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THE PRINCIPLES OF THE THEORY OF THE UNIFICATION OF SCIENCES

D. L. SZÉKELY

The "Unification of Sciences" is an urgent and imperative requirement of our disunited age of science. The historical expression "Unification of Sciences" covers our aim: a common metalogical control with an instrumentalized symbolism for the basic constituents of methodologies and fundamental concepts with a range reaching from the humanities to modern physics. To let this claim sound realistic we state at the very beginning: the methods of dimensional analysis are our leading ideals, and neither a monadology of Leibniz, nor a logically rich language of Couturat. The expression "Unification of Sciences" stands in our usage for a common metalogical control of methodologies, reaching to and comprising the principal constituents occurring in theory construction and application, which are for the purpose of unification re-edited in an adaptable common symbolism. This unifying common symbolism has been adapted for electronic instrumentalization. Practical unification applies—with and without instrumentalization—a compound common meta- and variable-structure code as its unifying target structure which has been constructed by including in its code syntax and code grammar metalogical rules applied for physical and intercommunicative requirements. The variable structure aspect allows for adaptation to future requirements. The theory of unification together with the practice of unification finds its application in the "Unificator" unit of the "General Purpose Artificial Intelligence".

§1. *Unification of sciences* is the abbreviated name of a metalogically controlled process of many, reconstruction aimed transformative translations into a common target theory and its symbolic means of expression; its methodology uses principally 'closed concatenations of elementary metalogical schemata'—usually several of them superimposed into 'compound concatenations'—and each of the closed concatenations containing as a constituent the 'unifying schema' **U**

1) $$\mathbf{U} = {}_{i}{-}{-}{-}{-}{-}_{obj.1,2,.,n} \cdot T^{-r} : Z_{n--1} . i_1, i_2, ., i_n : {}_{a}{-}{-}{-}{-}_{1,meta}$$

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The outstanding structural feature of **U** is the many-one coordinative rule Z_{n--1}, occurring between blanks reserved for instances of different type levels

$$-----:Z_{n--1}:----$$

wherein the different number of dashes stands for different type levels of its instances (resp. instance constituents).

The objects of the process of unification are called "unificanda". They are usually 'branches of science'. The left side blank is reserved for the unificanda, of which there are n; the right side is reserved for the target code of the unified domain. There are many unificanda coordinated to an unique target code for a given model of unification, therefore the many-one valuedness of the schema. Unification presupposes a very considerable reduction of the bulk of the unificanda and one of the tools of reduction is the introduction of a unique meta-target domain, being common to all of the unificanda domains, i.e. a many-one metarelation of many object domains coordinated to a single and common metadomain. Unification is a process of theory construction (resp. of the reconstruction of many object theories under the auspices of the theory of unification). As the object theories are of greatly different logical quality, some being approximately well constructed, others not exposing at the outset any well constructedness, the schema for unification has to contain symbols for instructions[25] to take into account the various technical levels of theory constructions encountered in the different unificanda. Prefixes were introduced for such levels, of which 'i' is the general one (e.g. $_i$----, the i'th level of theory construction, $_a$-- for its high level) and the same character i has been introduced as a symbolic operator (e.g. i_k representing the complementary set of basic constituents required to turn the existing set of basic constituents for an unificandum into the set of basic constituents for a well constructed theory). No efforts were saved to find a suitable symbolism and terminology for the many novel problems faced during the construction of a theory of unification. As we are dealing with a manifold of greatly different theories and interpretations, including physical interpretations, using points of reference external to each of them, we have to use a novel metatechnical symbolism. We shall introduce many basic problems of the application of logics to physics and other branches of science together with their problems of symbolism for unification.

The principal constituent of the schema **U** from a logical point of view is 'Z', the symbol for simultaneous consideration (resp. coordinative rule of the instances taken from physically heterogeneous domains). The simplest heterogeneous coordinative schema is

$$---.Z.---$$

with equal number of dashes on both sides of 'Z'. We shall express it as 'two three-dash blanks coordinated by Z to an elementary blank-schema'. Equal number of dashes implies the assumption of equal level of types for the instances (resp. of the arguments for the respective instance formulas for the blank formula). Blank formulas should have blanks of equal number of type level represented by dashes of equal numbers (or other analogously used blank elements) on both sides of a coordinative blank formula. If their number is different, a symbolic type level equalizing operator T should be applied. Repeated applications of T may be written in an abbreviated shape using repetition symbols, written as powers: T^2, T^x, T^{-1}, T^{-r}. The array of individual dash blanks with definite number of dashes

-- ; --- ; ---- ; ----- ;

is introduced as the artificial hierarchy of 'type levels' or types for individual blanks. If we disregard type levels, as in preparatory approach, we use '---', but in any other case the number of dashes (or other similar) elements is the definition of the type level in our artificial hierarchy. Therefore:

$$--.T^4 = ---.T^3 = ----T^2 = -----.T = ------$$

and using negative powers: $------.T^{-1} = -----.T^{-2} = ----.T^{-3}$ etc., for positive and negative integers. The point of this notation is that we may express symbolically any type level by any one of the given levels unifying symbolically the whole range of the artificial hierarchy to one of the given levels.

The unifying schema **U** is constructed starting with the incorporation of the elementary heterogeneous coordinative schema of indefinite type level $---.Z.---$ and by the following additional steps:

We declare the left side blank as reserved for unificanda (resp. the domains of the n unificanda and their 'source' objects) and the right side for the targets within the unified domain.

We allow for n unificanda blanks, of any level of constructedness, not excluding the level for well formed and well constructed structures. At the same time we allow for a single target domain only, thus turning the Z into a many-one Z_{n--1}.

We prescribe a difference of type level, requiring a lower level, by at least one level unit, on the unified side, fulfilling the condition of a meta-relation, combined with the many-one relation, for a many-one meta-relation. From now on we regard the left side as the 'object domain' side, and the right side as the 'common metadomain' side of the Z_{n--1} relation. To express the requirement of a difference of type levels, we affix to Z_{n--1} a T operator with the power $-r$, restricted later to integers.

The n different object unificanda are not only of different domains ('domains of heterogenity') but correspond to various levels of methodology of theory construction. Such levels are metalogically characterized by the existence or absence of certain theory constituents of basic importance, therefore we introduce for the symbolic representation of this situation the i-operators, mentioned already in the short explanation of the **U** schema.

There is an i_k for each unificandum-theory. Unification, even if symbolically, is supposed to be carried out in two steps: the transformative translation of the existing content of the unificandum theory and the elevation of the level of technical constructedness to a level characteristic of physics. The second step only requires the i-operators in their totality. If the n unificanda are of different types, each should have a separate T-power, but we abbreviate their totality as T^{-r}.

To emphasize the physical application of logics and of the metalogical schemata, we introduce specific terms and symbols. We intend to refrain from the application of terms used in non-applied logics in the case of physically applied logics, metalogics, and schemata, as the distinction of algebrosyntactic terms and methods from the physical ones is of outstanding importance.

For a set of physical elements, the members of which are different and (physically) mutually incompatible we use the term "agglomerate" and the character A. We need this term for expressions and phrases, like "Agglomerate of constituents" used for theory construction, and "Agglomerate of basic constituents".

Here is a list of symbols and symbol elements reoccurring frequently:

$j, k, n, m, ., r, s$ . . . . integers
o . . . . for any character which should receive a subscript etc..

Task indices:
The ascribed temporary task to be 'basic' . . . . o_b
The ascribed temporary task to be 'constituent' . . . . o_c
'Partial', 'sub-' o_s

Genetic level indices:
${}_{i}o$ . . . . . for any definite, i'th level
${}_{x}o$ . . . . . for variable levels
${}_{a}o$ . . . . for the level characterized by physical theories using measurements and dimensional analysis
${}_{\underset{\cdot}{a}}o$ . . . . for "well formed" calculi of the vacuogenous domain.

Constituents:
$v_{n,j}$ . . . . . . constituent, the j'th case of the n'th array of constituents
$v_{b,n,j}$ . . . . basic constituent
v_n . . . . linear ordered array of constituents, a "variable" for constituents, the n'th metavariable over constituents.

v_n collects mutually homogeneous constituents to an array; but in general, if v_n, v_m, v_s are different variables, they are supposed to be mutually incompatible or "heterogeneous": each having a different materializator (resp. physicalizator) by means of a coordinative definition ---.Z.---.

$$v_n. =_{def} . ---_{1,.,n}.ZT^x.---_1; \; v_{n,j}. =_{def} . ---_1.ZT^r.---_1$$

and the actual v_n is an instance for this schema.

We use the term 'agglomerate' for heterogeneous constituents of different parlances and metalevels of theory construction, i.e. for greatly various diversifiedness.

A . . . . agglomerate of constituents
A_b . . . . . . agglomerate of basic and only of basic constituents
A_{bd} . . . . . agglomerate of basic and of derived constituents
A_s, A_p . . . subagglomerate, partial agglomerate.

Note: No Boolean algebra may be used on constituents, as they are heterogeneous, are incompatible if belonging to different variables, and (some) are in dominant-dependent relation.
'.' and ':' are used as brackets if in pairs; a single '.' for subdivision of an array of juxtapositions. Dominant operational constituents, like 'Z', '=' are written between two dots as $.Z.$; $.=.$; $.=_{def}.$.

If we need a symbol for unificanda at all, we use 'u' with level prefix, e.g. ${}_iu$. No absolute hierarchy of types, nor any unit of type levels but the relation of form to its arguments as unit, are presupposed for unificanda.

The symbols $i_1,i_2,.,i_n$ refer to n different partial agglomerates of (basic) constituents with respect to a given i-level, which are required to complete a not well constructed first translation result of object unificanda for transforming them to the level of the well constructed unifying target domain. But on different levels of theory construction the constituents, their agglomerates and with them the characteristic methodologies are greatly different and, this creates problems to which we have to return later.

§2. *Fundamental hypotheses and premises of the applied theory of unification.* The statements of the following enumeration of fundamental premises are submitted as hypotheses and their totality, cooperating to a functional unit, is a more general kind of hypothesis. These hypotheses are enumerated by roman numerals, e.g. **H.I.** They comprise a functional framework of a very general and broad range and one open for many further refinements.

