MEANING, SYNONYMY AND TRANSLATION

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The aim of the present paper is to contribute to the development of a formal semantic theory with the publication of some initial results of research dealing with the logical interrelations among the notions of meaning, synonymy and translation. It also proposes to outline the work to be done.

At first sight the question of logical interrelations among the three notions mentioned above seems trivial. Two units belonging to some linguistic level /e.g. two morphemes or two sentences/ are synonymous if and only if their meaning is the same. The meaning of a linguistic unit is that something which is common in the units synonymous with it /including also itself/, or applying the usual set theory refinement of such definitons based on abstraction the meaning of a unit is that abstraction class with regard to synonymy as an equivalence relation which includes the form in question, or generalizing this method of set theory refinement, the meaning of a unit is the object assigned to this abstraction class where we can choose at will those objects which we assign to the abstraction classes belonging to the synonym with the only condition that the assignement should establish a one-to-one correspondence. Finally, translation is such a mapping of the units of a certain linguistic level of the source language onto the units of the target language belonging to the same level that leaves the meaning of the units unchanged.

But we have such simple relations only if homonymy is ignored. This can usually be justified methodically by the assumption that the elimination of homonymy /e.g. the addition of a homonymy-index to morphemes, or that of symbols expressing the results of the syntactic analysis of sentences, e.g. the provision of P-markers/ must precede semantic analysis. In practice, however, when eliminating homonymy we have to rely on semantic notions, first of all the notion of meaning. Consequently, we think it more correct to study the logical interdependence of the notions synonymy, meaning and translation with regard to the phenomenon of homonymy, even when this needs an examination of more complex interrelations than those outlined above. Also we have to eliminate the logical jump involved in the above reasoning which tries to define the notion of meaning within one language while in the definition of translation it already regards it as an interlinguistic notion.

Az I have done so far in this paper I am not going to state definitely on which linguistic level I am examining the three mentioned semantic notions. Although it is quite unusual to speak about translation on a lower level than the level of the sentence, in reality we always translate a text of the source language into the target language, and the sentence by sentence translation is only an approximation to the text translation taken in the strict sense, even though it is a better approximation than the word by word /or morpheme by morpheme/ translation. We do not usually call a grapheme by grapheme rendering a translation /that is, an approximation to the text translation/ but a transliteration.

For the sake of simplicity, however, let us remain within the scope of one single language, at least for the time being, and even within this frame at a definite linguistic level, and let us try to clarify the logical interrelations between the notions of meaning and synonymy taking homonymy into due account.

From a mathematical point of view the situation is the following. There are two sets, a set S of certain forms belonging to the language in question /in general complex symbols, markers/, furthermore a set Ω of certain objects /denoted things/, which can be denoted by the elements of S. Furthermore we consider a subset D of the Cartesian product of the sets S and Ω which include those and only those ordered pairs (s, ω) , where s is some element of the set S, while ω is such an element of set Ω that can be denoted by the linguistic form that is such an object which is a possible meaning of the form s. A form s $(s \in S)$ can have more than one meaning: several objects ω $(\omega \in \Omega)$ can have $(s, \omega) \in$ D /homonymy/ and vice versa, an object ω can be denoted by several form s /synonymy/.

Two forms, s_1 and s_2, may be called weak /or partial/ synonyms, if they have at least one meaning in common.

$$s_1 \mathfrak{S} s_2 \leftrightarrow \exists \omega((s_1, \omega) \in D \wedge (s_2 \omega) \in D), \qquad /1/$$

where $\mathfrak{S}$ denotes weak synonymy and the variables ω /with or without index/ range over the set Ω /while the variables s with or without index over the set S/.

Weak synonymy thus defined is evidently a symmetrical relation:

$$\forall s_1 \ \forall s_2 (s_1 \mathfrak{S} s_2 \longleftrightarrow s_2 \mathfrak{S} s_1).$$

If we assume it as an axiom that every form has at least one meaning:

$$\forall s \exists \omega((s, \omega) \in D). \qquad /2/$$

that is, we leave out of S the meaningless forms then weak synonymy becomes a reflexive relation:

$$\forall s (s \mathfrak{S} s).$$

/The meaningless forms would not be weakly synonymous between themselves./ With an example we can easily show that weak synonymy is not a transitive relation.

