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VERSUS

A METHOD OF RELATIVIZED CONCEPTUALIZATION

Mioara Mugur-Schächter [*]

«That a higher integration of science is needed is perhaps best demonstrated by the observation that the basic entities of the intuitionistic mathematics are the physical objects, that the basic concept in the epistemological structure of physics is the concept of observation, and that psychology is not yet ready for providing concepts and idealisations of such precision as are expected in mathematics or even physics. Thus this passing of responsibility from mathematics to physics, and hence to the science of cognition ends nowhere. This state of affairs should be remedied by a closer integration of the now separate disciplines.»

E. P. Wigner [1]

ABSTRACT

A general representation of the processes of conceptualization, founded upon a descriptional mould drawn from fundamental quantum mechanics, is outlined. The approach is called *the method of relativized conceptualization*. This stresses that the representation is not researched as a "neutral statement of facts" but, from the start on, as a *method* subjected to definite descriptional aims, namely an *a priori* exclusion of the emergence of false problems or paradoxes and of any gliding into relativism. The method is characterized by an explicit and systematic relativization of each descriptional step, to all the descriptional elements involved in this step, namely : the epistemic action by which the object-entity is generated, the object-entity itself, and the epistemic action by which the object-entity is qualified. Successive steps which complexify progressively a given initial description, form an unlimited chain of *cells* of conceptualization where the very first cell is necessarily *rooted in as yet strictly unconceptualized physical factuality* while the subsequent cells consist of increasingly abstract descriptions that are hierarchically connected. The chains interact at nodes where they branch, thus generating an indefinitely evolving, complexifying web of relativized conceptualization, free of ambiguities, and where each element stays under control.

The method contains the *posited* assertion of a realism of which a definite sort of minimality *follows* then inside the method. This generates a clear distinction between illusory qualifications of "how-a-physical-entity-is-in-itself", and *models* of this physical entity. Thereby a worked out connection with philosophical thinking is built in the method.

The method is shown to entail *a relativized genetic logic* and *a relativized genetic theory of probabilities*, more extended, respectively, than the classical logic and the classical theory of probabilities ; both are rooted in physical factuality whereby they merge in a unified representation of the logico-probabilistic conceptualization.

The relations between the general method of relativized conceptualization and the relativistic approaches in the sense of modern physics, are specified. These last ones, in contradistinction to the method exposed in

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[*] CeSEF (Centre pour la Synthèse d'une Épistémologie Formelle), 47 Bd Georges Seurat, 92200 Neuilly-sur-Seine, France.
[1] Wigner E.P., (1967, p. 37) *Symmetries and Reflections*, Indiana University Press.

this work, are shown to concern *exclusively* the ways of constructing qualifiers of object-entities in a way which insures intersubjective consensus among corresponding classes of observers ; while the ways of generating the object-entities which are qualified, and the consequences entailed by these ways, are not considered : like in the classical logic, like in the whole classical thinking, the object-entities are simply presupposed to always pre-exist available.

Traditionally, the emergence and elaboration of knowledge has always been studied from a point of view founded on psychological and neurobiological data, and in the spirit of a neutral account of the natural phenomena ; the modern cognitivistic approaches continue this tradition. The approach exposed in this work is probably the first one in which a systematic representation of the processes of creation of knowledge is founded on strategic data drawn from physics, and, correlatively, is constructed from the start on as a method for the optimization of these processes themselves, accordingly to definite aims.

I. INTRODUCTION

This work is submitted here as an illustration of how a formalized epistemology can be researched accordingly to the principles expressed at the beginning of this volume. Indeed what I call *the method of relativized conceptualization* can be already regarded, I think, as a first but rather firm form on the way toward a formalized epistemology. Namely a form induced by – specifically – the cognitive strategy brought forth by the analysis of fundamental quantum mechanics.

In a certain sense, the way in which the method of relativized conceptualization is offered here is highly artificial. This method developed in my mind very slowly, while periodically, year after year, on the occasion of my University lectures on elementary and advanced quantum mechanics, on probabilities and on information theory, I was once more scrutinising the formalisms of these three theories. This recurrence, by a process of integration, produced the method of relativized conceptualization at the *same* time with what I now call meta[quantum mechanics] and which – *a posteriori* – appears as a major illustration of the method belonging organically to it. But meta[quantum mechanics] is far too technical to fit into this volume [2]. So I chopped it down and I cured the wounds by a brief informal preliminary exposition of – strictly – only the essence of the considerations on quantum mechanics which triggered the method of relativized conceptualization. The result might be felt to have a certain queerness about it, by lack of access to the structure of mathematical features which determined it from inside fundamental quantum mechanics and which, together with the emerging method itself, guided the modified reconstruction called meta[quantum mechanics], which in its turn illuminates the method.

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[2] Partial indications on meta[quantum mechanics] can be found in various other works (refs. 15 to 19). A complete final account is not yet available but, I hope, will be published soon.

But on the other hand a method, once constructed, should be able to convince by itself. So in so far that the method, such as it is exposed here, fails to do this, it simply is devoid of a genuinely own conceptual and operational value.

Inside the community of physicists, this work will certainly appear as exterior to all the nowadays main streams. Of course, there have been many famous physicists who have tried to understand how quantum mechanics works, what it really asserts and what it leaves open. But, as far as I know at least, no physicist as yet has tried to work out specifically and systematically the general epistemological implications of quantum mechanics. So the physicists might experience a feeling of distance while reading what follows. In order to nevertheless gain their attention and fix it upon the epistemological problems dealt with in this work, I stress that these entail a clear optimization of the formalism of fundamental quantum mechanics with respect to its own descriptional aims, and they furthermore yield a thorough *understanding* of this formalism, which cannot but enhance the efficiency in dealing with the basic problems of nowadays physics.

The philosophers, with respect to their own knowledge and criteria, will certainly find in this work insufficiencies. I apologize to them for this : with the means available to me, I have tried to build a solid bridge between physicists and philosophers. Others might want to improve it variously.

Of course, a formalized epistemology, in the full sense assigned to this term in the introduction to the present volume and in the contributions from the first part, should incorporate methodological procedures explicated from also other modern disciplines besides quantum mechanics, in particular from mathematics, informatics, biology, cognitive and neurological sciences, linguistic, philosophy. Some steps in this direction can be found in other contributions to this volume.

II. RETRO-PERSPECTIVE

Before entering upon the exposition of the method of relativized conceptualization, I shall now briefly sketch out in what historical retro-perspective it fits in.

II.1. Objectivity and Descriptional Relativities

The concept of scientific objectivity is undergoing a revolution. The classical concept of objectivity was tied with the posit that science just *discovers* truths that are independent of any human aim-and-action, pre-existing "out there" such as they appear

when discovered. But throughout the last century this view kept receding. It became increasingly clear that objectivity in the classical sense was an illusion ; that scientific knowledge is *constructed* under certain constraints that characterize the epistemic situation and the epistemic aim of the acting observer-conceptor and imprint upon the result non removable descriptional *relativities* to this situation and this aim. More or less implicitly, awareness of quite essentially involved [epistemic situation)-(epistemic aim)] structures, developed steadily, perturbing the classical conception about objectivity while instating a new concept of objectivity in the sense of inter-subjective consensus.

So far however, only few have gained already an explicit and clear awareness of this evolution. Correlatively, on a metalevel, a fully organized and general view on the epistemic actions by which scientific inter-subjective consensuses are achieved, is still lacking. What, exactly, in scientific consensus, insures subjection to *also* what is called reality and truth, thereby transcending mere conventionality and withstanding relativism? How, in what a sense and to what a degree, is reference insured ? How, exactly, do the involved human aims and features come into play ? What particular sorts of strategies are put to work in order to construct scientific inter-subjective consensuses ? While such questions struggle for definite answers, the inertial forces that work inside language bring forth again and again the same old word – objectivity – to designate indistinctly either the emerging new concept, or the classical one. This favours the persistence of many circularities and confusions.

Let us consider now Physics. The employed cognitive strategy *varies* radically as one shifts from fundamental quantum mechanics, to the theory of relativity and to relativistic approaches in general.

Fundamental quantum mechanics incorporates – implicitly – a peculiar type of "basic" descriptional relativities which insert the very *first* stratum of conceptualization, deep into purely factual physical reality. The descriptional relativities of this basic type, when entirely explicated and then generalized, lead toward a recasting of epistemology. The main lines of this major consequence of the quantum mechanical strategy for constructing knowledge are captured in the method of relativized conceptualization. This method, while it strongly connects modern physics with philosophy, will be shown to entail also a non classical unification between logic, probabilities, and set-theory.

On the other hand, inside the theory of relativity and more generally inside the whole class of relativistic approaches, *another* sort of methods for constructing inter-

subjective consensuses have been developed. These, much better recognized than those involved by fundamental quantum mechanics, are only very indirectly and loosely connected with physical factuality. They are quasi exclusively dominated by abstract constraints of a logico-mathematical nature imposed upon the representational features tied with "states of observation". The formal constructs entailed by this sort of constraints manifest a vertiginous growing of the degree of conceptual freedom displayed by modern physicists in the representations of physical reality. In these constructs one can again identify forms of the general tendency, in modern physics, to merge with epistemology and philosophy.

So in modern physics, objectivity, quite generally, means constructed inter-subjective consensus founded on descriptional relativizations that point toward an underlying stream toward unification of physics, with epistemology and philosophy.

The method of relativized conceptualization, which is the core of this work, was crystallised out of this stream.

II.2. "Existents" or "Reality", and Objectivity

The existence, for each human being, of an inner psychical reality, probably has never been doubted by any normal person. Following Descartes, Berkeley, Kant, Husserl, the philosophers place it explicitly at the bottom of any knowledge. Physicists have never denied it. Nor did common sense. And nevertheless, paradoxically, for most people the quintessence of what is called reality, of what is hold to be "genuinely" existent, is the *exterior and physical* reality ; even if this or that marginal individual happens to perceive the exterior physical reality as less certain than his own inner reality, or even – at the solipsistic limit – as wholly illusive.

This entangled hierarchy has multiple manifestations. For instance, it is striking that concepts, and more generally knowledge, languages, science, are seldom explicitly taken into account as constituents of reality, strictly speaking. It is true that Teilhard de Chardin did so (this is his major specificity) ; that Karl Popper [3] asserted "three worlds", the physical reality, the states of consciousness, *and* knowledge, arts, cultural facts ; and that, no doubt, other important examples can be found. But on the other hand, up to this day the debate on the existents (do the unicorns exist ?) still continues among logicians [4],

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[3] Popper K.R. and Eccles J.C., (1977), *The Self and its Brain* , Springer.
[4] *Non-Existence and Predication*, (1985), Rudolf Haller Ed.

Platonism has enemies as much as adepts, etc. And, more or less implicitly, a general tendency can be observed to *set aside* the word reality for designating exclusively what is posited to exist outside any psychism and moreover is physical. A larval form of this tendency is present in particular in the reductionist view according to which anything which at a first sight seems not to consist of exclusively physical entities, in fact is strictly deducible – without any loss – from the existence and laws of the physical reality *alone*. This view, favoured by a loose contact between philosophers and scientists, is still quite active in many eminent minds, notwithstanding that most philosophers perceived it as naïve and illusive already since Descartes, while since Kant they almost unanimously banished it explicitly and radically.

On the other hand Einstein relativity and then – otherwise – quantum mechanics, induced a stream of change into the content assigned in physics to what is called truth and objectivity. The main contribution to this stream consists of deliberate *constructions* of symmetries concerning the processes of qualification of the considered object-entities, symmetries tied with groups of operations of transformation of the state of observation. But furthermore other modern developments of the "exact" thinking, logical, mathematical, informatical, also contribute, by direct elaboration of grammars (syntaxes) admitting of models (interpretations), by algorithms for reconstructing phenomena by simulation instead of representing them by assertions and proofs, etc. Now, all these new approaches are methods for constructing inter-subjective consensus concerning results of manners of conducting descriptional actions in order to reach a definite aim of knowledge. They all involve an explicit teleological dimension where factors of various natures – psychical or biological or physical, factual or abstract-conceptual – co-operate inside an organic whole. This amounts to an implicit deletion of the classical belief that consensus manifests a pre-existing objective truth which has to be just learned, apprehended.

This evolution induces the scientific thinkers into rediscovering by themselves certain basic features of Kant's constructivist view on objectivity [5], which, among those who work in the foundations of science, generates an increased receptivity with respect to

[5] Petitot J., *Objectivité faible et Philosophie transcendantale*, in "Physique et réalité, un débat avec Bernard d'Espagnat", Frontières ; and *Debate with Jean Petitot on Mathematical Physics and a Formalized Epistemology*, in this volume.
 Bitbol, M., *Some steps towards a transcendental deduction of quantum mechanics*, (1998), Philosophia Naturalis, 35, 253-280.

the philosophical thinking sedimented since millennia. While on the other hand the philosophers tend more and more to concentrate upon the methods and languages which emerge inside the sciences, trying to bring forth the new philosophical implications of these.

Globally, philosophy and the sciences are meeting in a process of re-elaboration of the concepts of reality and objectivity.

I shall now go to the bottom of this process, but specifically from the point of view of a physicist. I shall focus upon the content of the very *first* layer of the emergence of the inter-subjectively known, such as it can be characterized when the involved biological processes, though fully recognized to play a key role, are *not* themselves the object of investigation (like in the modern researches on cognition and consciousness [6, 7, 8]) but are regarded as only a datum to be explicitly taken into account.

II.3. Knowledge and Communicability [9]

Kant stated explicitly that exclusively phenomenal appearances are known in a non-mediated way. The word phenomenon designates here a conscious event from an individual mind, already cast in the *a priori* forms of human intuition, time and space. This conscious event can be conceived by the man who experiences it as reflecting, or not, some object-entity ; but in *any* case it somehow bears the mark of the acting, human, body-and-mind structure, in a non removable and inextricable way. This is the foundation of the well-known Kantian postulate of impossibility to know reality such-as-it-is-in-itself, i.e. independently of any structure interposed by the observer-conceptor.

It is curious to note that this famous Kantian impossibility concerns exclusively the reality that is exterior to the mind. Indeed if one chooses to point *via* this same term, reality, toward any sort of existent, no matter whether assigned to the exterior universe or to some interior universe, this rather natural extension of language generates an exception to Kant's postulate, a huge one. For on the one hand this extension of language entails that also a phenomenon from an individual mind is an element of reality. But on the other hand a phenomenon, by definition, *is* just what *appears* to the mind where it emerges. So,

[6] Changeux, J.-P., L'Homme neuronal, Fayard (1983) ; .....
[7] Edelman, G. M., *Bright Air, Brilliant Fire : On the Matter of Mind*, Basic Books (1992).
[8] Damasio A., *The Feeling of what Happens. Body and Emotion in the Making of Consciousness*, Harcourt Brace & Company (1999).
[9] This paragraph has benefited from precious remarks made by Hervé Barreau.

for the sake of self-consistency, a phenomenon, as such, has to be posited to be known by the mind where it emerges *precisely* such-as-it-is-in-itself. To assert the contrary would simply be a logical contradiction in the construction of the whole consisting of [language and what it is posited to refer to]. Later the considered phenomenon might be perceived differently by the person who experienced it, or if it is communicated to another mind, its description might there be variously interpreted, in psychoanalytical terms, or biological ones, etc. But in all such cases one is in fact speaking of another (meta)object-entity that is related with the initial phenomenon but is not identifiable with it. And this new (meta)object-entity, in its turn, again must be posited to be known by the mind where it emerges, such-as-it-is-in-itself, etc. [10]. This characteristic of the inner phenomena, however, is not in the least a "problem". On the contrary it seems to be in deep harmony with the Cartesian cut.

> Indeed the fact that an entity from an inner individual universe has to be considered to be precisely such as it is perceived, can be considered to mark a polarity of reality with respect to knowledge, by which, while the exterior reality *never* can be known such-as-it-is-in-itself, any piece of interior reality – at the time when it emerges in this or that individual mind – can *only* be known by that mind such-as-it-is-in-itself, whereby its "truth" is beyond any doubt (or a qualification devoid of pertinence, which amounts to the same thing), so it is endowed with the Cartesian sort of pre-eminence.

But let us come back to the fact that a phenomenon, by definition, can only exist inside an individual mind. At the time when a given phenomenon emerges in an individual mind, it is known there without being also communicated. The subject can even know it without having *ex*-pressed it for himself : it can remain an unexpressed, a-symbolic individual psychical fact, chained to, and somehow melted to a certain degree in the interior universe where it happened. On the other hand, according to thinkers who know Kant's work deeply, in the Kantian view any scientific objectivity is constructed by a method of "legalization" of the primary phenomenal appearances. In this respect Jean Petitot (ref. 5) writes :

> «*The object of experiment, of scientific knowledge, is not given in the donation of the phenomenon.* It emerges by objectual legalization of phenomena. So, apart from a descriptive dimension, any

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[10] Goodman, N., makes the same point in *Ways of Worldmaking*, Hackett (1978).

scientific knowledge presupposes in its very principle also a *prescriptive*, a normative dimension, that is *constitutive of objectivity*............In Kant's work – so concerning classical mechanics – *the method consists essentially in interpreting the categories of objectivity* [11] by starting from the instances of donation of the phenomena, that is, by starting from the forms of phenomenal manifestation. Since the interpretation of the categories of objectivity is operational only if it is *mathematical*, the forms of phenomenal manifestation themselves must be mathematized.»

But such a legalization involves communicability. So how is set up the transposition of phenomenon, into communicable symbolizations?

Here, at precisely this point, one is confronted with an obscure zone where is located – undefined – the structure of the very first stage of *inter*-subjective conceptualization, that on which the whole subsequent inter-subjective conceptualization is founded, so also objectivity in general and in particular scientific objectivity. Kant did not deal with this question [12]. And as far as I know, up to now the philosophical thinking did not yet concentrate constructive efforts upon this zone. But it produced already important "negative" developments. The whole question of *reference* on which Quine [13] and Putnam [14] for instance achieved so deep and compelling analyzes in order to establish the frontiers of the domain inside which language confines knowledge, takes its sources precisely in the above mentioned obscure zone.

Now, in as far that one agrees that any transposition of a phenomeno, in communicable terms, amounts to a description, the content of this obscure zone can be more narrowly pointed toward by the following formulation :

> ***Nothing*** *else but* ***descriptions*** *can be known in an inter-subjective way, neither exterior factual entities "themselves", nor* ***non-described*** *phenomena.*

This specification is far from being trivial : it focuses the attention upon the importance of the emergence of communicability. Communicability in general as a larger basis for the particular sort of communicability that is normed scientifically. By way of consequence it establishes the interest of defining a *canonical* structure for what is called

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[11] The "dynamical" (physical) categories of substance, of causality and of interaction, the categories of quality and quantity, and the "modal" categories of possibility (potentiality, virtuality), of reality (actuality) and of necessity.

[12] As Hervé Barreau puts it, on Kant's view the phenomena seem to emerge *directly* Newtonian, already cast in scientific Euclidean space-time. Any concern about geneses of the type of those examined later by Husserl, Bergson, Piaget, and so many others, is absent in the Kantian work.

[13] Quine, W.V.O., *Ontological Relativity and Other Essays*, Columbia University Press (1969) ; *Le mot et la chose*,Flammarion (1977).

[14] Putnam, H., *Reason, Truth and History*, Cambridge University Press (1981, and reprinted regularly, the last time in 1997).

a description, a normed form of the descriptions, a mould into which to pour in an agreed way any transposition of a phenomenal appearance, in communicable terms. It establishes the *inadequacy* of a notion of, directly, a "scientific legalization of phenomena". Correlatively it establishes the necessity to define some legalization *of the processes of description*. Indeed, only a conveniently structured general norm for accomplishing descriptions could act as a universal inter-subjective reference permitting to gauge against it *any* procedure for describing, the natural descriptional procedures as well as, in particular, the various procedures for a "scientific" legalization of the descriptions of conscious phenomena. These procedures could then be all qualified, compared, understood, inside a common frame where a certain unity is set in advance beneath the specificities tied to this or that descriptional approach.

But how, according to which criteria, shall we identify the canonical form to be required for any description ?

It is quite remarkable that the answer to a question of such generality can be drawn from a physical theory. For it is quantum mechanics which shows the way, if the descriptional aim chosen in it and the strategy practised in order to reach this aim, are thoroughly explicated.

III. THE COGNITIVE SITUATION THAT LED TO THE QUANTUM MECHANICAL DESCRIPTIONS

III.1. Historical Remarks

A cognitive situation like that one involved in the quantum mechanical formalism, so *extreme*, had never been dwelt with systematically before the construction of quantum mechanics. A cognitive attitude like that one induced by the mentioned cognitive situation, so radically creative, had never before been organized. But when a theory of "microstates" started being researched, the involved cognitive situation *acted*, without getting explicit for that. The various well-known contributions from Plank, Einstein, Bohr, de Broglie, Schrödinger, Heisenberg, Born, Pauli, von Neumann, Dirac, etc., led to a coherent whole because they all had to satisfy, more or less implicitly, the *same* strong and peculiar constraints, those imposed by the involved cognitive situation. (But, and it is curious to find this out, none among the so numerous and eminent contributors did fully grasp the new epistemological essence of the emerging construction). There has been no

equivalent, for quantum mechanics, of a Newton, or a Maxwell, a Carnot, a Boltzmann, an Einstein.

> The construction of the quantum mechanical formalism has been orchestrated by an impersonal, very peculiar *cognitive situation*.

This might explain why the formalism, notwithstanding its remarkable efficiency, is up to this very day thought to possess a cryptic character and to involve problems. These problems however, over and over again, are much more referred to the formalism itself than to the cognitive situation which commanded the form of the algorithms. While, as far as I know at least, the cognitive situation has never been explicitly and thoroughly reconsidered for itself. So, hidden beneath increasingly complex formal developments and surreptitious mutations of the theory as a whole, its seminal epistemological implications could remain for ever devoid of contour, their substance anonymously absorbed and assimilated in the process of evolution of physics.

In what follows I withstand this decay. In a very synthetic and simple way I shall outline the main specific epistemological features of the cognitive situation involved in the quantum mechanical formalism. Thereby, in fact, I achieve a first step in the direction of what I call meta[quantum mechanics]. Indeed, as already mentioned, this re-formalization of fundamental quantum mechanics of which certain rather elaborate and much more technical elements (but never the whole so far) have been exposed in other works [15],[16],[17], is founded on – both – the basic considerations exposed in III.2 *and* on the fully elaborated method of relativized conceptualization. Here however, the aim being exclusively to bring into evidence the source of the method, the very simple exposition that follows (which summarizes two earlier non-specialised presentations [18],[19]) should suffice.

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[15] Mugur-Schächter M., (1991) *Spacetime Quantum Probabilities I :.....,* Founds. of Phys., Vol. 21.

[16] Mugur-Schächter M., (1992), *Toward a Factually Induced Space-Time Quantum Logic*, Founds. of Phys., Vol. 22.

[17] Mugur-Schächter M., (1993) *From Quantum Mechanics to Universal Structure of Conceptualization and Feedback on Quantum Mechanics*, Founds. of Phys., Vol. 23.

[18] Mugur-Schächter M., (1997) *Les leçons de la mécanique quantique (vers une épistémologie formelle)*, Le Débat No. 94, Gallimard.

[19] Mugur-Schächter M., (1997) *Mécanique quantique, réel et sens* in "Physique et réalité, un débat avec Bernard d'Espagnat", Frontières.

III.2. The Cognitive Situation Involved in Quantum Mechanics and the Strategy Induced by it.

A description involves a definite object-entity (object-of-description) and qualifications of it. The basic object-entities of quantum mechanics are what is called states of microsystems (microstates) [20]. These are *hypothetical* entities that no human being (in the present-day sense) will ever perceive. The obtention for them of qualifications endowed with some sort of stability, raises difficult and deep questions. Nevertheless quantum mechanics exhibits a very performing description of microstates. This manifests a descriptional strategy that has succeeded to overcome the epistemological difficulties. We want to explicate this descriptional strategy.

Let us consider first the basic object-entities of the quantum mechanical descriptions, microstates. Since they cannot be perceived, such object-entities cannot be made available for study by just selecting them inside some ensemble of pre-existing entities. Nor can one study them by just examining observable marks spontaneously produced on macroscopic devices by admittedly pre-existing natural microstates : no criteria would then exist for deciding which mark is to be assigned to which microstate. The unique general solution, then, is to first accomplish a known and repeatable macroscopic operation posited to generate a given though unknown microstate, and to try afterward to somehow manage to "know" the generated microstate.

Consider the hypothetical microstate produced by a given operation of state-generation. The plan is to acquire concerning it information cast in certain pre-established terms, involving what is called "position", or "momentum", or "energy", etc. The grids for the desired sorts of qualification are conceived beforehand, quite independently of the generated object-microstate, and with respect to *these* grids the object-microstate emerges in general still entirely unknown, still strictly non-qualified. This assertion is not in the least weakened by the fact that the presuppositions of the existence of microstates and of the emergence of a given sort of microstate when a given operation of state-generation is realized, insert already the generated microstate into a net of pre-conceptualization, so of

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[20] The stable microsystems themselves (electrons, protons, neutrons, etc.) have first been studied in atomic and nuclear physics where they have been characterized by specific "particle"-constants (mass, charge, magnetic moment). Changes of stable microsystems (creation or annihilation) are studied in nuclear physics and in field-theory. States of stable microsystems – microstates – are specifically studied in fundamental quantum mechanics (for Dirac the word "sate" is short for "way of mouvement" of a dynamical system (microsystem)) where they are characterized by probabilistic distributions of values of state-"observables".

a kind of pre-*posited* knowledge : the generated microstate emerges non-perceptible, so *a fortiori* still entirely non singularized from the specific points of view expressed by the definitions of its desired further qualificators. But on the other hand it emerges also *relative* to the employed operation of state-generation in a non removable way, and this permits to *label* it : it is a result of *this* – known – macroscopic operation of state-generation. Let us immediately embody this possibility. Let us symbolize by G the considered operation of state-generation and by ms_G the corresponding generated microstate. Though in this incipient stage the symbols G and ms_G are devoid of any mathematical representation, their introduction is very important. Indeed it instates inside the realm of the communicable, the fact that the generated microstate, though unknown, is nevertheless captured, in the peculiar sense that one can now produce as many copies of it as necessary and subject each copy to some subsequent operation of examination, while communicating clearly what one does, by words and signs. This amounts to having achieved a sort of a-conceptual definition of an infinite set of replicas of the object-entity called a microstate generated by G and symbolized ms_G. A purely factual and nevertheless communicable definition. This is very remarkable because *it circumvents the lack, for defining ms_G, of any predicate: G is not a qualification **of** ms_G, it is the way of producing it*.

Thereby one of the extremities of the chain of information that was to be started, is now fixed.