H.I. The logic used for the theory of unification of sciences is the heterogeneously applied polybasic logic.
H.II. All the stated hypotheses are capable of co-action into a functional unit.
H.III. Each unificandum of any internal type level is either a framework of unificanda or subordinated to such a framework.
H.IV. For each framework of unificanda there exists an agglomerate of basic constituents in the theory of unification: for the i'th level unificanda and their domain and framework ${}_iuT^x$; for the i'th level agglomerate ${}_iA_b$. This agglomerate of basic constituents contains all the fundamental physical, logical and methodological constituents of metalogical importance which are necessary for the transformative translation of any ${}_iu$ (and without the loss of any principally important formal and non-formal

content of the unificanda) into the i-level symbolism of unification. A transformative translation without loss is a metalogically equivalent translation.

If for 'metalogically equivalent' we use $\equiv_m$ and for 'structure' (resp. 'derived structure') D, then

H.IVa. $_iuT^x . \equiv_m . {}_iA_p \vee D' \, {}_iA_p$

Any unificandum of the i-level is metalogically equivalent with a partial agglomerate of the i'th level $_iA_p$ or with a structure derived from $_iA_p$ by means of the rules of derivation occurring in $_iA_p$. In consequence of this equivalence $_iu$ may be replaced by a structure derived from $_iA_c$ or $_iA_p$. The transformative translation into the i-level and therefore still local $_iA_c$ symbolism is the first step toward unification.

Now, **H.IV.** presupposes the following:

H.V. If an unificandum has scientific content at all, it may be, after an analysis in the metalanguage used for theory construction, reorganized. The unificandum is a simulataneous occurrence of constituents and predecessors of i-level constituents: approximations to basic and derived structures by approximation of what could be some derivative method, to coordinative definitions and to instances used as predecessors of the process of materialization (resp. physicalization). Even if the results of such an analysis are very far from their well constructed counterparts of the systems from high levels of development, the early beginnings of approximation exhibit some affinity, usually the reference to some common kernel, to the better constructed counterpart. The collection of such 'proto-constituents' by a first analysis of the unificandum is the first preparative step done by the programmer.

The point here is the reorganization of the structure in which the constituents or proto-constituents do or pretend to occur in $_iu$. Even for the first step of unification we have to replace: (a) the proto-constituents by constituents from $_iA_b$ or derived from it, and (b) the structure in which the proto-constituents occur by a technically suitable structure conforming to the structural requirements of the target language of unification.

H.Va. $_iA_b \neq {}_jA_b$

H.VI. $_iv_{n,k} \neq {}_jv_{n,k}$ and $_iv_n \neq {}_jv_n$

H.VII. $_iv$ is, even if introduced as 'basic', not an ultimate element with respect to the metalanguage used for theory construction. It consists of at least two sections, of which one, $k_{n,j}$ (if on i-level, $_ik_{n,j}$) is called 'kernel'.

H.VIIa. To be 'basic' is an ascribed task decided on by the theory constructor. We do not suppose the existence of ultimate atomistic constituents. $_ik_n$, is the common kernel for all $_iv_n$ arguments. $_xk_n$ is the common genetic kernel across different levels of genetic prefixes.

H.VIII. An individual constituent of the i'th level $_iv_{n,k}$ is fixed and invariable with respect to its basic agglomerate $_iA_b$ and with respect to the variable ${}_{i}v_{n}$ representing all the ${}_{i}v_{n,x}$ values of the variable. If prefix i changes, this invariability ceases to exist.

H.IX. Genetic multilevel approach is arrived at by introducing instead of individual constituents *pairs* consisting of a level index and an individual constituent, or in a logically equivalent manner, of the individual constituent, and its relation to the agglomerate of its level. The pair is our compound unit. If $v_{n,k}$ has in general a structure which may be an instance for ---.Z.--- and is one of the pair, the other member of the pair is the prefix i. But instead of $i.R.\ v_{n,k}$ or $i\ .Z.\ v_{n,k}$ we abbreviate as ${}_{i}v_{n,k}$.

H.X. There exists a method to compare and to evaluate for theory constructing purposes the different A_b (resp. ${}_{i}A_b$) cases; it is possible to arrange them in ordered (linear) arrays according to their efficiency (resp. approximation) of well constructedness of theory construction. The symbol for such an array is ${}_{x}A_b$ and we may even order partial agglomerates A_s with respect to its ${}_{i}A_c$ for each ${}_{i}A_s$. ${}_{x}A$ represents the so called "genetic approach" or genetic development from a metalogical point of view. A "degree" of a genetic development theory is an individual name, given by using arrays or primitive arithmetization as a list of names, for agglomerates of preferably basic constituents, if the agglomerates are ordered amongst themselves in linear arrays or in "tree figures". At each node of the tree figure we have an ${}_{i}A_b$ or ${}_{i}A$ always with different i-prefixes.

The theories of exactitude, of precision, of articulatedness are interpretations, some of them partial interpretations, to the mentioned metalogical constellation of agglomerates of (basic) constituents.

H.XI. The total agglomerate for any i'th level ${}_{i}A_b$ is constructed and introduced together with each i-prefix. Therefore, it is possible to collect the complementary agglomerate $\bar{A}$ resp. ${}_{i}\bar{A}_s$ to any ${}_{i}A_s$.

H.XII. As the highest possible level of the genetic array we introduce the schema for well formed logical calculi (resp. operationally constructed arithmetics) and use for this limital level the prefix $\underset{\cdot}{a}$. (a over dot).

H.XIII. A theory is a physical, in general non-logical one, if its ultimate element is the schema ---.Z.---.

H.XIV. A physical (non-logical, non-algebrosyntactic) branch of science may have a degree of genetic development approximating the external limital case of the prefix $\underset{\cdot}{a}$, but it may never reach it. For good approximations we use the prefix ${}_{a}o$. and the phrase 'well constructed physical theory' where 'well constructed' approximates and never reaches 'well formedness'.

H.XV. It is possible to construct and express by means of ${}_{a}A_b$ and ${}_{a}A_b$ the complementary agglomerate with respect to any other prefix either in an immediate manner or in a step by step (resp. level by level) intermediate way. We used the symbol i_n for it in **U**.

Note: **H.XI** refers to a complementary within a given level; **H.XV.** to a complementary of agglomerates $i_1, i_2, ., i_n$ across the array of different levels, i.e. to a principally different operation on complementary constructs.

H.XVI. It is possible in the theory constructing meta-language to reconstruct the translevel complementary with respect to ${}_{a}v$ or ${}_{\dot{a}}v$ variables over constituents for any ${}_{i}v$ i'th level variable over constituents.

The symbols for them are: ${}_{\bar{i}}v$ (resp. ${}_{\bar{i}}v_n$).

H.XVII. From the occurrence of the meta-metapredicate "genetic" (e.g. genetic evolution) follows the presupposed existence of a possibly branched array of x' possible A_b cases, $x'_{\cdot}\,{}_{x}A_b$ in their potential totality and with the necessary array of ranges for each and the necessary meta-meta range for the totality of ranges.

H.XVIIa. For $x'_s < x'$ we may construct partial agglomerates and arrays of partial agglomerates $x'_s A_{bs}$. The importance of them is the partial agglomerate restricted to the vacuogenous, algebrosyntactic constituents, simulating for the domain of pure logics that genetic process, the principles of which were introduced by the great geneticists of biology in the 19th century.

H.XVIIb. If the prefixes x are restricted to those for which important basic constituents (so called indicator-constituents) occur for the first time, we receive the array of indicator constituents ${}_{x}A_{b,indic.}$ consisting of ${}_{i}A_{b,indic.}$ agglomerates. The array of $i_1, i_2, ., i_n$ complementary agglomerates of constituents are re-indexed with reference to **H.XVIIb.**, therefore, ${}_{i}A_{b,indic.} = i_1, i_2, ., i_n$ of formula **U**.

H.XVIIc. The range of $x'_{\cdot}\,{}_{x}A_b$ (resp. of $x''_{\cdot}\,{}_{x}A_{bd}$) basic and derived agglomerates includes the range for the ${}_{x}k_n$ of **H.VIIa.** This is not an independent hypothesis. The variable of the i'th level ${}_{i}v_n$ with the kernel ${}_{i}k_n$ is the minimal i-level agglomerate. ${}_{i}v_n$ is a general symbol for the individual argumental constituents collected to the n'th variable of the i'th genetic level. Any ${}_{i}v_{n,m}$ case consists of ${}_{i}k_n$ and its intersection with some secondary definitions making up for the individuality of that variable value.

H.XVIII The kernel ${}_{i}k_n$ contains, amongst others, the coordinative definitions to the i-level materializators (resp. to the a-level physicalizators, or, as identity case, to the a-level vacuomaterializator). Thus, all the variable values within a variable have the same materializator in common: they are homogeneous with respect to this materializator and we ascribe the same materializator to the variable, in spite of its being a mere symbol.

H.XIX. ${}_{x}k_n$ has as many different materializators as there are x prefixes. As an exception, the materializator may remain unchanged during the change of x_a to x_b. This is one of the interrelations between the two domains of ---.Z.--- for which one of the domains is reserved for the materializator (resp. physicalizator or physicalizing process) for different x-prefixes. x may be restricted to the number of accepted indicator constituents. This step turns the genetic theory into a totally artificial structure, but we use, often without knowing it at all, wholly artificial artifacts quite naturally. Thus, it appears to be better to have a metatechnical critical attitude and accept artificial structures in plain knowledge of their artificiality. We regard, as it shall be detailed soon, "truth" "probablity" and similar metatechnical evaluations as concepts within artificial structures as well.

H.XX. To be a materializator is an ascribed task within the (elementary) heterogeneous Z schema, the materializator being the palpable argument for one of the instances of the coordinative schema.

H.XXI. To be a physicalizator is a task of being a 'materializator with coordinated arithmetization', whereby this arithmetization is represented at least by a scale and a unit of the scale.