The question of the definition of meaning with the help of the notion of synonymy, if, for the time being, we interpret synonymy as weak synonymy, will lead to the following mathematical problem: Be given the set S and the reflexive and symmetrical relation $\mathfrak{S}$ defined in it. Is it possible to find such a set Ω that by suitably choosing the subset D of the Cartesian product $S \times \Omega(1)$ is fulfilled? To what extent does the relation determine the set Ω disregarding, of course, the notations of their elements, and also the set D?

I am going to demonstrate that the sets Ω and D can always be chosen in the specificd way, and generally in more than one way. For this purpose it is convenient to represent the σ relation with a graph, the verteces of which represent the elements of the set S, Furthermore, two of its verteces are then and only then connected by an edge if the relation holds among the elements of S represented by then. We denote this graph also with σ, and its verteces in the same way as the element of S represented by them. Since σ is a reflexive relation, from each of the verteces of the graph a " loop line " leads into itself. We leave these loops out of graph σ but even without them each of its verteces is considered to be connected with itself.

If such sets Ω and D exist, then for any of the elements Ω of ω the following is valid: those verteces of the graph to which /that is to the elements of the set S represented by them/ $(s, \omega) \in$ D holds are linked together in pairs because these elements are weakly synonymous for ω is their common meaning. Consequently all such verteces are the verteces of a total graph σ_ω which is the subgraph of the graph σ.

Any of the verteces s of the graph σ is also a vertex of at least one such total subgraph σ_ω because according to the axiom /2/ there is at least one such element ω of Ω for which $(s, \omega) \in$ D. Furthermore, any edge of the graph σ is the edge of at least one total subgraph σ_α. If, namely, the edge in question connects the verteces s_1 and s_2 of the graph σ then the s_1 and s_2 elements of the set S are weakly synonymous, that is Ω has at least one such element ω for which $(s_1, \omega) \in$ D as well as $(s_2, \omega) \in$ D. In this case both s_1 and s_2 are verteces of the subgraph σ_ω, consequently, as σ_ω is a total graph, the edge connecting the two verteces is an edge of σ_ω.

Conversely, let be given such a set M of the subgraphs of the graph $\mathfrak{G}$, that a/ each graph belonging to M is a total graph, furthermore, b/ each vertex of the graph $\mathfrak{G}$ is also a vertex of at least one graph belonging to M, and c/ each edge of the graph $\mathfrak{G}$ is at the same time an edge of at least one graph belonging to M, then we can obtain the sets Ω and D of the required property in the following way. Let us assign to the graphs belonging to M an arbitrary object in a one-to-one correspondence; be Ω the set of these objects /e.g. Ω be M itself, if we assign to each graph belonging to M, the graph itself./ Furthermore, let D be the set of all those ordered pairs (s, ω) , where $s \in S$, $\omega \in \Omega$ and which fulfil the condition that the vertex s of the graph $\mathfrak{G}$ is at the same time the vertex of the graph belonging to M to which the object ω is assigned. In this case /1/ is fulfilled. Indeed, be s_1 and s_2 two such elements of S that fulfil the relation $s_1 \mathfrak{G} s_2$, that is the verteces s_1 and s_2 of the graph $\mathfrak{G}$ are connected by an edge. This edge is because of c/ the edge of some graph belonging to M, let ω be the object belonging to this graph. Then $(s_1 \omega) \in$ D as well as $(s_2, \omega) \in$ D, because both s_1 and s_2 are verteces of that graph belonging to M to which the object ω is assigned. Vica versa, if for some object ω belonging to Ω $(s_1, \omega) \in$ D, and $(s_2, \omega) \in$ D, i.e. both of the verteces s_1, s_2 of the graph $\mathfrak{G}$ are at the same time verteces of that graph belonging to M to which the object ω is assigned then because of a/ s_1 and s_2 are connected with an edge within this graph, consequently, since this graph is part of graph $\mathfrak{G}$, this edge is also an edge of $\mathfrak{G}$, i.e. the relation s_1 $\mathfrak{G}$ s_2 will be fulfilled. Az a consequence of condition b/ also the axiom /2/ will be fulfilled.

