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LOGICAL EQUIVALENCE, INTENTIONAL ISOMORPHISM
AND SYNONYMY AS STUDIED BY QUESTIONNAIRES.

Sacred to the Memory of Gerrit Mannoury

In recent discussions on synonymy among logicians and philosophers who use logical analysis as the main tool for inquiry, there has not been much reference to observational data and techniques. It is therefore not to be wondered that there is a considerable lack of clarity in the treatment of the relationship between conceptual constructions and empirical research by means of questionnaires. In the following we shall discuss this relationship, keeping in close touch with the important contributions to the study of synonymy by Benson Mates.

Logical Equivalence and the Inconceivability of Difference as the Condition of Acceptance.

Among logicians it is common to think of synonymy as a narrower relation than logical equivalence: if two terms are synonymous they are of necessity logically equivalent, but if two terms are logically equivalent they may well be heteronymous. If this trend of usage and opinion is accepted, it will be a sign of the failure of a concept of synonymy if, according to that concept, all logically equivalent sentences are synonymous.

Benson Mates in his article "Synonymy"¹ offers "some comments on other people's views" and describes certain concepts proposed in my *Interpretation and Preciseness*.² These concepts are called 'Qs1A-synonymy', 'Qs1B-synonymy', 'Qs2A-synonymy' etc., 'Qs1', 'Qs2'. etc. are names of certain questionnaires, and 'A' and 'B' refer to the rules which are concerned with how the answers to the questionnaires are to be taken, i.e., as confirmatory (or disconfirmatory) evidence for the presence of Qs1A-synonymy, Qs1B-synonymy etc.

Mates finds it likely that according to one of the concepts introduced by means of questionnaires and the rules of confirmation for the

answers to them, "all logically equivalent sentences would be synonymous."³ The concept that Mates may have in mind here is Qs5B-synonymity. It has been introduced approximately as follows:

Two sentences, T and U, are said to be 'Qs5A-synonymous' in relation to a pair of texts S₁ and S₂ and for a person P, if and only if P answers negatively to the crucial question of a questionnaire of the kind Qs5 with T and U as parts of the texts S₁ and S₂.

The 'crucial question of Qs5' runs as follows: "Can you imagine circumstances (conditions, situations) in or by which you would accept T and reject U, or vice versa?"

Two sentences, T and U, are said to be 'Qs5B-synonymous' in relation to a pair of texts S₁ and S₂ and for a person P, if and only if they are Qs5A-synonymous in relation to that pair of texts and that person, and if P's answer is an answer to the crucial question of Qs5 as this question is interpreted by the framer of the questionnaire.

In order to subsume an answer to a questionnaire Qsx under those requirements establishing QsxB-synonymity, we not only must accept as tenable the hypothesis that the answer is meant to be negative, but also that the person tested interprets the question, *grosso modo*, as does the analyst.

The construction of Qs5 was inspired by philosophical writings and debates in which the *inconceivability of a difference as the condition of acceptance* seems to be taken as a criterion of synonymity, or of a very small distance of meaning.

In the following we shall discuss some of the difficulties which emerge when the discussion of synonymity as conceived by the logician and philosopher Benson Mates is compared with the efforts to study synonymity, or more generally, meaning-distance, by means of observations under standardized conditions. In the first part of this article our attention will be focussed on the question of how logical equivalence is related to synonymity, when the questionnaire Qs5 is used in the meaning distance study.

The empirical, soft-science methodology underlying the questionnaire approach does not require that one should attempt to find a definition, in the sense of 'definition' which seems to be used in articles by Tarski and Mates. Tarski asked for and proposed an "adequate definition" of truth agreeing at least to a large extent with ordinary usage. Mates says that "there is no doubt that this notion, however vague it may be, is of considerable philosophical importance, and a good definition of it is greatly to be desired."⁴ In a footnote he adds: "As I use the terms, "to find a plausible definition of the term", "to explicate the notion" and "to define the notion"

denote the same process”.

It is our view that the great range of phenomena more or less vaguely and ambiguously referred to by the term ‘synonymity’ is such that there is no reason to expect that an single, carefully introduced concept could somehow be made to cover *the* essential features of those phenomena. The studies by means of questionnaires, which Mates refers to, are inspired by the belief that there should be developed in relation to research techniques a large number of concepts of smallness of meaning distance. Only after some empirical work has been accomplished with hypotheses framed by means of these concepts, should the question be taken up as to how one can diminish the number of concepts to a minimum. It seems that Mates, on the contrary, is mainly interested in discussing concepts which in an outstanding way might express the essential features of what have so far been classified as cases of synonymity by competent people. Among the features considered by Mates to be essential is the one that not all logical equivalent sentences are synonymous.