Once the first stage, of production of a "given" object-entity, has thus been achieved, one can enter upon the second stage, of construction of a certain knowledge concerning the generated object-entity. Now, the object-entity denoted ms_G, such as it emerges from the operation G that generates it, in general does not reach the level of what is observable by man. So it has now to be *brought* to trigger on this level some observable manifestations. Furthermore these manifestations have to be endowed with significance, namely with precisely the researched kind of qualifying significance. In order to reach this new aim, *measurement interactions* M(X) with macroscopic measurement devices are organized for measuring the *quantum mechanical dynamical quantities* X (X runs over the set of dynamical quantities – position, momentum, energy, etc. – that are mathematically defined inside quantum mechanics ; M(X) designates the process by which X is measured). The formal representations of the measurement-interactions M(X) are mainly conceived in a peculiar sort of prolongation of the classical

mechanics. Thereby – implicitly – history and *models* come in (ref. 18 and 19). The practical realizations of the measurement interactions M(X) are planned such as to produce a perceptible set of marks $\{\mu_X\}$ upon a convenient X-registration-device of an apparatus A(X) "good" for measuring X on microstates. What this means is quite non-trivial. In fact the processes M(X) are produced by what is called the apparatus A(X). Each set $\{\mu_X\}$ of observable marks, once produced, is interpreted, it is *coded* in terms of a value X_j of the quantum mechanical dynamical quantity X (X_j is called an *eigenvalue* of X) ; j is a discrete or continuous index. Which j corresponds to which sort of mark has to be specified so as to define a stable code-language. The coding-rules are determined by the formal quantum mechanical definition of X and by the specification of the interaction chosen as a measurement process M(X).

Codability in this sense – a rather complex operation – is a central condition for M(X) to be acceptable as a "measurement" process of X, so for A(X) to be acceptable as a "good" apparatus for measuring X.

In this way – by a complex interplay of inherited pre-conceptualizations, of assumptions, implicit models, macroscopic operations, theoretical representations, and of calculi and codings –, are achieved the basic quantum mechanical qualifications of microstates.

Of microstates, indeed ? Let us avoid inertial steps in the way of speaking, and check the pertinence of each verbal expression. For it seems clear that in general a measurement interaction must be imagined to *change* the microstate initially created by the employed operation of state-generation, possibly quite radically in certain cases ; so the observable marks emerge indelibly *relative* to the employed measurement process. Which means that these marks characterize globally the measurement interaction, not separately the supposed object-microstate. One can however cling to the fact that the observable marks are relative to *also* the initially created microstate, while the type of change undergone by this microstate during a measurement interaction is ruled in an admittedly known way by what is called a measurement process M(X). One has then to take furthermore into account that two distinct processes of change of the initially produced object-microstate, corresponding to two distinct measurement interactions M(X) and M(X') of two different quantum mechanical dynamical quantities X and X'≠X, in general *cover two different space-time domains*. When this happens, the measurement-

processes M(X) and M(X') cannot be both simultaneously achieved starting from *one* single replica of a microstate ms_G : in *this* sense these two measurement interactions are mutually *incompatible*. So, if one wants to obtain observable qualifications involving the microstate ms_G, in terms of eigenvalues X_j and X'_k of *both* X and X', one has in general to generate *more* than only one replica of ms_G because one has to achieve two sorts of successions [(a given operation G of state generation),(a measurement process M(X) on the supposed result ms_G of G)] (in short [G,M(X)]) where X runs over the set (X,X'), and the chronometer is re-set at the same initial time-value t_o for the realization of each pair (refs. 18 and 19). Furthermore even the measurement on a microstate ms_G, of only *one* quantum mechanical dynamical quantity X, when repeated *via* the necessary successions [G,M(X)], in general does not yield systematically one *same* eigenvalue X_j, in general the results are distributed over a whole spectrum $\{X_j, j \in J]$ of possible eigenvalues of X (J : an index set, discrete or continuous). Moreover a given eigenvalue X_j can in general be obtained also with other microstates $ms_{G'} \neq ms_G$ corresponding to other operations of state-preparation $G' \neq G$. So a stable information – if it can be obtained – *cannot concern isolately one individual microstate ms_G*. It necessarily concerns some pair [G,M(X)], so the measurement interaction is also involved, and furthermore, in general a pair [G,M(X)] has to be repeated in order to become able to assert a stable result. This means that the observational invariants that can be obtained by the help of pairs [G,M(X)] consist of *probability laws* p(G,X) defined on the spectra $\{X_j\}$ of the quantum mechanical observables X. Now, nothing insures *a priori* the existence of such probability laws. This existence is not a logical necessity. And if no probability laws associated with the various pairs [G,M(X)] were found, one would be obliged to finally give up the aim to construct some stable observable knowledge concerning microstates. But in fact it turns out that probability laws p(G,X) *do* arise, for each pair [G,M(X)]. So :

> By a very big number of repetitions of pairs [G,M(X)] where X runs over the set of all the dynamical quantities defined inside quantum mechanics, classes $\{X_j, j \in J\}$ of eigenvalues are obtained, coding for sets of registered marks that are mutually incompatible in the sense specified above, and over these probability laws p(G,X) are found. These probability laws, like also the concerned observable events X_j and

their individual probabilities p(G,X$_j$), are *relative* to both the involved operation G of state-generation and the involved dynamical quantity X [21].

But thereby the studied object-entity itself, the hypothetical microstate labelled ms$_G$, remains non-severed from the pairs of operations **[G,M(X)]**. The descriptional strategy imposed by the cognitive situation leads to observable qualifications that can be posited to *involve* this object-entity, but cannot be assigned to *it* alone, separately from the macroscopic operations G and M(X). This is a serious hindrance when one wants to think and speak about "microstates". To overcome this handicap one can make use of a sort of an *ad hoc* conceptual construct. Instead of speaking of the probability p(G,X$_j$) of this or that observable event X$_j$ tied with a pair **[G,M(X)]**, one can, equivalently, speak of the *potentiality* of the microstate ms$_G$ itself to produce with probability p(G,X$_j$) the observable manifestation X$_j$ *if* a measurement M(X) is performed on the involved microstate ms$_G$. *Which centres the thought-and-locution upon the microstate ms$_G$ itself.* In this way the concept of relative potentialities of observable manifestations permits to found upon the observable marks μ$_X$ obtained by measurement interactions M(X), a standard way of speaking about the microstate ms$_G$ itself, namely in terms of potential and relative hypothetical "properties" which are "possessed" by it alone, before the changes undergone during the measurement interactions that led to observable marks μ$_X$ characterising these interactions as a whole. But, mind that, what is achieved in this way is not more than just a model that should by no means be confused for an *impossible* specification of how-ms$_G$-really-is-in-itself. A very remote and poor, minimal sort of model, in fact, because of the non removable double relativization, to G *and* to M(X), and of the only hypothetical, potential and relative character of the assigned "properties". But nevertheless a model that introduces a standard way of speaking of the posited microstate itself. Which is a precious alleviation for thinking of it.

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[21] The fact that repetitions of pairs [G,X] are necessarily involved in the construction of an observable knowledge concerning the hypothetical microstates, entails quite non-trivial conceptual questions. These, because no specific language for dealing with them conveniently has been constructed, have led to what is called the "problem of the completeness of quantum mechanics" (refs. 18 and 19). Here we slip over these questions because inside the method of relativized conceptualization we shall deal in detail with the sources of a generalalized equivalent of this problem. Let us only note that one probability law p(G,X$_j$) is not considered to be sufficient for an unambiguous characterization of the involved microsystem ms$_G$; to achieve such a characterization it is necessary to exhibit at least two such probability laws corresponding to two mutually incompatible observables X and X'.

The space-time incompatibilities between different measurement interactions M(X) achieved on distinct replicas of the microstate ms_G generated by a given operation of state-generation G, entail, in terms of the minimal model specified above, that :

The set of all the physical processes of actualization of the various relative potentialities of observable manifestations X_j assigned to a micro-state ms_G generated by a given operation of state-generation G, falls apart into a set of mutually incompatible classes of actualization. This brings forth a probabilistic whole of a new type, with a tree-like space-time structure, and involving triadic chains with potential-actualization-actualized links.

I called this structure *the quantum mechanical probability tree of the operation of generation G* (refs. 15 to 19). By systematic reference to the quantum mechanical probability trees, the quantum mechanical formalism can be understood clearly and in full detail. This sort of reference constitutes the key-procedure for the construction of what I call meta[quantum mechanics] (note 2).

The preceding account, brief and simple as it is, contains, I think, the whole essence of the quantum mechanical descriptional strategy and of the type of results brought forth by it.

What sort of objectivity do such descriptions insure ? The knowledge constructed by the quantum mechanical descriptions is endowed with objectivity in the following sense. All the physicists who, working at different space-time locations, are constantly devoid of acceleration with respect to one another, obtain the *same* probabilistic distributions p(G,X) when they apply the quantum mechanical prescriptions for obtaining observable results concerning a given pair **[G,M(X)]** : the quantum mechanical probability distributions p(G,X) are *invariant* with respect to (newtonian) changes of the space-time coordinates, they are physical "newtonian laws" associated with the considered pairs **[G,M(X)]**. That is, they are pieces of certain inter-subjective consensus involving physical operations and facts, insured inside a particular but "sufficiently" large class of different observer-conceptors.

III.3. Epistemological Universality

It appeared above that the quantum mechanical descriptions are the result of a deliberate construction of communicable knowledge, a construction founded on the systematic relativization to pairs of operations [G,M(X)]). In order to achieve a quantum mechanical description of a microstate it has been necessary :

(a) to achieve the epistemic action denoted G that introduces the object-entity, independently (in general) of any epistemic action by which this object-entity could be qualified ;

(b) to achieve the epistemic actions that lead to qualifications of the object-entity ;

(c) to realize both these distinct sorts of epistemic actions in a radically creative way, by *first* generating – physically, in space-time – an object-entity that did not pre-exist, instead of just selecting it among already available physical objects, and by *then* generating, again physically, in space-time, also observable manifestations of the previously generated object-entity, instead of just detecting pre-existing properties possessed by this entity ;

(d) to realize a big number of replicas of the pair [G,M(X)] for each quantum mechanical dynamical quantity X, in order to construct invariant probabilistic qualifications (because in general no individual invariants are found).

Now, this is a maximally displayed and creative way of achieving descriptions, where all the involved relativities, are active. It is crucial to realize clearly that such a degree of display and creativity is absent in most of our current classical conceptualizations such as they are reflected by the natural languages as well as by logic, probabilities, physical theories, Einstein relativity included. In the classical conceptualizations it has always been possible to suppose more or less implicitly that the considered object-entities *pre-exist* to the descriptional process, that they are "defined" in advance by properties which they possess already actualized and independently of any act of examination. As long as the peculiar aim of describing states of microsytems had not yet been conceived, this supposition never led to noticed difficulties. Therefore, classically, a description is conceived to consist exclusively in the *detection* of one or more among the actual properties of the pre-existing object-entity. *The question of how the object-entity is introduced is entirely skipped*. As for the dynamical evolution that creates knowledge of a qualification, it is shrinked into one static act of mere detection. With respect to the quantum mechanical descriptional scheme, this last classical

contraction is the source of the nowadays most explicitly known differences between quantum logic and probabilities, and classical logic and probabilities (ref.16). While in fact the – ignored – consequences of the explicit consideration of the way in which the object-entity is generated, are still much deeper.

It is however noteworthy that, while in classical logic and classical probabilities – the two most fundamental classical syntactical structures – the quantum mechanical descriptional scheme is not apparent, this scheme nevertheless is explicitly involved in many classical and quite current epistemic situations and procedures. Indeed, once one has clearly perceived the peculiar and very difficult epistemic situation dealt with in quantum mechanics, as well as the descriptional strategy that permitted to dominate it, a very paradoxical inversion arises, by a sudden variation that reminds of those which make appear certain drawings of a cube as sometimes convex and sometimes concave. What first, in the quantum mechanical approach, had seemed to be fundamentally new and surprising, abruptly appears on the contrary as endowed with a certain sort of universality, so of normality. It leaps to one's mind that :

* any explicit account of a process of description, in so far that it is self-contained, always includes a full specification of the action by which the object-entity is introduced, as well as a full specification of the action by which a qualification is obtained for this object-entity ;

* often these two actions are mutually independent ;

* the introduction of the object-entity is sometimes achieved by *creation* of this entity, while the operation of qualification, if it is a physical process, *always* – in principle at least – changes the object-entity, and sometimes radically, in which cases the relativizing consequences of one or the other or both these epistemic actions, upon the development of the process of description, have to be explicitly taken into account and thoroughly analyzed.

For instance, think of a detective who is searching for material indications concerning a crime. What does he do ? He usually focuses his attention on a convenient place from the physical reality, say the theatre of a crime, and there he first operates extraction of some samples (he cuts out fragments of cloth, he detaches a clot of coagulated blood, etc.) ; or he might even entirely create a test-situation involving the suspects, and insure registration by hidden apparatuses, of their behaviours. Only afterward does he examine the gathered samples or the behaviours registered during the test-situation. One can equally think of a biopsy for a medical diagnosis, or an extraction

of samples of rock operated by a robot on the surface of another planet, and the subsequent examinations. In all these cases the observer-conceptor – more or less radically – *generates* an object-entity that did not pre-exist in the desired state or quantity, in order to qualify it later by operations that are quite independent of the operation which generated these entities. And in certain cases the operation of examination so radically changes the object-entity, that, if several different examinations of this object-entity are necessary, also several replicas of it must be produced. Furthermore, the obtained qualifications arise indelibly marked by a double relativity : relativity to the way of generating the object-entity (this way can simply exclude certain subsequent examinations), and also a relativity to the sort of examination that was achieved.

The preceding considerations call forth the following two correlated remarks.

In the first place, the nature and realm assigned by classical thinking, to communicable knowledge, are misleading and shrinked. The whole zone where mind *actively constructs*, out of pure factuality, the very first forms of new communicable knowledge, is so deep-set that it remained hidden beneath the two basic building blocks of all the current occidental languages, namely subjects and predicates. These do both suggest available, pre-existing states of fact. Furthermore, the primordial creative zone of conceptualization remained cut off also from most classical scientific representations. Notwithstanding the well known analyzes of Husserl, Poincaré, Einstein, Piaget, and many others, not only classical logic and probabilities, but also the set theory (hence most domains of modern mathematics), modern linguistic and semiotic, etc., take their start from a level organized *above* language, by use of – quasi-exclusively – language : physical operations are not considered. And factuality – *via* language – is widely supposed to spontaneously imprint, upon passively receptive minds, information concerning already existing, actual properties of pre-existing objects. The active role is assigned quasi exclusively to the exterior factuality, not to the mind. This attitude, in fact, is stronger and more general concerning object-entities (typical grammatical subjects) than concerning qualifications (predications). Anyhow, globally, an attempt at an integrated and systematic representation of the emergence of individual object-entities and of qualifications of these, by deliberate epistemic actions, and the way in which these products get integrated into communicable concepts-and-language, is still lacking. From "the other part of the mirror" where the biological structure of the man's body is placed, the cognitive sciences are trying to initiate a representation of the sensorial bio-physiological processes involved in phenomenal appearances and in conceptualization,

by including into the domain of investigation the inner volume delimited by a man's skin. But if this inner volume is excluded, then it is quantum mechanics which – for the first time – suggests the possibility of, and the method for a most deep-set attempt at a purely psycho-operational representation of the processes of conceptualization : an attempt founded on the very first interplay of what is called mind, with unknown factuality, and involving explicitly the descriptional aims, the physical operations and devices, and the evolving stratum of pre-existing conceptualization.

In the second place, the descriptional scheme explicated from the epistemic strategy involved in quantum mechanics, is paradigmatic. It has captured in it a certain sort of epistemic universality. Quantum mechanics involves a particular embodiment of an extreme epistemic situation, namely that which is realized when a communicable conceptualization is researched concerning non pre-existing physical entities of which – *a priori* – only the possibility is conceived, and which, if then effectively generated, emerge non-perceivable. In such extreme circumstances one has been compelled to a *radically* active, constructive attitude, associated with a maximal decomposition of the global process. All the stages of the desired description have had to be *built* out of pure physical factuality, independently of one another, each one in full depth and extension : the severity of the constraints revealed the most complete and explicit descriptional scheme where any other more particular description *must* find lodging. In this sense the quantum mechanical descriptional scheme possesses a universal epistemological value.

As soon as this universal value has been understood, one finds oneself in possession of a starting point for specifying a convenient canonical form of any description. Indeed such a canonical form must be precisely a complete abstract structure with a maximally carved out capacity. It must be a void form, a mould, able to offer an available, specific, and sufficiently large location, for *any* possible stage of *any* possible descriptional process. In this or that given description, one or more locations offered by this canonical form might remain partially or totally non utilized. But this, if it happens, will be known since the form will exhibit a labelled void of estimated ampleness. For instance, if I say «I consider what I see just in front of my eyes and this is a red surface», by reference to the maximally complete descriptional mould drawn from quantum mechanics it will appear that in this case the two canonically distinct descriptional actions, of generation of the object-entity, and of qualification of this entity, have coalesced in the unique act of "looking just in front of my eyes", which *both* delimits and qualifies the object-entity. So

the location reserved for the stage of independent generation of an object-entity remains entirely void in this case. It will also be possible to estimate the magnitude of only partial voids and to draw consequences. For instance, imagine the assertion «I plucked this flower, I examined its morphology with a microscope, and the result is this». Comparison with the canonical mould brings forth that this amounts to a description where the object-entity – as such – is introduced by an only partially creative action – plucking a flower –, while the act of examination might only very little change the object-entity initially introduced in this way. So in this case the two distinct locations reserved in the canonical mould in view of a possibly radical creativity in both the stage of production of an object-entity and in that of qualification of it, are both made use of, but each one to only a very reduced degree. It follows that a classical treatment (assuming the pre-existence of the object-entity as well as its invariance with respect to the process of qualification) can be posited to produce a very good approximation to the result that would be obtained by a complete canonical treatment.

IV. NORMS FOR DESCRIBING :
THE METHOD OF RELATIVIZED CONCEPTUALIZATION (MRC)

IV.1. Preliminaries

Since 1982 I never ceased developing the method of relativized conceptualization [22],[23] (and ref. 17) – let us denote it MRC – founded on the generalization of the descriptional scheme which I explicated from the quantum mechanical descriptions. This method can be regarded as an attempt at a certain "normation" of the processes of description of any sort, or in other terms, *a normation of the processes of communicable conceptualization*.

Because of the descriptional relativitisations that are explicitly built into it at each descriptional step, MRC withstands by construction the insertion of false absolutes, thus warding off false problems or paradoxes. And because it roots its constructions in

[22] Mugur-Schächter M., A : (1984) *Esquisse d'une représentation générale et formalisée des descriptions et le statut descriptionnel de la mécanique quantique*, Institut de la Méthode, Lausanne ; B : (1995) *Une méthode de conceptualization relativisée : vers une épistémologie formelle apte à faire face aux complexités*, Revue Internationale de Systémique, Vol.9, No.2, pp.269-303.

[23] Mugur-Schächter M., (1992) *Spacetime Quantum Probabilities II : Relativized Descriptions and Popperian Propensities*, Founds. of Phys., Vol. 22, pp. 235-312.

physical factuality, at the lowest descriptional level that can be reached, MRC furthermore withstands any gliding into relativism :

MRC stands in polar opposition to what is called relativism.

It means confined, delimited, but strict precision of each descriptional step, associated with free though guided choices of the way of connecting the descriptional steps accordingly to the evolution of the descriptional aim. Which insures controlled rigor throughout a progressive construction of freely decided trajectories and nets of conceptualization, always indefinitely open.

The main difficulty has been to find a way of escaping the imprisonment inside the forms which current language, surreptitiously, imposes upon thought. In all the preceding publications concerning MRC, in order to achieve this liberation I made use from the start on of certain ideographic symbolizations, but I never tried to achieve a mathematical formalization. The ideographic symbolizations, however, have been felt by many to stay in the way of a natural and full access to meaning. Therefore in this work I adopt a different strategy. In a first stage I expose the nucleus of MRC in usual language, trying to get through the stubborn implicit forms of thought induced by the current usage of words, with the help of exclusively the resources of the associations of words themselves (and of abbreviating literal notations of words). In a second stage I give a summary of the ideographic symbolization utilized in all the previous expositions of MRC, because it permits a more suggestive and economic expression of certain basic concepts and assertions. Finally, in a third stage I sketch out a *mathematical* formalisation of the nucleus of MRC in terms of the theory of categories [24].

This chapter is devoted exclusively to the nucleus of MRC. The way in which the nucleus works will be illustrated in the subsequent chapter V, by showing how it generates a deep and fully relativized unification between the logical conceptualization and the probabilistic one.

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[24] The possibility of also another sort of mathematical formalization, more fit for calculations permitting numerical estimations – namely in terms of Hilbert-Dirac "individual" vectors (i.e. not belonging to a vector-space) – will be found in the exposition of meta-[quantum mechanics] (note 2). While in the chapter V it will become clear that the probably most natural vocation of MRC is to yield a non-mathematical formal system comparable to Russel and Whitehead's Principia Matematica, but concerning conceptualization in general instead of only logic.

IV.2. TheFirst Stage : a Presentation of MRC in Usual Language

In what follows I formulate definitions (D), a postulate (P), principles (P), conventions (C), and assertions which are called propositions (π) because they are justified by "natural deductions" (indicated by the word "proof" written between quotation marks in order to distinguish from deductions inside a formal system). Each step is labelled by the symbol of its nature – D, P, P, C, or π - followed by the ordinal of the step. There are 19 steps, namely 15 definitions, 1 postulate and 3 principles. When a step is splitted in sub-steps a sub-ordinal is added for each sub-step. A step is often followed by comments.

I proceed by enumeration of the steps and sub-steps. The sequence is interrupted by several intermediary titles which break the progression in small groups each one of which concentrates upon a given purpose.

Preparation of the concept of relative description

D1. *Consciousness functioning*. The activity of an observer-conceptor's mind – called here *consciousness functioning* and noted CF – is conceived to play a central generative role, acting on the exterior universe *and* on the interior universe where it belongs, and there, in particular, also on itself. This activity is regarded as the quintessence of the epistemic *actor*, irrepressibly anterior and exterior to any specified epistemic action. It is an (the ?) invariant among all the epistemic actions the observer-conceptor is aware of, it is the tissue of his continuity, and each one of its products becomes exterior to it as soon as it has been produced. It marks a mobile, permanent and non removable cut – a ultimate cut – between itself and the rest.

Comment. The Cartesian cut between *res cogitans* and *res extensa* is second with respect to this mobile cut.

Throughout what follows CF is explicitly incorporated in the representation. Thereby, from the start on, this approach breaks openly and radically with the classical concept of objectivity. It introduces basically, in a declared and systematic way, the supplementary representational volume that is necessary for a non-amputated expression of the new concept of objectivity in the sense of inter-subjective consensus, such as this concept emerged from modern physics, from quantum mechanics and Einsteinian relativity. That is, inter-subjective consensus founded on systematically extracted

fragments of *pure factuality* (quantum mechanics) and qualified by qualificators explicitly constructed in order to express definite classes of relative *observational* invariance (Einsteinian relativity). Indeed both these constraints, that are the core of modern physics, involve CF in a quite essential way.

D2. *Reality*. What is called reality is posited here to designate the *evolving* pool – always considered such as it is available at the considered time – out of which any given consciousness functioning either radically creates, or delimits, or only selects, object-entities of *any* kind whatever, physical or psychical or of a mixed kind. This pool will be indicated by the letter R.

Comment. This non restricted definition of "reality" refuses the disputes on "existence" (do unicorns exist ? does the number 3 exist ? does a class exist ? etc.). It will appear that inside the present approach the indistinctions entailed by this absence of restrictions entail no difficulties.

P3. *The realist postulate*. Throughout what follows is explicitly postulated the *existence* – independently of any mind and of any act of observation – of also a *physical* reality.

Comment. In the formulation of P3, as also in D1 and D2, the specific designatum of the expression "physical reality" (that implies that a sub-realm of what is called reality is considered), is assigned the status of a primary datum. This however is *only a starting point*. In what follows the general reflexive character of MRC will manifest itself, in particular, by the fact that, progressively, a more constructed distinction between "physical" reality and reality in general will constitute itself inside MRC [25].

[25] This specification takes into account concurrent remarks by Jean-Louis Le Moigne, Michel Bitbol, Jean-Blaise Grize, and Gérard Cohen-Solal who – independently of one another – argued that the concept of "physical reality" seemed to them neither clear *nor necessary* in a context of the nature of MRC ; that inside such a context this concept should *emerge*. Furthermore, on H. Barreau's opinion, speaking of "physical" reality might erroneously suggest some confusing necessary connection with Physics, which the word "empirical" would avoid. It will however appear that the crucial definition D14.3.1 of a basic transferred description, as well as the preparatory points 8 to13, are endowed with significance *exclusively* with respect to what is usually called physical reality, while with respect to reality in the general sense of D2 – which includes, for instance, *empirical* economic or cultural data, empirical aspects or components of what is called art, etc. – the formulations from the points 8 to 14 are *meaningless*. So I simply do not know how to avoid the assertion *ab initio* of P3 such as it is expressed above : such is the force of language. On the other hand, throughout the points 8 to 14 the concept of physical reality keeps acquiring constructed specificity. In this sense, a progressive specification of P3 *does* emerge from the evolving MRC-context, as desired by the above-mentioned colleagues, but it emerges on the basis, also, of P3 itself. So my final option is to conserve

The posit P3 of existence of a physical reality might seem to be entailed by D2, so redundant, but in fact it is not. Indeed, though everybody agrees that what is called physical reality does contribute to the pool out of which the consciousness functioning extract object-entities to be studied, nevertheless the various disputes concerning "existence" of this or that sort of object-entity (does Jupiter exist ?) continue steadily. The association [D2+P3] is intended as *(a)* a *memento* of the fact stressed most by Descartes and recognized by the majority of the philosophers, that, in the order of the emergence of knowledge, the assertion of the existence of physical reality *cannot* be considered to be *primary* with respect to the assertion of the existence of subjective psychical universes (as classical physics might seem to suggest) : the word «also» in the formulation of P3 is intended to provocatively remind of this ; *(b)* an explicit refusal of solipsism, on the other hand ; *(c)* an inclusion in what is called reality, of the concepts and systems of concepts, of the behaviours, beliefs, social and economical facts, etc. (the third world of Popper).