Thus we have yet to show that the subgraphs of the graph $\mathfrak{G}$ have such a set M which satisfies a/, b/ and c/ conditions. Such a set M is formed by the isolated verteces that is, those not connected with any other vertex of the graph $\mathfrak{G}$, as total graphs with one single vertex, further the edges of the graph G , as total graphs of two verteces. But such a set M form also the maximal total subgraphs of the graph G , that is the total subgraphs of G such, that not a single vertex of the graph G is connected by means of an edge of the graph G^* with each vertex of the graph G , unless the vertex in question is not a vertex of the graph G^* , /Each total subgraph of the graph G is the element of some maximal total subgraph of G^*. Thus each vertex of G can be interpreted as a total subgraph with one vertex, and all its edges as total subgraphs with two verteces. That means that each of the verteces of G is also the vertex of some of its maximal total subgraphs and each of its edges is also the edge of some of its maximal total subgraphs. We can obtain such a maximal total subgraph from the total subgraph G' of the graph G by adding to it a vertex /if there are more we can choose one at will/ of the graph G which is connected by means of an edge of the graph G with any one from among its original or added verteces but we add also the connecting edges until the graph has some left.

The two sets M that we have mentioned by way of illustration are in general different /disregarding the trivial case when graph G has no total subgraph with three verteces which would correspond to a language that does not exhibit three, pairwise weakly synonymous forms. This shows that weak synonymy taken in itself is not suitable for the definition of the meaning of linguistic form, not even if we leave out of consideration the choice of the objects acting as meaning. Hence, if we want to define the notion of meaning with the help of synonymy then, beside weak synonymy, we have to take into consideration also some other kinds of relations of synonymy as well.

Such a relation is, first of all, strong synonymy. We call two linguistic forms s_1 and s_2 strongly /or totally/ synonymous if all their meanings are common:

$$s_1 \Sigma s_2 \leftrightarrow \forall \omega ((s_1, \omega) \in D \leftrightarrow (s_2, \omega) \in D)$$

/3/ where denotes strong synonymy. In other words, two forms are strongly synonymous if and only if the sets of their meanings are equal:

$$s_1 \Sigma s_2 \leftrightarrow \hat{\omega}((s_1, \omega) \in D) = \hat{\omega}((s_2, \omega) \in D).$$

From this it directly follows that strong synonymy is a reflexive, symmetrical and transitive relation, i.e., it is an equivalence relation:

$$\forall s (s \Sigma s),$$

$$\forall s_1 \; \forall s_2 \; (s_1 \Sigma s_2 \leftrightarrow s_2 \Sigma s_1),$$

$$\forall s_1 \; \forall s_2 \; \forall s_3 ((s_1 \Sigma s_2 \wedge s_2 \Sigma s_3) \rightarrow s_1 \Sigma s_3).$$

Furthermore, if two forms are strongly synonymous then they are also weakly synonymous:

$$\forall s_1 \; \forall s_2 (s_1 \Sigma s_2 \rightarrow s_1 \sigma s_2), \qquad /4/$$

for if forms coincide in every meaning then they have a common meaning since according to /2/ they have meaning. Finally, if among three forms the first two are weakly and the second and the third strongly synonymous then the first and the third are weakly synonymous:

$$\forall s_1 \; \forall s_2 \; \forall s_3 ((s_1 \sigma s_2 \wedge s_2 \Sigma s_3) \rightarrow s_1 \sigma s_3), \; /5/$$

because in this case the first two forms have common meaning and this is the common meaning also of the first and the third forms for each meaning of the second form is the meaning of the third form as well.

The question of the definition of the notion of meaning with the help of the notions of weak and strong synonymy leads to the following mathematical question: Be given the set S, and the reflexive and symmetrical relation σ defined in S, finally an equivalence relation Σ interpreted in S which additionally fulfill also conditions /4/ and /5/. Is it possible to find a set Ω and a subset D of the Cartesian--product Sx Ω such that assuming axion /2/ /1/ and /3/ are fulfilled? To what extent do the relations σ and Σ determine the set Ω /disregarding the notations of its elements/ and the subset D of the Cartesian-product $S \times \Omega$?

