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A PRELIMINARY REPORT ON THE THEORY OF UNIFICATION OF SCIENCES AND ITS CONCEPT TRANSFORMING AUTOMATON

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SUMMARY: "The theory of unification" is an abbreviated name for several simultaneously applied constituent theories. Its principal constituents are the theory of manyfold meta-relations with arguments of variable types, applied to a heterogenously interpreted polybasic logic. Unification is a preliminary condition of concept transformation, which is the prerequisite for the so called "qualitative approach", and for artificial intelligence as well.

Concept transformation presupposes a well formed unification over a closed set of basic constituents. Over a field of mutually transformable concepts we construct a compound meta-code and adapt it to the technical requirements of instrumentalization. The argumental case for the meta-logical schema called "code" is, after its technical adaptation, a 'model of unification' within the general theory and the machine-language of the instrument with the suggested name "unificator".

The theoretical and technical research for the unification of science developed into a new branch of science with its own logical and metalogical methods and its own technics of engineering. As a reconstruction of all the greatly different branches of science, with their differently developed methodologies is a practically unsolvable task, unification theory proceeds instead of this with the transformative translation of the basic constituents of the branches to be unified, the 'unificanda', into a common-meta code-language, devised for this purpose. Thus, the basic constituents of the specific branches only are the subjects of unification, supposing that anything not basic may be arrived at by derivative methods of the internal logic of the scrutinized branch—and there do not exist any branch of science without some internal logic. Even in the so called non-exact sciences one may detect their internal logic. We may go still further: primitive cultures, pseudosciences and mental diseases have a good deal of internal logic, which may be twisted and not free of contradictions, but is still something similar to logic and it may be the subject of a transformative translation. As regards contradictions, we cannot discard with a branch

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of science in consequence of a rigorous request to avoid undecideability and are compelled to use it with serious reservations.

Unification is, in the first approximation, a transformative translation of the unificandum into the unifying code-language. This code-language is basically a manyone valued compound code consisting of several meta-levels, each for a different logical task, each in a well defined relation to the other levels and to the object domain. The unificanda are turned into argumental cases for the several object domains and translated (or transformed and afterwards translated) into the compound meta-code. The possibility of a translation does not prove, in itself, well-constructedness. Any reconstructive step towards well-constructedness turns the simple translation into a transformative one as the condition for the usage of the term 'reconstruction' is some change on the foundations of the unificandum-branch. In the case of intended unification we have to start usually with the reconstructive process and we are greatly interested in a reconstruction effecting what we call "the elevation of the degree of exactness". This means the replacement of the usual foundations of the respective branch of science by a methodologically better one with regards to the technical and metalogical requirements of the unifying process. Thus, unification proceeds to translate in a transformative manner greatly different unificanda into a *common target language*, and applies as a target language common-meta codes able to deal with the remaining different degrees of exactness.

A code on a metatechnical level is a metasemantic construct having something like a calculus of notations for his syntactic domain and a theory of (metatechnically controlled) interpretations as its domain of designata. The semantic approach is a polybasic approach restricted to *two* mutually exclusive domains; the semantic method of interpretations is a greatly restricted specific case, being restricted to two domains. We have to lift this fundamental restriction to two domains and accept the possible occurrence on N mutually exclusive and independent domains (N is a positive integer). The *polybasic* syntax deals with the algebra over basic conditions, and the polydomain theory of interpretations with anything else. We refer to a logic over a materially interpreted polybasic constellation of basic domains as the "heterogenous logic". Semantics is a greatly restricted case of it; algebra and syntax, or using the term coined by R. Carnap, the 'algebrosyntactic' domain is a special case, restricted to a single domain, of semantics. But, with reference to the theory of interpretation, we prefer to use, instead of 'algebrosyntactic', the metapredicate "vacuogenously materialized" or simply "vacuogenous domain". This term illustrates the inclusion of the algebraic and syntactic domain-levels into the general framework of the heterogenously interpreted polybasic logic, a step which has an outstanding epistemological importance. Besides this, by putting algebras and syntaxes into the same vacuogenous domain, it reduces their manyfold differences into those of more or less successful construction of theories, to different levels of well-formedness. We restrict the usage of the terms "well-formed", "exact" to such domains and prefer "well constructed" and "precise" for non-vacuogenous or physically interpreted occurrences.