D4. *Generator of object-entity and object-entity*. The epistemic operation by which a consciousness functioning introduces an object-entity will be regarded as an action upon R achieved by CF by the use of a *generator of object-entity* denoted G. The spot (or zone, or the sort of domain) from R where a given generator G acts upon R, is considered to be an essential element from the definition of that generator, and which has to be explicitly specified ; it will be denoted R_G. The object-entity introduced by a given generator G will be denoted œ_G. For methodological reasons, a one-to-one relation is posited between a given definition of a generator G and the corresponding object-entity œ_G : *that* which emerges as the product of a given G-operation, *whatever it be*, is called "the object-entity produced by G" and is labelled œ_G.

Comment. Any description involves an object-entity. Usually it is considered that it suffices to name or to label this object-entity thus just directing the attention upon it before it is more thoroughly examined. This attitude is restrictive since not any conceivable object-entity pre-exists available for examination. Therefore throughout what follows it is required that the basic epistemic action accomplished upon R which brings

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[D2+P3]. For the moment it is sufficient to understand the qualification "physical" as pointing toward anything involving an in principle definable amount of mass-energy. Then certain non-physical entities, like "art", etc., can involve physical *aspects*, while others, like the concept of the number 3, do not.

into play the considered object-entity – as such –, no matter whether this action is trivial or not, be *always* indicated explicitly and fully.

A generator G of object-entity can consist of any psycho-physical way of producing out of R an object for future examinations. Such a way involves systematically some psychical-conceptual component, but which can combine with concrete operations. A generator G can just *select* a pre-existing object or on the contrary it can radically create a new object. If I point my finger toward a stone I select a physical entity by a psycho-physical selective gesture that acts in a non creative way on a physical zone from R (R_G is the volume where the stone is located). If I extract from a dictionary the definition of a chair I select by a non creative psycho-physical act, an abstract conceptual entity materialized by symbols in a physical zone from R consisting of the dictionary (so here $R_G \equiv$ dictionary). If I construct a program for a Turing machine in order to examine the sequences produced by this program, I bring into play a creative, instructional conceptual generator of object-entity that acts on a zone from R containing subjective and inter-subjective knowledge as well as material supports of these. If, in order to study a given state of an electron, I generate it by using some macroscopic device that acts on a place from the physical space of which I suppose that it contains what I call electrons, I delimit a physical object-entity, by a psycho-physical creative action. If now I apply the *same* operation upon a mathematical theory, or upon a place from the physical space where the vibrations of a symphony can be heard but the presence of electrons is improbable, I am making use – by the definition D4 – of *another* generator, since it involves *another zone* R_G, and, in consequence of the one-one relation posited between G and œ$_G$, I delimit *another* object-entity (interesting, or not, probably not, in this case). When I define by words a new concept, as I am doing now, in order to later specify its behaviour, I produce a conceptual object-entity, by working, with the help of a psycho-conceptual-physical creative generator, upon the spot from R consisting of the reader's mind.

The inclusion, in the definition of G, of the "zone" R_G from R where G is supposed to act, requires two important specifications. *(a)* R_G is *not* a qualification *of the produced object-entity œ$_G$*, obtained by examining *this* object-entity in order to learn about *it*. It is a condition imposed upon the operation of generation G in order to insure the location of *all* the products of G, inside a pre-decided conceptual volume indicated by some verbal label, "microstate", "chair", "program", etc. (In particular, in the case of a selective generation like for instance pointing toward a stone, this pre-posited conceptual volume

where G has to act, might degenerate in the conceptor's mind into an identification with the physical location of the object-entity $œ_G$). The methodological necessity of such a pre-decided conceptual location will be fully understood later, in the comment of the definition D14.3.1. *(b) The "zone" R_G from R where G is supposed to act permits of uncontrollable fluctuations concerning what is labelled $œ_G$.* The physical region from R where I act in order to generate a given microstate of an electron, can contain non perceptible and uncontrollably variable fields, etc. ; the reader of these lines can happen to be a 16 years old boy, or a mature intellectual. These fluctuations entail an unavoidable non-predictability concerning the effect labelled $œ_G$ of an operation of generation of an object-entity. However one should clearly realize that it simply is *inconceivable* to "entirely" immobilize *a priori* the effect of G denoted $œ_G$: this would require to specify "completely" R_G. But such a requirement is both impossible (circular) and unnecessary. One simply cannot *start* a process of representation of the way in which descriptions, i.e. qualifications of any object-entities, emerge out of R, by specifying, so qualifying R itself everywhere and for any time, and also from any point of view. Such a circle cannot be realized. While the *a priori* non-determination concerning the effect of the individual operations of generation of an object-entity, is by no means an insuperable problem or a difficulty. It simply is an unavoidable constraint that MRC is obliged to recognize, include and control. The recognition of this constraint plays an essential and very original role in the dynamics of conceptualization from MRC. It brings into evidence one of the roots of human conceptualization and it comes out to be intimately tied with a reflexive character of MRC, of maximal *a priori* freedom, followed by *a posteriori* controls and restrictions. It opens up the way toward a constructive incorporation (*via* the sequence D14 of definitions of relative descriptions) of the fundamental fact called "non-determination of reference" established by the deep analyzes of Quine (ref. 13) and Putnam (ref. 14), which marks the breaking line between factuality and mere language.

Consider now the one-one relation posited between a given definition of an operation G of object-entity generation and what is labelled $œ_G$. This relation is intimately tied with the above mentioned *a priori* non-determination involved by R_G, so also with the non-determination of reference. It is important to realize that *no other relation could be uphold ab initio*. Indeed in general the object-entity labelled $œ_G$ emerges still non qualified from the standpoint of the subsequently intended examinations, if not, in general its generation would be unnecessary for this aim. It can

even emerge still entirely inaccessible to direct knowledge of any sort, if G is a radically creative and physical operation of generation (as in the case of the microstate generated by most quantum mechanical operations of state-generation). In these conditions what we called a one-one relation between a given definition of an operation G of object-entity generation, and the mere *label* œ$_G$, obviously *cannot* mean that the still unqualified replicas of œ$_G$ are all "identical" in some inconceivable absolute sense.

> The one-one relation posited between G and œ$_G$ amounts to just a ***methodological pre-organization of the language-and-concepts***, unavoidable in order to be able to form and express a beginning of the desired representation of a human conceptualization.

Indeed if from the start on we imagined that G might produce sometimes this and sometimes something else, how would we *speak* of what it produces, or think of it ? We would have to re-label in only *one* way the product entailed by a given definition of G, whatever it be, and thus we would come back to precisely our initial choice of language and notation. On the other hand, if we asserted *a priori* a "real" one-one relation between G and what is labelled œ$_G$, we would thereby assert the sort of view that is sometimes called metaphysical realism (a God's Eye view, as Putnam puts it), which would directly contradict the very philosophical essence of the present approach. In the sequel, each time that some definite consequence of this *a priori* choice of language will appear, we shall deal with it for that definite case.

The explicitly methodological character of this constructive strategy adopted in the definition D4, is a quite crucial step. It saves premature, void, illusory questions and paradoxes that simply cannot be solved *a priori*. Instead, as it will appear, it brings forth *a posteriori* a clear, fully *relativized* operational concept of "identity" that emerges progressively in π12, π13 and D14.1 and then is specifically defined in π18.1 ; which suppresses inside MRC one of the most noxious false absolutes induced by current language. And the relativization of the qualification of identity permits then immediately to show by π18.2 and π18.3 that MRC, inside its *soma* progressively structured from the precedingly posited definitions, postulate and principles, eventually entails a well-defined sort of *minimality* of the realist postulate P3, initially posited without any further qualification. By this minimality the "metaphysical realism" will appear to by organically rejected by MRC.

D5. *Qualificators*.

D5.1. *Aspect-view*. Consider a grid for examination which, *via* certain operations of examination performed on an object-entity œ$_G$, can be *a priori* imagined to produce qualifications of this entity. Such a grid will be called an *aspect-view* and will be denoted V$_g$. By definition V$_g$ is structured as follows.

- The qualifications that can be generated by V$_g$ are contained inside a semantic dimension called *the aspect g* and labelled globally by the index g (which can take on any graphic form : another letter, a group of letters, some other sign).

- The qualifications that can be generated by V$_g$ are called *g-qualifications*. The set of all the possible g-qualifications is allowed to be arbitrarily rich but it is required to be finite, so discrete. Each g-qualification is called *a value k of the aspect g*, in short a gk-value, where gk – in one block – functions as only *one* index. The aspect g is conceived to *contain* the corresponding finite set of gk-values, not to identify with it.

- A gk value itself is permitted to be of either a physical or an abstract nature, but it is required to be directly perceptible by the involved observer-conceptor, *via* his mind and his biological senses.

- The aspect g is considered to be defined *if and only if* the specification of its values gk is associated with also the explicit specification of an effectively realizable modality – physical, or conceptual (in particular formal), or mixed –for :

* Accomplishing the examinations – physical, or psychical or conceptual – from the semantical dimension called the aspect g.

* Expressing the results of these examinations in terms of "values gk of the aspect g", which amounts to the explicit specification of certain *coding-rules*.

Any object, device or algorithm involved by the modality required above, is to be included in the definition of the aspect g.

Comment. So, in contradistinction to the grammatical or logical predicates, an aspect-view V$_g$ is endowed by definition with a *structur*e, and with coding-rules which fix a finite "gk-language" consisting of operations, signs, names, referents, and the stipulation of the relations between these.

This structure exhibits explicitly all the restrictions to which is subjected an *effectively* realizable operation of qualification, that can be made use of without incurring ambiguities. If these restrictions are not all satisfied we simply are not in presence of an aspect-view in the sense of D.5.1.

Let us note that an order between the values gk of an aspect g is *not* required but is permitted.

The distinction between an aspect g and the set of all the gk values contained inside that aspect, takes into account the remarkable psychological fact that any set of gk-values, even only *one* such value, as soon as it is "conceptualized" (i.e. as soon as it ceases to be a mere "primeity" in the sense of Peirce), generates in the consciousness a whole semantic *dimension* g (a genus) that exceeds this set and constitutes a ground on which to place it : every gk-value determines a location (a specific difference) on this semantic domain g that grows spontaneously beneath it (for instance, if gk labels the interior event toward which the word "red" points, this event, when conceptualized, generates the carrying semantic dimension toward which the word "colour" points). We are in presence of a fundamental law of human conceptualization that moulds logic, language, and even metaphysics (the concept of "substance" is the semantic ground on which are located the ways of existing of material systems, etc.). The adopted definition reflects this law, on which it tries to draw the attention of the cognitivistic approaches (what are the corresponding bio-functional substrata ?).

Finally let us also note that, by definition, an aspect-view V_g acts like a qualifying *filter* : it cannot yield qualifications different from any corresponding gk-value.

D5.2. *View*. A grid for examination that consists of a finite but arbitrarily large set of aspect-views, is called a view and is denoted V.

Comment. The complexity and the degree of organization of a given view V are determined by the number of aspect-views V_g from V and by the structures of the various sets of gk-values introduced by the various involved aspect-views from V (number of gk-values, "position" (central, extreme) of each set of aspect-values on the corresponding semantic dimension g, existence or not of an order among the gk-values of a fixed aspect g, a reference-gk-value (a gk-zero), etc.). In particular a view can reduce to only one aspect-view or even, at the limit, to one aspect-view containing only one gk-value on its semantic dimension g. There is nothing absolute in the distinction between an aspect-view and a view : an aspect-view can be transformed in a view by analysis of its aspect in two or more sub-aspects, and *vice-versa* the set of distinct aspects from a view can be synthesized into a unique aspect. This stresses that a view, like also a generator of object-

entity, is just a construct freely achieved by the acting consciousness-functioning CF, in order to attain a definite epistemic aim.

D5.3. *Physical aspect-view and view*. Consider an aspect-view V_g where the aspect g is physical and requires physical operations of examination of which the results consist of some observable physical effects. Such an aspect-view will be called a *physical aspect-view*. A view containing only physical aspect-views will be called a *physical view* (concerning this language cf. note 25).

Comment. This definition can be best understood *per a contrario*. A mathematical or a logical view is not a physical view, though the involved examinations do involve certain physical actions (writing, drawing, etc.), because what is called the results of the examinations (not their material expression) consists of concepts, not just of physical entities (marks on a measuring device, for instance). (And of course, a physical view does not in the least necessarily involve Physics).

D5.4. *Space-time aspect-views*. One can in particular form a *space-time aspect-view* V_{ET}. Accordingly to Einsteinian relativity the double index ET can be considered as *one* aspect-index g=ET where E reminds of the current Euclidian representations and T stands for time. However the partial aspect-indexes E and T can also be considered separately from one another, setting g=E or g=T. The space-aspect E is associated with space-values or "positions" that can be denoted E**r** (setting a position vector **r** in the role of the index k introduced in D5.1) and the time-values can be denoted Tt (setting a time parameter t in the role of k). Indeed though in general the *numerical* estimations indicated by **r** and t are not mutually independent, nothing interdicts to symbolize separately the spatial position-value and the time-value.

Infinitely many space-time views can be constructed (by varying, in the representations, the choice of the origins of space and time, of the units for measuring intervals, the form and direction of the involved reference-axes). Any space-time aspect-view introduces an *ordered* grating of space-time values. This is a specificity with highly important epistemic consequences (refs. 15 and the chapter V2 in this work).

D6. *Epistemic referential and observer-conceptor*. A pairing (G,V) consisting of a generator G of object-entity and a view V, is called an *epistemic referential*.

A consciousness functioning CF that endows itself with a given epistemic referential is called an *observer-conceptor* and can be denoted [CF,(G,V)].

Comment. A pairing (G,V) is permitted to be entirely arbitrary *a priori*. This is a methodological reaction to an unavoidable constraint : the capacity of a pairing (G,V) to generate meaning, can be examined only after having considered that pairing. This particular methodological reaction is a new manifestation of an already mentioned general reflexive strategy practised in MRC, of a tentative *a priori* approach that is entirely non restricted, but is systematically followed by *a posteriori* corrective restrictions.

An observer-conceptor [CF,(G,V)] is the minimal epistemic *whole* able to achieve epistemic actions in the sense of MRC : by itself an epistemic referential (G,V) is not yet a closed concept, nor does it designate an active entity. This concept becomes closed and activated only when it is associated with the consciousness functioning CF that generated and adopted it.

D7. *Relative existence and inexistence*. Consider an *a priori* pairing (G,V_g). If an examination by the aspect-view V_g of the object entity $œ_G$ generated by G, never reveals to the involved observer-conceptor some value gk of the aspect g, we say that *the object-entity $œ_G$ does not exist (is not pertinent) with respect to the aspect-view V_g* (or equivalently, that V_g does not exist with respect to $œ_G$, or that $œ_G$ and V_g do not mutually exist) [26].

Suppose now, on the contrary, an act of examination by the aspect-view V_g of the object entity $œ_G$ generated by G, that *does* reveal to the involved observer-conceptor one or more values gk. In this case we say that *the object-entity $œ_G$ exists with respect to the aspect-view V_g* (or that V_g exists with respect to $œ_G$, or that V_g and $œ_G$ do mutually exist).

Comment. The definitions of relative inexistence or existence can be transposed in an obvious way to one single value gk of an aspect g, or to a whole view V.

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[26] If one examined with the help of a voltmeter, a symphony by Beethoven, the operation might never produce an estimation of a difference of electrical potential (accidents being neglected). Of course during a more realistic sort of tentative research a mutual non-pertinence can be much less apparent *a priori* than in this caricatured example.

The concepts of mutual inexistence or existence concern, respectively, the general *impossibility* or *possibility* of the emergence of meaning, as well as the intimate connection between meaning and descriptional aims, which are induced by a tentative pairing (G,V_g) or (G,V). These concepts are essentially semantic.

They express the general fact – *previous to any qualification* – that a given object-entity can be qualified only *via* the views to the genesis of which it can contribute by yielding matter for abstraction. Furthermore, the concepts of relative inexistence and existence permit to cancel *a posteriori*, among all the initially only tentative pairings (G,V_g) or (G,V) that an observer-conceptor has introduced, those which appear to be non-significant; while the other pairings can be kept and put to systematic descriptional work. The possibility of such a selection illustrates again the general reflexive strategy of MRC: maximal *a priori* freedom followed by *a posteriori* controls and restrictions.

The concepts of relative inexistence and existence have quite fundamental consequences, but with respect to which the classical conceptualizations are more or less blind. This generates various sorts of false problems and paradoxes. Formal logic for instance, because it is posited to concern exclusively the qualifications of mutual consistency (formal truth), decidability concerning consistency, and formal completeness, banishes the semantic concepts of relative existence. But formal truth, surreptitiously, *via* the axioms *considered as propositions*, introduces factual truth into the formal systems, and factual truth, in order to be defined, requires mutual existence as a preliminary condition. This, according to MRC, is intimately tied with the non-decidability paradoxes, and leads to certain reservations even with respect to Gödel's proof of non-decidability, though non-decidability itself, as defined for formal systems, *follows* inside MRC (cf. V.2).

P8. ***The Frame-Principle***. I posit the following principle, called *frame-principle* and denoted FP.

Consider a *physical* object-entity œ_G that can be (or is conceived to have been) generated by some definite physical generator of object-entity, G. This entity œ_G does exist in the sense of D7 with respect to at least one physical aspect-view V_g (D5.3) (if not the assertion of a physical nature of œ_G would be devoid of foundation (content)).

The frame-principle FP asserts the following.

- If the physical object-entity $œ_G$ does exist in the sense of D7 with respect to the physical aspect-view V_g, then *ipso facto* $œ_G$ exists in the sense of D7 with respect to also at least one view V formed by *associating* V_g with a convenient *space-time view* V_{ET} (it cannot exist with respect to *any* such association, if only because the values gk of a given aspect g can appear or disappear with respect to a given space-time view when the space-time units are changed). But the object-entity $œ_G$ is non-existent in the sense of D7 with respect to *any* space-time view that acts *isolated* from any other physical aspect-view V_g where g≠ET : *the space-time views are **frame**-views which, alone, are blind, they cannot "see" nothing*.

- According to what precedes what is called "physical space-time" *cannot* be regarded as a physical object-entity $œ_G$. Indeed the assertion posited in the first part of this principle does *not* apply to what is called "physical space-time" : the designatum of this expression *itself*, considered strictly *alone*, is non-existent in the sense of D7 with respect to *any* physical aspect-view $V_g$where g≠ET, and it is equally non-existent with respect to any association of such a physical aspect-view, with a space-time aspect-view. In this sense :

> What is called "physical space-time" is − itself − only the locus of all the possible space-time frame-views (referentials), the genus of these. It is the conceptual volume where physical entities, facts or aspects, can be assigned space-time specifications which, if this is desired, can be numerically defined by the use of space-time referentials.

Comment. The frame principle FP adopts, transposes in terms of MRC, and specifies, the Kantian conception according to which man is unable to conceive of physical entities outside physical space-time, that he introduces as *a priori* "forms of the intuition" inside which he casts all his representations of physical entities. FP isolates and stresses certain particular implications of this Kantian conception which so far seem to have remained insufficiently noticed by physicists. Namely that any mature and normal human being, by the nature of his consciousness functioning, as soon as he perceives or even only imagines a phenomenal appearance which he connects with what he conceives to be a physical entity $œ_G$, *ipso facto* introduces more or less explicitly :

(a) a space-time frame-aspect-view V_{ET} (the observer-conceptor's body tends to yield – vaguely – the intuitive origin, the units, and – variable – directions of the axes, whereas in the technical or scientific approaches these are explicitly and freely specified, in a precise and stable way) ;

and furthermore

(b) at least one aspect-view V_g where g is a physical aspect *different* from V_{ET}, relatively to which the considered physical entity $œ_G$ does exist in the sense of D7, and the values gk of which he combines with the value-indexes E**r** and T**t** of the space-time aspect-view V_{ET} (in mathematical terms, with the space-time coordinates yielded by V_{ET}). J. Petitot (ref. 5A, p. 216) writes concerning Kant's conception on space and matter:

> "As quality (not as quantity any more), matter is *filling* of space. This filling is very different from a mere "occupation" (anti-Cartesianism). It is a dynamical and energetical process characteristic of the substantial "interiority" of matter."

In P8 the necessity of the presence of at least one physical g different of space or time aspects, is a way of expressing *the presence of the matter which fills the space-time, and of asserting that any phenomenal manifestation to human minds stems from this matter, not from spact-time itself* ; of asserting hat

 (c) by the help of a space-time frame-view *alone*, in the strict absence of any other sort of physical aspect-view V_g (colour, texture, whatever) man is unable to perceive or even to imagine a physical entity. He simply is unable to extract it from the background of only space-time frame-values which, by themselves, act exclusively as elements on *a grid of reference* inserted in an abstract, void *container* labelled by the words "physical space-time". By themselves these elements from a grid of reference act exclusively as potential land-marks that can be "activated" only by the values of some other aspect g≠ET.

The assertion that the designatum of the words "physical space-time" cannot be treated itself as a physical (object-)*entity* – probably obvious for most physicists – is introduced here explicitly mainly in order to emphatically block certain very confusing ways of thinking induced in the minds of non-physicists by the verbal expressions by which the physicists use to accompany their relativistic formalizations : these verbal expressions suggest that what is currently called space-time would itself *possess* this or that *metric* ; while in fact any space-time metric is just *assigned* by construction to this or

that space-time frame-aspect-view, on the integral level *or on the infinitesimal differential level*, on the basis of some definite (even if implicit) descriptional aim (this is discussed in the last chapter of this work).

C9. *Conventions*. In order to take explicitly into account the frame principle FP we introduce the following conventions.

- Any view V considered in order to examine a *physical* object-entity will contain a space-time aspect view V_{ET} and one or more physical aspect-views V_g.

- The aspects denoted g are always *different* from the space-time aspect ET.

P10. ***The principle of individual space-time mutual exclusion***. Consider a *physical* object-entity $œ_G$ corresponding to a physical generator G. Let V be a *physical* view with respect to which $œ_G$ does exist in the sense of D7, involving two distinct physical aspect-views V_{g1} and V_{g2} a well as a space-time view V_{ET} (accordingly to C.9). The *principle of individual space-time mutual exclusion* posits the following.

- Any physical examination involved by V quite systematically *changes* the state of the examined physical object-entity $œ_G$, even if only to a degree which in this or that context can be neglected : the state of a physical object-entity is not a stable datum with respect to an act of physical examination (in informatics one would say that it is a "consumable" datum).

- If, when performed separately on different replicas of $œ_G$, the examinations involved by V_{g1} and V_{g2} can be shown to cover different space-time domains - the referential and the origins for space-time qualifications being kept the same – which involves that they change differently the state of $œ_G$ – then it is not possible to perform both these two sorts of examinations simultaneously upon a ***unique*** replica of $œ_G$ produced by only ***one*** realization of G (the word «individual» from the denomination of P10 refers to this crucial unicity of the involved replica of $œ_G$).

If the type of impossibility specified above manifests itself, the two physical aspect-views V_{g1} and $V_{g2} \neq V_{g1}$ are said to be mutually *incompatible*. In the alternative case V_{g2} and V_{g1} are said to be mutually *compatible*.

Comment. It is probably possible to draw P10 *deductively* from the assertion of *other* more basic space-time mutual exclusions (or from ultimately basic space-time

mutual exclusions, non-reducible to a still more basic ones) (an attempt has been made in ref. 22 B, p. 290). But here, for simplicity, we start from the formulation P10 because it is more immediately related with the consequences pointed out in the sequel.

The quantum mechanical principle of "complementarity" can be regarded as the realization of P10 for the particular category of physical object-entities consisting of states of microsystems. This brings into clear evidence the often only obscurely perceived fact that complementarity in the sense of quantum mechanics has an – exclusively – *individual* significance : indeed two mutually incompatible quantum mechanical measurements **can** be simultaneously realized on two distinct replicas of a given microstate (object-entity), and if this is done two distinct and useful pieces of information are obtained in a quite compatible way (ref. 16). But this brings already up on a statistical level, and there what is called the mutual incompatibility of two physical aspect-views *is not manifest any more*. What *is* impossible indeed is only the simultaneous realization upon *one* same replica of the considered microstate, of two mutually incompatible quantum mechanical measurements.

> *The concept of incompatibility of two physical aspect-views is defined only with respect to **one individual replica of some given object-entity** : it is not intrinsic to these physical aspect-views.*

This is of crucial importance from a logical point of view (cf. V.1.2)

π11. *Proposition*. Consider a physical object-entity $œ_G$ corresponding to a generator G and a *physical* view V with respect to which $œ_G$ does exist in the sense of D7. In general, in order to perform upon $œ_G$ *all* the operations of examination corresponding to *all* the different aspect-views V_g from V, it is necessary to realize a whole set of *successions* **[**(one operation of G-generation of $œ_G$), (one operation of V_g-examination of that replica of $œ_G$)**]** (in short $[G.V_g]$) containing (at least) one such pair for each physical aspect-view V_g from V.

"*Proof*". In order to achieve examinations of $œ_G$ *via* mutually incompatible physical aspect-views V_g from V, the operation G of generation of $œ_G$ has to be *repeated* (the time parameter being re-set to its initial value t_0 (like in sport-measurements, in the repetitions of chemical or physical experiments, etc.)) and paired *successively* with these incompatible aspect-views.

Comment. This, though an obvious consequence of P10, is highly *non trivial* by itself. It is important to know explicitly that the achievement of complex examinations of an object-entity involving "consumable" characters, entails in general the condition of reproducibility of all the involved pairs [G.V_g] (either in succession or in simultaneity), thus involving a whole set of replicas of the involved sort of object-entity œ$_G$. (The proposition π11 and its "proof" admit of generalization to also certain *conceptual* referentials (G,V)).

π**12.** *Proposition*. Consider a physical object-entity œ$_G$ corresponding to a given generator G, and one given *physical* aspect-view V_g with respect to which œ$_G$ exists in the sense of D7. When a succession [G.V_g] is repeated a big number N of times (the time parameter being re-set for each pair to its initial value t_0) or when it is simultaneously realized on a big number of replicas of the object-entity œ$_G$, it is not impossible that the same observable gk-space-time-values be found in each instance ; in such a case one can say that an *individual qualificational N-stability* has been obtained. But in general this does not happen : in general the N obtained gk-space-time-values are *not* all identical, notwithstanding that in each realization of a pair [G.V_g] the operations G and V_g obey strictly the same defining conditions.

"Proof". This follows *per a contrario* : to posit *a priori* that the results produced by repeated realizations of a given succession [G.V_g] are all identical "because" in each pair both G and V_g obey the same specifications, neither follows with necessity from the previously introduced definitions and principles, nor could it be found *a posteriori* to be always factually *true*. To show this last point it is sufficient to produce a counter-example. Consider an object-entity generator G which acts by definition on a zone R_G from R consisting of a piece of land, and that delimits there the object-entity œ$_G$ consisting of a definite area of one square kilometre. Let V_g be an aspect-view (structured accordingly to D5.1 and C9) that permits to establish the aspect g $\equiv$ [association of mean-colour-value-and-space-position over a surface (any one) of only one square *meter*] : inside the epistemic referential (G,V_g), two distinct realizations of the succession [G.V_g] in general yield two different results, even though both G and V_g satisfy each time to the same operational commands.