Mates seems to have asked the following question: is the concept of Qs5B-synonymity such that all pairs of logically equivalent sentences are *ipso facto* synonymous?

This formulation of the problem is misleading, for the following reason.

The concept Qs5B-synonymity should not be viewed as a concept of synonymity in the narrow sense of an *adequate definiens* or *explicitatum* of ‘synonymity’, but as a concept belonging to an open family of concepts of smallness of meaning distance which is (at the present time) fruitful in empirical studies of the heterogeneous phenomena vaguely and ambiguously referred to as synonymity.⁵

Complex designations such as ‘Qs5B-synonymity’ and ‘questionnaire-synonymity’, which contain as subordinate parts (i.e., as designation *fragments*) the terms ‘synonymous’ or ‘synonymity’, are to be considered as *technifications* of ‘synonymous’ and ‘synonymity’, and not as definitions as in the terminology of Tarski or Mates.

Therefore, if the concept of Qs5B-synonymity is accepted, and all logically equivalent sentences should turn out to be Qs5B-synonymous, this would not warrant us to deduce that all logically equivalent sentences are synonymous.⁶ The acceptance of Qs5B-synonymity does not imply the acceptance of it as an adequate definition or even the acceptance of the possibility or desirability of constructing adequate definitions.

Let us then proceed to the question: Is it not to be expected that all logically equivalent sentences as a matter of fact turn out to be

Qs5B-synonymous?

Sentences of the skeletal form "T is Qs5B-synonymous with 'U'" might be taken as abbreviations for "T is Qs5B-synonymous with 'U' for all persons, in relation to all texts'. If the sentences are used within a discussion concerning a definite investigation which involves a class of persons and texts previously mentioned, 'all' might be taken to refer to all members of this class. If not, it is much less obvious what 'all' might refer to. The possibility that 'all human beings' is meant, may be discarded, because hardly any expressions would then ever fall under the concept. For the sake of illustration, let 'all persons' stand for 'all students at the University of Oslo' and 'all textst' for 'all English textbooks used by those students.' Since Mates in his article "Synonymity" quotes Carnap, let 'logical equivalence' be understood in the sense which Carnap in his *Introduction to Semantics* attributes to 'L-equivalent', that is, mutual L-implication.⁷ It is defined in relation to a set of rules, not to use-occurrences of expressions.

Suppose, now, that two sentences 'T' and 'U' are logically equivalent in a language model L, which is supposed to cover the natural language of the person P, belonging to the class of persons under consideration. By saying that 'T' and 'U' are logically equivalent (in the sense of Carnap), it is not implied that anybody knows or ever will know that they are logically equivalent. Nor is it implied that 'T' and 'U' have ever been *used* before appearing in the texts selected in Qs5. No previous use-occurrences may have been produced. Consequently, logical equivalence between 'T' and 'U' does not imply that they have ever been used in accordance with or in disagreement with any explicit or implicit or implicit semantical rule. If 'T' and 'U' have been used, they may have been used in any way whatsoever. Two logically equivalent sentences in L may, for instance, happen always to have been *used* as autonyms.

If, now, P is confronted with a questionnaire Qs5, and if the logically equivalent sentences 'T' and 'U' are used as crucial sentences, it may or may not turn out that they are Qs5B-synonymous for him in relation to the pair of texts chosen. There is, in other words, no guarantee that logically equivalent sentences are Qs5B-synonymous. In spite of this, it may be methodologically justifiable tentatively to assert as a soft-science working hypothesis: All pairs of logically equivalent sentences are Qs5B-synonymous.

There may be high positive correlations between the two properties within important classes of sentences and of people, or there might be in the future a well established hypothetico-deductive system covering these phenomena, from which a theorem implying

the hypothesis could be deduced.

Considering the absence of an established correlation, the above-mentioned hypothesis, if formulated as an assertion, would seem at least premature.

Let us then suppose that P believes that 'T' and 'U' are logically equivalent (in the sense of Carnap). It is to be expected that this highly increases the chances that they are Qs5B-synonymous for him — in general or at least in relation to certain wide classes of contexts. If they happen to be Qs 5A-heteronymous, might we then say that P's answer to Qs5 is due to mistakes in logic or to a misinterpretation⁸ of the questions? I do not think so.

Let the two sentences, 'T' and 'U', be ' 2^{10} is less than 1000' and ' 1024 is less than 1000'. Hypothesis: for at least 5 per cent of those who believe firmly that 'T' and 'U' are logically equivalent, they are at the same time Qs5B-heteronymous.