Thus, the unification of sciences is a compound task, involving several constituent theories, asking for generalisations and for new practical and engineering methods as well. The following are the more important constituent theories utilized:

1. The polybasic syntactical theory;
2. The general theory of interpretations;
3. 1) and 2) interacting to a heterogenously interpreted polybasic logic;
4. Chapters of a theory of meta-relations and real meta regresses.
5. The approach to dimensional analysis as a metalogical theory, putting its basis on heterogenous logic, thus generalizing it.
6. A general theory of metalogical evaluations, including ascendingly ordered sets of artificially constructed levels, as those for the degrees of exactitude, precision, etc.
7. The theory of transformative translations of source unificanda into common-meta target codes and target chiffres.
8. Notational systems imbued with rules similar to those occurring in calculi.
9. Adaptation of the notational systems for instrumetalization by binary coded machines.

If requested, phonetization may be added to the above list, as a very important mnemotechnical aid of no theoretical importance. We intend to return to this aspect later. Actually, in the case of a phonetization with some similtude to the spoken languages, we may call a code by the term "artificial language".

The resulting structure responding to the above list of conditions is a notationally very elaborate code-language, called often "the matrix-language" as its "machine-words" are matrica, made up of variables belonging to two or to three different meta-levels. More technically we refer to it as compound common-meta code using matrix-notation.

Now, let us ask the question: When does the transformative translation entitles its result to predicate as "unified"? We may suppose that not any, more or less mechanically translated unificandum will be permitted to enter the domain of the unificated translation-results.

An isolated translation-result, if it does not form a consistent constituent of the target language, is practically unimportant. The meaning of "to be unified" or "to enter the domain of unifiedness" is to be subject of the internal rules of transformation and reduction of redundancy within the target-domain. One of the several aims of the unification is the reduction of the tremendous redundancy of concept and semiconcept–construction of our century. But, it may be hoped, that a consequent pursuit of this aim will result in a field of unification controlled by forms and rules making up some kind of calculus, or a compound calculus resulting out of the metatechnical superposition of a few calculi. In this case the target domain will have a compound calculus for unification. A compound calculus may have an unsurpassed efficay, but within cautiously applied limits only, as a consequence of its superposedness, be subject of indecideability. This is the high price to be paid for very high efficiency.

Thus, no isolated transformative translations are the aim, but a target being a consistent part the unified field. Starting from the unified field, we may basically reconstruct the former source into a consistent and in general well constructed "reconstructed branch of science under the meta-technical control of unification".

The gist of unification is a reconstructive meta-translation of *different objects* by using the *same* set of basic constituents and a many-one valued compound meta relation, and to construct in the one-valued domain of this meta-relation a compound code with a corresponding notational calculus-approximation and a composit system of interpretations.

Transformative translation means the transformation of the source or unificandum, occurring usually at a comparatively low level of exactness or preciseness into a target matrix of higher technical level—if possible, into a 'well constructed' target structure. This means, as mentioned already, the reconstruction in a high level, matrica using code language. During reconstruction we try to retain the source designata as far as possible, concentrating on their logically important components, if any. Usually this task cannot be carried out without some complementary steps, as the addition of some basic constituents. As other less important components have to be neglected during reconstruction, a shift in the meaning in consequence of these operations is unavoidable. But at the same time a shift towards well-constructedness has been carried out. Only a common core may hint that the target-concept is the reconstruction of the source concept. We accept this as quite natural, as the natural change of the designata dependent on the technical development. Let us remember, as a primitive example, the change of meaning of the word "house" since it occurred first on the cuney-form writings on clay 5 millennea ago up to our days in consequence of the development of technics. But the modern designatum of the word "house" and its ancient counterpart with its simple designatum have a common core and just this common core contains the essentials of the concept.