Comment. Notice that if an individual qualificational N-stability *is* found for a given succession [G.V_g], this does by no means exclude the possibility that in another series of N' repetitions (with N' bigger or smaller than N) no individual stability be found any more.

Furthermore, and this is more important, if for a given object-entity $œ_G$ corresponding to a given generator G, an individual N-stability with respect to the examinations by a given aspect-view V_g *is* found, this does by no means involve that for the same object-entity $œ_G$ but another aspect-view $V_{g'}$ with g'≠g one will find again some individual stability for some big number

> The individual stability of the qualifications of an object-entity $œ_G$ or the statistical
> character of these, are relative to the qualifying aspect-view V_g.

It is utmost important to realize that – quite generally – a generator G of a physical object-entity being fixed by some operational definition of it, it would even be *inconceivable* that for *any* association of G with some aspect-view V_g, the results of repetitions of the corresponding sequence [G.V_g] shall all be identical : that would be a *miracle* in so far that absolute identity – independent of the considered aspect-view V_g, i.e. for *any* tried aspect-view V_g – has never been observed concerning a *physical* object-entity (this probably holds even for a conceptual object-entity, like, say, the number 5). As for "identity" in *absence* of *any* view – which, as many do in fact surreptitiously and vaguely imagine, would mean identity of $œ_G$ with *itself* from one realization of G to another one, not of the qualification of $œ_G$ *via* V_g when the succession [G.V_g] is repeated –, it is but an illusory concept tied with the quest for an impossible absolute objectivity of the thing-in-itself. (The psychological difficulty encountered to realize this stems from the physical, "exterior" nature supposed for $œ_G$, which surreptitiously inclines to posit that – like $œ_G$ itself – the *qualifications* of $œ_G$ also exist independently of any observer-conceptor, as "properties" of $œ_G$).

The above considerations bring back to the only methodological meaning which can be *a priori* assigned to the one-one relation posited between G and $œ_G$, and, correlatively, they bring back to also the roots of the non-determination of reference.

Notice that all the preceding assertions acquire inside MRC a deductive character, in the sense of the sort of natural logical construction practised here (i.e. outside any formal system). Which is a quite non-trivial feature of MRC.

π13. *Proposition*. Given an epistemic referential (G, V_g) where both G and V_g involve *physical* operations, in general no stability at all is insured for the gk-space-time values obtained by repeated or multiple realizations of the succession $[G.V_g]$, neither on the individual level of observation, nor on the statistical one.

"Proof". If only a maximal, an individual N-stability is considered, i.e. identity of all the N groups of observable gk-space-time values corresponding to N realizations of a succession $[G.V_g]$, then π13 becomes a mere repetition of π12, hence the "proof" of π12 still works. But suppose that no individual N-stability has been found, i.e. that a whole statistical distribution of dispersed triads of gk-space-time-values has been found. Then it still remains *a priori* possible that a big number N' of repetitions of a series of a big number N of repetitions of the succession $[G.V_g]$ (N'≠N in general), shall bring forth, when N' is increased toward infinity, a convergence in the sense of the theorem of big numbers, of the relative frequencies of occurrence, in the mentioned statistical distribution, of the dispersed triads of gk-space-time-values. In this case one can speak of a *probabilistic (N,N')-stability*. However, up to some given arbitrary pair (N,N') of big numbers, it might appear by experiment that in fact this second possibility does *not* realize either, even though G and V_g have been previously found to mutually *exist* in the sense of D7. Nothing excludes this possibility, neither some previous MRC-assumptions, nor the empirical experience. If this negative possibility does realize indeed, then only two solutions are left : either one continues the search with pairs of increasingly bigger numbers N, N', or one stops at some given pair (N,N') and announces *a posteriori* that, even though G and V_g do mutually exist in the sense of D7, their pairing (G, V_g) has nevertheless to be (N,N')-cancelled from the subsequent conceptualization, because, while no individual N-stability has been observed, this pairing does not generate a probabilistic (N,N')-stability either ; *tertium non datur* because apart from an individual or a probabilistic stability, no other sort of still weaker stability has been defined so far (in V2 this question is treated more thoroughly). Anyhow, for *any* given pair of big numbers (N,N'), it is quite possible that no stability at all be found for the results of repeated successions $[G.V_g]$. Which establishes π13.

Comment. The "proof" of π13 does by no means exclude the possibility that, if the succession $[G.V_g]$ does produce a probabilistic (N,N')-stability, another succession $[G.V_{g'}]$ with G the *same* but with $V_{g'} \neq V_g$, shall produce qualifications that are endowed with some *individual* N-stability, or with no stability at all, neither probabilistic nor individual :

The **existence** *of a probabilistic stability of the qualifications of a given object-entity* $œ_G$ *is relative to the qualifying aspect-view* V_g *just like the existence of an individual stability. The* **nature** *– individual or probabilistic – of the stable qualifications of a given object-entity* $œ_G$, *is relative to the qualifying aspect-view* V_g *just like the existence of stable qualifications.*

The concept of relative description

D14. *Relative description*.

D14.1. *Relative description of a physical object-entity*. Consider an epistemic referential (G,V) where G is a *physical* generator that generates a corresponding *physical* object-entity $œ_G$, and V is a *physical* view with m aspect-views V_g with respect to each one of which $œ_G$ does exist in the sense of D7, and, as required by P8 and C9,V contains also a space-time view V_{ET} introducing an *ordered* space-time grating (D5.4). Furthermore consider, for *each* V_g from V, a big number N of realizations of the corresponding sequence $[G.V_g]$, in simultaneity or in succession, the time parameter being re-set at the same initial value t_o for each realization of a sequence $[G.V_g]$.

Suppose first that, when the succession $[G.V_g]$ is realized N times, for *each* aspect-view V_g from V, *identical* outcomes of the corresponding configuration of gk-space-time-values are obtained, i.e. only *one* same "individual" result appeared N times. We shall then say that an *N-individual* outcome has been obtained (since nothing excludes that for another sequence of successions $[G.V_g]$ some dispersion be found). The set of N-individual configurations of gk-E**r**-Tt-values corresponding to *all* the m distinct aspect-views V_g from V, constitutes in the abstract representation space of V ordered by the space-time grating introduced by V_{ET}, a definite "form" of gk-E**r**-Tt-values. This "form" will be called an *N-individual relative description, with respect to V, of the physical object-entity* $œ_G$, (in short an individual relative description) and it will be indicated by

the notation $^ND/G,œ_G,V/$ to be read «the description relative to the triad $G,œ_G,V$ and to N» (in current usage the index N, supposed to be big, will be dropped). The individual relative description $D/G,œ_G,V/$ defined above can also be regarded as the set of all the individual *relative-aspect-descriptions* $D/G,œ_G,V_g/$ with $V_g \in V$.

Suppose now that, when the various successions $[G.V_g]$ with $V_g \in V$ are realized N times, *not* all the successions $[G.V_g]$ are found to reproduce identically one same configuration of gk-Er-Tt-values ; that at least for one $V_g \in V$ (not necessarily for all) the corresponding succession $[G.V_g]$ produces a whole set $S_{gi}=\{c_{gi}\}$ of mutually distinct, dispersed configurations c_{gi} of gk-Er-Tt-values, (with $i \in I$ and I a finite index-set, to preserve the finitistic character of this approach) ; but that, for *any* succession $[G.V_g]$ which produces dispersed results, when N is increased toward infinity, the relative frequency $n(c_{gi})/N$ of occurrence of *each* configuration $c_{gi} \in S_{gi}$ converges toward a corresponding probability p_{gi}. In these conditions each configuration $c_{gi} \in S_{gi}$ will be called an *elementary-event-description* corresponding to the succession $[G.V_g]$ with $V_g \in V$ and it will be denoted $D_{p(gi)}/G,œ_G,V_g/$. The epistemic referential (G,V) will be said to produce *a probabilistic relative description* of the physical object-entity $œ_G$ which will be denoted $D_p/G,œ_G,V/$ [27].

Comment. The definition D14.1 is the core of MRC. It finally assigns a *significance* to what has been called a physical object-entity $œ_G$. A significance which, though it is relative to a view V and in certain "basic" conditions that will be specified in D14.3.1 is far from being fully "satisfactory", nevertheless is now quite definite *and* endowed with communicability. Whereas G alone cannot systematically insure for "$œ_G$" a significance distinct from just the conventional label «effect of a realization of G», because the results of G might emerge still entirely non perceptible.

D14.1.1. *Reference and relative meaning*. In any case of qualificational stability, individual or probabilistic, we shall say that $œ_G$ *is the reference of* $D/G,œ_G,V/$ while $D/G,œ_G,V/$ *is the meaning of* $œ_G$ *relatively to V.*

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[27] This definition of a probabilistic description is incomplete and simplifying. It will be thoroughly reconstructed and completed in V2. A more ancient but full treatment can be found in the reference 23. In this stage of the development of MRC we are obliged to introduce it in this unachieved form, as a provisional support for essential distinctions that cannot be postponed.

Comment. It thus appears that the initial methodological assertion of a one-one relation between a given definition of an operation G and its result labelled œ$_G$, does not hinder the subsequent construction of all the necessary specifications. On the contrary, it founds them.

The following is worth to be noted.

The condition of existence of individual or probabilistic stability of the outcomes of the successions [G.V$_g$], with respect to repetitions of these, **presupposes** *the possibility to achieve arbitrarily many successions [G.V$_g$], for all the V$_g$∈V.*

This is a strong restriction. But when it is insured it extracts out of temporality the concept of "description" founded upon it and it puts it directly on highways of communicability where reference, meaning, and objectivity in the sense of intersubjective consensus, can most immediately be attained. Furthermore, it sets a standard with respect to which relaxing generalizations can be now defined.

D14.2. *Two generalizations of D14.1*.

D14.2.1. *Relative description of a non-physical public object-entity*. Let us suppress in the definition D14.1 the restriction to physical generators, while *excluding* generators that act on only one individual inner universe (there, in general at least, the sequences [G.V$_g$] cannot be repeated (in succession or in simultaneity) and so the condition of stability of their results cannot be insured). Thus relaxed, the definition D14.1 enlarges to object-entities from the non physical but public, exterior reality (economical, social) for which the repeatability of sequences [G.V$_g$] and the condition of stability of their results still do make sense. The new sort of description obtained in this way will be called a *relative description of a non physical and **public** object-entity* and it will be indicated by the notation (NPP).D/G,œ$_G$,V/, in short (NPP).D.

Comment. The generalization D14.2.1 holds in particular concerning any already accomplished *description* in the sense of D14.1, selected as a new, always *conceptual* object-entity, to be examined in a subsequent description *via* some new view. Thereby :

The definition D14.2.1 opens up specifically and explicitly the whole crucially important sub-realm of R consisting of a stabilized communicable conceptual

reality, on which objectivity in the sense of intersubjective consensus is founded and where, in particular, "logic" is constructed.

In the case of non-physical object-entities that admit of a description in the sense of D14.2.1, any reference to the frame-aspect of ("physical") *space* can obviously be dropped, and so the obtained relative description amounts to a "form" of only gk-time values. If moreover it appears that the considered description can be regarded to be independent also of time values, (as for instance in the study of a fixed formal system), the reference to the frame-aspect of time can be equally dropped. (For instance, the dependence on time cannot be dropped for the relative description pointed toward by the verbal expression «this theory is true» : the truth-value yielded by the examination of the object-entity consisting of a theory, *via* the aspect-view V_g where g=truth, *does* depend on the structure of knowledge (information's, understanding, modalities of verification, etc.) available to the acting observer-conceptor at the considered time ; on the contrary, for the relative description indicated by the verbal expression «the sum of the angles of a Euclidean triangle is 180°», the time dependence can be dropped). Consider then a relative description where both the space qualifications and the time-qualifications can be dropped. If no one among the involved aspects g introduces by its own definition an order (cf. D5.1), this description consists of one or several *non-ordered* but *stable* configurations of gk-values. What does this mean ? It means that the involved non-ordered configurations are characterized by some *correlations*, which are stable with respect to repetitions of the sequences $[G.V_g]$ permitted by the view V, i.e. a given gk-value is found to be associated with this or that other g'k'-value (g'≠g or k'≠k or both), always, or *never* (which is as strong a correlation as always), or with this or that probability.

D14.2.2. *Relative testimony*. Take again as a starting point the strong definition D14.1, and suppress now in it both the restriction to only a physical generator of object-entity *and* the condition of repeatability of the sequences $[G.V_g]$ for the V_g from V. What becomes of D14.1 ? It reduces to a mere set of "qualifications" generated by a definite epistemic referential. Indeed as soon as an epistemic referential (G,V) is given and the condition D7 of mutual existence is satisfied for the pair (G,V), qualifications *via* V can arise for the object-entity œ$_G$ produced by the generator G. From now on any structure of

such qualifications will be called a *relative testimony* and will be denoted $\theta/G, \text{œ}_G, V/$, in short θ.

Comment. The generalization D14.2.2 of D14.1 gives a definite status inside the MRC-language to all the qualifications of *unique* object-entities of *any* nature. In the case of physical object-entities, uniqueness is often intimately connected with space-time singularity in particular with the principle P10 of individualizing space-time mutual *exclusion*. This will come out to have a surprising importance in the identification of the characteristics of the deepest stratum of an MRC-logic (V.1.2).

Furthermore D14.2.2 introduces in the MRC-language all the qualifications of psychical events from the inner universe of a conceptor-observer.

This is a huge inclusion that lays down a foundation for the future research of a clear connection *in MRC-terms*, between introspective reports and neurological facts. Which might lead to comparability of the MRC requirements on this sort of connection, with important new views on body *versus* mind, like those of Edelman (ref. 7), Changeux (ref.6), Damasio (ref.8), and more generally with the whole avalanche of results continually produced in the cognitive sciences.

Thereby the problems of reference and truth that haunt this vast recent domain might find the conceptual framework for a guided approach.

Finally, the relative testimonies in the sense of D14.2.2 permit to take into consideration the historical descriptions, the poetical ones, etc. For these the fundamental concepts of reference and truth still remain wide open for discussion and for methodological organization.

D14.3. ***Basic transferred relative descriptions***. In what follows we finally shall touch and transpose in quite explicit and generalized terms, the fundamental epistemological innovation specifically implied by quantum mechanics.

D14.3.1. ***Basic transferred relative descriptions of a physical object-entity***. Consider a relative description *in the sense of D14.1* where :
- The generator consists of a physical operation and it produces a physical object-entity that cannot be perceived directly by man. Such a generator will be called a *basic generator* and will be denoted $G^{(o)}$.

- The object-entity produced by a basic generator $G^{(o)}$ will be called a *basic object-entity* and will be denoted $œ^{(o)}$ (a simplified notation standing for $(œ_{G(o)})^{(o)}$).

- The view able to draw phenomenal manifestations out of a basic object-entity is necessarily such that the phenomenal content of each gk-value of each involved aspect g consists of features of a material device for gk-registrations, biological or not, but which always is *different from the studied object-entity*, these features emerging as "marks" produced by the interactions between the registering-device and replicas of the considered basic object-entity. These marks acquire *significance* by their coding in terms of values gk of the aspects from the acting view. A view of the just specified kind will be called a *basic transfer-view* (in short a basic view) and will be denoted $V^{(o)}$. The aspect-views from $V^{(o)}$ will be called basic aspect-views and will denoted $V_g^{(o)}$.

- The epistemic referential $(G^{(o)}, V^{(o)})$ will be called a *basic epistemic referential*.

- A relative description in the sense of D14.1, individual or probabilistic, achieved with a basic generator and *one* basic transfer-aspect-view $V_g^{(o)}$, will be called a *basic transferred relative **aspect**-description* and it will be denoted $D^{(o)}/G^{(o)}, œ^{(o)}, V_g^{(o)}/$.

- A relative description in the sense of D14.1, individual or probabilistic, achieved with a basic generator $G^{(o)}$ and a basic transfer-view $V^{(o)}$ involving at least two *mutually incompatible* basic aspect-views $V_{g1}^{(o)}$ and $V_{g2}^{(o)}$, will be called a *basic transferred relative description* (also, in short, a basic description or a transferred description) and it will be denoted $D^{(o)}/G^{(o)}, œ^{(o)}, V^{(o)}/$ (in short $D^{(o)}$).

- A basic transferred description $D^{(o)}/G^{(o)}, œ^{(o)}, V^{(o)}/$ is posited to *characterize* observationally the involved object-entity $œ^{(o)}$, which means that it is posited that no other operation of generation $(G^{(o)})' \neq G^{(o)}$ can be found which, associated with the same basic view $V^{(o)}$, shall produce the same basic transferred description.

Comment. It is difficult to fully grasp the meaning and the importance of the concept of basic transferred relative description. But it is crucial to grasp it fully. Indeed it is by *this* concept that MRC penetrates beneath natural language and the forms of thought involved by it, establishing a definite relation between conceptualization and physical factuality. Therefore I shall comment on it in detail, even redundantly.

To begin with, let us stress that a basic physical object-entity produced by a basic physical operation $G^{(o)}$, *if* furthermore this sort of object-entity has *never* before been qualified *via* any transfer-view $V^{(o)}$ whatever, emerges still entirely unknown *in terms of the knowledge researched concerning it specifically*, notwithstanding that the operation of generation $G^{(o)}$ *does* singularize it out of the whole of reality. Indeed – factually – the result labelled $œ^{(o)}$ *is* entirely "specified" by $G^{(o)}$, it is "defined", since it can be held available for any possible subsequent examination and, accordingly to the posited one-one relation between the operation $G^{(o)}$ and its result $œ^{(o)}$, it can be deliberately reproduced. More. Factually, each such result emerges from the operation $G^{(o)}$ that produced it, *fully* individualized, it lies on a level of zero-abstraction, still filled with its whole untouched concrete singularity. Which no language whatever could never do because we generalize as soon as we speak : full singularity is unspeakable. But – consequently in fact – this result produced by $G^{(o)}$ alone, not yet followed by an operation of examination, is individualized in *other* terms than those in which knowledge concerning it specifically, is researched ; namely in only factual physical terms. It is true that the specification of the generation operation $G^{(o)}$ involves necessarily some position of a pre-decided conceptual volume (tied with the "zone" R_G from R where G is supposed to act (D4 and comment on it). By its definition $G^{(o)}$ drops its products inside this pre-decided conceptual volume. That what is labelled $œ^{(o)}$ is pre-constrained to emerge inside this or that space-time domain where $G^{(o)}$ acts, it is produced so as to correspond to some definite verbal designation ("a manifestation of stellar life", or "a state of a microsystem", etc.). In this sense $G^{(o)}$ and its result labelled $œ^{(o)}$ might be considered to never be "purely" factual. But :

> The preliminarily *posited* conceptual volume where the operation $G^{(o)}$ drops its products, cannot be equated to the *new* knowledge that is *researched* concerning these products. The elaboration of this new researched knowledge is the task left by construction for examinations achieved *subsequently* upon the already produced $œ^{(o)}$, by this or that basic aspect-view $V_g^{(o)}$ that exists in the sense of D7 with respect to – non specifically – anything lying inside the pre-decided conceptual volume where $G^{(o)}$ drops all its products.

It is important to realize that the specification of the operation $G^{(o)}$ of generation of an object-entity *must* contain a conceptual receptacle attached to the physical action involved by $G^{(o)}$; a conceptual receptacle to be lowered with this action into the depths of pure as yet non-conceptualized physical factuality, in order to receive inside it the results of the operation $G^{(o)}$ so as to be able to hoist them up into the stratum of the concepts-and-language. This is an unavoidable condition because *only* a receptacle made of concepts-and-language can hoist up into the thinkable and speakable a lump of pure factuality. A macroscopic operation $G^{(o)}$ can be itself shown, teached, repeated, and also said. But if nothing thinkable and speakable were posited concerning what $G^{(o)}$ produces, which by hypothesis is not perceivable, then this, the product, even if factually it has been produced, would simply stay out of conceptualization. While human mind, in order to be able to *think* about a non perceivable thing, needs, not only to have labelled it by a repeatable operation of generation and by a notation, but furthermore to have endowed it with some initializing conceptual status, with at least some approximate preliminary speakable location inside the unending and infinite-dimensional space of concepts [28].

But of course a basic description $D^{(o)}$ does not *indefinitely* produce an object-entity $œ^{(o)}$ that is still unknown, specifically and precisely in the desired terms. Knowledge about $œ^{(o)}$ is a subjective and moving character. Think of a basic description that is repeated by the observer-conceptor X after having produced for him the desired knowledge concerning $œ^{(o)}$: then, even though $œ^{(o)}$ is generated by the same generator $G^{(o)}$ and emerges beneath the level of the directly observable by man, it is nevertheless already known by X (while for another observer-conceptor it can be strictly unknown, even if the knowledge acquired by X has been made socially available in public registration devices (catalogues, books, etc.).

The only specific and perennial features of a "basic" description $D^{(o)}$ and of what is here called a "basic" object-entity $œ^{(o)}$ stem from the constant character of the involved referential, a "basic" referential $(G^{(o)}, V^{(o)})$ where $G^{(o)}$ works on the

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[28] It was Evelyne Andreewsky who, by repeated questions and remarks, incited me to specify how, exactly, the *pre-existing* conceptualization and the descriptional *aims* act upon the extraction of new knowledge out of as yet unconceptualized physical factuality.

physical factuality and $V^{(o)}$ is a transfer-view as specified in the definition D14.3.1 : it resides in the fact that what is called a basic description $D^{(o)}$ consists by definition of *exclusively* features imprinted upon registering devices that are all different from the studied object-entity $œ^{(o)}$.

Consider now the following question which is fundamental for the MRC treatment of reference : does indeed the definition D14.3.1 of a basic description open up a way toward a communicable characterization of – specifically – the basic object-entity $œ^{(o)}$? The final posit from D14.3.1 concerns this question. Consider a basic *aspect*-description $D^{(o)}/G^{(o)},œ^{(o)},V_g^{(o)}/$ (the basic view consists of only one basic aspect $V_g^{(o)}$). In this case it seems clear that $D^{(o)}$ does *not* yield a characterization – individual or probabilistic, no matter, but specifically and isolately – of what is labelled $œ^{(o)}$, since it points toward observable manifestations brought forth by interactions between $œ^{(o)}$ and a material device for gk-registrations. Which changes what was labelled $œ^{(o)}$ (P10) and produces perceivable results that depend on the device for gk-registrations as much as of $œ^{(o)}$. But what about a "binocular" basic description $D^{(o)}$ where the basic view $V^{(o)}$ consists of two mutually incompatible basic aspect-views $V_{g1}^{(o)}$ and $V_{g2}^{(o)} \neq V_{g1}^{(o)}$? In quantum mechanics, for the particular case of a basic object-entity that is a state of a microsystem, it is (implicitly) admitted that, together, two quantum mechanical descriptions of a same microstate *via* two mutually incompatible quantum mechanical views, characterize that microstate. Which means only that no other operation $(G^{(o)})' \neq G^{(o)}$ of generation of a microstate can be assumed to yield both these same two quantum mechanical descriptions. The final posit from D14.3.1 generalizes inside MRC the above-mentioned quantum mechanical implication. It would be satisfactory of course to found this posit upon a constructed argument (for instance a *reductio ad absurdum*). But so far I did not succeed to find one. So I introduce the condition as just a supplementary security for the solidity of MRC). This completes now on the observational level the methodological posit from D4 according to which a given operation of generation of an object-entity is assumed to always produce the same object-entity. The necessity of a complement of this type can be best understood *per a contrario*. In the absence of any phenomenal, specific, normed, communicable set of qualifications associated specifically with what has been labelled $œ^{(o)}$, one would have to regard

"œ$^{(o)}$" as just a label that labels nothing distinct from this label itself. Then speaking and thinking of "what has been labelled œ$^{(o)}$" would be only a void sophistic trick, amounting to arbitrary implicit postulations [29]. We would be obliged to admit that pure factuality and human communicable knowledge stay for ever apart from one another. But this just does *not* happen. Quite on the contrary, our capacity to adapt to the environment and the technical powers that we are able to acquire manifest continually the astonishing, even miraculous agreement between human knowledge and factual being, attesting intimate transmissions which somehow manage to emerge between them.

> The posit from D14.3.1 incorporates into the MRC-representation a feature asserting a definite way in which a basic object-entity produced by a basic generator G$^{(o)}$, *can* be conceived to be hoisted up into the conceptual net of inter-subjective knowledge : it is that what produces a pair of sets of mutually incompatible observable manifestations which – accordingly to the final posit from D14.3.1 – cannot be obtained by the use of any other operation G$^{(o)}$'$\neq$G$^{(o)}$.

At a first sight the concept of a basic transferred description might seem very particular, and too radical. But in fact *it possesses absolute priority and non restricted generality inside the order of cognitive elaborations*. Quite universally, any object-entity corresponding to any generator, if it *did* reach the consciousness of an observer-conceptor, then it reached it *first* by some transferred descriptions. We remain unaware of this because usually the phenomenal appearance of the gk-values involved in these transferred descriptions stems from marks imprinted directly upon the biological domains of sensitivity of the observer's body which act at the same time as generators of object-entity and as views in the sense of MRC. So the involved epistemic referentials are of a nature which, with respect to the general MRC-descriptional mould, is particular and degenerate (cf. the global comments on D14, the comments o D19.4, V.1.1 and V.1.2). This entails the following effects which occur all at the same time and beyond any control of logical consistency :

(a) It hides the transferred character of the marks.

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[29] Putnam's thought experiments concerning the non-determination of reference (ref. 14) are very suggestive in this respect.

(b) It inclines toward assigning systematically a passive role to the mind, in its interactions with physical factuality. The mind is supposed to just *receive* marks irrepressibly imprinted upon the sensitive apparatuses of the body by incessant streams from the physical factuality. How far one is thus kept from realizing the possibility and the universal methodological value of radically active epistemic stages during a deliberate achievement of "unnatural" transferred descriptions, like those on which quantum mechanics throws light!

(c) It pushes surreptitiously toward ontological absolutizations. Indeed one encounters severe difficulties to realize that the (various) transferred descriptions of this chair, which my consciousness functioning achieved spontaneously by the help of my biological views (involving the eyes, the nervous system, the ears and fingers, etc.), cannot, without contradiction, be identified with "the-way-in-which-the-chair-in-itself-really-is" ; that nothing, never, will be able to prove that this or that model of a chair "exists" independently of any perception, of any view. More, that such an instinctive hope contradicts both philosophy and logic, since in the absence of any view the very concept of description, of even only qualification, vanishes (cf. π18, D19.1, D19.2). It is really hard to withstand the irrepressible trend toward identification of our spontaneous modelizations stemming from descriptions transferred on the human biological registering devices, with ontological credos that float on self-contradicting assemblages of words, alike to Magritt's tree that floats with its roots in the air. Kant, Poincaré, Einstein, Husserl, Quine, Wittgenstein, Putnam, have founded famous analyses on the explicit recognition of this fact.

