appropriate translation in S_i the expression

(4) $(\exists y)(x)\left[(HOx \equiv (x=y)) \cdot RUy\right]$

(where 'HO' is a predicate constant which is a translation of Engl. horse, 'RU' is a predicate constant which is a translation of Engl. to run).

3. It is obvious that a translation like (4) does not account for the tense of the verb.

In order to be able to represent in our semantic system the tense distinction from natural languages, we take the following way:

1°. We shall transform our earlier system S_i into a coordinate language (in the sense of Carnap's, Introduction..., pp. 161-171; see also Carnap, Meaning and Necessity, 1960, pp. 74-75).

The individual expressions in standard form are referring to 'positions' in an ordered domain. An expression like 'a^i_j' would designate the 'position i' at the 'time j'.

For our further discussion is enough to interpret each

location '$\underset{j}{a}^1$, $\underset{j}{a}^2 \ldots \underset{j}{a}^k$' as different "things' in the universe, and each expression of the form '$\underset{1}{a}^k$, $\underset{2}{a}^k \ldots \underset{m}{a}^k$' as different "locations" in time of the same "thing". The expression '$\underset{0}{a}^k$' has to be interpreted as designating a thing with no respect to its "time location"; in other words such an expression is to be understood as referring to a thing "abstracted" from time, or - what is the same for us - being in any time. The expression '$\underset{0}{a}^0$' refers to the "empty" position or to the "null-thing". The number of the "positions" is, perhaps, unfinite.

2°. We introduce now the following two-arguments predicates with the corresponding designation rules:

(5) SIMxy = '$\underline{x}$ is simultaneous to $\underline{y}$'

(6) POSxy = '$\underline{x}$ is posterior with respect to $\underline{y}$'

(7) ANTxy = '$\underline{x}$ is anterior with respect to $\underline{y}$'

Relation referred to by (5) is reflexive, symetric and transitive. Relations referred to by (6) and (7) are irreflexive, antisymetric, but transitive.

Finally we introduce the predicate 'I' by means of the following definition:

(8) $Ixy =_{df} (x = y)$

Herefrom we can state:

(8') $\sim Ixy = (x \neq y)$.

3°. We establish now the following 'meaning postulates' (in the sense of Carnap's, Meaning and Necessity, Supplement: B. Meaning Postulates, pp. 222-229).

Meaning postulates:

(9) $(x)(Ixa^i_j \supset SIMxa^0_j)$

(10) $(x)(Ixa^i_{k>j} \supset POSxa^0_j)$

(11) $(x)(Ixa^i_{k<j} \supset ANTxa^0_j)$

(12) $(x)(SIMxa^0_j \supset \sim SIMxa^0_{k \neq j})$

(13) $(x)(SIMxa_j^\circ \supset \sim POSxa_j^\circ \cdot \sim ANTxa_j^\circ)$

The expression 'a_j°' in (9)-(13) above refers to an arbitrary 'time location' of any 'thing'.

j. It is known that, as far as the natural languages are concerned, the category of tense could be roughly defined as the relation between the time of the action (expressed by the verb) and the time when the message is uttered; that is to say the present "expresses" the simultaneity with the time the message is uttered, the past expresses the anteriority with respect to the time of the message and the future expresses the posteriority with respect to the time of the message.

This use of defining tenses suggests the following treatment of tense category in terms of our semantic system:

1°. The time of the message is to be represented by any value of j from the expression 'a_j°'.

2°. If x is the 'thing' referred to by an individual description, then an expression like '$SIMxa_j^\circ$' expresses exactly the relation of the 'thing' referred to by the variable x and the "time of the message" expressed by 'a_j°'. That is, '$SIMxa_j^\circ$' means "x is simultaneous with the time of the message", which corresponds to the definition of the present. Analogously we may interpret the expressions '$POSxa_j^\circ$', '$ANTxa_j^\circ$' as corresponding to the definitions given to the future and the past, respectively.

According with 1° and 2°, we may establish the following translation rule:

(14) Translation rule: Replace the symbols Prez, Past, Future from the sequences Prez ⌢ Verb, Past ⌢ Verb, Future ⌢ Verb generated by a grammar G_i by the expressions: '$SIMxa_j^\circ$', '$ANTxa_j^\circ$', '$POSxa_j^\circ$', respectively.

Let us assume now sentence (3) is given together with its underlying P-marker in the three tense versions above discussed. We shall get the following three translations:

(4a) $(\exists y)(x)\left[(HOx \equiv Ixy) \cdot RUy \cdot SIMxa_j^\circ\right]$

(4b) $(\exists y)(x)\left[(HOx \equiv Ixy) \cdot RUy \cdot ANTxa_j^\circ\right]$

(4c) $(\exists y)(x)\left[(HOx \equiv Ixy) \cdot RUy \cdot POSxa_j^\circ\right]$

Obviously (4a) is the translation for the present version, (4b) - for the past version, (4c) - for the future version.