There does not exist some absolute, non-relational materialization. What we face here is either a simultaneous consideration of heterogeneous domains (resp. domain elements) or, on a higher technical level, the relational consideration structurally enriched by functional coefficients of physical origin. If the materializator has an unit, from the very existence of that unit follows logically the existence of arithmetization. Arithmetization is the coordination of one of the many possible arithmetics or some structure borrowed from them by means of a Z-schema. From a metalogical point of view even the coordination of the array of two numbers, e.g. *0,1,* presupposes the coordinative schema and as an argument for the instance, an arithmetic rich enough to have these two integers. Arithmetization may be regarded as a vacuomaterialization. The materializator, regarded as a physical entity for itself and without the Z-coordination, may be of any internal structural organization and its symbolic description of any corresponding type level. It may be a single physical entity or a complicated dynamic mechanism. Even the unit itself, if analyzed independently of its materializator task, may be of any internal structure. A rod of platiniridium may be accepted as well as the rotation of the earth around the sun for a sideral year, or the wave length of cadmium light. The point is the conventionalization and the acceptance of its invariance.

H.XXII. From the coordination of two heterogeneous domains follows metalogically the coordination of their physically characterized type hierarchies. The coordination of two hierarchies is carried out by the coordination of a chosen 'outset type level' from each hierarchy. Any other level must be related to the outset level of its hierarchy and by means of it to the coordination of the outset levels. For $---_a.Z.---_b$ and for their respective hierarchies T_a^x and T_b^y this coordination of outset levels is $T_{a,o}^x .Z. T_{b,o}^y$.

H.XXIII. A maximal descriptive efficiency is given by the best approximation to the limital condition $x = y$ (resp. $x/x = y/y$, if x/x and y/y are the respective units of type level).

H.XXIV. It is permitted to insert for one of the blanks of a Z schema another Z schema. The result is a subordinated coordinative schema. The subordination may be repeated (but for practical reasons not more than 4 times).

----.Z_1.(---.Z_2.---) is the simplest subordination. The four dashes stand for the *3*rd level of types, the expression in the brackets has two *3*rd level blanks, these with the coordinating schema make up for the fourth level required by the primary schema. If --- stands for any level of types, · · · · (four dot blank) for an arithmetized structure of one level higher type than ---, let us introduce

$$---.Z.\cdot\cdot\cdot =_{def} \cdot\cdot\cdot\cdot(---)$$

and call the right side a 'physicalized scale'. In this case the schema ---.Z_2. · · · · (---) stands for what is usually called a phenomenon and (· · · .Z_2. · · · · (---)) .Z_3.T^2.-- for giving a *name* to this phenomenon of the type corresponding to --.

H.XXV. A phenomenon is an instance for an (open or closed) concatenated metalogical structure of elementary physical schemata.

The instances for compound metalogical schemata, derived by concatenation and subordination of elementary schemata are important unificanda. The first step toward the unification of such unificanda is to find out the concatenated and subordinated structure of the metalogical schema for which they are instances. By repeated concatenations we are able to construct chains of elementary schemata for which the first and the very last domains are either identical, or we may regard it as an approximation to the same domain. We refer to such chains as "zero closed concatenations" (resp. "approximations to zero closure") of elementary metalogical coordinative schemata . Where abbreviations may be used, we refer to this kind of concatenation derived schema as a "ring".

H.XXVI. The fundamental task of analiticity of $_a$-prefix level calculi, of (vacuogenous) mathematical logic has its counterpart in physical heterogeneous logic in the concatenation of elementary logical schemata to a zero closure (resp. to an approximation of zero closure).

The single ring of concatenations may have one or more superimposed secondary rings: each of them with its own local zero closure, and with a zero closure for the superimposed structure of ring schemata. If the superimposed ring is vacuogenous, of purely logical charater, zero closure is required. In some combined cases of physical application, the domain concatenation returns to itself, with a zero closure, but the practical operations result in approximations. The zero closure schema has amongst others a well known application, called "verification". With respect to their internal structure of concatenations and subordinations, overriding concatenations, etc., there are many different closed and closure approximating schemata.

At the end of this chapter we introduce a relation between certain signs, and call it "membership", or in short 'member of' written by bold **m**. A variable is a member of an aggregate, a value of a variable is a member of a variable; a single elementary coordination is a member of a chain. But a blank formula has instances and an instance is a formula. A single blank within a blank formula is a 'constituent blank', and the part of an instance corresponding to a constituent blank is an 'instantial blank argument'. All members of an agglomerate are different and incompatible; if not heterogeneous, then of different type level. All members of a variable are different in a non-quantitative sense of the word, the difference given by the meta-metaconstituents extraneous to the kernel of the variable. In this abridged introduction we do not want to present details of symbolic formulations, as our aim is to draw attention to the general outlay and the specific techniques leading to an instrumentalized model of the theory of unification. We want to emphasize that the unification of the exact sciences and of physics is not our principal aim, but the demonstration of the feasibility of a general unification of the fundamental features for the so-called exact and non-exact humanistic sciences and arts. Unification will turn out to be a tool for various applications: for instrumentalization of certain thinking and reasoning operations, for an epistermological revaluation of accepted and suggested methods, for a criticism of the methods of brain thinking and its conditionedness by classical habits and linguistic methods, and for research toward heutristic instruments.

§3. *Modalities, evaluations and probabilities.* This section is in its totality a hypothesis of metalogical character. Its main purpose is to replace methodological concepts which are more or less independent as we meet them today, by an artificial frame-construct in accordance with basic requirements of the theory of unification. Within a well formed calculus the rules of derivation make the individual name for a derived case superfluous. We drive at something analogous for our physically applied metalogics by means of constructibility starting with a given basic agglomerate. Our unificanda are the present day scientific concepts of the exact and non-exact sciences as well. Some of them were constructed in a conscious manner, a few are well formed, others nearly well constructed, but the great bulk may be regarded as endeavours of intermediate success corresponding to the preunified age of science characterized by isolated methods.

This remark is valid to a great extent in respect to the great variety of concepts denoted by such terms as 'modalities', 'evaluations', 'probabilities'. (These terms are given here in plural as each of them occurs in a plurality of suggested structures.) We suggest for their unification and corresponding reformulation a metalogical approach allowing for more than one meta level and the instantiation of these concepts for closed or zero closure approximating rings and superimposed rings. These rings are constructed by concatenating elementary metalogical coordinative schemata, and by superimposing (resp. 'incatenation') of an overriding ring over a basic ring. The zero closure condition must hold for each componental ring for itself and for the totality of the superimposed ring as well.

One of the conditions the three above mentioned unificanda have in common is the inclusion of an one-many valued coordinative relation $Z_{1,.,n}$ in direct and in converse direction into the closed ring. The one-manyness of the relation refers to the relation of one unificandum to the several possible so called 'evaluenses' of the meta-target domain, of which usually one has to be chosen. The target domain element is of lower type level than the unificandum and usually even the total array of values is of lower type level than the unificandum.

We have to distinguish between arithmetized and non-arithmetized application, which refers first of all to the structure occurring in the target domain and which we call, for the general case 'the array of evaluenses'. Arithmetization means the coordination of some form of arithmetical calculus, or a section from such a calculus or even of the two figures 1,0. For structurally less simple cases we may have pair-based arithmetics and arrays with convergence defining an external limital concept and its numerical value. As probability concepts usually presuppose arithmetization, at the beginning we shall refer to modalities and not yet arithmetized evaluations only. It should be noted that there are evaluation arrays corresponding to different i-levels even at levels for which a simple arithmetic structure is yet impossible. The i-prefix for the unificandum in its task as evaluandum and that of the evaluenses are in general different. If there is a coordination to arithmetics, we may regard the target domain array as homogeneous; if not, we are not justified to suppose the same. Thus, an arithmetized array or series of evaluenses belongs to the same (vacuogenous) domain, but in the case of non-arithmetized evaluenses we have to check this aspect for each case. The more general case is that different evaluenses do belong to different domains: in this case, only, we may use the symbol $Z_{1,.,n}$ and the characteristic s c h e m a element $---.Z_{1,.,n}.T^{-r}.---$ to be included in the closed ring.

To regard the evaluenses within an array as homogeneous is a silent assumption, which may have advantages, but we do not intend to accept this assumption for our more general approach. We do not intend to accept the single evaluenses or their array as either 'natural' or as final members of a concatenated partial ring of elementary metaschemata. Both aspects reflect silent assumptions; both assumptions are restrictions in theory construction. If the linear array of evaluenses is homogeneous, we face a specific case. There is nothing 'natural' in the evaluenses and in their array, but the mere fact that some comparatively very poor structures do occur in natural languages gave, historically, the impulse for research. Examples are: the two valued array of evaluenses 'true-false', arrays, for which 'valid', 'necessary' are evaluens cases. Already such evaluens as 'confirmable' do not refer to natural structures of the colloquial language, but to the products of constructive activities of logicians.

Let us insert here an important remark: We use the term 'evaluens' if we regard an isolated array of them for itself. If there exist a coordination in the shape of a relation of a function, the term for the distribution cases of the whole coordination of the function is 'value'. Thus, the usage of the term 'value' is conditioned by the existence of a relatedness, into which the evaluens entered already. "Value" is the name of a Z-schema including T^{-r}.

The evaluenses may be coordinated in three principally different directions:

(1) to the evaluanda; (2) to another domain, e.g. one for materializators of static or operational character; and (3) concatenated to elementary schemata: to any of the three main kind of them (a) ---.Z.---, (b) ---.Z. . . . , and (c) . . . .S. . . . . Cases (2) and (3) greatly widen the range of the metaconcepts "modality, evaluation, probability". Of the two, case (3) is the more general one. Therefore, we add it to the list of our hypotheses.

H.XVII. If there exists a concatenated coordination to the domain of evaluenses we face a metalogical schema called "second kind of modality".

This kind of 'modality', with concatenated and coordinated elementary schemata does occur in colloquial languages and in brain thinking without scientific aids. The coordinated domain may have materializators of great variety and we want to draw attention now to the 'operational materializations' not yet mentioned in this paper.