But, and this is noteworthy, as soon as the transfer-view from a considered basic transferred description $D^{(o)}$ does not directly involve the biological human terminals – the nearest and which *in fine* cannot be eliminated –, as soon as the transfer-view $V^{(o)}$ from $D^{(o)}$ involves marks registered on devices that are exterior to the observer's body (as it happens indeed for micro-states), it suddenly becomes quite clear that $D^{(o)}$ itself constitutes a constructed intermediary object-entity which relays the access of the basic a-conceptual object-entity $\text{œ}^{(o)}$, to the observer-conceptor's consciousness-functioning ; that phenomena are not mind-independent facts, that they are constructions which do not always emerge spontaneously, but might have to be planned and produced by method. Then, like in quantum mechanics, the two distinct and mutually independent stages

involved in a transferred description – the stage of generation of an object-entity œ$^{(o)}$, and the subsequent stage of creation of observable manifestations drawn from œ$^{(o)}$ by interaction with gk-registering devices – appear as obvious. Their active and deliberate character strikes the mind, and the invaluable normative value of the concept of basic transferred description can be fully understood.

The basic object-entity œ$_G{}^{(o)}$ from a transferred description D$^{(o)}$ roots this description directly into the physical factuality. Correlatively the transferred description D$^{(o)}$ achieves for the involved basic object-entity œ$_G{}^{(o)}$ a very first passage from pure physical factuality, into the domain of communicable knowledge. It yields for it a first communicable form, a first observable expression that points communicably toward the involved object-entity. The basic transferred descriptions are the *local zero-points* of the chains of conceptualization, in the following sense. Each basic transferred description D$^{(o)}$ starts from a conceptual situation where, even though some conceptual environment of the basic object-entity œ$_G{}^{(o)}$ (genus, etc.) is more or less explicitly posited *a priori* (at least *via* the definition D4 of G$^{(o)}$), nevertheless nothing is known concerning œ$_G{}^{(o)}$ *specifically*.

The very first stratum of communicable knowledge available at any given time consists of the basic transferred descriptions achieved up to that time, not of just phenomenal appearances in the Kantian sense.

> *The transferred descriptions are the channels through which as yet non semantized but semantizable factual matter, is adduced into the domain of the inter-subjectively semantized. The "scientific legalization of phenomenal appearances" in Kant's sense (II.3) begins by the construction of transferred descriptions, of which D$^{(o)}$ yields a form that is* **normed***.*

This is a quite fundamental contribution of MRC to epistemology : it defines the structure of the connection between knowledge and *Being*. The whole rest of the available knowledge consists only of subsequent developments of this first – evolving – stratum of transferred descriptions : namely of space-time modelizations which endow the basic transferred descriptions with the features required by the frame-postulate P8,

thus insuring for them an "intelligibility" of which initially they are devoid ; and then, a non limited succession of complexifications (D.19).

I add a last remark concerning the concept of basic transferred description. From the viewpoint of MRC the quantum mechanical descriptions of micro-states appear as particular instances of transferred descriptions of physical entities : the strategy of quantum mechanics, once identified explicitly, brings into evidence an example of the universal way in which the conceptualizations are rooted into pure physical factuality, and, for this example, it displays all the stages of the rooting. MRC recognizes the universality of this rooting and extends it to any sort of physical factuality, re-expressing it in general and *normalized* terms.

D14.3.2. *Basic description of a psychical object-entity?* Notwithstanding important difficulties (the non pertinence of the repeatability of the successions $[G^{(o)}.V^{(o)}]$ and of the stability of their results), it might turn out to be possible to forge a useful concept of basic description of "psychical basic object-entities $\text{œ}^{(o)}$", by some combination of testimonial descriptions θ in the sense of D14.2.2, with "biological basic transferred descriptions". Thereby I mean a *conscious* but *not* yet conceptualized psychical object-entity, a *primeity* in the sense of Peirce that emerges in the acting observer-conceptor's *interior* universe, and, though perceived, is still entirely *un*known, non-qualified (A. Damasio (ref. 8) has elaborated a very subtle structure of concepts-and-facts concerning events of this sort). Think for instance of all the feelings of mere *existence* of an inner fact of which one becomes suddenly aware strictly without explicitly knowing as yet what and how they are, so *a fortiori* without understanding them ; think of the genuine *research* conducted by Proust in order to identify the subjective *meaning* of such feelings; think also of the psychoanalytic methods which deal with features as if transferred upon behavioural "devices" (reactions, ways of acting, feelings) by interactions between a hypothetical entirely unknown inner configuration, and various accidental or systematically arising exterior circumstances ; this hypothetical inner configuration is precisely what the therapies try to first somehow delimit "operationally" (analyses of dreams, etc.) and then to examine by tests (associations, etc.) and to interpret. The obtained description *is* then in a certain sense precisely what seems to deserve being called a basic relative description of a psychical object-entity.

It is however clear that for the moment these are just conjectures. The central concept of basic transferred description has an indisputable pertinence only with respect to physical object-entities.

Global comment on the definitions D14. Finally, let us now consider globally the whole set of definitions D14 and make some comments on the general concept of relative description.

The general notation $D/G,œ_G,V/$ stresses that any description that is normed in the sense of MRC brings into play a triad $G,œ_G,V$ to which it is essentially relative : this is the general descriptional mould induced from quantum mechanics and required now for any description, whether it is basic, transferred, or not. The first location from this triad is the place reserved for an epistemic action, the generation of an object-entity, which up to now has quasi systematically been ignored, because the canonical basic transferred descriptions where the generation of an object-entity plays a separate and active key role, were ignored. Indeed for a description that is not transferred, the operation of generation of the desired object-entity is often accomplished without any difficulty, in a natural or even implicit way. While when the transfers occur on – directly – the biological sensorial apparatuses (views, in the sense of MRC), the involved view V *acts also like a generator G* which just selects out of R an object-entity, namely the field of perceptibility of V, and – simultaneously – also qualifies this object-entity : we can symbolize by G(V) such a *generator of a view* and by (G(V),V)) the corresponding epistemic referential. This highly degenerate and so wide-spread natural situation contributed strongly to the lasting occultation of the fundamental role of principle of the operations of object-entity generation. Quantum mechanics, for the first time and only implicitly, made a separate use of the operations of generation of object-entity, which permitted to become aware of their general and fundamental epistemological importance.

> *The generator of object-entity remained the big omission of the grammars, the logic, and of all the approaches that involve the processes of conceptualization.*

This is why the question of reference has raised insuperable problems : the basic object-entities are only *surreptitiously* drawn into the natural basic descriptions – the *degenerate* ones produced in a reflex way *via* the biological sensorial apparatuses –,with the status of a present but non specified reference ; the problem of identifying *a posteriori*, starting

from the already achieved description, of what this reference consists, has stubbornly resisted solution.

But accordingly to MRC, an operation of generation of object-entity is *always* involved, even if in a non separated and implicit or reflex way.

By construction, any relative description $D/G,œ_G,V/$ is, itself, distinct from the generator, the object-entity and the view involved by it, to all of which it is conceptually posterior ; it qualifies only the object-entity which it concerns, not also the generator and the view of which it makes use, nor itself, globally. As for the generator and the view, these are by definition distinct from one another, often by their content, but in *any* case by the *role* held during the process of description.

> In the definition of a relative description the three notations $G,œ_G,V$ designate three descriptional **roles**, three descriptional functions, **not** the nature of the entities to which these roles are assigned in the case of this or that particular relative description.

And all these three roles are systematically played in any relative description, even if an actor cumulates distinct roles, or plays a role superficially, or both. For instance, if I say «"red" is a too poor expression, better say "colour of blood"», the first proposition expresses verbally a relative description $D/G,œ_G,V/$ where "red", though grammatically it is an attribute, holds the role of the object-entity $œ_G$ (generated by use of a generator G which is a selector acting upon the spot R_G from R indicated by the word "colour"), while "poor" is placed in the role of the view V. But if I say «my cheeks are red», "red" plays the role of the view. So the structure required by the definition D5.1 of an aspect-view, is only a necessary condition for acting *as a view,* but this condition does not hinder a view in the sense of D5.1 to act also in the *role* of an object-entity (like in the first above example) or in the role of a generator G(V) of object-entity that generates its field of perceptibility by interaction with R.

> According to MRC no operation or concept possesses intrinsically a fixed descriptional role.

In each descriptional act, the descriptional roles are assigned by the acting consciousness functioning, and in general this roles change from one description to another one. When a natural description is examined in order to compare it to the MRC norms, the first step is

to examine what plays the role of object-entity, what the role of generator, and what that of view. A description $D/G,\text{œ}_G,V/$ is a piece of constructed normed meaning which, essentially and explicitly, is relative to the epistemic actions that achieved the semantization asserted by it. *Any* asserted meaning bears inside it the genetic structure designated by the sign $D/G,\text{œ}_G,V/$, but it can include this structure in a more or less implicit, truncated, malformed way. Whereas in the normed form $D/G,\text{œ}_G,V/$ all the three involved roles $G,\text{œ}_G,V$ are explicitly indicated, each one at its own location and following the genetic order of the corresponding epistemic actions. They are to be treated as void, available, labelled rooms that have to be filled up in a reference-questionnaire to which any achieved or envisaged description must be subjected.

The distinction, inside a relative description $D/G,\text{œ}_G,V/$, between the relativity to the operation G of object-entity generation of which the role is to produce an object-entity, and the relativity to this object-entity œ_G itself of which the role is to bear subsequent qualifying examinations, is one of the most subtle and important features of MRC. In particular it preserves from the very strong inertial tendency induced by classical thinking, to forget that as soon as an entity is regarded as playing in a description the role of object-entity, *ipso facto* a corresponding epistemic action of generation of object-entity has produced it *as such*, implicitly or explicitly, even if this entity somehow pre-existed and so has only had to be selected as object-entity, not to be radically created as such. The importance of a normed *memento* of this fact will fully appear in V.1 and V.2.

The association, in any relative description $D/G,\text{œ}_G,V/$, between a one-one relation $G–\text{œ}_G$ and the requirement for D of, indifferently, either a strong individual stability or an only probabilistic one, is intimately related with the impossibility, for mere language as well as for mere notations, to grasp and capture the factual individualities, neither in an absolute sense *nor* in only a relativized sense (cf. π12, its "proof" and the comments). Umberto Eco remarks : «The tragedy comes from this that man speaks always in a general manner about things which always are singular. Language names, thus covering the non transcendable evidence of individual existence» [30]. Indeed each predicate (view) is general, and no conjunction of a finite number of predicates can exhaust the open infinity of the possible qualifications of a physical object-entity.

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[30] Eco, U., *Kant et l'Ornithorynque*, Grasset 1999, p. 29. My translation from the French edition.

The concept of relative description is selective. It does not admit inside the class delimited by it, illusory descriptions where one of the three roles G, $œ_G$, V is not played at all. Consider for instance the famous illusory description «this is a lie» (or «I am a lie»)» where the word "this" (or "I") masks the absence of specification of the operation G of generation of object-entity, so also *the absence of specification of the object-entity $œ_G$ itself.* This blocks any further conceptual development. Indeed, previously to any research of a truth-qualification of the description, one finds oneself in a situation of impossibility to decide concerning the mutual existence in the sense of D7 between the involved object-entity $œ_G$ – non specified – and the involved view V. If this primary non-decidability concerning the *a priori* possibility of meaning, were permitted to enter the concept of relative description, it would manifest itself later in the form, also, of a paralysis of any attempt at a metaqualification of the *relative proposition* founded on this illusory description *via* the values gk=true or gk=false of a meta-aspect-view .g=empirical truth (cf. DL.2 and DL.3 in V.1.2).

When descriptions that violate the MRC norms, are reconstructed in a normalized way, the paradoxes stemming from them disappear. There is no need for this to introduce levelled languages of logical types, the illness is cured *locally* by the normed reconstruction of only the considered description.

But nothing hinders to generate (select) as an object-entity any natural description excluded by MRC, and to characterize its incapacities or specificities by reference to the MRC-norms. In this sense the methodological selectivity of the concept D/G,$œ_G$,V/ by no means constitutes an *a priori* pauperisation of the ensemble of descriptions that can be studied inside MRC.

Finally, the general concept of relative description, by its various realizations, permits to discern definite categories inside the realm of the problem of reference and of meaning, and a *dégradé* of proposed solutions : the definitions D14.1, D14.2.1 and D14.3.1 introduce, for the corresponding circumstances, what might stand as a solution or be completed to become one ; the definition D14.2.2 suggests a possible approach concerning some of the circumstances to which it applies, while others are isolated as the most problematic ; finally, the non achieved definition D14.3.2 concentrates in it definite questions and suggestions.

Cells of relative description. Chains of descriptional cells. Non-reducible complexification of the conceptualization.

P15. ***The Principle of Separation***. Since any one relative description D/G,œ$_G$,V/, whatever its complexity, involves by construction one generator of object-entity, one object-entity, and one view, all well defined, as soon as some change is introduced in the actor designated for holding one of the roles from the triad G,œ$_G$,V, another description is considered.

By a methodological principle called the *principle of separation* and denoted PS, this other description must be treated ***separately***.

Comment. Any human observer-conceptor, in presence of reality, is condemned to parcelling examinations. The successivity inherent in human mind, the spatial confinements imposed by the bodily senses – whatever prolongation is adjusted to them – and the absence of limitation of what is called reality, compose together a configuration which imposes the fragmentation of the epistemic quest. MRC reflects this situation in the relativity of any one description, to one triad G,œ$_G$,V. Indeed the relativity to one triad G,œ$_G$,V specifies, but also limits the capacity of one given relative description to generate information possessed.

Relativization, limitation, and precision, are tied to one another in an unseparable way. *They constitute together an indivisible whole that withstands relativism.*

On the other hand any fragment generated out of reality in order to play the role of an object-entity, admits of an infinity of kinds of examinations. Moreover any examination achieved on this object-entity, raises the question of the appearance of its result *via* this or that view with respect to which this result exists in the sense of D7, or the question of the relations of this result, to other object-entities, etc., thus multiplying the conceivable subsequent object-entities and examinations. These confinements and these endless and changing vistas call forth haste and panics of the mind which entangle in knots of "paradoxes" and block the understanding. So they also block the further development of the started conceptualization. The limitations imposed by each specified description are flooded by the implicit fluxes of the rush toward more conceptualization. Without being aware of this, mind yields to whirls of implicit interrogations which generate a subliminal tendency to fluctuate between different operations of generation of an object-entity and different views ; a tendency to work out simultaneously several different descriptions. But as soon as the elaboration of several different relative

descriptions is simultaneously tried, the various involved generators of object-entity, object-entities and views, are offered a ground for oscillation. And then the oscillations actually happen, because it is very difficult to perceive them, so *a fortiori* to hinder them. So the different descriptions that are simultaneously entered upon, get mixed, and in general none of them can be achieved. Their interaction coagulates nonsense that stops the conceptualization.

The principle of separation hinders such coagulations. It requires the conceptualization, by method, to be achieved by explicit separation in mutually distinct, successive, closed, cellular descriptional steps.

In particular the principle of separation PS surveys the saturation of a description. It rings the bell as soon as the descriptional capacities of a started description must be considered to have been exhausted, because all the qualifications *via* the view chosen for acting in that description, of the object-entity corresponding to the generator chosen for acting in that description, have been already realized by performing a big number of repetitions of all the successions $[G.V_g]$ available in that description. PS announces that once this has been done, the descriptional cell potentially delimited by the chosen epistemic referential (G,V) has been saturated with actualized qualifications ; that from now on any attempt at obtaining new information inside this same epistemic referential, either is useless or it manifests the surreptitious intrusion of another generator of object-entity, or of another view, or both ; that – to avoid stagnation, paradoxes or infinite regressions – one has to stop this intrusion or mixture, by identifying the new epistemic referential that weighs with subliminal pressure upon the consciousness functioning, and by putting it explicitly to work in its own turn, separately.

The systematic application of the principle of separation plays, in the development required by MRC for a process of conceptualization, a role similar to that hold by the sign "." or the word "stop" in the transmission or writing down of a message ; or else, a role similar to that played in algebra by the closure of a previously opened parenthesis. Thereby any process of conceptualization that is normed accordingly to MRC, is clearly divided in a sequence of localized descriptional cells, and thus it develops by systematically renewed local frameworks, under systematically renewed *local* control.

While the tests of mutual existence (D7) detect the *a priori* impossibilities to construct meaning, the principle of separation permits to avoid any stagnation – illusory paradoxes, infinite regressions – throughout the processes of development of meaning.

The concepts of mutual inexistence and the principle of separation co-operate for the task of preventing sources of unintelligibility, and also of detecting and suppressing them.

The principle of separation possesses a remarkable capacity of organization of the conceptualization. This assertion will find many illustrations in the sequel of this work.

D16. *Relative metadescription*. The principle of separation requires descriptional closures and new starts. These entail the necessity of an explicitly and fully relativized concept of metadescription prescribing how to transcend "legally" an already saturated description.

Consider a precedingly achieved relative description to which the *order* 1 is assigned conventionally : $D^{(1)}/G^{(1)},\text{œ}^{(1)},V^{(1)}/$ (in short $D^{(1)}$; and instead of œ_G we write œ, to simplify the graphism). Consider a generator that selects $D^{(1)}$ as a new object-entity $\text{œ}^{(2)}$, denote it $G^{(2)}$ and call it a *metagenerator (or a generator of order 2) relative to $D^{(1)}$*. So we have $\text{œ}^{(2)} \equiv D^{(1)}$. Consider also a view involving *aspects of order 2* with respect to which $D^{(1)}$ does exist in the sense of D7 (for instance the aspect of factual truth of $D^{(1)}$, or else some aspect of *relation* inside $D^{(1)}/G^{(1)},\text{œ}^{(1)}{}_G,V^{(1)}/$, between the various gk-space-time qualifications produced by the examinations of $\text{œ}^{(1)}$ by the initial view $V^{(1)}$, etc. ; call it a *metaview (or a view of second order) relative to $D^{(1)}$* and denote it $V^{(2)}$. The description which is relative to the triad $G^{(2)},\text{œ}^{(2)},V^{(2)}$ will be called a *metadescription (or a description of order 2) relatively to $D^{(1)}$* and it will be denoted $D^{(2)}/G^{(2)},\text{œ}^{(2)},V^{(2)}/$ (in short $D^{(2)}$).

The same denomination and notation are conserved if *(a)* $G^{(2)}$ selects as a new object-entity $\text{œ}^{(2)}$ not only $D^{(1)}$ considered globally, but furthermore it includes in $\text{œ}^{(2)}$ also separate elements from $D^{(1)}/G^{(1)},\text{œ}^{(1)}{}_G,V^{(1)}/$ specified explicitly ($G^{(1)}$, or $\text{œ}^{(1)}{}_G$, or $V^{(1)}$, or two or all three of them) which permits then to introduce in $V^{(2)}$ aspects of relation between such an element, and the global result $D^{(1)}$ to which it has contributed. Or if *(b)* $G^{(2)}$ selects a whole *set* $\{D^{(1)}{}_1, D^{(1)}{}_2,...D_m{}^{(1)}\}$ of previously achieved relative descriptions (with an explicit reconsideration, or not, of elements from these

descriptions), in which case $D^{(2)}$ is relative to all these descriptions. In this way a very free and rich concept of normed relative metadescription is introduced [31].

Comment. The definition D.16 can also be applied to $D^{(2)}$ thus leading to a metadescription $D^{(3)}$ of order 3 relatively to $D^{(1)}$ and of order 2 relatively to $D^{(2)}$, etc. In this way it is possible for any consciousness-functioning CF to develop unlimited descriptional chains $D^{(1)}, D^{(2)}, ... D^{(j)}... \ \ D^{(n-1)}, D^{(n)}$ of hierarchically connected relative descriptions of successive orders j=1,2,....n – with an arbitrary origin denoted $D^{(1)}$ – in each one of which the involved metaview can contain all the desired pertinent new meta-aspects of order n.

So *in general the order of a description is not an absolute*, it labels the place where this description emerges inside the considered chain of conceptualization, while a chain can be started *conventionally* by these or those previously achieved descriptions to which the order 1 is assigned.

*But a basic transferred description can only have the **minimal** conceivable order, no matter in which chain it is involved*. Therefore this non-conventional minimal order will be denoted by 0, to distinguish it from any conventional initial order 1.

And any chain, if it has first been conventionally started with already previously achieved descriptions to which the order 1 has been assigned, can always be later completed downward until a set of basic transferred descriptions is identified which root the chain into pure factuality. Thereby the chain hits an absolute end (or equivalently, it finds its absolute beginning), which entails a corresponding re-notation of all the successive orders of the involved descriptional cells. But a given relative description can belong to

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[31] Here we can go back to the important distinction from the note 20 between "objectual" qualifications – call them "objectities" – and "state"-qualifications (note 20). The objectities are (relatively) stable qualifications that apply in an invariant way to a whole class of evolving states, thereby definig the "object", in the current sense, that assumes this or that state. So according to this language *the term object-**entity** labels only **a descriptional role** in the sense of the general comment of D14, while "object" in the current sense means «endowed with some objectities»* : inside MRC these two words should not be confounded. For instance, the state-qualifications called position, momentum, energy, etc., can vary or evolve from one state to another one, thereby introducing an infinite class of states of a definite sort of "object" labelled, say, "electron", that is characterized by the *meta*qualifications consisting of the numerical values obtained (with some given system of unities) for objectities like mass, charge, spin, that are the same inside the whole class of what is called "states of electrons". These objectities however can themselves change by creation or annihilation of the corresponding object, and when the conditions for such changes are realized they can be regarded as states of some more general object (at the limit, of what is called field or energetic substance). In this way the language introduced here can organize conveniently various hierarchies of degrees of abstraction.

different chains that meet in it (it can be a node of the web of chains of conceptualization) ; so, regarded as a cell from distinct chains, a same description can have different orders. But the feature of being a metadescription (or not), is an absolute *if* transferred descriptions constitute the origin used as reference, since the zero order of a transferred description is an absolute. This amounts to the remark (rather obvious *a posteriori*) that :

> The (open) set of all the possible relativized descriptions falls apart in just *two* (evolving) layers : **(a)** the layer of transferred descriptions of physical basic object-entities which, by definition, are not themselves previously achieved descriptions, and **(b)** the layer of metadescriptions in the absolute sense, i.e. of descriptions of object-entities consisting of previously achieved descriptions [32]. Both layers have an evolving content.

Through the first layer, the prime matter for the elaboration of meaning is drawn into conceptualization, and inside the second layer the basic meaning produced in the first layer undergoes abstract transformations which progressively elaborate indefinitely complexified meanings.

It is essential to note that in any chain, for each passage from a descriptional level n to the following level n+1, the new epistemic referential to be used $(G^{(n+1)}, V^{(n+1)})$ is freely decided by the acting consciousness-functioning CF, as an expression of his own (evolving) descriptional curiosities-and-aims, such as these emerge at any given time from his own biological, temperamental, and social-cultural background : it is the consciousness-functioning CF who, step by step, chooses the "direction" of the descriptional trajectory drawn by the succession of the cellular but connected descriptional closures $D^{(n-1)}$, $D^{(n)}$, $D^{(n+1)}$,.... which, accordingly to [P15+D16], produce the indefinite progression of a hierarchical chain started by conventionally initial conceptual descriptions $D^{(1)}$ or by absolutely initial basic descriptions $D^{(o)}$.

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[32] However it is curious to note that there are various sorts of rooting of a basic object-entity, into pure factuality : the *objectual* manifestations of a basic object-entity, in the sense of the note 31 can be *conceived* (not known, just imagined) to be tied with pre-existing "own" features of this basic object-entity (cf. D19) which, though unknown, are always the *same*. In this sense, a basic object-entity which is *a priori* researched as located inside the genus labelled micro-*object* (i.e. is researched exclusively *via* objectual manifestations) is thereby *a priori* endowed with a rooting into pure factuality which is less hidden than that of a basic object-entity researched *a priori* as located inside the genus labelled micro*state*, because it is posited to reach the level of observability by just a time-invariant coding transposition, not by the coding of the effects of a (measurement) *evolution* produced by the processes of examination. These remarks amount to the assertion of various possible deliberately chosen *depths* of the rooting of a transferred description, into physical factuality.

A descriptional chain remains a concept that cannot be absorbed in the concept of computation, as long as no method or algorithm is found for determining automatically, as a function of some definite parameters, a new epistemic referential, when a passage from a description to a metadescription (with respect to it) takes place. And even if such an algorith were specified, furthermore also the determination of the parameters should emerge automatically : accordingly to what criteria ? Etc. The subjective successive descriptional aims play a decisive role.

Π17. *Anti-reductionist proposition*. Inside MRC the "reduction" of a metadescription of order n (D.16) to the descriptions and elements of descriptions of order n-k, k=1,2,...n-1 involved in it, is in general impossible.

"Proof". Consider the metaobject-entity $œ^{(n)}$) from a metadescription which, inside the considered chain, is of order n, $D^{(n)}/G^{(n)},œ^{(n)},V^{(n)}/$. An isolated element from $œ^{(n)}$ (a description $D_j^{(n-1)}$ of order n-1, or some other descriptional element of order n-1 from such a description (generator, object-entity, view)) in general simply *does not exist in the sense of D7 with respect to the new meta-aspects of order n from $V^{(n)}$*. For instance, a metaview $V^{(2)}$ of order 2 from the metadescription $D^{(2)}/G^{(2)},œ^{(2)},V^{(2)}/$ relatively to $D^{(1)}/G^{(1)},œ^{(1)},V^{(1)}/$, can contain the aspect of *distance* between two space-gk-qualifications of order 1 involved by $D^{(1)}/G^{(1)},œ^{(1)},V^{(1)}/$, with respect to which these qualifications *themselves* do not exist in the sense of D7. Or else, $œ^{(2)}$ can contain two previously achieved descriptions of physical object-entities, $D_A^{(1)}$ and $D_B^{(1)}$ involving both a same view $V^{(1)}$ (so qualifications of a same nature) while $V^{(2)}$ contains a meta-aspect of order 2 of *comparison* of these qualifications, whereas neither $D_A^{(1)}$ alone nor $D_A^{(1)}$ alone, nor descriptional elements from these, do exist in the sense of D7 with respect to this meta-aspect of comparison. In general terms, the new qualifications of order n that can be involved in a metadescription $D^{(n)}$ while they cannot be involved in the descriptions of order n-1 contained in $D^{(n)}$, consist of *global* or *connective* metaqualifications of order n concerning two or more descriptional entities of order n-1 from the object-entity $œ^{(n)}$ from $D^{(n)}$ (consisting of whole descriptions of order n-1, or generators of object-entities, or object entities or views, of order n-1). These, when considered separately inside the descriptions of order n-1, *do not exist in the sense of D7 with respect to any of such new metaqualification of order n involved by $D^{(n)}$*.