The many-one meta structures have twofold task during the operations towards unification. 1) To help reduce the manyfoldness, the many greatly different source domains and structures to one using its many-one structure, and 2) in each individual case, to reduce the rich set of components of the object-domain to a comparatively restricted set of *meta*-constituents of a not very rich metalanguage. But, even if not rich of constituents of secondary importance, all the principially and basically important theory constituents are present in the basic set of constituents of the many-one and common metalanguage.

This two reducing steps are fatefull for the unification. Both of them are capable to reduce greatly divers manyfolds, respectively the components of importance of them, in a quite surprising degree. And this is definitely necessary if we want to start a unification, and not to remain at a level on which we are even not able to state clearly, what unification should be.

The possibility of an unified control has been proved for Physics since

it started to be a measuring science. It is the dimensional method, using two to five basic dimensional units and controlling nevertheless the methodology of Physics in its totality. The dimensional method is one of our most important point of orientation in our theoretical search for the unification of science. This has been stated by Philipp Frank of the Unity of Science Movement on several occasions.

But dimensional analysis is a metatheory in relation to the objects controlled by its conditions. Thus, we have an example of an existing metalogical unifying control method, used just in the most developed branch of science, in Physics.

Accepting the challenge of the scientists, whose cooperative effort resulted in the "*Encyclopedia of the Unified Science*" and the slogans of "unification of science", and "physicalismus" respectively, we have to look for a generalised reconstruction of the dimensional analysis, erected over an N-basic polybasis, having a general theory of interpretation for semantic, and of materialization for more general polybases. The theory in its totality should remain on a meta- level with respect of any object-theory or object-branch of science which should be "controlled" or "unified" by it. But we do not intend at a pair of synonymes "to control" and "to unify". Correlated as they are, they are not synonymes. To control a precise object-structure by means of a metamethodology is not the same as to reconstruct the object in a metadomain. The diversity is much more emphasized if we reconstruct by elevating the level of preciseness during transformative translation.

Thus, physicalismus is not directly a special case of unification, but they are somehow connected.

Two fundamentally important terms did not occur in our introductory descriptions: A) measurement; B) arithmetization.

A detailed theory of measurement and a quite specific method of arithmetization of its results are the additional basic features of the physical method. We mentioned already "materialization" of the basic units by conventionalized methods and the meta-character of the dimensional analysis. Now, the purpose of this specific method of arithmetization is to reach an invariance of the—semantically expressed—designatum, detected by means of the measuring operation. The really important basic constituent is neither the measurement in itself, nor the arithmetization, but the invariance arrived at by the cooperation of these two methods.

The somewhat analogous non-exact counterpart of this focal point is the approximated invariance of the semantical designation in humanistic and other non-exact sciences by means of social conventions, habits, more or less vague descriptions, imitation and training. Thus, we detect the same effect on primitive level, without arithmetization, without rules for changes of units, and without zero balance concationations of complete chains of operations. Invariance appears on any level, the others are characteristic for high levels of development.

But invariance of a general designatum is not that of a numerically meant measurement and non-arithmetized invariance blocks the way towards

quantitative approach. Thus, e.g. the nice hierarchy of the concepts of psychology as it reappears after the unification, do not permit a quantitative approach at the present state of research, and this in spite of the well constructed concepts with mutual transformability. What we did not learn yet is the application of closed chains of concatinations with a zero balance for these qualitatively defined conceptologies. But the localization of the missing constituent is the first step towards solution and let us hope that our localization will help to someone to find the requested methodological steps.

Unification does not mean a 'qualitative and quantitative' methodology, as quantitative methods presuppose suitable variants of arithmetization together with a materalizator or physicalizator simple enough for measurement.