Present day logic is practically restricted to the assertive approach. The second kind of modality transgresses this limitation, as it deals with structures including transassertive structural elements like shall, ought, must, with their negatives, and many variants of this situation. These are external normative or compulsive directives, attached to a basic schema by coordinated or concatenated additional schema elements.

Evaluenses may have simple material 'materializators'. The value concepts developed historically from such simple cases, e.g. the monetary value unit 'shekel' from the unit for the weight of silver ('shekel' meaning originally 'one weight unit of silver'), changing later into "the value of one weight of silver". But the second kind of modal structures do presuppose differentiated social conditions. Their materialization is operational-functional. Some social enforcement, real or potential coercion, lurks behind these modalities ("For a certain distribution of argumental constituents you must, for others not, for some you must not"); and could be chosen as a basic case for the introduction of the second kind of modalities ("If you do not comply accordingly, the enforcement will follow"). If the enforcement is potential, the case has a materialization reminiscent of the formal vacuogenous materializations. But this case could be used for the introduction of a 'moral' modality into our general framework.

We cannot dwell for a long time on this very broad subject: the great many variabilities of operational materializations, but we want to emphasize that not only transassertive logic, but hitherto logically untreated humanistic branches of science may be included into the range of unification by means of the second coordinative schema, if this has an operationally instantialized second domain. In addition to this, vacuogenous variants are possible and do enlarge the range of unification towards juridical, moral and theoretically political applications of the theory of unification.

After these preparatory remarks let us return to the essential aspects, to the construction of metalogical schemata and their different and modifed interconnections.

H.XXVIII. If two rings are interconnected or concatenated, or if a secondary ring is superimposed on a primary or basic ring, the condition of zero closure (resp. its approximation for physical cases) must hold (a) separately for each componental ring; (b) for the totality of interconnected or superimposed rings; (c) if the number of rings is n, the same condition holds for all of them separately and for the totality of their interconnection and for any section of that totality, if necessary, by means of virtual completion. If two rings have a single domain in common, we call them 'tangentally concatenated rings'. If two rings have a single elementary coordination Z in common, we call them 'single Z concatenated rings'. (This means usually two domains.) If two rings have more than a single Z concatenation, it is a case of 'a secondary ring' superimposed on a basic (or primary) one. The most important of these cases is the case of two single concatenations. The branch of the two rings between the two concatenated elements is common to both of them. Let us remember, that within a ring the order of the domains and of the elementary schemata is not interchangeable, $a_m a_n \neq a_n a_m$. Modalities, evaluations and probabilities are modified instances of a closed ring with an overriding ring, combined with type reduction, local deheterogenization, common metaarithmetization, etc. at the domain of incatenation for the overriding secondary ring. The combined ring allowing for a metaconstellation is characteristic for all of them, but several further operations may be interwoven, enriching the methodology, without altering the main outlay of the schematology. Thus, the methodology of a complete evaluation process is given by a two-level ring. The concept of 'value' is a section of the total ring for the methodology of the process. The concept of value contains (a) the coordinative relation; (b) the type level difference T^{-r}; and (c) the one-many valuedness of Z, basically to n heterogeneous evaluenses, but if combined with deheterogenization, to a homogeneous or vacuogenous array of 'evaluenses'. In the case of the concept of measurement, further operations; in the case of probability, extended basis and common metaarithmetization are involved, enriching the basic schematology to a considerable extent.

H.XXIX. The methodological related concepts 'modalities', 'evaluations', 'probabilities' are different instantiations of the same principal two-level metalogical ring. They differ in schema elements of considerable importance, but in secondary ones, if compared with the principal ones.

H.XXX. The concept of value is a section of the ring in **H.XXIX**, extending over a coordinative relation and over greatly different possible materializator and physicalizator coordinations. Evaluens arrays and their materializators (resp. materializator arrays) or for more sophisticated variants, their physicalizators are artificial constructs. Even the simplest two valued modalities have nothing 'natural' in them. Values are human coordinative structures with social conventions for their acceptance.

H.XXXI. The incatenation of an operational materialization produces the schema, which we intend to call 'second kind of modality', important for the nonassertive logic.

§4. *Fundamental rules for the usage of schemata.*

A. Rules of axiomatic character.

Abbreviations: An 'abbreviation' is the exchange of a full sign vehicle structure for a shorter, partial or symbolic sign vehicle. The operation 'abbreviation' presupposes a constructive convention and we symbolize it as $.=_{abbr}.$, a dyadic constructing operation.

(1)	$---.Z.---\ .=_{abbr}.\ [Z]$	(1a)	$\ldots.S.\ldots\ .=_{abbr}.\ (S)$
(2)	$---.Z.\ .=_{abbr}.\ Z$	(2a)	$\ldots.S.\ .=_{abbr}.\ S$
(3)	$.Z.---\ .=_{abbr}.\ \bar{Z}$	(3a)	$.S.\ldots\ .=_{abbr}.\ \bar{S}$
(4)	$(---.Z.---).Z.---\ .=_{abbr}.\ [Z]Z$	(4a)	analogously $(S)S$
(5)	$---.Z.(---.Z.---)\ .=_{abbr}.\ Z[Z]$	(5a)	analogously $S(S)$

(6) $---_b.Z.---_c.=_{abbr}.Z_{bc}.=_{abbr}.Z_a.\ \ldots$ 'nominator bound schema'.

R1. $Z = Z$. Any elementary coordinative schema is identical with itself.

R2. $Z \neq \bar{Z}$ (resp. '$.Z.---$' $.\neq.$ '$---.Z.$'). An elementary coordinative schema is directed, therefore not identical with its own converse.

R3. $Z = \bar{\bar{Z}}$. An elementary coordinative schema is identical with the converse of its converse.

R4. $Z_a = Z_a$. A nominator bound schema is identical with itself as long as the nominator remains the same.

R5. $Z_a = Z_b = Z_c$ if and only if the nominators a,b,c refer to the same domain and if the value indices are the same in all the cases. (This is what remains of transitivity.)

R6. $Z_a \neq Z_b$. Two elementary (and derived) coordinative schemata, even with the same formal structure, if nominator bound, are not identical or equivalent in the theory using nominators. The nominator reference, given by the subscript, replaces, as an abbreviation, secondary coordinative or incatenative steps.

R7. $Z[Z] \neq [Z]Z$. A subordination has a direction, see (4) and (5) above.

R8. $Z[Z[Z]] \neq [[Z]Z]$. Repeated subordinations have a direction. R8 holds for any number of single branch directed subordinations. This direction is fixed and unalterable. Even in the case of symmetrical schema connections the direction remains.

R9. $[Z_a]\,Z\,[Z_b] \neq [Z_b]\,Z\,[Z_a]$.

R10. $|Z_a|\,Z\,|Z_b| \neq |Z_b|\,\bar{Z}\,|Z_a|$. The coordination of two elementary schemata has its thorough going direction.

R.11. A symmetrical schema derived from elementary schemata has its thorough going direction.

The above rules refer to the usage of single or a few coordinated or subordinated elementary schemata. Such schemata and schema connections may be a part of a methodology, but as soon as we are interested in what has usually been called "methodology" we have to turn our attention to the zero closure approximating, or if analytical (resp. vacuogenous), to zero closed rings of concatenations of elementary schemata. Such a ring forms the basis of a given methodology and open branches may occur as attached (resp. incatenated) (usually in pairs) to a basic ring, or even to a multilevel basic ring.

As mentioned already, the zero closure replaces, at least in its fundamental importance, in the transdominal logic the role of analiticity of the vacuogenous exact domain, in which present day well formed mathematical logic has been constructed.

B. Rules with reference of rings of concatenations using elementary coordinations as constructive outset elements. The symbols used are:

$> 0 <$	open ring of concatenations
$< 0 >$	closed ring of concatenations
$< e0 >$; $< 0e >$	zero closure approximating closed ring, with indication of the convergence in relation to the limit
$< e0e >$.............	zero closure approximation with convergence from more than one direction
$< a0 >$; $< 0a >$; $< a0a >$	cybernetic, feedback initiated closure (the feedback starting at the value 'a')

$< 0 > .Z. < 0 >$ stands for the coordination of two rings without further details. The coordination of an additional domain to a closed ring is $< 0 > .Z.--- .=. ---.\bar{\bar{Z}}. < 0 >$ If there are several superimposed rings, dots above 0 should mean 'basic' and dots under 0 'overriding'. $< \theta >$ stands for a multilevel ring, closed in its totality. Basic and possibly several overriding rings are supposed to be included.

The interrelations of closed and open rings:

(A) $< 0 > .Z. --- .=. > 0 <$
(B) $< 0 > .Z. (---.Z.---) = > 0 < \vee > \theta <$
(C) $< 0 > .Z. (---_a.Z. --- .\bar{Z}.---_a) .=. > 0 <$
(D) $< 0 > .Z_1. (---_a.Z.---.\bar{Z}.---_a) \wedge Z_2(---_c.Z.---.\bar{Z}.---_c) .=. < 0 >$
(E) $< 0 > .Z. (---_a.Z., \cdots\cdots \cdots\cdots.Z. ---_a) .=. < 0 >$
(F) $< 0 > .Z. (---_a.Z., \cdots\cdots \cdots\cdots, ---_m.Z.---_n.\bar{Z}.---_m,$
$\cdots\cdots .\bar{Z}.---_a) .=. < 0 >$
(G) $< \theta > .Z. < 0 > .=. < \theta >$
(H) $< \theta > .Z. --- .=. > \theta <$

(A) The coordination of a single domain to a closed ring results in an open ring.
(B) The coordination of an elementary schema to a closed ring results in an open ring.

(C) The coordination of a minimal closed ring to a closed ring results in a closed ring which may be a two level closed ring as well.
(D) The coordination of more than one closed ring to a closed ring results in a closed ring.
(E) is (D) for any number of coordinated rings.
(F) is (D) for more levels or intermediate links.