With a reasoning similar to the above, it can be demonstrated that the sets Ω and D can always be chosen in the required way. It is again expedient to visualize relations σ and Σ by means of a graph as explained in the above; these graphs will be denoted by σ and Σ , resp. and their verteces will be denoted in the same way again as the elements of the set S represented by them. The graph can be divided into such /uniquely determined, maximal/ total subgraphs, which have no common vertex /not even two of them have/ because Σ is an equivalence relation. This graph Σ is, because of /4/, the subgraph of graph σ . Further, if, as a consequence of /5/, a vertex of Σ is connected by an edge σ with a vertex of the maximal total subgraph of σ , then it is connected by means of an edge of σ with each vertex of this maximal total subgraph. This circumstance makes it possible to define the so-called vector graph of σ with respect to the subgraph of Σ . We obtain this factor graph from σ by replacing each of those verteces with a new one, that are verteces of the same maximal total subgraph of Σ , and we connect two such new verteces with an edge if and only if each /as pointed out above, any two/ of the verteces of those maximal total subgraphs of Σ whose verteces have been replaced by the new verteces in question, are connected by an edge of σ . This factor graph is usually denoted by σ / Σ .

According to a reasoning similar to the above we obtain all possible sets Ω chosen in the required fashion and the sets D belonging to them in the following way. Consider a set M of the subgraphs of the graph σ/Σ that fulfills conditions a/, d/ and c/ in which, however, the graph σ is to be replaced by the factor graph σ/Σ . We establish a one-one correspondence between the graphs of the set M, and some objects. The set of these will be Ω . D will be the set of those ordered pairs (s, ω) for which $s \in S$, $\omega \in \Omega$ and which satisfy the condition that the vertex of the factor graph $\mathfrak{G}/\Sigma$ that replaces the s vertex of the graph $\mathfrak{G}$ in this factor graph and also those verteces of $\mathfrak{G}$, that are verteces of the maximal total subgraph that contains also s among its verteces, is also the vertex of that graph of M to which the object ω has been assigned.

If these Ω and D sets were uniquely defined then the meaning of the forms belonging to M could be defined with the help of the notions of weak and strong synonymy, as follows. The meaning of a form s is the object assigned to the graph belonging to the set M to the verteces of which belongs the vertex of the factor graph $\mathfrak{G}/\Sigma$ that replaces the vertex s of the graph $\mathfrak{G}$ in this factor graph /among others/ where $\mathfrak{G}$ and Σ are the graphs depicting weak and strong synonymy in the above manner, while M is the set of the subgraphs of the factor graph $\mathfrak{G}/\Sigma$ satisfying the above a/, b/ and c/ conditions, though in the conditions b/ and c/ the graph $\mathfrak{G}$ should be replaced by the factor graph $\mathfrak{G}/\Sigma$. Finally, the assignement of the objects to the graphs of the set M brings about a one-to-one correspondence.

However, the set M, except for the trivial case when the factor graph $\mathfrak{G}/\Sigma$ has no total subgraph with three verteces, can be chosen in several ways. Consequently, the notions of weak and strong synonymy are not even together suitable to define the notion of meaning with their help. For this purpose we have to take into consideration some further notions of synonymy.

A great number of synonymy relations can exist between two linguistic forms, e.g. they may have at least two meanings in common, or may have at least three common meanings, etc., with one exception at most each of their meanings is common /that is, they have the same number of meanings and among them there is only one different, and not more, or each of the meanings of a form is also the meaning of the other form, but this later has one additional meaning/, all their meanings are common except maximum two, etc., furthermore, there may be such a relation where two forms have more meanings in common than different ones. It seems probable that generally it is possible to define precisely the notion 'synonymy relation' with taking into consideration the structure of the formula expressed in terms of the symbols of mathematical logic which formalizes the definition of 'relation'. /See formulae /1/ and /3/./ Of course, these synonymy relations, too, reveal certain characteristics. /Namely, weak synonymy is reflexive and symmetrical, strong synonymy is an equivalence relation/. On the other hand, there are also certain connections among them /as, for example, the connections between weak and strong synonymy expressed by formulae /4/ and /5/./