The author of this article is a person who belongs to this 5 per cent. In the way I and many others have been taught arithmetic, it is necessary to do some calculations in order to establish that $2^{10} > 1000$, but not in order to establish that $1024 > 1000$. I believe that I am able to conceive of mistakes having been made in any calculation. Therefore I believe that I am able to conceive the possibility that 2^{10} is less than 1000. This I am able to do in spite of my conviction that 2^{10} is greater than 1000. ' 2^{10} is less than 1000' and ' 1024 is less than 1000' are consequently Qs5B-heteronymous for me, because I can conceive the possibility of a text showing that 2^{10} is less than 1000. If this text precedes a use-occurrence of ' 2^{10} is less than 1000'. I would accept it, but still reject ' 1024 is less than 1000'.

For persons for whom the above exemplifications of 'T' and 'U' are Qs5B-synonymous, 'Philip believes that $2^{10} < 1000$ ' and 'Philip believes that $1024 < 1000$ ' are very likely to be Qs5B-heteronymous. Thus, the complication discussed by Mates does not arise in the way he describes, since the conceivability of a difference in cognitive acceptability is taken as a criterion in questionnaires of the kind Qs5. This does rule out that Qs5B-synonymity is not too wide a concept for certain purposes. The usefulness of the concept of Qs5B-synonymity is apparent only as a part of a conceptual structure in which similar, but not identical, concepts serve similar, but not identical, purposes.

If 'logical equivalence' is not taken as referring to rules but to a kind of relation between sentences in use, the relation between logical equivalence and Qs5B-synonymity might well be very intimate. In no case does it seem, however, convenient to use only those concepts

of logical equivalence such that logically equivalent sentences could not possibly be questionnaire-heteronymous.

Intentional Isomorphism.

One of the main trends in the use of the expression 'expresses the same assertion as' is such that explications in the direction of intentional isomorphism seem more adequate than those in the direction of logical equivalence.

It is an important question how one could best study empirically this trend of usage, and construct concepts in line with it. The well-founded rejection by Carnap, Mates and others of a general identification of synonymy with logical equivalence or with identity of the conditions of confirmation — in those senses of these terms which they have in mind — seems in part to be the result of the view that the term 'synonymy' ought to be used in such a way that intentionally heteromorphic expressions cannot be synonymous. It seems that they believe or assume that such a proposal would lead, if followed, to a usage in substantial agreement with usage in general or in the texts written by linguists, logicians or philosophers.

In the material gathered by questionnaires there are a number of answers symptomatic of that trend. Many expressions can be viewed as complexes consisting of simple or atomic expressions. If subjects are confronted with texts in which both the complex and the atomic expressions occur, there is a strong tendency to judge the complex to be questionnaire-heteronymous with the atomic, regardless of all other relations between the expressions.

This tendency has been studied by means of the questionnaires Qs1-Qs5. Examples: 'in the year 1920' is sometimes judged to be questionnaire-heteronymous with 'in the year 1920 A.D.' even in texts in which only happenings in this century are discussed. Even in a context with explicit, obvious references to Oslo, 'at the University' is sometimes judged to be heteronymous with 'at the University of Oslo', etc.

The arguments offered in such cases are mainly of the following kind: "The expression 'xyz' is heteronymous with the expression 'xy' because 'z' has a meaning and it occurs in 'xyz' but not in 'xy'". This argument is used in spite of the circumstance that the subject interpreted the text in which 'xy' occurred in no way different from that in which 'xyz' occurred.

On the other hand, there are rather marked tendencies in usage (including that of linguists) of such a kind that requirements of sameness of intentional structure (including the case of intentional

isomorphism) are far too strong. The widespread tendency to answer affirmatively to questions whether 'is true', 'is the case' and 'is perfectly certain' are synonymous, is symptomatic of less rigorous requirements.⁹ I cannot see why future research should be better served by making a monopoly of the use of the term 'synonymity' in such a way that one trend of usage, the one roughly in the direction of sameness of intentional structure, is taken as the best or most convenient. Another point: whatever the direction of explicitation, any concept of synonymity should be constructed with careful reference to research techniques that have already been tested in studies of natural languages.

The following term, 'isomorphical N-synonymity', is proposed as a concept which so to speak lies between the concepts adapted to formalized languages with systems of explicit rules and the concepts concerned with the delimitation of kinds of usages:

Let 'a' and 'b' be two sentences. And let the analysis of them down to the smallest meaningful parts (according to a given system of classification) be such that they can be written

' $_1a_2a \dots _ma$ ' and ' $_1b_2b \dots _nb$ '.

(1) 'The sentences 'a' and 'b' are *isomorphically N-synonymous*' shall mean the same as $m = n$, and there is a set of k rules, $R_1 \dots R_i \dots R_k$, by means of which it is stated that for all i , ' $_ia$ ' shall mean the same as ' $_ib$ ' within the field of application M , and there is no rule stating anything logically inconsistent with this set of rules.