Until now we had to deal with single schemata, closed or open ones, fundamental or superimposed ones. All of them could have been represented in a plan as a graphic figure. Now we want to refer to the simultaneous occurrence of two or more schemata, each complete for itself, each representable in a plan, and let us suppose that each of them belongs to a different plane. This geometric visualization is only a help for introduction and we shall dispense with it as soon as problems of axiomatizations appear in the discourse.

For the sake of brevity, we drop the very important distinction of zero closed and zero closure approximating rings and shall write $<0>$ for closed and $>0<$ for open rings for all of the three main kinds of closure. For superimposed rings, be it once or more times superimposed, we use the character θ as $<\theta>$ (resp. $>0<$). The coordination of two schemata is a fundamental step which deserves a new type level in our artificial hierarchy of types, e.g. the level which could be described by the operator T^7 with respect to the basic level of the hierarchy. The operator T^x represents a very simplified arithmetization of the consecutive theory constructing operations in a high level metalanguage for which just the counting of undifferentiated operations and their sequence remains.

With respect to the visual aid, we shall refer to coordination of total schemata in general as 'interplan' schema coordinations, and symbolize it by a bold **Z** and supplement it with the number of planes as a prescript, $^2\mathbf{Z}$. We intend to mention just the minimum of the syntactic possibilities in this context, sacrificing interesting exceptional cases to the main aim of this outline.

C. Rules with reference to coordination of rings from different planes.

Z, **S** are the symbols for coordinations of schemata as total units taken from different planes, 'interplanar-coordination'.
$^n\mathbf{Z}$, $^m\mathbf{S}$ . . . . the number of plans is n, resp. m.
(I) $< 0 > {}^2\mathbf{Z} < 0 > =_{def} < 0,0 >$
(J) $< 0 > {}^2\mathbf{Z} < \theta > =_{def} < 0,\theta >$
(K) $< 0,\theta > \neq < \theta,0 >$
(L) The interplanar coordination of open rings may result either in open or in closed rings, according to details.

If $0.Z$--- and ---$Z.0$ are opposed and concatenated, local closure is the result. But in general:

(M) $< 0 > {}^2\mathbf{Z} > 0 < \; = \; > 0,0 <$, for 0, θ, $_a0$ and $_a\theta$ as well.

(N) $< 0 > Z\ [< 0 > (Z_1{-}{-}{-}_a; Z_2{-}{-}{-}_b;\ Z_3{-}{-}{-}_c)]\ \&\sim \exists Z\,(a,b), Z(b,c), Z(c,a)]$
$= > 0,0 <$

If we coordinate a closed ring with attached three open branches, which do not make up amongst themselves a closed ring, to a closed ring of another plane, the result is a two-plane open ring. This is the repeated application of (A) to a closed ring taken from another plane. If we use *0* or θ, the rules do not change. A special case is of outstanding importance: the overriding vacuogenized arithmetizing ring, which has not been incatenated at an initial and returning joint, but completed by a rule aiming at the invariance of the numerical value occurring in the overriding ring. Here we mean the independence rule from the change of the size of the dimensional unit. If the incatenation is supported by additional rules, we use instead of θ the character '*8*', e.g. as $< 8 >$. A separate symbol is justified by the outstanding importance of such schemata in measurement based science. If the interplanar coordinations are arranged into a chain returning to the outset plan, we use the symbol $< 0 >^2$.

(P) Any of the closed or closure approximating rings including those with closed superimposed rings has a direction. The converse direction may be constructed and coordinated to the direct one. If the converse returns us to our starting point or blank, we write this as '.=.*0*', disregarding that the existence of zero presupposes arithmetization. The converse of $< 0 >$ is written as $< \overline{0} >$.
(P.1.) $< 0 > .S. < \overline{0} > .=. 0$
(P.2.) $<_a 0 > .S. <_b \overline{0} > .=. 0$ if and only if $a = b$.

If we have instead of *0* a modal θ, the schemata connections (P.1.) and (P.2.) are generally not valid. For a multiplan schema connection, if not modal, but with closed cycles:

(P.3.) $<_c 0^2 > .S. <_d \overline{0}^2 > .=. 0$ *if* $c = d$.

For rings with external coordinations and for open rings and not with cyclic multiplan connections the rules are less simple.

(P.4) (P.1.) and (P.2.) hold for overriding arithmetized non-modal cases, and for closed multiplan cycles of assertive kind.

(P.1.) and (P.2.) are not valid for the methodologies of atomic physics and biology. In the case of schemata for cybernetics we have instead of zero a finite limital value for feedback. (We restricted ourselves to general principles and did not deal with the equally important 'domain specific' principles.)

D. On schemata for transassertive logics.

Command sentences, situations, questions, moral and other 'ought' sentences, religious, juridical and certain kinds of critical and humoristic sentence structures presuppose at least two-plan schemata, for which at certain domain connections they could be instances.

As a basis of the logical constellation we have the plan for the assertive structure: an assertive ring, with or without an overriding evaluative local metaring. Without this basic ring the whole construct does not make sense. We may regard the assertive ring as an argumental structure to a more complicated structure constructed over several plans and having a schematic or schematic functional character. Anyhow, transassertive logic is characterized by an external incatenation, or a pair of them with respect to a basic assertive ring unit. This unit may have its own evaluative overriding ring; it may have its own external coordinative connections for measurement, etc. of physical data—we regard them as a totality organized in a single plan. The transassertive constituents, make up sections of an open ring. We prefer to visualize it as organized in a second plan, interconnected by $:Z:$ to the first one. If necessary, we may use as many plans as the constellation requires for a comprehensible analysis. Therefore, transassertive logic is one using methods instantial to:

$$>_a 0 < :Z: < 0 > .Z.{-}{-}{-}_{1,2} \;.\underset{\cdot}{\vee}.\; < \theta > .Z.{-}{-}{-}_{1,2} = >_a^2 \theta < .Z.{-}{-}{-}_{1.2} \quad ,$$

in the case of two plans and two external connections for the assertive ring.

Logically the assertive ring has a dominant priority and this has been exploited for unification. Unificanda like jures, moral subjects, and ethics have been incorporated as assertive structures completed by a variable of a third componental metacode, interpreted as the transassertive metaconstituent of the unificanda.

§5. *Hypotheses on the nature and logics of brain thinking.* In the following we present several hypotheses which refer to the thinking activities of the human brain as it is conditioned by the logic inherent in colloquial languages.

H.B.I. The range of brain thinking is not finite, as it is conditioned and limited by the non-finite colloquial language. (The infinity of natural language has been proved by Noam Chomski.)

H.B.II. Brain Thinking (abbreviated as BT) is comparatively poor in logical constituents, especially in constituents of structural complexity, but the existing ones are used in a greatly iterated way.

H.B.IIa. In BT different metalevels and potentially different genetic levels are used in a freely intermixed manner. No explicit rule against intermixing different type levels, different domains (in the sense of heterogeneous logic) exist, but they are to some extent observed by habit in a semiconscious manner.

H.B.III. The logical syntax of the colloquial language, with all the above mentioned deficiencies and with the corresponding great elasticity of iterated applications, is the principial logic of BT. Scientific training teaches methods which exceed the original range of BT.

H.B.IV. The outsets and proto-forms, even proto-schemata of many kind of 'parlances', 'modes of speaking', 'first level two- (and more) valued modalities', 'second level modalities' do already exist in the colloquial language. The well reconstructed formulations of them use metarings, open or closed ones and a considerable syntactical apparatus. Some of these problems are still awaiting their due appreciation and formalization, but their rudiments are used in the colloquial language and with it in BT.

H.B.V. Colloquial language and BT take in account the different levels of consciousness. (See **H.B.IIa.**)

H.B.VI. The memory for BT is a biological one with a totally different structure than artificial memories, with biological retrieving methods and with some psychological blocking possibilities. We are compelled to assume that brain memory, at least in its way of functioning, has some form of stratification, the different strata being of various structure. Some of them are predominantly biological, others in an emphasized way sociologically shaped.

H.B.VIa. The colloquial language selectively influences, forms and limits the conscious layer of the brain memory (resp. the constituents) stored in it.

H.B.VIb. Consciousness is, in this respect, the application of socially conventionalized and accepted forms either to impulses received from the external environment or to constituents retrieved from brain memory. We refer to the hypothesis of the identity of the socially conventionalized forms used during BT and linguistic activities (designata, domain of the 'designatum' to 'nous' hierarchy of linguistic forms) with the usage of forms making up what is usually called 'consciousness' as the Hypothesis of Bridgman, as the physicist P. W. Bridgman expounded it in his works. (The same famous physicist is the author of the classical textbook *Dimensional Analysis* (1922). By no means is this a mere chance: to recognize identities of this kind requires the same insight which we acquire by using dimensional analysis. The same kind of insight is one of the cardinal tools of unification of sciences.)

H.B.VII. The psychological structure of brain memory: suppressed, censored memory constituents (S. Freud) are in a well organized sequence of stratification (W. Reich) and block the access to certain stored contents (and may lead to their partial replacement by psychosymbols).

H.B.VIII. A block of the brain memory functions is not restricted to the brain as a biopsychological organ. Block vehicles are fixed muscular and other contractions; if there are several of them, their sequence is identical (resp. equivalent) with the sequence of memory blocks.

Conclusions: BT is conditioned by the syntax and metalogics of the colloquial language, and is therefore indefinite, not finite, short of limiting rules. Rules excluding the uncontrolled intermixture of (1) different metalevels; (2) different domains of basic and derived heterogenity; (3) different parlances; (4) different hierarchies and different levels of the same hierarchy of types; (5) different modalities; (6) correctives for psychosociological blocks; (7) different genetic levels; etc. do not exist in an explicit manner and are observed only to a very restricted extent just by analogy and habit and in a not quite conscious manner.

Therefore, a simulation of the elementary and other processes supposedly occurring in BT, may have certain initial advantages, but is, for planning in the long run, certainly a wrong approach. As BT is conditioned by the colloquial language and its methodologies, social forms and tabus, genetic random results, etc. we have for unificatory purposes to discard the usage of the colloquial language as conditioning agent. We have to replace colloquial language and its manifold logical pseudomethods by artificial constructs. Just the same holds for instrumentalized thinking with respect to natural BT: Simulation would mean conditioning of the instrument (resp. its governing codes) at least partially by colloquial-social-random methods and protomethods.