However, we need not consider every possible synonymy relation. It would be enough to find a complete system of synonymy relations in the sense that the synonymy relations belonging to this system, except for the one-to-one correspondence, uniquely define the meaning of the linguistic forms. More precisely, the formulae (δ) defining the synonymy relations belonging to the system together with the formulae (ε) formalizing the characteristics of the synonymy relations belonging to the system and also, the synonymy relations belonging to relations existing between these characteristics have the property that it is always possible to find a set such that for the given set S and the relations interpreted on it, that correspond to the formulae (ε), leaving out of consideration the notation i.e., the one-to-one correspondence , in a unique way, furthermore, it is possible to find in a unique way, a subset D of the Cartesian-product $S \times \Omega$ such that beside axiom /2/ the formulae (δ) are fulfilled.

If we knew a total system of synonymy relations then with the help of the synonymy relations belonging to this system, or with the help of the graphs depicting them /which is the same/ we could define the meaning of the linguistic forms, but, of course, in a more complicated way, than with the aid of the abovementioned notions of weak and strong synonymy used for the definition of meaning /which is unsatisfactory because these relations do not form a total system/.

However, the question, or better to say, the problem of how to render a total system of synonymy relations, is, for the time being, mathematically unsolved. At present I cannot even prove that such a system exists, although this seems highly probable.

4. As I have already mentioned, no definition of meaning can be regarded as satisfactory from the viewpoint of the theory of translation if it tries to solve this problem within the frame of one single language and thus, does not consider also the logical, interlinguistic character of meaning. An entirely satisfactory definition of meaning must be based on the corresponding interlinguistic notion, on the notion of translation and not on that of synonymy within one language.

Let us confine ourselves to only the simplest "interlinguistic case", the case of two languages. Remaining at one single linguistic level, we consider three sets, the set S_1 of forms belonging to the level in question of one of the languages, the set S_2 of the forms belonging to the same level of the other language, and lastly the common set Ω of the meanings of the forms. Furthermore we consider a subset D_1 of the Cartesion-product $S_1 x\ \Omega$, and a subset D_2 of the Cartesian-product $S_2 x\ \Omega$: D_1 contains the ordered pairs (s_1, ω) , and only those, for which $s_1 \in S_1, \omega \in \Omega$ and ω is the /or a possible/ meaning of the form s_1, while D_2 contains those, and only those ordered pairs (s_2, ω) for which $s_2 \in S_2$, $\omega \in \Omega$ and ω is the /or a possible meaning of the form s_2. Let us assume once again, that each of the forms belonging to S_1 or S_2 has at least one meaning.

We call the form s_2 belonging to the set S_2 to be the weak translation of the form s_1 belonging to the set S_1, if the forms s_1 and s_2 have at least one meaning in common, that is, there is at least one such object for which

$$(s_1, \omega) \leftarrow D \wedge (s_2, \omega) \in D$$

holds. We say that s_2 is the strong translation of s_1, if every meaning of s_1 and s_2 is common, that is, if

$$\forall \omega ((s_1, \omega) \in D \leftrightarrow (s_2, \omega) \in D).$$

We can define in a similar way further translation notions falling between the notions of weak and strong translation as well.

In order to arrive at a definition which takes into account also the proper, interlinguistic character of meaning, we have to study the characteristics of the translation notions as well as the relations holding between them, if necessary with the assumption of some further axioms. One such axiom could be that any of the forms of a language has at least one translation possibility in the other language and vice versa, each form of the second language is the translation of a form of the first. Or, we could assume it as an axiom within one single language i.e. that any object ω has at least one such form, which is the only meaning of ω . /"That which can be expressed at all, can uniquely be expressed"/ Finally, a total system of translation notions should be found, in the same sense as I have explained in tha above in connection with the total system of synonymy relations, and we should define the notion of meaning with the help of the translation notions belonging to this system.

Such a definition could also show what kind of a meaning notion should we apply in order to satisfy the given requirements in connection with translation. This is essential because even on the same linguistic level we could speak about several weak or strong translation notions because we can raise different requirements as to the kind of nuances in meaning the translation should express. On the other hand, we can relax the requirement that the forms of the source language should have a grammatical translation in the target language, the only important thing being that the meaning of the form in the target language should be comprehensible. Thus, studies concerning the degrees of grammaticality could also influence the theory of translation.