So in general $D^{(n)}$ is not reducible to the descriptions or descriptional elements of orders n-k from the same chain.

Comment. On each descriptional level of a given order n from a descriptional chain (D.16), the descriptional cell $D^{(n)}$ placed on this level introduces, *via* the condition of relative existence D7, the possibility of new qualifications, of which the very definibility and meaningness are conditioned by the previous achievement of the descriptions from all the previous levels n-1, n-2, ...n-n :

> Throughout the development of a process of conceptualization normed accordingly to MRC one can literally watch the creative complexifying work of cognitive time : *one can literally see what "emergence" means*.

It is remarkable that inside MRC this conclusion follows from the system of basic definitions, postulate and principles, in a way that permits a clear perception of the nature of each contribution to the conclusion. One can distinguish between contributions of a factual nature as for instance those of a basic description $D^{(o)}$, and on the other hand contributions of psychological nature like the choices of epistemic referentials for the successive descriptional cells, or of methodological nature like the condition D7 of mutual existence and the principle of separation P15 :

> There is no need any more for pleading, arguments, etc. in order to draw attention upon the specific character, the mechanisms and the features of what is labelled by the words "complexity", "complexification", "emergence".

So, by normed complexification, the transferred descriptions that start from the inside of pure factuality and by which phenomena acquire a first communicable form, are then developed in unlimited chains of hierarchically connected metadescriptions of increasing order. These chains can meet and interact variously at various levels and thus they weave indefinitely compexifying and non predictable forms of communicable significance.

The consequences of the association between the principle of separation and the concept of relativized metadescription, are innumerable and always important. But in the absence of a normed descriptional structure to which any description be referable, they cannot be systematically identified.

Reference, and minimality of the MRC-realism

In this stage of the elaboration of MRC it is already possible to entirely elucidate *a posteriori* the *a priori* somewhat obscure features introduced by the definition D4 of a generator of object-entity (the posited one-one relation G–œ$_G$) and by the realist postulate P3 (cf. note 25). We shall now achieve this by a succession of three propositions. Thereby also the reflexive character of MRC will gain new illustrations.

π18. *Propositions on reference and minimal realism*.

π18.1. (On comparability, identity, and the relation G–œ$_G$). A basic object-entity is inexistent in the sense of D7 with respect to any "comparison-view" : such a view is a metaview with respect to which only descriptions exist in the sense of D7, never basic object-entities.

"Proof". What is not already pre-qualified cannot be compared. Only two (or more) previously achieved descriptions D_1 and D_2 can be compared, and only concerning some definite aspect-view or view with respect to which these descriptions do both exist in the sense of D7. One can for instance ask : are D_1 and D_2 identical or different with respect to this or that gk-value of the aspect-view V_g? If V_g is absent in one or in both considered descriptions, the question is *meaningless* because D_1 and D_2 constitute together a meta-object-entity $(D_1,D_2)^{(2)}$ that does not exist in sense of D7 relatively to a metaview of g-comparison, say $V^{(2)}{}_{gc}$, so *a fortiori* a gk-identity can be neither established nor refuted. If on the contrary both D_1 and D_2 do make use of V_g, then $(D_1,D_2)^{(2)}$ and $V^{(2)}{}_{gc}$ do satisfy D7 and so one can research whether yes or not they do possess some gk-identities. In this example I have brought into play a most simple comparison-view, with respect to only one aspect g. Nevertheless this view is already, quite essentially, a *meta*view. One can form much richer metaviews of comparison. But all are metaviews relative to definite views with respect to which only previously achieved descriptions can exist in the sense of D7.

> A basic object-entity – a bulk of pure a-conceptual factuality – is not a previously achieved description. Therefore it cannot be compared, neither to "itself" nor to something else.

Comment. So the whole stratum constituted by the very first products of the epistemic actions – the stratum of basic object-entities introduced by basic generators – is not reachable by the concept of comparison and by the qualifications derived from it, identity, difference, degree of similitude. For basic object-entities these qualifications cannot be established by investigation, they can only by posited by method (like in the definition D4 of a generator of object-entity). When a given basic operation $G^{(o)}$ of generation of object-entity is repeated, it simply is meaningless to ask whether yes or not the object-entities $œ^{(o)}$ produced by this operation are all identical : this finally *founds*

"deductively" inside MRC the **impossibility** *to assign a general meaning to the question whether yes or not the repetition of a given operation G of generation of an object-entity* œ$_G$, *produces identical results* œ$_G$. So the posit of a one-one relation G–œ$_G$ appears *a posteriori* to be necessary indeed in order to be always able to speak and think fluently concerning the products of G ; while the significance of this posit, already specified to a certain degree in the comment on π12, becomes now fully clear.

The one-one relation G-œ$_G$ founds a methodological strategy according to which the reference œ$_G$ – *defined from the start on* and posited to be unique – associates coherently with, both, the *a priori* condition of possibility in the sense of D7 of an as yet non-defined meaning of œ$_G$ with respect to a given view V, and with a subsequently constructed specified meaning of œ$_G$ with respect to V (while for another view V'≠V, the relative existence D7, or a meaning of œ$_G$, or both, might fail to exist).

Thus *the question of reference obtains a self-consistent and effective solution*.

π**18.2**. ***"Local" proposition on the realist postulate***. Consider a *physical* object-entity œ$_G$. This is a fragment of physical reality generated by a given physical operation of generation G. The fact that any communicable knowledge is description, and the relativity of any basic description to a basic view, *entail* that the sequence of words "knowledge of how œ$_G$ is in itself" is void of significance.

"Proof". Consider a physical object-entity œ$_G$. Any communicable knowledge concerning œ$_G$ amounts to some relative description D/G,œ$_G$,V/. Any relative description D/G,œ$_G$,V/ belongs to some net of descriptional chains that is rooted in pure factuality *via* a (finite) number of *basic* transferred descriptions $D^{(o)}/G^{(o)}$,œ$_G^{(o)}$,$V^{(o)}$/ where the basic object-entity œ$_G^{(o)}$ somehow contributes to œ$_G$, has hereditarily transmitted into œ$_G$ some of its own semantic substance. Now, in each one of these basic transferred descriptions, the transfer-view $V^{(o)}$ acting there yields for the involved basic object-entity œ$_G^{(o)}$ a very first access to observability. But the principle P10, the propositions π11, π12, π13, and the definition D14.3.1 of a basic description, show that, and how, the basic transfer-view $V^{(o)}$, while it yields this first access, also *inserts a non removable opaque screen between the acting consciousness-functioning CF and «œ$_G^{(o)}$-in-itself»*, it bars the way of human knowledge toward «œ$_G^{(o)}$-in-itself». So the unavoidable and non

removable descriptional relativities explicated inside MRC, and the fact that any communicable knowledge is description, entail inside MRC that [knowledge-of-the-physical-reality-as-it-is-in-itself] is nothing more than a meaningless combination of words, devoid of any designatum.

Comment. Since Kant the impossibility to know how a physical entity "is-in-itself", is accepted as an obvious postulate inside philosophy. But many physicists still are reluctant to fully realize this definitive limit of human rational knowledge. So is seems worth mentioning explicitly that inside MRC this limit follows from the exposed assumptions, so that there is no need to assert it as a logically independent assumption. Then those who contest this limit should specify which assumptions they contest.

π**18.3**. "*Global" proposition on the realist postulate : minimality*. Inside MRC the realist postulate P3 can only be given a *minimal* significance : it can only be understood to assert *exclusively* the credo of the **existence**, apart from the interior reality from my own mind, of also a physical reality independent of any act of observation ; but an existence which is strictly *non-qualifiable* "in-itself", beyond the mere trivial and non-informative, idempotent assertion of its relativized qualifi*ability*, if acts of observation of it do take place in the conditions D4-D7 (in the absence of which P3 would be aimless).

"Proof". According to the definition D2 "the physical reality", globally considered, is just a *posited* substratum wherefrom all the *basic* object-entities $œ_G^{(o)}$ considered in π18.1 and in the proof of π18.2, are conceived to be extracted. Only this and nothing more. It would then be an arbitrary conceptual discontinuity, a leap, a kind of spontaneous generation, of *Deus ex Machina*, and even an inner inconsistency, to assign to this substratum posited by *us*, properties that transcend the very descriptional essence of *all* the fragments $œ_G^{(o)}$ that we extract from it, namely the impossibility shown by [π18.1+π18.2], to know any qualification whatever concerning a basic object-entity $œ_G^{(o)}$ in-itself.

Comment. It is quite non-trivial that inside MRC this minimality of the realist postulate P3 is a feature that emerges as a consequence – in the weak sense that marks all the "proofs" – of the non removable descriptional relativities. So much more so that the forces which withstand the distinction between mere existence of something, and *knowledge* of *how* this something *is*, are huge.

Final global comment on the realist postulate (cf. note 25). By now, I think, the specificity of the concept of "physical reality" with respect to the general concept of reality introduced by D2, has come out with satisfactory definiteness, mainly *via* the frame principle P8, the principle P10 of individual mutual exclusion, the propositions $\pi11$, $\pi12$, $\pi13$, the concept D14.3.1 of basic transferred description, and the propositions from this point 18. Thereby, retroactively, the necessity of the postulate P3 as well as its significance should have become clear. This necessity lies in the fact that *the formulations mentioned above would not have been possible without P3*. As for the significance of P3 inside MRC, it can be best grasped *per a contrario* : it is that which inside MRC makes no sense, or no clear sense, when one considers elements of reality consisting of *concepts*, social facts, etc.

As for the minimality of the realism asserted here, I suppose that notwithstanding the proposition $\pi18.3$ many will tend to continue to nurture in their minds a non-minimal realism. But reconsider in full light the quasi irrepressible hope that, in spite of all, some model or "only some invariants", might some day transpierce the obstacle generated by the descriptional relativities and inform us definitively, even if only in a coded way, on *how* the physical reality is-in-itself, independently of any perception. And on the other hand, consider the necessarily fragmenting character of the knowledge that human mind can construct, the indefinite and evolving multiplicity of the possible basic object-entities $œ^{(o)}$ as well as of the basic transfer-views $V^{(o)}$ which – now or in the future – could be found to exist in the sense of D7 with respect to a given basic object-entity $œ^{(o)}$: these stress even more, if this is still possible, the illusory character of such a hope for non-minimality. Indeed, given the non removable dependence of thought on perception, given the non removable dependence of perception on fragmenting descriptional relativities, given the unpredictable and incessant complexifications brought forth by the so various, and unbounded, hierarchical chains of metadescriptions that are growing everywhere, given the unpredictable changes of "viewpoint" (of epistemic referential) which these complexifications might bring forth – certainly radical from time to time – on *what* a rational basis could one uphold the postulation of some convergence toward a definite, definitive, terminal, absolute descriptional structure (supposing that this succession of words were endowed with some meaning) ? What a sort of invariants, magically stabilized against all the changes brought forth by the growth of thought, and magically freed of any descriptional relativity, could, thus stripped, nevertheless carry *knowledge* of

the way of being of physical reality in-itself, beyond the posit of its mere existence ? When knowledge *is* nothing else than qualifications *via* some view, of a somehow delimited object-entity, so qualifications relative to some view and some generator of object-entity ? Obviously one ends here up in a whirl of circularity.

Relative models versus minimal realism

But if any knowledge-of-how-physical-reality-is-in-itself, is indeed an illusory self-contradicting concept, *why do our minds so stubbornly keep to this concept ?* This is a question which has to be examined.

So I close now this exposition of the nucleus of MRC as follows. First I shall show why the illusory belief in the possibility to reach knowledge of how physical object-entities are in-themselves, is quasi irrepressibly generated by human mind, in consequence of the frame-pronciple P8. And then I shall show how, once identified, the fallacy vanishes and leaves place to dimensions of conceptual liberty.

I proceed by defining a last group of four concepts which specify the philosophical status of the minimal realism asserted here.

On the insufficiency of the basic transferred descriptions. Consider first an *individual* transferred description $D^{(o)}/G^{(o)}, \text{œ}^{(o)}, V^{(o)}/$ of a physical basic object-entity $\text{œ}^{(o)}$ (i.e. for any aspect-view $V_g^{(o)} \in V^{(o)}$, when the succession $[G^{(o)}.V_g^{(o)}]$ is repeated, always the *same* value gk is obtained). In this case, by hypothesis, the epistemic referential $(G^{(o)}, V^{(o)}$ insures for the transferred results the *strongest* possible sort of qualificational stability ($\pi 12$, $\pi 13$, D14.1). Thereby, since according to D14.3.1 the basic transferred description $D^{(o)}$ *characterizes* observationally the involved basic object-entity $\text{œ}^{(o)}$. So one finds oneself already in possession of an observational invariant that associates a quite definite *meaning* to what has been labelled *a priori* "$\text{œ}^{(o)}$" (cf. the comments on the final posit from D14.1.3). It might then be argued that this "suffices", that in such conditions there is no reason for researching further specifications concerning what has been labelled $\text{œ}^{(o)}$. But the fact is that in general such a "sufficiency" simply is not experienced by the observer-conceptors : in presence of even an *individual* transferred description $D^{(o)}$ that produces a most immediately manifest observational stability, many thinkers (if not most) − quite modern thinkers, and even physicists − experience an irrepressible tendency toward a subsequent epistemic elaboration that shall

produce a better, a clearer meaning assignable to what was labelled œ$^{(o)}$. But a "better, clearer meaning of œ$^{(o)}$", in what a sense, exactly ?

When one tries to answer this question it appears that what is researched is a representation of œ$^{(o)}$ that shall endow it with an *own* form of **space-time**-*gk-values*, *separated* from any process of observation and any registering device ; and moreover a form of space-time-gk-values possessing "unity", i.e. covering a connected space-domain obeying some definite dynamical law.

Furthermore a global and explicit space-time representation is (vaguely) desired for also the processes that led from the basic object-entity œ$^{(o)}$ with its own space-time location, to its basic transferred description. ***The frame-principle P8 is here at work***.

The requirements of the frame-principle cannot be violated definitively. One can at most postpone dealing explicitly with them. The frame-principle expresses a psychical fact which is as irrepressible as the physical fact that masses are tied with gravitation. If a basic transferred description of a basic object-entity is asserted, then one should be able to imagine some possible own form of space-time-gk-values of this object-entity, as well as some possible own structure of space-time-gk-values of the process that generated the description. If not, the frame principle will keep active and upset us.

A basic transferred description D$^{(o)}$, though, yields no hint for satisfying these requirements. It is expressed *exclusively* in terms of observable features **of** *registering devices* which are all *distinct* from what is labelled œ$^{(o)}$. It yields no representation whatever concerning the space-time location of the basic object-entity œ$^{(o)}$ itself. Inside a basic description D$^{(o)}$ the involved basic object-entity œ$^{(o)}$ is not represented as an autonomous individuality endowed with an own form, it still floats behind as a mere labelled nebula suggested by the words basic object-entity and their notation œ$^{(o)}$. And even if, for a moment, we suspend any question concerning specifically œ$^{(o)}$. and we consider D$^{(o)}$ as a whole, again we find ourselves in presence of of an absence of space-time intelligibility. Indeed, given that each registered mark gk involved by D$^{(o)}$ is found on a g-apparatus and that the transfer-view V$^{(o)}$ must involve at least two different g-apparatuses for measuring two mutually incompatible basic aspect-views, the "form" of space-time-gk-values involved by the basic transferred description D$^{(o)}$ *itself* is found to

cover a scattered domain of space, tied with different registering devices that can lie arbitrarily far from one another. And given that the time-origin t_0 has to be re-established after each realization of a succession $[G^{(o)}.V_g^{(o)}]$, it is not even clear whether it is possible to somehow associate this form with some continuous evolution (or persistence) ordered by a unique increasing time-parameter.

In short, by $D^{(o)}$ alone one cannot "understand" intuitively, neither how the basic object-entity can be conceived to "be", nor in what a sense, exactly, $D^{(o)}$ is a "description" of this basic object-entity. This situation is tiring for the mind. Therefore an individual basic transferred description $D^{(o)}$ is not perceived as an *achieved* descriptional action. It is not felt to have reached a conceptual stage of epistemological equilibrium. It is obscurely felt as if loosely fixed on a steep conceptual slope where a conceptual force draws it toward a separated representation of $\text{œ}^{(o)}$ in terms of own gk-*space-time* aspect-values. This sort of need might be regarded as a methodological instinct tied with the frame-principle, induced by the adaptive biological evolution of our minds.

All the preceding remarks hold also concerning a probabilistic transferred description. The now seventy years old debate on the interpretation of quantum mechanics proves this enough.

So one is led to consider the following question : is it possible to elaborate, out of a previously achieved basic transferred description $D^{(o)}$, a separated description of the basic object-entity $\text{œ}^{(o)}$ involved in $D^{(o)}$? Not a description of «how $\text{œ}^{(o)}$ really is» – by now such naïve epistemic quests can be supposed to have been entirely transcended inside MRC –, but a specification of just a possible modus of *thinking* of $\text{œ}^{(o)}$ in a self-consistent, transparent, intellectually operational way that be naturally insertable into the current language-and-conceptualization. The answer to this question is positive and it is brought forth by the following three new definitions.

D19. *Intrinsic metaconceptualization. Intrinsic model*.

D19.1. *Intrinsic metaconceptualization of a basic transferred description*. Consider a basic transferred description $D^{(o)}$ of a physical object-entity $\text{œ}^{(o)}$, individual or probabilistic.

- Let $G^{(1)}$ be a metagenerator of object-entity consisting of a conceptual selector (D4) that selects for examination the meta-object-entity consisting of $\text{œ}^{(1)} \equiv [D^{(o)} + \text{œ}^{(o)}]$.

- Let $V_I^{(1)}$/indicate an *intrinsizing metaview* (I : *intrinsizing*) which, starting from the initial, purely observational, transferred description $D^{(o)}$, works out *intrinsic* qualifications of the basic object-entity $\text{œ}^{(o)}$ involved in $D^{(o)}$ (intrinsic : word used in order to distinguish from the philosophical term "in itself"). This, inside the new epistemic referential $(G^{(1)}, V_I^{(1)})$, is achieved as follows.

* Let $V_{Ig}^{(1)}$ (I fixed, g=1,2,...m, Ig functioning as *one* compact index) be a set of m intrinsizing meta-*aspect*-views which, together, constitute the intrinsizing metaview $V_I^{(1)}$.

* Each intrinsizing meta-aspect-view $V_{Ig}^{(1)}$ involves an *abstract*, conceptual $V_{Ig}^{(1)}$-operation of examination *of the metaobject-entity[$D^{(o)} + \text{œ}^{(o)}$]*, namely an examination constructed in a way such that its possible results – necessarily values (Ig)k of $V_{Ig}^{(1)}$, accordingly to the definition D.5.1 – are all *conceivable* as separate intrinsic qualifications (Ig)k of the basic object-entity $\text{œ}^{(o)}$ that are compatible with $D^{(o)}$.

* The values (Ig)k of the intrinsizing metaview $V_{Ig}^{(1)}$ are furthermore constructed as : *(a)* intrinsic qualifications of $\text{œ}^{(o)}$ *at the time t_o* which is the time-origin re-established at the beginning of each succession [G.V_g] having contributed to the elaboration of $D^{(o)}$; *(b)* qualifications located inside a connected space-volume $\partial \mathbf{r}$ which $\text{œ}^{(o)}$ is posited to occupy at the time t_o.

 The relative metadescription $D^{(1)}$/$G^{(1)}, \text{œ}^{(1)}, V_I^{(1)}$/ constructed as specified above will be called an *intrinsic metaconceptualization of the basic (individual or probabilistic) transferred description $D^{(o)}$/$G^{(o)}, \text{œ}^{(o)}, V^{(o)}$/* and it will be also assigned the alternative more specific symbol $D_I^{(1)}$/[$D^{(o)}, V_I^{(1)}$].

Comment. We speak of "an" (not "the") intrinsic metaconceptualization of $D^{(o)}$, because in general many different intrinsizing metaviews can be constructed, and each one of these yields a corresponding and possibly specific intrinsic metaconceptualization.

An intrinsic metaconceptualization of a basic transferred description $D^{(o)}$ realizes a *retro-active* localizing projection of the scattered form of $D^{(o)}$, onto a connected and instantaneous space-time domain $[\partial \mathbf{r}.t_o]$. The uniqueness of the temporal qualification t_o, even though it is retro-active, suffices now for permitting to posit, starting from it, an intrinsic time-order that is hidden to observation. This permits now to assign a law of intrinsic evolution to what has been labelled $\text{œ}^{(o)}$, underlying any evolution of the observable transferred description $D^{(o)}$. As for the transferred description $D^{(o)}$, it can now finally be *explained*. The basic object-entity $\text{œ}^{(o)}$ can now be conceived to have "possessed" at the time t_o – on the connected spatial domain $\partial \mathbf{r}$ – the features assigned to it by the intrinsic metaconceptualization $D_I^{(1)}/[D^{(o)},V_I^{(1)}]$. These, one can now think, were *own* features of $\text{œ}^{(o)}$, separated from those of any measurement device, independent of them, but features which $D^{(o)}$ has been able to transpose into observable manifestations, only by disorganising the form of intrinsic gk-space-time aspect-values constituted by them. The scattered form of space-time-gk-values involved by $D^{(o)}$ can now be thought of as the result of a bursting and change of the initially integrated intrinsic features of $\text{œ}^{(o)}$ itself. A bursting produced by the mutual incompatibility of certain aspect-views $V_g^{(o)}$ from the transfer-view $V^{(o)}$ which has obliged us to perform a set of *different* successions $[G^{(o)}.V_g^{(o)}]$, $V_g^{(o)} \in V^{(o)}$ in order to obtain the global transferred description $D^{(o)}$ (according to D19.1 at least two such incompatible aspect-views $V_g^{(o)}$ are necessary in order to characterize $\text{œ}^{(o)}$).

In short, by the assumptions from D.19.1 the basic object-entity $\text{œ}^{(o)}$ has acquired the specification of an *own* form of gk-space-time aspect- values, and the process of emergence of the basic, transferred description $D^{(o)}$ has been *causalised* : the categories of space, time and form have been restored for $D^{(o)}$ and $\text{œ}^{(o)}$, so they have now become *intelligible*.

D19.2. *Intrinsic model of a physical basic object-entity*. So the intrinsic metaconceptualization $D_I^{(1)}/[D^{(o)},V_I^{(1)}]$ constructs (explanatory) *relations* between its global meta-object-entity $œ^{(1)} \equiv [D^{(o)} + œ^{(o)}]$ and the basic object-entity $œ^{(o)}$ involved by $D^{(o)}$, as well as an own space-time representation of this basic object-entity $œ^{(o)}$. Once this construction has been achieved it is possible to extract from it exclusively the representation of the basic object-entity $œ^{(o)}$, in the following way.

The set of intrinsic qualifications of the basic object-entity $œ^{(o)}$ produced by the intrinsic metaconceptualization $D_I^{(1)}/[D^{(o)},V_I^{(1)}]$, when considered *alone*, severed from all the other elements with which it is tied inside the intrinsizing metadescription $[D_I^{(1)}/D^{(o)},V_I^{(1)}]$, will be called an (intrinsic) *model of $œ^{(o)}$* and will be symbolized by $M(œ^{(o)})/[V^{(o)},V_I^{(1)}]$ in order to remind explicitly of the non-removable relativity of this model to the pair of views $[V^{(o)},V_I^{(1)}]$ which determined its genesis and its characters.

Comment. It is important to realize clearly that an intrinsic model $M(œ^{(o)})/[V^{(o)},V_I^{(1)}]$ is *not* a relative description *of $œ^{(o)}$* in the sense of the definitions D14.

The intrinsizing meta-aspect-views from $V_I^{(1)}$ that produced the qualifications assigned to $œ^{(o)}$ by the intrinsic model $M(œ^{(o)})/[V^{(o)},V_I^{(1)}]$, have examined *the meta-object-entity $œ^{(1)} \equiv [D^{(o)} + œ^{(o)}]$, **not** the basic object-entity $œ^{(o)}$*.

The model $M(œ^{(o)})/[V^{(o)},V_I^{(1)}]$ occupies finally a position of full epistemological saturation and equilibrium of the meaning assigned to what had been initially labelled $œ^{(o)}$. Its genetic compatibility with the transferred description $D^{(o)}$, as represented by the intrinsizing metaconceptualization $[D_I^{(1)}/D^{(o)},V_I^{(1)}]$, detached it from $D^{(o)}$ like a mature fruit that has been plucked from its tree. The model $M(œ^{(o)})/[V^{(o)},V_I^{(1)}]$ superposes now to the initial purely observational basic description $D^{(o)}$, a pragmatic, economic and stable conceptual *closure*. Namely a closure consisting of *an invariant with respect to the group of transformations from one succession $[G^{(o)}.V_g^{(o)}]$, $V_g^{(o)} \in V^{(o)}$ that contributed to the elaboration of $D^{(o)}$, to any other such succession with a different*

*aspect-view in it, $G^{(o)}$ being **fixed*** : the observable effects of all these different successions $[G^{(o)}.V_g^{(o)}]$, $V_g^{(o)} \in V^{(o)}$, are now all assigned one common and definite "causal" ancestor which produces various perceptible manifestations, in a "normal" way i.e. in a way that is understandable accordingly to the frame-principle P8.

When the basic transferred description $D^{(o)}$ on which the model $M(œ^{(o)})/[V^{(o)},V_I^{(1)}]$ is founded involves exclusively the human biological sensorial apparatuses, this sort of closure emerges in an unconscious, non-mediated, genetically wired way : it *is* precisely what we believe to perceive, and *this* we automatically assign to, exclusively, the involved object-entity....*in-itself* (think of perceptions via a microscope or a telescope). The stage of a transferred description $D^{(o)}$ remains unknown. And even when fabricated apparatuses are connected to the biological ones, if the whole apparatus thus obtained still offers a directly intelligible form of space-time-gk-values, this form, again, is irrepressibly felt to reveal how the perceived object-entity is *in-itself*. More : if the observable basic transferred data do not themselves offer a directly intelligible form of space-time-gk-values, so if the intrinsic model $M(œ^{(o)})/[V^{(o)},V_I^{(1)}]$ has to be explicitly constructed from these data treated as mere coding signs, still, once constructed, the model is usually felt to be satisfactory and *necessary* to such a degree that its only *hypothetical, retro-active, and relative* character tends to be skipped. Implicitly and fallaciously the intrinsic model $M(œ^{(o)})/[V^{(o)},V_I^{(1)}]$ conquers inside our minds a primary and absolute status.