There are several quantitative methods with different basic principles and their respective applicability and efficiency is dependent on the object and its characteristics and *not* merely on the theory of unification. A more efficient theory may change our approach, but not the inherent characteristics of the object. The theory of unification, when in action, enters a formal relation, actually a very specific meta-relation with the objects in their object-domain. The same holds for the dimensional theory of Physics, as stated by H. Dingle (but without the additional "meta-"). The range of the theory of unification is that of a compound meta-object relation, and not that of one of its domains, especially not of its meta-domain.

Quantitative methods require some form of arithemetization coupled to the meta-domain, but justified by the object-conditions. The sign-vehicles of the meta-domain code are supposed to retain their coordinative connections to their object domain counterparts (if any) or the objects therein. At the acceptance of the meta-code in its totality we are accepting a hypothesis and we do this in the hope to have the possibility to proceed in some deductive way. Arithematization, if combined with zero balance closed concatinated chains of operations, proved to yield such deductive methods. But no arithmetization is justified as long as the object domain does not give the justification, and the same holds for deductive methods. "Deductive method" means the heterogenous coordination of a logical calculus, arithmetization that of a calculus rich enough to include numerical methods, usually not exceeding real numbers, but principially even algebraic number concepts.

The theory of unification deals principially with coordinations and subordinations of calculi and systems having structures corresponding to calculi with a physically usual approximation. Thus, the problems of arithmetization are a typical but special problem within the broad framework of the theory of unification.

Accordingly, the code for unification has to be adapted primarily to problems arising in the coordinated manipulation of systems having the structural compoundness corresponding logically to calculi.

The *range* and the efficiency of the code are dependent on the presence of basic calcul constituents (of a heterogenously interpreteable poly-basic

calculus) within the closed set of basic constituents used for its construction. A change of a single constituent results in an other *model of unification.* Any code constructed is the representant of one of the possible models. This excludes the intuitionistic indefinite picture of the unification of science.

There is an apparent contradiction between the term "unification" and the statement of different models with different ranges and efficiency. What do we mean by Unification, if there are several different unifications?

All the models were constructed, and are supposed to be constructed within the framework of the general theory of unification. The general theory is the unification, and any code and instrument by the name Unificator, is just a realization of a partial range of the general theory. Here it should be emphasized, that the general theory is a comparatively new one with great possibilities of its future development and quite surprising results.

One of these surprising results should be sketched here:

If we succeed in unifying a set of different objects and/or object concepts within the frame theory and code language as given and restricted by a model (and possibly by its instrumentalized Unificator), we actually may dispense with the whole set of unified concepts: All but one of them are superfluous, and their names turn into redundant abbreviations. Any element of the set of unificanda, complemented by symbolic operators representing machine states in relation to the state of the given object-concept, will do to express any other by means of affixed complementing constituents. Actually, after the transformative translation of the unificanda has been completed, using the given set of basic constituents of a model, the *language of machine states* may *replace* the code-language, reducing the task of the code language to that of an intermediatory language in relation to the internal machine language of the given Unificator. The machine-language is usually an adapted specific case if compared with the more liberally designed code-languages, as these codes do retain some characteristics of the brain-thinking. Machine-state language and unifying meta code are different interpretations of the same logical structure, whereby we utilize greatly different sign-vehicle systems and materializators.

The theory of unification may have methodologically far reaching effects in the basic research in several fields of science. It gives a general framework, suggesting broad generalizations, for which the following are just specific cases: a) mathematical logics and syntactics, (assigned to the vacuogenous domain of a polybasic logic with heterogenous interpretations); b) dimensional analysis as a metatheory over several domains of the same; c) a very general theory of evaluations, including probability and decision bound methods and having a metameta character; d) Theories of levels of exactitude, etc., enabling generic approaches, excluding antionomies in consequence of intermixture of mutually exclusive level-structures, etc. This effects fundamentally our epistemological relation to humanistic and exact sciences, including them into a common metalogical framework, in which they represent different levels with an evaluation of the level characteristics.

Unification theory, if complemented by mnemotechnic methods for its code-language, could greatly rationalize the teaching and learning of science and be helpful in its organization. But these questions suggest a more detailed report, in a more technical language and demonstrating it on examples.