Let us suppose that each of the rules $R_1 \dots R_k$ as well as 'a' and 'b' are used at least once and that no violation of the rules has occurred. If the rules are followed, ' $_ia$ ' means the same as ' $_ib$ ' *in use*. But what does that mean? In order to obtain a concept of isomorphical N-synonymity which allows subsumption and which is related to procedures already existing, a modification of (1) shall be proposed:

Let " $_ia$ shall mean the same as ' $_ib$ '" be changed to " $_ia$ shall be used in such a way that ' $_ia$ ' and ' $_ib$ ' are Qsl-synonymous for the users'. Let (1), thus modified, be referred to as (2).

Now, the existence of explicit, semantical rules for the vernacular which hold without exceptions is doubtful, and, in any case, such rules are rare.¹⁰ A concept which made no reference to rules might be more useful.

(3) 'The sentences 'a' and 'b' are *isomorphically Os1-synonymous* for the person P in the class of situations S ' shall mean the same as 'the pairs of the smallest corresponding parts of 'a' and 'b' which P considers meaningful are for P in S Qsl-synonymous, and so are 'a' and 'b'.'

S can be interpreted narrowly as a class of verbal contexts or more widely as a class of situations in which 'a' or 'b' or parts of them occur.

By means of this concept of isomorphical Qs1-synonymity, we may now, returning to our previous discussion, say that there is a certain percentage of persons for whom no pair of sentences are Qs1A-synonymous¹¹ which are not also isomorphically Qs1A-synonymous. Or, tentatively, the stronger assertion may be made that for a certain percentage of persons two sentences are Qs1A-synonymous if and only if they are isomorphically Qs1A-synonymous.

The goal of formulating criteria by means of which " 2^{10} is less than 1000" is distinguished from " 1024 is less than 1000" can be attained by a questionnaire, let us call it Qs22. It may roughly be said to be concerned with the operations which are performed in order to verify the truth of a statement. To the extent that the smallest meaningful parts of two statements have differences corresponding to differences in operation, one may expect that Qs22, or questionnaires of a similar kind, can bring the differences to light. Qs22 contains three questions:

1. How would you go about showing or proving that T is true?
2. How would you go about showing or proving that U is true?
3. Is there any part — including the smallest details — of the first procedure which would have to be different from the second?

If the test person points out a difference, T and U will be said to be Qs22-heteronymous. If the answer is negative, it will be taken as a confirmation that T and U are Qs22-synonymous.

In the case of ' $2^{10} \leq 1000$ ' and ' $1024 \leq 1000$ ', most people would, I tentatively assert, answer 3) affirmatively, by saying for instance, that the behavior involved with ' $2^{10} \leq 1000$ ' includes the multiplication $2 \cdot 2 \cdot 2 \dots$, or looking into a table of powers, whereas the second procedure would not include this.

In general, any application of different semantical rules would result in Qs22-heteronymity.

It is hoped that this article throws some light upon the relationship between conceptual constructions and empirical research in general, and questionnaire procedures in particular. It cannot be overemphasized that conceptual construction must have some basis in empirical observation and that more research is needed in order to develop further the relationships between technical concepts such as that of intensional isomorphism or interchangeability *salva veritate* and the empirical phenomena for which they are formulated in the last analysis.

EQUIVALENCE, ISOMORPHISM AND SYNONYMY

1. P. 213 ff, *Univ. of California Publications in Philos.*, v. 25, 1950. Reprinted in *Semantics*, ed. L. Linsky, Urbana 1952.
2. Oslo 1953.
3. Mates, *op. cit.*, p. 215
4. *Ibid*, p. 208.
5. In *Interpretation and Preciseness* the terminology is sometimes misleading, suggesting as it does, that Qs5B-synonymy and, in general, concepts, of questionnaire synonymy, are offered as candidates for the title 'adequate definition of synonymy'.
6. The term 'synonymy' is not taken here in any technical sense; it corresponds to the occurrences of 'learning' or 'intelligence' in the titles of articles in which certain technical concepts of learning or intelligence are introduced and made use of.
7. Cp. p. 61 ff, particularly D14-B2, p. 70. Strictly speaking, I do not know, for certain what Carnap would wish to mean by 'L-equivalent' if used in reference to ordinary language. The following rests on one interpretation among many possible ones.
8. A question of a questionnaire is here said to be 'misinterpreted' if the interpretation is different from that intended by its framer.
9. Cp. Arne Naess, *An Empirical Study*, Det Norske Videnskaps-Akademi i Oslo, 1954, No. 4.
10. In school we learn that the correct vernacular is based on explicit rules (usually having some exceptions), but in the light of linguistics such a view is not tenable — without heavy modifications.
11. QslA-rather than QslB-synonymy is used in this hypothesis because the test persons seldom interpret the question sentence of Qsl as its framer does.