This is the fallacy that instates the irrepressible belief that physical object-entities can be *known* "such as they are in themselves".

The unavoidable dependence of any intrinsic model of $œ^{(o)}$, on *both* an initial transferred description $D^{(o)}$ that has had to be achieved first and has involved some particular transfer-view $V^{(o)}$, and a subsequent process of intrinsic metaconceptualization $D_I^{(1)}$ involving a particular intrinsizing metaview $V_I^{(1)}$, tends to be overlooked. It tends to remain unnoticed that ***another*** *pair $(V^{(o)}, V_I^{(1)})$ would have led to a **different** model of* $œ^{(o)}$.

These occultations mark all the classical descriptions, in physics, in mathematics, etc., as well as in the current thinking expressed by the current language : they are the opaque fictitious platform on which is erected the classical concept of objectivity. The roots which insert the conceptualizations into physical factuality, with the relativities involved by them, are hidden beneath this fictitious platform.

Starting from the transferred data that are available for it and on which it takes support without trying to express them, human mind always rushes as rapidly and as directly as it can toward a representation of the involved object-entity by an intrinsic model. As soon as such a representation has been attained, it is spontaneously felt to be "true" in a primary, certain and absolute way, without reference to the initial transferred data on which it is founded and forgetting that it is just an economic, hypothetical, retro-actively imagined *construct*. While the initial transferred data, even though they are the sole certainties, because of their dispersed unintelligible phenomenal appearance, are implicitly and irrepressibly perceived as nothing more than "subjective" tools for finding access to the "objective truth" : *a fallacious, illusive inversion.* We systematically commit what Firth [33] called «the fallacy of conceptual retrojection». Simplicity, invariance, and what we tend to call "truth" and "objectivity", have coalesced in a knot imprinted upon our minds by ancestral processes which, by implicit pragmatic causalisations, optimizes the efficiency of our behaviour, but blocks and botches the reflexive knowledge of our fundamental epistemological functioning. The interpretation as ontological assignments, of the results of our instinctive human adaptive constructs involving the frame-principle, is one of the worst and most stubborn pathologies of thought.

But in quantum mechanics this process has hit an obstacle. Up to this very day a type of intrinsic model $M(\text{œ}^{(o)})/[V^{(o)}, V_I^{(1)}]$ fitting satisfactorily the quantum mechanical transferred descriptions of what is called a microstate, has not yet been found. So it has been necessary to stop the attention upon these transferred descriptions themselves such as they have emerged, and to embody these transferred descriptions in mathematical expressions able to yield, if not understanding, at least numerical predictions. And then, like a tireless insect when its instinctive constructive actions are hindered, human mind came back again and again upon these quantum mechanical transferred descriptions that resist modelization. And so it has become possible to discern

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[33] Firth, R., Reply to Sellars, (1981) Monist vol.64 pp. 91-101 (the quotation is from p.100).

and define explicitly their specificity, which here has been called a "basic transferred" character, and to finally become aware of the unavoidable necessity of a quite universal first phase of conceptualization in terms of basic transferred descriptions. Which led to MRC.

Inside MRC the distinction between illusory ontological assertions concerning an absolute way in which œ$^{(o)}$ «really-is-in-itself», and relative methodological intrinsic models of œ$^{(o)}$, is quite radical, elaborate and clear cut. And the genetic order of the descriptional steps is re-constructed correctly and is fully displayed.

In these conditions the irreplaceable pragmatic and heuristic power of intrinsic models can be put to work without triggering any more insoluble philosophical pseudo-problems. Correlatively, the vain and exhausting battle between positivists and defenders of modelization, evaporates. The transferred descriptions are the unavoidable first stage of our processes of conceptualization, while the intrinsic metaconceptualizations of the initial transferred descriptions and the relative models extracted from these are a stabilising subsequent stage which, if realized, brings us down onto a (local and provisional) minimum of our potential of conceptualization.

There is no choice to be made. There is just an unavoidable *order of elaboration* to be observed, in a normed way, or to be recognized when it occurs implicitly.

D19.3. *Minimal intrinsic metaconceptualization. Minimal intrinsic model*. Consider a basic transferred description $D^{(o)}$ of a physical basic object-entity. The effect labelled œ$^{(o)}$ of the basic operation $G^{(o)}$ of generation of an object-entity can *always* be trivially metaconstructed accordingly to D19.1 so as to be conceivable as :

A bulk of potentialities of future observable manifestations, determined by $G^{(o)}$ on a finite space-domain $\partial^3\mathbf{r}$, at the time t_o when $G^{(o)}$ comes to an end, each one of these potentialities being relative to an aspect-view $V_g^{(o)}$ from the basic view $V^{(o)}$ operating in $D^{(o)}$.

For this it suffices to posit in D19.1 the *minimal intrinsizing view corresponding to* $V^{(o)}$ – let us denote it $[\min.V_I^{(1)}/V^{(o)}]$ – defined as follows. For each basic aspect-view $V_g^{(o)}$

from the basic view $V^{(o)}$, $[min.V_I^{(1)}]$ contains a corresponding intrinsizing minimal meta-aspect-view $[min.V_{Ig}^{(1)}]$ possessing a unique *minimal meta-aspect-value* denoted Ig_{min} that consists of the intrinsic *potentiality*, assigned to what has been labelled $œ^{(o)}$, to produce at a time $t_g > t_o$, any one among the transferred observable aspect-values gk of the basic aspect-view $V_g^{(o)}$, iff $œ^{(o)}$ is subjected at t_o to an $V_g^{(o)}$-examination ($t_g - t_o$: the duration of a $V_g^{(o)}$-examination, characteristic of the considered aspect g) (I recall that "intrinsic" means here assigned to $œ^{(o)}$ itself as an own feature, the word having been chosen in order to distinguish from the meaning of the philosophical term "in itself").

   The trivial realization of the definition D19.1 specified above will be called *the minimal intrinsic metaconceptualization of the basic transferred description $D^{(o)}/G^{(o)}, œ^{(o)}, V^{(o)}/$* and it will be denoted $[min.D_I^{(1)}/D^{(o)}]$ (the relativity to the acting intrinsizing view $V_I^{(1)}$ is now included in the definition of the minimal intrinsizing view $[min.V_I^{(1)}/V^{(o)}]$). The intrinsic model of $œ^{(o)}$ extracted from $[min.D_I^{(1)}/D^{(o)}]$ will be called *the minimal intrinsic model of $œ^{(o)}$* and will be denoted $[min.M(œ^{(o)}/V^{(o)}]$.

   Comment. The following consequence of the final posit from D14.3.1 is quite worth being noticed. Any basic view $V^{(o)}$ that involves two mutually incompatible basic aspect-views $V_{g1}^{(o)}$ and $V_{g2}^{(o)} \neq V_{g1}^{(o)}$ entails a minimal intrinsic model $[min.M(œ^{(o)}/V^{(o)}]$ which now characterizes $œ^{(o)}$ *conceptually* (by predication). It yields a conceptual definition of $œ^{(o)}$ that can now be added to the purely factual definition of $œ^{(o)}$ insured initially by the operation $G^{(o)}$ alone (whereby $œ^{(o)}$ still remained outside knowledge) and to the subsequent purely observational description of $œ^{(o)}$ offered by the basic description $D^{(o)}$ (whereby $œ^{(o)}$, though characterized observationally, nevertheless was still devoid of an own conceptual representation). MRC brings forth *degrees* of characterization of a basic object-entity $œ^{(o)}$, which compose the complexifying sequence [purely factual→purely observational→conceptual]. From that stage on, chains of *non* minimal intrinsic metaconceptualizations can indefinitely increase the degree of conceptual characterization of $œ^{(o)}$. This illustrates the reflexivity of the method and its unlimited character.

As any intrinsic metaconceptualization and any intrinsic model, the trivial minimal models also may be perceived as "opportunistic" constructs where what is actually observed is posited to stem from an *a posteriori* imagined *ad hoc* explanatory potentiality. This however does not in the least diminish the pragmatic importance of the fact that a minimal model of what is labelled œ$^{(o)}$ is a representation that permits a most natural, easy insertion of œ$^{(o)}$ into the conceptualization. Moreover it is always and automatically realizable. It is however useful to remember again and again that inside MRC this sort of representation is accepted as just an unavoidable strategic step that must be carefully distinguished from an ontological credo : nothing whatever is naïvely asserted concerning the impossible question of how the basic object-entity œ$^{(o)}$ «really-is-in-itself». It is only stated how this object-entity can be most simply conceived in order for us to become able to speak and think of it in structured, consistent, fluent terms.

Final comment on the realism involved in MRC. The concept of *minimal* realism possesses, I think, an essential philosophical importance. Imagine an abstract surface on which are displayed all the grammatically correct structures of words that human mind can compose about the physical reality. On this surface, the concept of minimal realism is delimited by a boundary which coincides strictly with the boundary that separates the domain of communicable *knowledges*, from the domain inside which only grammatically correct verbal expressions can be found that are *devoid of reference* : this boundary defines the extreme limit which expressions of communicable knowledge can reach. The communicable knowledges cannot transcend this frontier. They can just advance toward it and eventually hit it by this or that basic transferred description which acts like a small squad carrying a local net of pre-conceptualization inside which it captures a small load of as yet unknown physical factuality which it hoist up on the very first level of speakable, communicable knowledge. But thereby the progression of the squad from inside the zone of knowledge, toward the physical reality, is stopped. The squad is reflected *back* like an elastic ball toward the inside of the realm of relative descriptions where it delivers its load which, from that moment on, can indefinitely be elaborated along innumerable branches of complexification by intrinsic metaconceptualizations and of and by extraction of corresonding intrinsic models. But each one of these complexifying elaborations introduces new descriptional relativities which *thicken* the screen between physical reality in-itself, and our mind's representations of it, they

thicken this screen so as to *improve intelligibility* and thereby the capacity to think and to act. Such is the paradoxical relation between physical reality and mind.

It is crucial to become aware, intensely, of the surreptitious advent of this *inversion* in our direction of conceptualization, of these unavoidable rebounds in the opposite direction each time that the extreme frontier of the domain of communicable knowledge is hit by a basic description. If not, we remain imprisoned in the inertial illusion that by modelizing more and more we *approach* more and more the knowledge of how the physical reality "is-in-itself". The grammatically correct associations of words which express this illusion are founded upon a self-contradicting concept of reality-in-itself, namely the concept of a *qualifiable* reality-in-itself. *Whereas reality-in-itself – by definition – is precisely what cannot be qualified more than by its mere qualifiability*. By these words, "in-itself", what is pointed toward deliberately is *nothing* more than a posited existence, furthermore *posited* also to be qualifi*able* but to be devoid of any other more specifying qualific*ation*. Any further qualification, even the most feeble one, the most vague, is either idempotent, or generates contradiction.

*This is not a matter of **fact**, it is a matter of structuration of language-and-concepts.*

The words "description" and "physical reality in itself" must be somehow endowed with a definition (even if only implicitly). And when this is done, what is called description arises as opposed, by construction, to what is called "physical reality in itself". One might perhaps believe, for instance, that it is possible to gain one more inch by specifying that the reality-in-itself is "such" that the qualifications which it admits from our part are precisely those which are elaborated by our senses and our investigations. But when we focus attention on this supposedly supplementary specification, trying to capture an element of positive novelty added by it to the minimal realist postulate, we find only nothingness. We find ourselves placed on exactly the same content of information as before. Between the realm of specified qualifications, of descriptions, and the realm of reality-in-itself, there is an abrupt solution of continuity which expresses that what is called a description is the result of a cognitive interaction with reality-in-itself, an interaction which marks the result, indelibly, by the relativities to that which interacts and to how this interacts. Any attempt to superpose some nuance expressible in terms of approximations or of asymptotic apprehension of *how* the physical reality is in itself, would only manifest a misunderstanding of the nature of what is here involved, namely

an optimized organization of concepts-and-words. One can reasonably try to fight against a physical circumstance, even if it is a "physical law", trying to master it in order to realize some technical aim. But trying to fight against the limitations entailed by a conceptual-linguistic organization, manifests a confusion concerning essence : what meaning would that have, for instance, to fight against the limitations imposed by a previously constructed formal system, say arithmetic, which one does not criticize and inside which one has placed oneself ? "The-way-of-existing-of-reality-in-itself" is a self-contradicting notion stemming from a confusion between empirical circumstances and conceptual organizations of which on the other hand one makes use. This confusion entails chimerical aims and fictitious problems ; or else, like in the quantum mechanical orthodoxy, an arbitrary positivistic interdiction of intrinsic metaconceptualizations and intrinsic models *because these are confounded with impossible qualifications of reality-in-itself*. This mythic fauna that spouts from the bursting of an inertially oriented impetus to understand more, against the barrier placed by thought between all that is speakable, and a posited and denominated rest, must be exorcised.

The minimal realism involved by MRC has a composite nature. While the feature of minimality follows "deductively" inside the method (π18), the main term, realism itself, is just a posit, the postulate P3. It is a declaration of metaphysical belief, wholly subjective. Any question of truth or objectivity is meaningless concerning it. But this metaphysical belief plays a fundamental role for MRC : it seats the method on a unifying ground. It asserts that beneath the endless proliferation of branching relativities which mark the contents of descriptions, there exists a substratum of non referred absolute, wherefrom the relativities emerge together with the conceptualizations. I say "beneath" in order to stress that the thesis of realism draws *out* of the domain of language and descriptions. By the mysterious powers of self-transcendence of language, this thesis acts like a verbal directional indicator, pointed from inside the volume of the expressed, but which points toward an existence from outside this volume. It grasps the attention, displaces it, and installs it at the very core of the non expressible. There, inside this background of unverbalisable which it succeeds to designate, the realist thesis fixes the ends of the threads with the help of which the basic transferred descriptions web to one another the two regions that stretch out on the two sides of the ghostly but insuperable wall betweenwhat is by construction devoid of communicable expression, and the formulated and communicable.

It might seem that this background of non referred, because it is absolute, is incompatible with the method of relativized conceptualization. But, and it is important to stress this, MRC by no means banishes *any* absolute. It banishes exclusively the false absolutes, those which hide descriptional relativities of which the presence can be identified, and which, if ignored, can generate illusory problems. But it is clear that when one constructs, it is unavoidable to posit certain absolutes. All the definitions from MRC, principles, etc., as *such*, have nothing relative about them. They are absolutes of the method, by the help of which the descriptional relativities are defined. And the existence of a physical reality posited in P3 is also an absolute of the method. It rejects any descriptional relativity because any descriptional relativity is a *meta*-qualification of some previously *specified* qualifications while the physical reality postulated in P3 is by definition devoid of any specified qualification, exclusively its unqualified existence is posited. So this concept is introduced as just the absolute reference without which thought would get lost in an unexplained profusion of diversity ; an absolute reference which unifies in one coherent whole all the indefinitely evolving descriptional relativities defined by the method.

I confess that the beauty which, to my eyes, emanates from this unification, appears to me irrepressibly as a sign of pertinence. Man and "reality" form a whole, and the feeling of beauty that can emerge in a human mind, intimately tied with coherence, has for me the significance of an announcement that certain slopes of the real have been embodied without having been violated. Whatever the unimaginable designatum of the succession of words which I just aligned, I want to align them, for we must somehow speak in order to communicate – paradoxically and in spite of all – concerning the unspeakable.

Global remarks on the nucleus of MRC

MRC is :

* ***Explicitly founded upon the functioning of human mind, with its cognitive aims***. The choices of the epistemic referentials that generate the relativized descriptions, stem from the consciousness functioning of the acting observer-conceptor. Each such choice expresses a curiosity, a descriptional aim of this consciousness functioning. The descriptional aims expressed by the successive choices of an epistemic referential, inside a chain of conceptualization, express the evolution of the descriptional aims of the acting consciousness functioning, and thereby they determine the "direction of

conceptualization", step by step. Inside MRC, in its present stage at least, the descriptional aims do not follow from methodological prescriptions. This means that no AI-machine could, by applying MRC, work like a human being, without being directed by a human being. But an AI-machine endowed with an "MRC-program" (if this is possible) and drawn by a man, would work exactly like that man. This specifies the difference between AI and MRC as well as the particularity of an "MRC-program".

* ***Explicitly rooted in pure factuality***, which entails the possibility of a systematic and constructed distinction between potentiality of an infinity of processes of actualization of relative observable manifestations, and this or that actualized observable manifestation (cf. V.2.2). Thereby it brings in the modal dimension potential-actualization-actualized.

* ***Radically relativizing***. The whole approach bears the seal of the mutual existence of object-entities and views (or, equivalently, of generators of object-entity, and views) and of the relativities of descriptions to the triads $G, \text{œ}_G, V$.

* ***Methodological, normative, legalizing***. MRC is not an attempt at describing the natural processes of conceptualization. Though data (introspective, linguistic, etc.) concerning these natural processes are strongly taken into account, nevertheless MRC recognizes the *impossibility* of a "purely" descriptive account on the processes of description. So, deliberately, it takes distance with respect to such an aim, by constructing definitions and principles conceived in order to optimize the conceptualization in compatibility with definite goals, namely the elimination of any false absolutization, reflexivity, construction of a conceptual structure with respect to which it be possible to "localize" any other descriptional structure, natural or not, etc.

* ***Finitistic, cellular, local***. The fact that the construction of knowledge requires parcellings, steps, is taken into account quite fundamentally throughout MRC, *via* the principle of separation P15 and the concept D16 of relative metadescription.

* ***Globally unlimited***. Though everywhere there are strict *local* delimitations of the descriptional quest that withstand any gliding into relativism, globally nowhere a boundary is pre-imposed : the finalized finitism of MRC generates infinities.

* ***Hierarchical***. MRC generates *hierarchical* **trajectories** of conceptualization, in contradistinction to the theory of logical types, or that of levels of language, which introduce extended hierarchical *strata*.

* ***Directional and reflexive***, endowed with a capacity for an *a priori-a posteriori* double way progression. Before starting a given descriptional cell, a free choice of the

direction of conceptualization desired by the observer-conceptor is expressed in a corresponding choice of an epistemic referential. Later the results of this choice can be rejected or kept and developed, on the basis of explicitly defined criteria.

The various features enumerated above are not exhaustive. Nor, by no means, are they mutually independent. Quite on the contrary, they all stem from one core-structure that induces an innumerable host of connections between these features. This core-structure is dominated by the systematically recurrent role of the consciousness functioning which introduces the epistemic referentials. Along the whole hierarchy of distinct descriptional cells of increasing order from each chain of conceptualization from the web of such chains, the same fundamental MRC-requirements for a relativized normed conceptualization manifest themselves with a sort of fractality : each time that an epistemic referential has been chosen, the generator of object-entity, the object-entity and the view from it entail non removable descriptional relativities to them.

On the conceptual status of MRC

To what class of conceptual beings does MRC belong ?

Any representation of "natural facts" is more or less normative, never purely descriptional as the classical myth of objectivity involves. So MRC, while strongly stressing its deliberately methodological content, can also be regarded as an attempt at a finitistic representation of the natural processes of generation of meaning, where both relativism and false absolutizations are excluded *ab initio* by explicit rooting into pure factuality and by systematic relativizations.

The fact that throughout the process of constructing MRC one acts "logically", is neither a circularity, nor does it involve that MRC is reducible to a logic. It only illustrates the general reflexive, (*a priori*)-(*a posteriori*) character of any approach and in particular of this one : *a priori* the logical criteria are supposed to be fulfilled and they are utilized implicitly [34], but later, at a convenient level of development of the approach, the logical criteria – as it will be shown in V.1 – become *a posteriori* explicitly expressible in MRC-terms. (This sort of inner evolution partakes of the general reflexive character of MRC that has permitted to admit *a priori* the possibility of any pairing (G,V) and to

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[34] Grize, J.B., (1993) *Pensée logico-mathématique et sémiologie du langage*, in Pensée logico-mathématique...... Nouveaux objets interdisciplinaires, Olivier Houdé et Denis Melville, P.U.F. The "natural logic" developed by J.B. Grize is the sort of logic that seems the nearest to that which acts throughout the elaboration of the nucleus of MRC.

introduce only *a posteriori* criteria concerning the relevance of a given pairing (G,V) : first became expressible the criterion of mutual existence D7, and then the subsequent criterion of stability involved in the definition D14.1).

So probably the best characterization is as follows. MRC is a strongly normative representation of the processes of conceptualization, of which the major specificities are the place explicitly reserved to the consciousness functioning, the radical descriptional relativizations, and the fact that it explicates the structure of the very first step in the construction of objectivity, in the course of which intakes of a-[conceptual-linguistic] fragments of pure factuality adduce into language and thought the hard core of scientific objectivity.

Now, should MRC be formalized ? Could it be formalized ?

IV.3. The Second Stage : an Ideographical Symbolization of MRC

In all the expositions of MRC that preceded the present one I included in a presentation made in usual language, an ideographic symbolization which - without being neither a formalization *stricto sensu* nor a mathematical representation - permits certain suggestive and economic expressions. In this work I present it simplified and separately. In this way the symbolizations are made available while the drawbacks as well as the advantages appear clearly.

- A *consciousness functioning* CF is represented by the sign $\circlearrowleft$ suggesting the whirling place from D1 that acts on both the Exterior Universe and the Interior Universe where it belongs, and in particular also on itself.

- *Reality* is again symbolized by the letter R.

- A *generator G of object-entity* will be represented by the sign Δ and will be *re-named* a *delimitator* of object-entity, in order to stress that, whatever the nature of G, the final result is a delimitation, out of R, of a corresponding object-entity. Thereby however one *looses* the accent placed by the term "generator" upon a (possibly) of a *radically creative* character of an operation of object-entity generation. Then :

- The "place" from R where Δ works will then be denoted R_Δ.

- The object-entity produced by Δ will be denoted by œ_Δ.

- The *process of delimitation* by Δ, of an object-entity œ_Δ, will be represented indifferently by

$$\Delta R_\Delta \Rightarrow œ_\Delta \quad \text{or} \quad œ_\Delta \Rightarrow \Delta R_\Delta$$

where the two arrows do *not* have a logical meaning and cannot be considered separately, they are cemented into the global symbolizations which read respectively : "the delimitator Δ, acting on R at the place R_Δ, produces the object-entity $œ_\Delta$", and "the object-entity $œ_\Delta$ produced by the delimitator Δ that acts on R at the place R_Δ". Notice that the introduction of these symbolization permits to *distinguish* between :

* Δ : an epistemic opera*tor* (in the sense of usual language, *not of mathematics*) ;

* $\Delta R_\Delta \Rightarrow œ_\Delta$: *a process*, that mentions its beginning and its result ;

* $œ_\Delta \Leftarrow R_\Delta$: an explicit specification of an object-entity *via the process that produced I,* which permits to specify an unobservable object-entity, by the way of producing it. Thereby the expressivity concerning this zone from MRC is considerably increased.

   - An *aspect-view* will be symbolized by the same sign V_g as before ;

   - The *operation of examination of $œ_\Delta$ by* V_g will be represented by

$$V_g œ_\Delta$$

   Notice that the introduction of these symbols permits to *distinguish* between :

* the epistemic opera*tor* V_g (in the sense of usual language, not of mathematics)

* the opera*tion* of examination $V_g œ_\Delta$.

Which, again is an increase of expressivity.

   - A *view* will be symbolized as before by V.

   - The global *operation of examination of $œ_\Delta$ by* V (achieved accordingly to $\pi 11$), will be represented by

   $$V œ_\Delta$$

   The remarks concerning V_g hold also concerning V.

   - An *epistemic* referential continues to be represented as before by (Δ, V).

   - The representation of an observer-conceptor [CF,(G, V)] becomes [, (Δ, V)].

   - The *mutual inexistence* between an object-entity $œ_\Delta$ and a view V will be symbolized by

$\not\exists\, œ_Δ/V$ or $\not\exists\, V/œ_Δ$

which reads, respectively, "the object-entity $œ_Δ$ does not exist with respect to the view V", "the view V does not exist with respect to the object-entity $œ_Δ$".

- The *mutual existence* between an object-entity $œ_Δ$ and a view V will be represented by

$\exists\, œ_Δ/V$ or $\exists\, V/œ_Δ$

which reads "the object-entity $œ_Δ$ does exist with respect to the view V", "the view V does exist with respect to the object-entity $œ_Δ$". (All these symbolizations can also be used, in particular, with the symbol of an aspect-view V_g instead of V, which changes the meaning correspondingly).

- A *space-time view* is represented as before by V_{ET}.

- The *frame-principle* can be symbolized in the following way :

$$[\,\exists\, œ_Δ/\, V_g] \to [\,\exists\, V_{ET} :\ \exists\, œ_Δ/\,(V_{ET} \cup V_g)]$$
$$[\not\exists\, œ_Δ/\, V_{ET}]\,,\quad \forall\, V_{ET},\ \forall œ_Δ$$

(where : the arrow, quite independently of any connotation suggesting *formal* logic, reads "entails that" (in the sense of natural logic) $\exists$ and $\not\exists$ - outside any *formal* system, just in the sense of usual language or of "natural logic" - read, respectively, "there exists" and "there does not exist" ; $(V_{ET} \cup V_g)$ considered as a one-block symbol, reads "the view formed with a space-time view V_{ET} and another *physical* aspect-view V_g". The global reading of this symbolic picture is the verbal formulation of P8.

- The symbol of a *relative description* $D/G,œ_G,V/$ becomes $D/Δ,œ_Δ,V/$, and the symbol for a *basic relative description* $D^{(o)}/G^{(o)},œ_G^{(o)},V^{(o)}/$ becomes $D^{(o)}/Δ^{(o)},œ_Δ^{(o)},V^{(o)}/$, and a relative metadescription of order n, $D^{(n)}/G^{(n)},œ_G^{(n)},V^{(n)}/$, n=0,1,2,...., is symbolized by $D^{(n)}/Δ^{(n)},œ_Δ^{(n)},V^{(n)}/$.

Together, these symbolizations constitute *the ideographic representation [$\square$, Δ, $œ_Δ$, V, ($D^{(n)}$, n=0,1,...)] of MRC.*

IV.4. The Third Stage : a Scheme of a Mathematical Representation of MRC in Terms of the Theory of Categories

The verbal formulation of MRC conveys a methodology by which the activity of constructing knowledge, though it is exposed with the help of words, nevertheless is extracted from *mere* language. The above ideographic symbolization increases the degree of this extraction. But in order to increase this liberation still more, it seems important to achieve now a mathematization. Indeed current language inextricably incorporates hosts of surreptitious false absolutizations, of insidious obscurities, a pullulation of sonorities and implications that arouse unpredictable philosophical suspicions, refusals, passions. Furthermore, it is devoid of a clearly defined structure. Neither a verbal extraction *via* a system of definitions, postulates and axioms, nor an ideographic symbolization associated with such an extraction, cannot sufficiently remedy to all that. A transposition of the definitions and principles which form the nucleus of MRC, in *mathematical* terms, would re-produce the essence of MRC in a still more unambiguously defined form, a more synthetic form, more purified of uncontrolled philosophical harmonics. It would also open up the possibility of calculatory treatments.