The following remarks contain some comparisons of unification, information processing theories and existing instruments:

A) The theory of unification is a metatheory with very general foundations, set out with the intention to include information processing as one of its special cases.
B) Certain restricted and adapted cases within the framework of the general theory are called "model of unification".
C) A model may have several different metatechnical general interpretations (or realizations), e.g. as a code using printed symbol vehicles, or as a code with phonetization to resemble languages and exploit mnemotechnics; or as a mechanical or electronic device constructed for the internal machine state language and using either an one-dimensional symbolism, or a two-dimensional matrix using technics of symbols.

We have strong evidence to suppose, that the general theory of unification includes that of information processing as one of its adapted special cases. Within the range of the compound meta codes we may restrict ourselves to the metasemantic domain, and, after the necessary adaptations, reconstruct IP codes.

To amalgamize the experience collected on the information processing technics with the general theory of unification could be of extreme importance. The matrix technics, with its detailed frame and internal structure gives additional efficacy to symbol usage; it reduces link operations to juxtapositions within the matrix-frame, etc. The mutual transformability of the units called 'concepts' reduces their number very considerably.

Mutual transformability is a consequence of the finite set of basic constituents used. The same constituents may appear as values of variables, assigned to the various meta-levels occurring within the matrix. The matrix itself is a schema for these variables, restricting by means of its structure the free combinatorics of the variables to permitted ones—and permissible cases are the "words" of the matrix using language, machine states language or unifying meta code respectively.

The variables within the matrix-schema are assigned to three different meta-levels, and those belonging to the same level are collected into partial matrica. An additional partial matrix replaces indicia and serves as a local command structure for the totality of the matrix. Type-level, heterogenity and modality are governed by it. The partial matrix assigned to the first componental meta language serves as a restricted system of syntactical notations and is adaptable, whenever the partial matrix mentioned above commands it, for heterogenous interpretations. The variables of the second meta-language refer to the constellation derived from the polybasis and the structure of the applied interpretation. Its single cases are called, in rela-

tion to the other parts of the matrix, 'nominators', 'materializators', etc. The variables called "evaluators" are themselves 'meta-' with respect of the other partial matrica. Thus, the matrix-word of the code-language appears as a structured and controlled juxtaposition of metavariables, making up a string of variable-values and is subdivided into partial matrica, resp. strings, assigned to different meta-levels. The rules of language formation are reflected in the structure of the matrix and certain cases only are permissible or well constructed.

The idea of using components of different meta levels has been borrowed from the analysis of the colloquial languages and of the structure of classical texts, which are both "meta-superposed", and use structures originating at different meta levels within the same linguistic framework.

If we proceed to arithmetization, each meta-level has to be dealt with separatedly and the same holds for instrumentalization. Thus, the arithmetized counter-part of a matrix is not a single number, but a set of two to five numbers.

The machine-language adaptation of the code for unification touches new theoretical problems in the theory of automata. It is a multiple heterogenous automation, of the two-way kind for each of the metavariables. Heterogenity appears in the form of restrictions and exclusions of the simultaneous occurrence of certain pairs and n-tuples of variables. As far as I am informed, this chapter of the theory of automata awaits still its expounder.

The all-important task of the first models of unificators is to demonstrate the viability of the unification of science. This is not so simple as in the case of a computer, as no isolated single result will corroborate our thesis. The local conceptologies of isolated branches of science have to be transformed into a coherent combinatorics over the same basic constituents. The best way is to start within a very broadly defined semantics, including natural and artificial languages, arts, music and semantically restricted psychology. The next step is to generalize from the two-domain to the more domain, eventually to the N-domain treatment of the problems.

The research for further development of the theory of unification, concept transformation within a qualitative set out and instrumentalization is an extremely promising on, requiring coordinated research. As the general theory of unification introduces much more general and "deeper" levels for the foundation of sciences, as usual, it fulfills the most important conditions for possible far reaching new results.

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