Let us suppose that, in the 'state of affairs' referred to by our expressions, the only thing having the property 'horse' is the thing being in the point '$a_o^\bullet$'; let us consider further 'a_5°' representing the 'time of the message'. In this case, if we put '$a_5^\bullet$' instead of y, we may say that

(4a') $(x)\left[(HOx \equiv Ixa_5^\bullet) \cdot RUa_5^\bullet \cdot SIMxa_5^\circ\right]$

is true; moreover, (4a) is factually true.

If the position referred to by $a_o^\bullet$ does not have actually the properties predicated by (4a') or if there are several positions having the properties predicated by (4a'), then (4a') is false, and moreover, factually false.

In contradistinction with the truth conditions of (4a'), which are factual, the truth conditions of the following expressions are logical;

(4a'') $(x)\left[(HOx \equiv Ixa_6^\bullet) \cdot RUa_6^\bullet \cdot SIMxa_5^\circ\right]$

(4a''') $(x)\left[(HOx \equiv Ixa_4^\bullet) \cdot RUa_4^\bullet \cdot SIMxa_5^\circ\right]$

(4b') $(x)\left[(HOx \equiv Ixa_6^\bullet) \cdot RUa_6^\bullet \cdot ANTxa_5^\circ\right]$

(4b'') $(x)\left[(HOx \equiv Ixa_5^\bullet) \cdot RUa_5^\bullet \cdot ANTxa_5^\circ\right]$

(4c') $(x)\left[(HOx \equiv Ixa_4^\bullet) \cdot RUa_4^\bullet \cdot POSxa_5^\circ\right]$

(4c'') $(x)\left[(HOx \equiv Ixa_5^\bullet) \cdot RUa_5^\bullet \cdot POSxa_5^\circ\right]$

It is obvious that all these expressions are false only as consequence of the meaning postulates (9)-(13) and hence are logically

false.

The intuitive interpretation of the L-falsehood of these expressions runs as follows: for instance (4a") says that a past event is simultaneous with the time of the message; sentence (4a") says that a future event, that is an event which is not yet occuring in the time of the message is simultaneous with the time of the message. These interpretations seem to me as giving a purely semantic expression of pragmatical facts where the 'atitude' of the speaker towards the universe is involved.

5. The above proposed interpretation may account also for some ambiguities of the natural languages. We shall take an example from other language than English, which makes a distinction between the 'pure present' and the "progressive present". For instance, in French the sentence:

(15) Le chien qui dort, mange beaucoup.

might be interpreted as saying that:

(15a) the dog sleeps and eats at the time when the message is uttered

or

(15b) the dog sleeps at the time when the message is uttered and in general eats (much).

Obviously interpretation (15a) characterizes (15) as L-false, (15b) as possibly F-true.

This situation can be accounted for by supplementing the translation rule (14) with the following statement:

(14a) Replace the symbol Prez by:

(α) SIM_{x}^{a};

or by

(β) SIM_{x}^{a}.

The underlying structure of (15) is represented by the sentences

(15α') Le chien dors.

(15β') Le chien mange (beaucoup).

(We shall disregard the word beaucoup, because it is irrelevant for our discussion.)

Let 'CH', 'DO' and 'MA' be the predicates by which chien, dormir and manger are to be translated in S_i and 'a°_{j}' the time of the message. The translation of (15α',15β') will be, respectively:

(15α'') $(\exists y)(x)\left[(CHx \equiv Ixy) \cdot DOy \cdot SIMxa^{\circ}_{j}\right]$

(15β'') $(\exists y)(x)\left[(CHx \equiv Ixy) \cdot MAy \cdot SIMxa^{\circ}_{j}\right]$

Let us consider S_i, accounting for French, has a meaning postulate saying predicates 'DO' and 'MA' are incompatible simultaneously.

Obviously, in this case the class comprising sentences (15α', α'') is inconsistent, or: the conjunction of (15α') and (15β'') is L-false.

If we choose the other possible translation, i.e.

(15β') $(\exists y)(x)\left[(CHx \equiv Ixy) \cdot DOy \cdot SIMxa^{\circ}_{j}\right]$

(15β'') $(\exists y)(x)\left[(CHx \equiv Ixy) \cdot MAy \cdot SIMxa^{\circ}_{o}\right]$

Then the class comprising (15β', β'') can be possibly F-true and so can be their corresponding conjunction.

Translations (15α', α'') account for the 'meaning' (15a); translations (15β', β'') account for the meaning (15b).

It is easy to see that the facts accounted for in 5 are of purely semantic nature, in contradistinction with the merely pragmatic nature of the facts accounted for in 4. In the former case only the 'meaning' of the expressions 'CHx', 'DOx', 'MAx' and '$SIMxa^{\circ}_{o}$' is involved, whereas in the cases under 4 we have had to do with various possibilities of "referring" being at the disposal of the speaker.