We strongly disadvise from any simulation of the brain-thinking behavior by instruments for anything but neurological research. Artificial 'thinking' instruments should be based on artificial, metalogically controlled codes including in their vacuogenous domains for well formed objectlogical calculi. BT and colloquial language are representatives of a ''natural'' unit: 'artificial code built by means of heterogeneous polybasic metalogic', and thinking instruments are representatives of another kind of much better constructed unit. They cannot be discussed without reference to their respective unit frameworks.

A final hypothesis with respect to BT should conclude this section. Returning to BT IV, we emphasize that brain thinking uses prototypes, first rudiments and methodological kernels of several methods or potential methods of greatest importance, sometimes freely intermixed, but even then habit and experience put brakes on free interconnections and unwarranted mixing of techniques and methodologies. No explicit rules prevent, e.g., the intermixture of inductive and deductive, assertive and transassertive methods. Nevertheless, one is apt to commit this kind of error comparatively seldom. If we try to formalize (resp. schematize) these rudimentary present methods, we are confronted with the necessity of developing quite impressive logical structures, new and sophisticated branches of logic with possible designations like 'physical logics', 'schematized and formalized inductive logics', etc. There may be found rudimentary brain methods suggesting further developments of logic, the successful development of which would possibly change the whole perspective prevailing in our days and would put present day mathematical logics and contemporary electronic machinery in appropriate corners of an incomparably richer general logic. The same holds for present day epistemology. Let us remark in this connection: disregarding verification, deductive method is subject to a single plan schema, but inductive methodology starts with multiplanar conditions even if it aims at a limital single plan deductive schema. The physical application of a deductive method affixes coordinative steps to the ready past closed deductive schema $<O>$ either according to formula (M) or to (N) and turns it for application into $<_a0>$ .Z. ---1,2. The open ends, like the bearings of a truss, are the connections to the plan of applications.

The principal control method of physics, dimensional analysis, is a closed schema deductive theory and already exerts its metalogical control by means of theory coordination at the very beginning of theory construction based on inductive data.

During the constructive genesis of a theory for physical or humanistic applications a recurrent interplay of inductive preparatory states occurs, each of them multiplane based, each of them using a slightly different basic agglomerate ${}_{i,1}A_{b,d}$, ${}_{i,2}A_{b,d}$, $\cdots\cdots {}_{i,n}A_{b,d}$ for its basis. The experiments in theory constructions relying on these different basic agglomerates are aimed at a deductive single plan formalism, based on ${}_aA_{b,d}$ with a minimum of necessary external connections '.Z.---$_{1,2,\ldots}$' to the $<_a0>$ or $<_a\theta>$ in the single plane. .Z.---$_{1,2,\ldots}$ refer to the 'external' connections of the theory and its method $<_a0>$, necessary for verifications. The verified methods of the different methods suggested (resp. constructed) over the above mentioned different basic agglomerates are compared and evaluated; the results of this comparative evaluation serve as the basis for decision. It has to be decided, which of the several suggested methods is the most efficient with respect to the entity serving as the material basis of the evaluens, (or to the prefered evaluens, if the evaluenses are heterogeneous amongst themselves). The theory with the best approximation to zero closure involving a broader conceptual context and a more suitable logical range and range of application is regarded as the more efficient one.

The term is not just 'efficient', but a comparative one 'more efficient', possibly a scaleable arithmetized term. This remark refers to the same constellation we know from the problematic connected with the different ${}_iA_{b,c}$ based evaluens scale, allowing for scales like 'true-false', 'confirmed-not confirmed', 'more confirmed than . . .', 'of higher evaluens value in an arithmetized scale (of corroboratedness)'. The problem is well known from the famous debate between R. Carnap, Karl Popper, Y. Bar-Hillel and references of H. Reichenbach, Wesley C. Salmon, Kybourgh and many others interested in inductive methodology. The problem revolves on the ${}_iA_{b,c}$ at the command of the theory constructor. There are tremendous differences in the constructively 'deduced' results, if using different cases of them.

The genetic emergence of a theory with respect to theory construction by means of inductive methodology could be schematized by finding a well ordered array of ${}_iA_{b,c}$ agglomerate cases. A well ordered array of x agglomerates is supposed to be a 'converging' one to an external limital agglomerate, say ${}_eA_{b,d}$ constructed in a single plan. The condition of convergence is the better closure within the conditions for better efficiency.

If we succeed to overcome randomness and reach a converging array ${}_{x\to a}A_{a,b}$, converging clearly enough to serve as an indicator for the construction of its limital target, and constructing the target in a single plan over ${}_aA_{b,d}$ with a minimum of external connections $.Z.{-}{-}{-}_{1,.,n_{min}}$ for deductive applicability, we have completed a typical cycle of the inductive theory constructive procedure. Such a cycle could be, without its details, expressed by symbols for metalogical schemata. This is, in principle, the convergence of an array of open r-plane schemata to a single plan closed schema, external and limital to the convergence and constructed under the directives received by a theory construction aimed interpretation of the process of convergence: written with the bases under a horizontal line and the schemata over their bases:

$$lim \frac{{}_x{>}_e^r 0 <}{{}_{x\to a,x}A_b} =_{def} \frac{{}_a{<}^1 0 >.Z.{-}{-}{-}_{1,.,n_{min}}}{{}_aA_{b,d}}$$

We do not intend to enter details of the voluminous problems of inductive logics and its methodologies on different i-levels and within different metalogical ring schemata, but it is impossible to refer to unification without a reference to this kind of schemata. Therefore, we conclude this chapter with the following hypothesis.

H.B.IX. The rudiments of the multiplan based $>_a 0,\theta <$, convergence producing ${}_x{>}_e^r 0 <$ and inductive cycle schemata are already present and capable of application within not too strict requirements.

§6. *Black box, brain methods and colloquial language.* The black box method is a hypothesis supposing that from the given outputs and inputs of the same process some insight may be deduced metalogically regarding the detailed nature of the unknown structure 'within the black box'. The hypothesis restricts itself to the assertion of the existence of an unknown methodology, supposedly closed $< X >$ or with an unknown approximation to closure $< {}_iX >$ and equally unknown instance or instances for the same. External tests suggest that there must be some efficient logic supplying efficient structures as instances for the transformation of the input into the resulting output. Being a method, it must be a $< {}_iX>$ instance, being metalogical, as methods usually are, and a structure, we have to insert a T^{-r} operator. Now, this $< {}_iX>.T^{-r}$ may be written with blanks for input and output, e.g. $---_i$, $---_o$, coordinated as free ends, and thus we have a formula for the black box method BM:

$$\text{BM} =_{def} <_iX_N > .T^{-r} : Z_{1-1} : ---_i, ---_o$$

N refers to N heterogeneous domains, r to alteration of type level, $-r$ to metaconstellation, Z_{1-1} to the one-one coordinative relation between input and output. If the N domains are interconnected and subordinated pairs, we write $Z_{(N)}$. No reference to the instance itself has been included yet. As input and output are physical, we may write for the instance the coordination of a syntactical domain structure C_k to its system of interpretations I_j as $C_k.Z.I_j$, neglecting genetic prefixes:

$$\text{BM} =_{def} <_iX_N >.T^{-r}(C_k.Z.I_j) :Z_{1-1} : ---_i, ---_o$$

The human brain and its colloquial conditioner both use the two domain semantical method, expressed by $C_k.Z.I_k$. But the semantical method involves an artificial simplification accepting anything physical as a single domain of brain memory elements and structures, with some inter-individual or social comparison for control, the so called domain of designata (etc.). I_j is supposed to belong to this domain. Behind this brain method simplification we have the structure of subordinative interconnections of the different N domains $Z_{(N)}$, important enough to compel us to introduce a componental metalanguage L_{II} dealing principally with the co- and subordinative structures interconnecting domains and rules for total domains. Without entering details, we have to replace I_j by I with a reference to the N heterogeneous domains, $I_{(N)}$ and arrive at the formula

$$\mathrm{BM} =_{def} <_i X_N > . T^{-r}(C_k.Z.\ I_{(N)}):Z_{1-1}:\ ---i,\ ---o$$

The BM, if the human brain is regarded as a black-box, applies a closure approximating concatenation of elementary metalogical coordinative relations extending over N heterogeneous domains, applied for them various type levels and including the type reductive methods characteristic for metarelations. As for instantial structures, the brain itself governs a domain of designata and similar structures, consisting of memory structures of variable type levels and domain-origin, with a preference to syntactical, logical, algebraic constituents, collected in the domain C_k and coordinated, as the actual task requires, either to brain memory constituents of the I_j domain, or to their actual sources in say $N\text{-}a = M$ domains. This re-connection to the stimulus producing end of the process is symbolized by $Z_{(N)}$, as it is supposed that in the total heterogeneous constellation the M domains and C_k are making up N domains.

Now, as colloquial language has been defined as $C_k.Z.I_j$ on the type level suitable for accepting calculi and their syntactic genetic predecessors, and I_j as the world of forms over brain memory elements and structures as controlled by a society, I_j is at the same time a very essential constituent of brain method and language as well, and is therefore able to exert a control, which justifies describing it as "conditioning effect". Without this constellation we could hardly deduce something on the logical actions of BT. The close knit relationship between BT methods and colloquial thinking methods have been one of our guiding principles in several aspects of the construction of a theory of unification.

§7. *Sequences and arrays of models of unification and their epistemological background.* I think it is appropriate to start the following very general trains of thoughts on different possible models of unification by citing a few words, written by the physicist P. W. Bridgman, advocate of the operational parlance: "To me now it seems incomprehensible that I should ever have thought it within my povers, or within the power of the human race for that matter, to analyze so thoroughly the functioning of our thinking apparatus that I could confidently expect to *exhaust the subjects* and eliminate the possibility of a bright new idea . . .'' Not the chapter on brain thinking, but the one on the arrays of models of unification should be headed by this remarkable assertion.

We intend to elucidate the basic ideas of the theory of unification against a broader and sometimes epistemologically tinted background. To concentrate our attention on agglomerates of basic constituents is an abstract metalogical method of many advantages. We prefer agglomerates which are the total 'agglomerates' for a certain i'th genetic level. The possible partial agglomerates of the same are of no interest at present. With the exception of the very meagre agglomerates for the lowest i-levels, each of the agglomerates ${}_iA_b$ (resp. ${}_iA_{b,d}$) may serve as the basis for the constructive derivation of a model of unification. Each of the models may be materialized as a code to be applied for transformative translative operations characteristic for unification.

If we try to order the different ${}_iA_b$ cases, we arrive at an array. If we find a method of well-ordering them, we may refer to a sequence of ${}_iA_b$ cases; let us symbolize the sequence as ${}_xA_b$ (resp. ${}_yA_b$) and the array as ${}_{i_x}A_b$ (resp. ${}_{i_y}A_b$) x used for independent and y for dependent variability. We have a correspondence, based on metalogically controlled construction reminiscent of derivation, of any ${}_iA_b$ from ${}_{i_x}A_b$ or ${}_{i_y}A_b$ or simply ${}_xA_b$ to a model of unification **M** with the same prefixes, say ${}_{i_x}$**M** and a code constructed for the same model ${}_{i_x}L$. This correspondence holds for the whole array. To try to prove it would be misleading, as it does not have to be proved: we decided to construct them in this way and the proof could demonstrate only that we committed no aberration with respect to the prescriptions for ourselves. Sequences appear to be constructable, but we prefer to use the term 'array'. The array of the basic agglomerates ${}_{i_x}A_b$ (resp. ${}_{i_y}A_b$) is an important subject of inquiry. The array has been called a genetic one, growing by inclusion of additional constituents as members, which are usually of higher complexity and type level as the array proceeds. For different agglomerates we have models of different ranges of unification. By the concept of range we want to refer to the structure deriving range, and neither to a set-theoretical range nor to a vacuogenous 'logical range'. (Let us recollect that for the indices $i < j$, ${}_iA_b$ is not a partial or sub-agglomerate of ${}_jA_b$, even if j is the immediate successor of i, and that we refer to full constituents and not to the possible kernel of the constituents used to collect individual constituents into variables of them constructed with reference to their common kernel.)

Any model of unification centers around a **U**-formula which has been adapted to the occurring prefixes and the ranges dictated by them and this **U** formula, built itself around the elementary schema for transformative translation, is an instantial formula for a closed, or closure approximating $<0>$ with external connections $.Z.$---, i.e. $<{}_a0>.Z.$---(**U**).

This **U**-formula, as it appears instantial to a closed or closure approximating and perhaps superimposed and more than single plan ring of metalogical concatenations, involves an array of agglomerates with different i-values. We suppose now, (1) that $<0>$ remains the same in all of its principal concatenations for the whole array; and (2) that 'Z' (resp. '$.Z.---$') or $.Z.---_{1,.,n}$, where n stands for the number of different possible materializations within the schematic isomorphism conditions for the same three-dash blank, remains schematically unchanged for the whole array.

Note: We must not assume (2) for modern physics. In modern physics we have no single --- domain blank, but a relational value for a $---.Z.---$ schema (resp. for an instantial relation for it) serving as basic materialization. (As this structure could not be named by a term coined from the classical word 'materia', we suggested instead the term 'physicalizator'.)

The $\mathbf{U}$ formula refers to a range of an array $_{i_x}A_b$ delimited and expressed by prefixes and these prefixes for $\mathbf{U}$ and for A_b are identical. But if we do not assume (1), we have to complete $<0>$ by prefixes indicating the possible alterations in the structure of the ring.

Three questions of epistemological importance arise in this connection:
(A) Is there an upper limit for the array $_{i_x}A_b$ or $_{i_y}A_b$ and for the corresponding structures? This refers to the citation from Bridgman: Is there an upper limit to human ingenuity for devising new methodological tools to scan the external world for new phenomena? Is there, within the same framework, a limit for vacuogenous constructs?
(B) What is the principal justification of the A_b-arrays and $<0>$ using methodology disregarding its possible efficiency?
(C) Is the formula $<_a0>.Z.---$ $(_{i_x}\mathbf{U})$ more, in principle, than an elementary coordinative relational schema $---_b{:}Z{:}---_a$ for which the b-blank is reserved for metalogically controlled physical formalisms like $<_a0>(_{i_x}\mathbf{U})$ and the a-blank is reserved for what we may accept as originating immediately (or for our present tasks immediately) from the so-called external world of phenomena: for low level methods—the invariances detected by our body as measuring instrument, and for refined methods—phenomena related invariances detected by physical measurements involving methods. If it is just a coordinative schema, it may be written as

$$<_a0>(_{i_x}\mathbf{U})\ {:}Z{:}\ ---_a$$

Anything at the left side of this schema is human construction: schemata, forms, basic and secondary coordinations and interpretations, etc. Anything on the right side is immediate (or as immediate as possible) stimulus reception (resp. intermediate responses) to supposed natural phenomena, the interaction with them and turned to instantial or to argumental value by one of the methods of our variable precision levels.

We scan physical reality by alternating everything on the left side, sometimes according to a plan for research, and looking for the best approximation of zero closure, giving preference to the more closely knit formalistic texture, to the more general framework and higher i-prefix basic agglomerate and its range.

As an epistemological step we declare that the formalism with the best closure within the best context with the most general range has a structure which is isomorphic to that present in the physical world, certainly in relation to us and hypothetically without any relation to human interference. In this research constellation the mutual restrictions on both domains, created by the relational schema are of overwhelming importance. Without them there would be no need to have arrays of agglomerates. If for a measurement result, supposedly belonging to a new phenomenon, we are not able to construct a structure over any of the agglomerates of our array, the supposed phenomenon giving that measurement result remains isolated and does not enter the context of the physical world of science based on the prevailing array.

Now, if we want to include, and for that matter contextually include, the new phenomenon into the accepted conceptual world of science, we have to introduce a new agglomerate rich enough for the physically formal requirements of that phenomenon. As the first impulse came from the right side, we should denote this new agglomerate by ${}_{i_y}A_b$. The closure producing forms, which we constructed by using it, we have to interject at the right side of the relation for receiving there the measurement results stimulating interactions as the arguments of this instantial form.

The genetically ordered array of agglomerates is certainly one of the most important instruments in the methodological arsenal of the epistemologically minded scientific innovator. It is as well an important tool in the theory and application of the General Purpose Artificial Intelligence for its general and heuristic programming.

With the development of science the array proceeds as well, but we may not assume that it has an upper limit: and this is in agreement with the cited opinion of Bridgman. We may express it as

$$\sim \exists_{\max}\ {}_{i_y}A_b$$

as a preparation for a more formalized dealing with epistemology. Anyhow, this is the answer to question (A).

As for the theory of unification, the important aspects are the following. There is an interdependence along relational lines between two domains: the domain of the unificanda and the domain of the unificata. An analogous interdependence with a mutual limitation of the domain ranges has just been described, existing between the two domains of the epistemological basic coordination

$$i_y < {}_a0 > : Z : {}_{i_x}{-}{-}{-}_{1,.,n}$$

written in a slightly modified form by adapting it to the just preceding remarks.

There is a common schematic background in the relation serving as basis for epistemological activities and in the relation serving as basis for unifying activities. If we are asking the question for a justification of the method of unification, we want to play on this common schematic structure.

Before going on, let us stop and ask what the colloquial expression 'justification' (resp. 'justification of a method') should mean?

A method cannot be 'true' as 'true' is a meta-evaluens, taken from a very simple and usually two valued array of logical evaluenses. Moreover, it refers to a certain type level within a modal calculus. Neither lower types than that for assertions, nor higher than that for connectives may be evaluated by the value 'true'. Now, the type level of the term 'method' is higher than suitable for 'true'. We use the evaluens 'true' only, as 'not-true' is of a broader range (a fact which has been expounded by Karl Popper, *The logic of scientific discovery*). For structures of higher level of type we need other evaluenses. A suggestion for them, expressed in operational parlance, may be 'justification of a method'. A second one may be 'efficiency' of a method. A method is justified, if it is efficient. The metalinguistic term, expressed in an extensional parlance, 'efficient' intends to communicate the same metalogical designatum as the second metalinguistic term 'justified' expressed in an operational parlance and having a tint of a second kind of modality. We have to approach the problem by other means. As 'efficient' and 'justified' are extremely interconnected, the following analysis holds for both of them: We have methods of different i-levels:

(a) X is efficient;
(b) X is more efficient than Y;
(c) X has the degree of efficiency D;
(d) The degree of efficiency D_2 of X is higher than the degree of efficiency D_1 for Y.
(e) In addition to (d) we may arithmetize or pseudoarithmetize the sequence of degrees.

For which of the five different concepts of justificiation, (resp. efficiency) are we looking?

Any of the five may refer to a method or to a theory. Now, we learned that there exists an interrelation between the two sides of the basic epistemological relation. That means: the technical quality of the logics applied directly or for introjection of structures on both sides of the relation should be of similar genetic level. The five possibilities of "justification" (resp. efficiency) do correspond to five different i-values. Thus, for simple methods we should ask for "justification", for better ones, "which is more justified", and for the very best ones for "degrees", with a possible arithmetization of the array or "sequence of degrees of justification".

To prove the justification of the method for unification, we assume that the colloquial language and the physical world corresponding to it and its vulgar logic has a justification. How else could we exist, if this would not be the case? Colloquial language corresponds to a low level, say u-prefix agglomerate, allowing for very few formal operations: ${}_uA_{b,d}$. Its justification may be abbreviated as ${}_uJ$. The total range of u-level unificanda is transformatively translated into the code language of unificatory methodology, using an agglomerate with the prefix 'a' and a much more developed logic. The interactive effect of this a-level logic with respect to the u-level unificanda and their ${}_uJ$ justification is our next point.

The higher-level logic requires a higher-level evaluative concept: instead of "justified", "of a higher degree of justification". If the u-level unificanda are based on an ${}_uA_b$ derived method which is "justified", the a-level unificata, based on an ${}_aA_b$ are to be evaluated by ". . . . is of higher degree of justification than . . . ."; if the very little logic of ${}_uA_b$ could justify the vulgar linguistic method, much more logic could justify the a-level method and assert that "method of the prefix 'a' is of higher degree of justification than the method of the prefix u" as long as justification is measured with reference to the array ${}_{i_y}A_{b,d}$ and the included logic, which is the logic constructable using the respective basic agglomerate.

Thus, if we can not prove directly the degree of justification for the a-level method, we may show, that it is at least as justified as the method of the colloquial language and its logic, and as a second step that it contains more logic, is therefore 'more justified' with respect to the colloquial vulgar logic based method. More logic—and in the broadest sense of the term 'logic'—means higher i-prefix for $A_{b,d}$, a better constructive potential. Different models of unification have different efficiency as methodologies which, in their turns have different capacities to scan, structurally describe, and in a verifiable manner predict the phenomena of the physical world and their interplay. As they are centered around their respective ${}_{i_y}A_{b,d}$ case within a somewhat ordered array, this array may be turned into an instrument for approximative predictions with respect to future development of the general tendency of science.

In **H.IV** the undefined term "metalogically equivalent" or $\equiv_m$ has been used. We should now replace it by "equally justified" with a recursive remark, that whatever will be the rigorous definition of "justifiable" it will be a meta-evaluens with some operational addition to the meta-evaluens for high level evaluanda "efficient", (resp. "a more efficient than b", or "the degree of efficiency of a is higher than the degree of efficiency of b").

H.IVb. A well constructed code is at least as efficient, as the intercommunicative structure, in which the unificanda are formulated.

The metalogically collected content for retranslation of any unificandum of the i'th level is $\equiv_m$-equivalent or of higher degree of efficiency than the frame enclosed and structurized juxtaposition of constituents (resp. metavariable values) in the shape of a matrix using code.

The thirty-one hypothetically given metalogical rules **H.I—H.XXXI**, the rules for concatenated elementary coordinative schemata, rings, etc., the hypothetical rules governing the logic of BT make up together a body of directives which we intend to include into the grammar and syntax of our predominantly metalogical code for unification.

Unification is, as emphasized elsewhere, the preliminary condition for concept transformation and instrumentalized conceptual "thinking". The same body of rules and assertions must be, therefore, re-edited as a body of code-rules. No single code could be found yet for our aims, and a compound code of two to three metalevels had to be constructed for which we use the symbol CML (Compound Metacode Language). The range of a code, even of a compound code, is more limited than the range of constructive possibilities of all the agglomerates serving as basis for the compound code. Not all these possibilities could be included into a finite structure like the code. But after the restrictions for the sake of a code, the remaining structure may have several isomorphic materializations. (This aspect has been stressed to some length in my recent paper "The epistemology of the General Purpose Artificial Intelligence" *Cybernetica* I, 1963), in which a definition of the general purpose logical machines have been given in the above context.)

George Boole liberated mathematics from its subordination to arithmetization. Our generation of logicians should redeem logic from its vulgar-linguistic conditionedness to open the way for its expanding development.

§8. *The main features of the unifying code and of the Unificator-unit.* From interconnected studies of metalogics, combined with a genetically oriented analysis of the colloquial language and of finite state language projects, of the hypothetic methodology of BT and with a side glance to psychology and linguistic conditioning we collected a body of directives and principles. We assume that this agglomerate of principles has a decisive importance for the control of theory construction and particularly for the construction of models for the unification of sciences, for unified artificial conceptologies, their code representation and for several important tasks in the near future: the instrumentalization of conceptual thinking by means of the General Purpose Artificial Intelligence and for instrumentalized heuristics.

All these tasks are essentially interconnected, even interwoven. All of them use arrays of basic agglomerates within a fixed or a variable structure $<\theta>$ of some kind. Their common schema is

$$\frac{{}_x<{}^r_e\theta>(---_{1,.,n})}{{}_{i_y}A_{b,d}}$$

with different instances for the three dash blank allowing for n different 'interpretations'.

If the three dash blank has as instantial elementary coordinative schema a 'code', the result is the 'language of unification', and if this code has been transformed into the grammar and syntax—alias circuitry rules of an electronic instrument—we have a materialization in the form of an instrument: we want to denote this instrument as the "Unificator". Its formula is

$$\frac{{}_x<{}^r_e\theta>(C.Z.\ (I_a \equiv_m I_b)),\ (---_{1,.,n-2})}{{}_{i_y}A_{b,d}}$$

as of the number of interpretations of --- two were inserted already.

Now we turn our attention to that code, which fulfills the conditions of an instance for this schema. With respect to BT, **H.B.IIa,** and taking in account the length of the i_y-prefixed array of agglomerates, we decide, after experiments with other numbers, for three levels for our code, which could be regarded, if required, as three metalevels. To each of them a section of the array may serve as basis. Each has its own grammar, (resp. syntax) and each has its own semantical system and methods. Thus, the code rules for each of them will be of different character. We shall refer to these as "componental codes" and to their synchronized application as the "compound common metacode" (CCML).

The constituents of these i_y sections we shall reorganize and collect, based on some common kernel, if any, into 'metavariables', each consisting of a general variable symbol and its variable cases. The variables shall be interconnected by a finite state code grammar (N. Chomski) and represented by a technique, which we call "matrix word technique". One value of each of the variables within the structural array called here a matrix, is a "matrix word".

Let us symbolize the componental metacodes by L with roman numerals as subscripts: L_I: first level componental metacode; L_{II}: second; and L_{III} . . . . . third. If we regard the principal schema of $< o >$ as a fixed one, the highest type level of variability is that of the interplay of the componental metacodes. They are necessarily, unavoidable. But their interrelation may change: juxtaposition, functional relation, subordinative metarelation, etc., are possible.

Two cases are important for us: (1) $(L_{III}(L_{II}(L_I))) = CCML_a$; and (2) $L_{III}, L_{II}(L_I)) = CCML_b$. We decide, led by practical requirements, for the alternated usage of both, according to the requirements as

$$\frac{{}_x< {}^r_e\theta > ((L_{III}(L_{II}(L_I)))\ .\text{v}\!:\!(L_{III}, L_{II}(L_I)))}{{}_{iy1}A_{b,d,}\ {}_{iy2}A_{b,d,}\ {}_{iy3}A_{b,d}} = {}_{def}CCML_{a,b}$$

and assert that the degree of justification of this method ${}_yJ$ is higher or at least equal to the degree of justification ${}_u\bar{J}$ of the method by which colloquial language and vulgar brain technique are describing their world for intercommunicative purposes. In simpler words: the logic used for the unification of science is a more efficient one than the logic of the colloquial language level and so is its code.

The construction of the compound code and in particular the distribution of the constituents to the componental codes with a minimum of redundancy is a matter of experience and skill, controlled by the principles described in this paper.

Concluding remarks. Let us recollect the main points of importance of the theory of unification:

(1) The theory of unification is one of the theories which are instantial to zero closure directed concatenation of metalogical schemata. The metalogical schematization of methodologies is the general framework, in which the schema used for unification is one of the less complex examples.

The schema based method using rings or circuits of the first or second power, superimposed rings, multiplan methods in the case of more than one basis is one capable of much further development. Concepts of the logic of sciences may be pinpointed and defined unambiguously with reference to the structure of the schematology of their methodologies.

(2) The practice of unification, which at some early stages of development preceded the theory, cannot be developed without relying on theory. But the control of the theory with respect to secondary details is a very liberal one.

(3) The outstanding points of the theory of unification are: Reconstruction for replacement according to the schema of a transformative translation under the guidance of a zero closure approximating schema $<_a0>(\mathsf{U})$. This means the replacement of the classical isolating method for introduction of concepts or small clusters of interconnected concepts by matrix-generated reducible finite and integrated fields of concepts which are artificial and act as unificata. The structure of such an 'alternating range' matrix is a quite rich one; the structural features are utilized as vehicles of the principal metalogics, whilst at the grid points variable values are inserted, which are taken from an ordered array of "metaconstituents", making up one of the variables of the matrix. The constituents are taken from two to three "componental metacodes" interrelated into a compound common metacode: the code language of the full matrix.

The constituents, their agglomerates and the full matrix characterize a "model" of unification and its range. Unification in general proceeds in "models" and models are a function of the task, the range of unificanda.

Unification is, therefore, not an absolutistic task. As the range of the unificanda is being enlarged, so the models. The question of the upper limit, the widest possible model, is quite unclear yet.

Any of the well constructed models of unification are reducible to its general variables supported with indices for the specific variable values. The whole of the conceptology of a model is, therefore, theoretically superfluous and is replaceable by the just mentioned tools of expression.

The elements of most fundamental character are:

(a) The domain connecting and compound domain deriving elementary coordinative schema ---.Z.--- with its many variants;

(b) The metalogical schemata derived by concatenation and subordinative coordination, etc. from ---.Z.---.

Their most important representative is $<0>$ (resp. $<_a0>$) introducing schematologies, for which methods and methodologies are the instances. $<0>$ is supposed to take the place of analyticity in vacuogenous domain mathematical logic and in physical and physically applied metalogics. Well formed (vacuodomain) calculi retain their cardinal importance, even after their adaptation and inclusion in non-vacuogenous domains at the price of the sacrifice of their analiticity, turning thus $<0>$ into $<_a0>$;

(c) The semi-arithmetization, combined with iterability, called "hierarchy of main types";

(d) The **U**—schema extending over genetic theory or ${}_{i_y}A_{bd}$.

Some of the theoretical instruments presented in this abridged introduction exhibit the possibility of their further development.

This very abstract approach has as its advantages drawing attention to deeper than usual foundations of science and to the surprising consequences of their application. Research in this direction appears to be extremely promising.

Jerusalem, Israel