On the other hand, the full content conveyed by the verbal presentation should be kept in mind : it certainly points best toward the whole wealth of the singular conceptual being symbolized «MRC» which, like any singular designatum, escapes an*y* sort of language, but, if touched and grasped by the mind in prolongation of a "direction" of thought well materialized by associations of words from current language, acts as a guide and a fertiliser of the process of understanding.

Preliminary summarizing

The first target of a mathematical expression is a re-expression of the skeleton of the nucleus of MRC. So we begin by extracting this skeleton.

Imagine a consciousness functioning CF in interaction with the reality R.

- This interaction induces inside CF epistemic *aims* that generate there the conception of corresponding epistemic referentials, i.e. *a priori* non restricted pairings (G, V_g) or (G, V).

- The epistemic aim synthesized by (G, V_g) (or (G, V)) leads to a first epistemic *action*, namely of G upon the corresponding "spot" R_G from R, that generates out of R

the object-entity $œ_G$, thereby contributing to the content of an *evolving* set of object-entities.

      - Consider now the definition D7 of mutual existence of G and V_g (or V). If G and V_g (or V) do not mutually exist in the sense of D7, then the *a priori* pairing (G,V_g) or (G,V) must be *a posteriori* dismissed ; but if G and V_g (or V) *do* not mutually exist in the sense of D7, then the action of V_g (or V), upon $œ_G$ – to be accomplished accordingly to the principles P8 and P10 and to the proposition π11, when time is involved – produces observable results.

      - Concerning these results consider now the condition of *stability* from D.14.1 (cf. also π12 and π13). If this condition does not obtain, neither on the individual level of description nor on the probabilistic one, then the *a priori* pairing (G,V_g) or (G,V) must be *a posteriori* dismissed, eventhough it has resisted the first test D7 of mutual existence. But if the condition of stability does obtain either on the individual level of description or on the probabilistic one, then hierarchical chains of relative descriptions $D^{(n)}/G^{(n)},œ_G^{(n)},V^{(n)}/$, n=0,1,2,... involving (G,V_g) or (G,V) can be constructed accordingly to the principle of separation P15, the concept D16 of metadescription, and to the concepts D19 of intrinsic metaconceptualization ; these enrich the content of an *evolving* net of chains of relative descriptions.

      This is the whole essence of the skeleton of MRC.

Mathematical framework in terms of the theory of categories

      We seek now a mathematical representation of the skeleton of MRC. It is crucial to begin by making use of the weakest possible mathematical structure, i.e. which introduces a minimum of formal restrictions not stemming from MRC itself. Only in this way can it be hoped to avoid a too amputating transposition of the content of the verbal presentation. Too often the formalizations, and in particular the mathematical ones, amputate under cover of insuring "generality". Later it will be useful to specify *local* restrictions in order to characterize particular types of MRC-conceptualizations (logical, probabilistic, this or that sort of theory). But the general framework has to be maximally comprehensive. No pre-existing mathematical structure, I think, can yield a fully satisfactory formal expression of MRC. This is so because of the very peculiar character of the basic descriptions (D14.3.1 and D14.3.2) which introduce explicitly into the

representation features reflecting fragments of as yet non conceptualized factuality. But the theory of categories seems to be a good candidate for just a start. So we remind briefly of the basic definitions from the theory of categories.

Consider the concept of category (Encyclopedia Universalis Vol. 3, France S.A. 1976, p. 1057) (my translation, where also the notations are correspondingly translated : instead of Fl (flèche) we write Ar (arrow), etc. ; these notations, of course, can be optimized later) :

«A category C consists of the specification of :

a) a class Ob(C) of *objects*, and a class Ar(C) of *arrows* ;

b) two applications s and t from Ar(C) into Ob(C) (for any pair (A,B) of objects one denotes by Hom(A,B) the class of arrows f having the *source* s(f)=A and the *target* t(f)=B; if f∈Hom(A,B) one writes f : A→B, or A→B :

c) an application that associates to any pair (g,f) of composable arrows, i.e. such that   s(g)=t(f), a composed arrow denoted g∘f or gf, with source s(f) and target t(g).

The concepts thus defined being subjected to the two following axioms :

(C.1) For any object A there exists a unit arrow 1_A : A→A such that 1_A∘f=f and g∘1_A=g, for any arrow f with target A and any arrow g with source A ;

(C.2) If f : A→B, g : B→C and h : C→D, then (hg)f=h(gf)

The mathematical structures (sets, groups, topological spaces, etc.) are usually endowed with morphisms (applications, homomorphisms, continuous applications, etc.) and they determine categories (Set, Top., etc.) whose objects are the structured sets and whose arrows are the morphisms ; the source and the target of a morphism are here, respectively, the starting set and the arrival set of the morphism. One immediately obtains categories that are not of the preceding type, *via* formal constructions like the following ones : if C_1 and C_2 are two categories, the product category C_1xC_2 has as objects the pairs formed with an object from C_1 and an object from C_2, the arrows with source (A_1,A_2) and target (B_1,B_2) being the pairs (f_1,f_2) where f_1 : A_1→B_1 and f_2 : A_2→B_2. The dual category corresponding to a category C* is obtained by «reversing» the direction of the arrows from C.

If C and C' are two categories, a functor F from C into C' associates to any object A from C an object F(A) from C', and to any arrow f : A→B, an arrow F(f) : F(A)→F(B) such that :

(F.1) for any object A from C, $F(1_A)=1_{F(A)}$.

(F.2) if (g,f) are composable in C, F(gf) = F(g)F(f)».

C_{MRC}

Preliminaries. We shall now try to represent the skeleton of MRC, in the terms of the theory of categories. So we shall introduce a category denoted C_{MRC}. This is *not* attempted under the constraints of the theory of models. Indeed in consequence of the primordial role assigned in it to the consciousness functioning, MRC has a strongly *teleological* character. Furthermore, because the transferred descriptions root it into pure factuality, *beneath* language, MRC also has a basically *intensive* character, namely an actively created and relative intensive character. Whereas nowadays semantics takes its start *on* the level of languages and of classical logic, so it incorporates the assumption of pre-existing and absolute object-entities and predicates, and its difficulties are well-known : an intensive semantics is not yet accomplished, even the relations to be required between extensive and intensive semantic features are still very obscure. As for pragmatics as a discipline incorporating teleology, it is still very incipient. It would be at the same time hopeless and *pointless* to try to submit *a priori* an approach like MRC, to requirements induced by other still non-stabilized approaches that start from the current languages and from classical logic. On the contrary, it can be hoped that a free mathematical representation of MRC, as that one attempted below, if it succeeded, would help to build a deep-rooted and sound extensive-intensive pragmatical semantics.

Since C_{MRC} is attempted as a particular interpretation of the abstract concept of a category, the semantics associated with the involved objects and arrows will be given as much importance as the syntactical constraints imposed by the theory of categories.

$Ob(C_{MRC})$

The objects from the class $Ob(C_{MRC})$ are called *epistemic sites* (in short, sites) and are denoted S. A site is posited to designate a definite sort of conceptual ground – just a semantic receptacle similar to an axis in a graphic representation, or, more generally, to a multidimensional representation space – available for lodging inside it an evolving and unlimited content to which no general structure is pre-imposed (for the representation of

particular MRC-problems one can pre-impose a particularly adequate structure, for instance an order). This content, however, is required to have a nature consistent with the general definition of the considered semantic receptacle (to "fit" into it, as, for instance, the red of this flower or the dark of this cat do fit into the semantic dimension labelled by the word "colour", but not into that labelled by the word "form"). The most important feature of the content of a site is that it is not required as given from the start on (though it is permitted such) : in general it is conceived of as being created progressively and indefinitely.

The distinction itself between a stable pre-existing conceptual receptacle (a genus, an axis, a multidimensional conceptual space), and a corresponding sort of content of which any constituent or part can always be lodged inside this receptacle, indefinitely, at this or that definite "location" (specific difference, point), is by no means new. Quite on the contrary, more or less explicitly it underlies the whole classical organization of thought (linguistic, logical, mathematical ; it was already quite explicit for Aristotle), and it includes also the basic notion of a referential. But neither classical logic nor nowadays mathematics do represent in general and explicit terms the most complete possible process of *generation* of the content of a pre-posited conceptual receptacle, as specified in the concepts basic transferred descriptions and of subsequent intrinsic metaconceptualizations and modelizations. And very often this content is tacitly supposed to somehow be entirely "given" from the start on, to somehow pre-exist all done, "out there", in a Platonic manner. Only if *ab initio* this hypostatic view is systematically replaced by a genetic one, will it be possible to mimic in the terms of the theory of categories, the fundamental MRC-concepts of basic transferred description and of intrinsic metaconceptualization. This is why here a specific definition of the concept of "site" is needed.

The sites from $Ob(C_{MRC})$ are :

- S_R that represents formally the location of the evolving content of the reality R, as defined in D2 ;

- S_{CF} that represents formally the *location* of the evolving content of the consciousness-functioning CF, as defined in D1.

- $S_{œ}$ where have to be located all the *formal representations* of the object-entities $œ_G$ defined in D4, as these emerge ;

- S_D where have to be located all the *formal representations* of the relative descriptions $D/G,\text{œ}_G,V/$ (def. D14.1) or metadescriptions $D^{(n)}/G^{(n)},\text{œ}^{(n)},V^{(n)}/$, n=0,1,2,... (def. D16), as these emerge.

As already stressed, the explicit distinction between a permanent site determined by a static definition, and the (in general) evolving content located on this site, is quite essential for $Ob(C_{MRC})$. Furthermore, according to MRC it is necessary to posit explicitly that $S_R \supset [(Ob(C_{MRC})]$, which will induce *reflexive* features into the formalization [35].

In a future elaboration of particular MRC-problems, $S_\text{œ}$ and S_D will have to be assigned structures. $S_\text{œ}$ will have to become a mathematical space lodging in it an evolving content of some sort of specified mathematical beings (real or complex functions, kets, sequences of signs, etc.) generated one by one and in general independently of one another and offering a convenient representation of the considered sort of object-entities (for instance, in the particular case of the Hilbert-Dirac formulation of quantum mechanics $S_\text{œ}$ becomes the Hilbert space of state vectors). S_D will have to become another kind of mathematical space, lodging in it an evolving content of some other sort of mathematical beings, again generated one by one and in general independently of one another and representing conveniently the considered type of achieved descriptions (in the case of quantum mechanics S_D consists of the space of column-matrixes that represent any state vector in some given basis). These spaces will have to be endowed with general structures such that the formal behaviour of the elements from the space is tied with *physical* object-entities œ_G, when combined with the other elements of the mathematization, shall permit to reflect conveniently the space-time restrictions imposed by the principles P8 and P10, as well as the propositions $\pi11$, $\pi12$, $\pi13$. Moreover the two structures posited on $S_\text{œ}$ and S_D will have to be connected with one another consistently from both a mathematical and a semantic point of view. In order to reflect formally this or that particular class of object-entities and/or of descriptions, further more specific structural restrictions can be added.

$Ar(C_{MRC})$

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[35] Matthieu Amiguet, in a private communication, has made interesting suggestions in this respect.

Consider now the class of arrows, $Ar(C_{MRC})$. The arrows from this class will be called *epistemic arrows*.

Inside the theory of categories, given some category C, an arrow from $Ar(C)$ is currently conceived to represent an already constituted morphism that pre-exists in a Platonian manner. This sort of semantics, however is not coherent with our previous definition of $Ob(C_{MRC})$ as containing sites with evolving content. For consistency with the definitions from MRC and with our previous definition of $Ob(C_{MRC})$, any arrow from $Ar(C_{MRC})$ will be posited to represent a process of which the action is unlatched inside the source-site, at a definite "content-point" which in certain cases is itself created by that process, as its source-point; then the process develops in time (and sometimes in space-time) always ending by the creation at its head of a local contribution to the evolving content of the target-site. In this sense an C_{MRC}-arrow is posited as a *local genetic arrow*.

The epistemic arrows from $Ar(C_{MRC})$ themselves are generated inside the consciousness functioning CF *or by its **free choices***, in consequence of its interactions with the contents of S_R and with itself. So :

> Though it does not belong to $Ob(C_{MRC})$, the generic concept $Ar(C_{MRC})$ can be best described by making use again of the concept of site, a site bearing an evolving content of arrows.

The set of arrows $Ar(C_{MRC})$ can be split in two sub-classes of epistemic arrows, a sub-class of *primitive epistemic arrows* $PAr(C_{MRC})$, and a sub-class of *composed epistemic arrows* $\mathbf{C}Ar(C_{MRC})$.

PAr(C_{MRC}). The primitive epistemic arrows from $Ar(C_{MRC})$ are :

- *Data-arrows* d→ denoted d, with $s(d)=S_R$ and $t(d)=S_{CF}$ (so belonging to $Hom(S_R,S_{CF})$), that represent the generation of data inside CF, by the influx of data from the reality R.

- Endomorphic *aim-arrows*, of two kinds :

> *(Object-entity-generation-aim)-arrows* GA→ (in short GA) with $s(GA)=S_{CF}$ and $t(GA)=S_{CF}$ (so belonging to $Hom(S_{CF},S_{CF})$, that represent the process of constitution inside CF of the aim to know specifically about a somehow pre-figured sort of object-entity $œ_G$.

(Qualification-aim)-arrows or, in short, *view-aim-arrows*, of two kinds, $V_gA{\to}$ or $VA{\to}$, indistinctly short-noted VA, with $s(VA)=S_{CF}$ and $t(VA)=S_{CF}$ (so again belonging to $\text{Hom}(S_{CF},S_{CF})$, that represent the process of constitution inside CF of the aim to qualify (some object-entity) *via* an aspect-view V_g or, respectively, a view V.

- *Operational-arrows* of two kinds :

(Object-generation)-operational-arrows or, in short, *generation-arrows* $G{\to}$ (in short G) that represent the epistemic operations of *effective* generation of an object-entity. By definition $s(G)=S_R$ and $t(G)=S_{\text{œ}}$, so $G{\to}$ belongs to $\text{Hom}(S_R,S_{\text{œ}})$.

Qualification-operational-arrows of two kinds, *aspect-view arrows* $V_g{\to}$ or *view-arrows* $V{\to}$, indistinctly called *view-arrows* (in short V), with $s(V)=S_{\text{œ}}$ and $t(V)=S_D$ (so belonging to $\text{Hom}(S_{\text{œ}},S_D)$). The view-arrows represent the elaboration of relative descriptions by operations of qualification of an object-entity *via*, respectively, examination by an aspect-view or a view. Mind that a view-arrow $V{\to}$ represents *globally* all the processes of examination that establish the *one* corresponding relative description, so it has to be *constructed* from aspect-view-arrows $V_g{\to}$ by taking into account the proposition $\pi11$.

- *Aim-activating-arrows* $Aa{\to}$(in short Aa) of three kinds, that represent the passage (decided by the working consciousness functioning) from a given epistemic *aim*, to the corresponding effective epistemic *operation* :

(Generation-aim)-activating-arrows $GAa{\to}$(in short GAa) with $s(GAa)=S_{CF}$ and $t(GAa)=S_R$, so $GAa{\to}$belongs to $\text{Hom}(S_{CF},S_R)$;

(View-aim)-activating-arrows $VAa{\to}$(in short VAa) with $s(VAa)=S_{CF}$ and $t(VAa)=S_{\text{œ}}$, so $VAa{\to}$belongs to $\text{Hom}(S_{CF},S_{\text{œ}})$) ;

(Descriptional-aim)-activating-arrows $DAa{\to}$ (in short DAa), that just initiate *globally* the whole descriptional program involved in the choice of an epistemic referential. (An arrow $DA{\to}$ itself, a descriptional-aim-arrow, is a *composed* arrow and as such it will be defined below. Nevertheless the corresponding aim-*activating*-arrow $DAa{\to}$ is a monolithic primitive arrow with $s(DAa)=S_{CF}$ and $t(DAa)=S_{R\cap D}$, so $DAa{\to}$belongs to $\text{Hom}(S_{CF},S_{R\cap D})$ (we have $S_R{\supset}S_D$, so $t(DAa)$, being in S_D, is also in S_R).

- *The unit-arrows* required by the theory of categories for each site from C_{MRC} could be introduced as purely formal arrows. However it is obvious that a fully satisfactory MRC-interpretation of the theory of categories should endow each unit-arrow, with an adequate semantics. This might be possible but it might involve quite non trivial epistemological considerations. It might even lead to certain deep and rigorous explicitations concerning the reflexive features to be assigned to the sites from C_{MRC}. (For S_{CF} the role of unit-arrow could be assigned to each one of the already defined endomorphic aim-arrows, which arises a problem of choice). So, for the moment, we leave open the question of a meanigful definition of the unit arrows.

Before continuing with the sub-class of composed epistemic arrows, let us note the following. An epistemic referential (G,V) as defined in D6 can be now represented formally by the corresponding pair of operational arrows $(G\rightarrow,V\rightarrow)$. In order to represent formally the *a priori* possibility of any MRC-pairing (G,V), inside C_{MRC} any pairing $(G\rightarrow,V\rightarrow)$ will be permitted *a priori*. An observer-conceptor as defined in D6 can then be represented inside C_{MRC} by the association $[CF, (G\rightarrow,V\rightarrow)]$ between the evolving content CF of a site S_{CF} and the representation of an epistemic referential.

c *Ar(C_{MRC})*. The composed epistemic arrows from Ar(C_{MRC}) are :
- Given two aim-arrows GA$\rightarrow$ and VA$\rightarrow$, whatever they be, they are always composable in any order, since s(GA$\rightarrow$)=t(QA$\rightarrow$)=s(GA$\rightarrow$)=t(VA$\rightarrow$)=S_{CF}. However the MRC-semantics requires to take into consideration only the order GA$\rightarrow$oVA$\rightarrow$. So, denoting the result DA$\rightarrow$ (in short DA), we have with s(DA)=t(DA)=S_{CF}. We call it a *descriptional-aim-arrow* and we write

DA = DA$\rightarrow$ = GA$\rightarrow$oVA$\rightarrow$

> *This descriptional-aim-arrow DA$\rightarrow$=GA$\rightarrow$oVA$\rightarrow$, like a fragment of DNA, holds in it, still non-realized so still a-temporal, the whole descriptional program corresponding to the pairing (GA$\rightarrow$,VA$\rightarrow$), whether realizable or not [36].*

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[36] The *selection* - among all the syntactical possibilities offered by a formalism - of exclusively those that translate the *semantic* features to be represented, is unavoidable when an interpretation of a formal system is built. In particular the procedure is quite current throughout mathematical physics. (For instance, in a quantum mechanical problem of square potentials, the general solution of the differential equation of the

Given a pair of arrows $d\rightarrow$, $DA\rightarrow$, the composition, in this order, is always possible formally. But it is MRC-significant iff $DA\rightarrow$ corresponds to the content of data supposed to be carried by $d\rightarrow$ (this, being a fundamentally semantic matter, cannot be established formally). The composition will be taken into account only when it is meaningful. We then call it an *induction arrow*, we denote it ind.$DA\rightarrow$ (in short ind.DA), and we write

ind.$DA\rightarrow$ = $d\rightarrow_o DA\rightarrow$

$s(\text{ind.DA})=S_R$ and $t(\text{ind.DA})=S_{CF}$, which represents formally an induction of a descriptional aim from R into CF.

– Consider the representation $(G\rightarrow,V\rightarrow)$ of an epistemic referential. Formally the two operational arrows are always composable in this order. MRC also requires, for methodological reasons, to systematically admit the composability *a priori*, but to exclude it *a posteriori* if the condition D7 of mutual existence or the condition of individual or probabilistic stability involved by D14, appears not to obtain. So inside C_{MRC} we proceed as follows. First, systematically and tentatively, we do form the composition between $G\rightarrow$ and $V\rightarrow$, in this order, naming it a descriptional arrow $D\rightarrow$ (in short, D). Thus we write

$D\rightarrow$ = $G\rightarrow_o V\rightarrow$

with $s(D)=S_R$ and $t(D)=S_D$ (so belonging to $\text{Hom}(S_R,S_D)$). But if later it is found that no description arises because D7 or the condition of stability from D14 fails (which, being fundamentally a matter of semantics, cannot follow syntactically), then we cancel *a posteriori* the previously formed arrow $G\rightarrow_o V\rightarrow$ *and* the corresponding epistemic referential $(G\rightarrow, V\rightarrow)$. Any epistemic referential considered in what follows is supposed to have been found to satisfy both D7 and D14. The composed arrow $D\rightarrow=[G\rightarrow_o V\rightarrow]$ formed with such a "good" epistemic referential is the operational nucleus of C_{MRC}. It has to be constructed so as to yield a satisfactory formal expression of all the conditions

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problem offers exhaustively all the possible formal terms ; among these, those which have no physical correspondent in the data of the problem are dismissed, while the conserved expressions are specified as required by these data (limiting or initial conditions, etc.), which cannot follow syntactically. Another example can be found in Schrödinger's solution of the problem of a one dimensional harmonic oscillator where subtle and very constructed physical arguments are introduced in order to identify restrictions that are not imposed mathematically ; etc.).

relevant to the considered description, as required by D14 (so P10 and π11) as well as by (according to the case) P15, D16, D19 :

In consequence of P10 and π11, D$\rightarrow$ involves an (in general) non-commuting algebraic structure imposed upon the set of arrows V$\rightarrow$.

- Given an epistemic referential (G$\rightarrow$, V$\rightarrow$), the following corresponding composition, called a *complete-description-arrow* (in short CD) is always possible and significant :

$$CD\rightarrow = CD = d\rightarrow_o DA\rightarrow_o DAa\rightarrow_o G\rightarrow_o V\rightarrow = indDA\rightarrow_o DAa\rightarrow_o G\rightarrow_o V\rightarrow$$

with $s(CD)=S_R$ and $t(CD)=S_D$ (so belonging to $Hom(S_R,S_D)$). Which reeds : data from the reality R induce a descriptional aim into the consciousness functioning, this is activated, and so first an object-entity is generated out of R (which brings on the site of object-entities) and then this object-entity is qualified, whereby a description is obtained (which brings on the site of descriptions). The explicit "sites-trajectory" of a complete descriptional process arrow CDP$\rightarrow$ is

$$S_R\text{-}S_{CF}\text{-}S_{CF}\text{-}S_{CF}\text{-}S_R\text{-}S_{\text{œ}}\text{-}S_D.$$

The triplet $S_{CF}\text{-}S_{CF}\text{-}S_{CF}$ expresses satisfactorily the dominant role of the consciousness functioning in a descriptional process.
- Other compositions also are permitted by the introduced definitions (for instance GAa$\rightarrow_o$G$\rightarrow$, VAa$\rightarrow_o$V$\rightarrow$, etc.). But it seems not necessary to examine them exhaustively.

Notice that the MRC-definition D2 of reality requires to extend now the previous assumption $S_R \supset [(Ob(C_{MRC})]$ by positing explicitly $S_R \supset [(Ob(C_{MRC})+Ar(C_{MRC})]$.

The axioms C1 and C2
They seem to raise no problems.

Representation of the evolving contents of the C_{MRC}-sites
The theory of categories does not specify a general modality for expressing individualizations *inside* an object from Ob(C), as being the source or the target of an

arrow tied with that object. While MRC involves such individualizations quite essentially. So we construct the necessary individualizations as follows.

We consider only the operational arrows $G \rightarrow$ and $V_g \rightarrow$ that form the hard core of C_{MRC}. This will suffice.

Each arrow $G \rightarrow$ can be labelled by a pair of indexes $(R_G, \text{œ}_G)$ defining respectively its local start inside S_R (by the "spot" R_G where G has to be applied (D4)) and the element œ_G from the evolving set $\{\text{œ}\}$ that constitutes the content of $S_{\text{œ}}$ by the creation of which the considered $G \rightarrow$ arrow ends. So for each definite arrow $G \rightarrow$ we shall write $(R_G, \text{œ}_G) \rightarrow$, which distinguishes it from any other arrow $G \rightarrow$. Thereby the set $\{(R_G, \text{œ}_G) \rightarrow\}$ associated to the generation arrows $G \rightarrow$, itself also an evolving set, is now *connected with the evolving inner contents of the two sites S_R and $S_{\text{œ}}$* represented, respectively, by the evolving sets $\{ R_G \}$ and $\{\text{œ}_G\}$. This connection can be then organized more by putting mutually compatible structures on the sets $\{R_G\}$, $\{\text{œ}_G\}$ and $\{(R_G, \text{œ}_G) \rightarrow\}$ (physical operations of object-entity generation are subject to the frame-principle P8, which requires a convenient extension of the principle P10 of mutual exclusion, to operations of object-entity generation also).

Mutuatis mutandis one can connect in a similar way each definite processual arrow $V_g \rightarrow$, with a "pair" of indexes $(\text{œ}_G, \{gk\})$, k=1,2,..., by re-writing $(\text{œ}_G, \{gk\}) \rightarrow$, k=1,2,... where k takes on a unique value if the attempted descriptional process reveals an individual stability, or a whole set of different values if it reveals a probabilistic stability ((D5.1), $\pi 12$, $\pi 13$, D14). In $(\text{œ}_G, \{gk\})$ the index œ_G defines the element from the discrete evolving content of the source-site $S_{\text{œ}}$ where $(\text{œ}_G, \{gk\}) \rightarrow$ begins, and $\{gk\}$, k=1,2,... defines the element from the discrete evolving content of S_D by the creation of which $(\text{œ}_G, \{gk\}) \rightarrow$ ends. So the (evolving) set $\{(\text{œ}_G, \{gk\}) \rightarrow\}$ of aspect-view arrows is connected with the evolving content of the sites $S_{\text{œ}}$ and S_D, expressed respectively by the sets $\{\text{œ}_G\}$ and $\{gk\}$ (where $\{gk\}$, k=1,2,..., g fixed, amounts to the description of œ_G *via* V_g, which is an element from $\{D\}$). The connection between the evolving sets $\{\text{œ}_G\}$, $\{(\text{œ}_G, \{gk\}) \rightarrow\}$ and $\{D\}$ can be then organized more, by putting on these sets mutually compatible structures obeying all the MRC-requirements and furthermore conveniently reflecting the particular considered class of descriptional processes (the nature presupposed for the object-entities and the aspect-view-examinations).

The procedure can be extended to the class of arrows $V \rightarrow$: in consequence of D5.2 each *definite* $V \rightarrow$ arrow is a *set* of arrows $\{(\text{œ}_G, \{gk\}) \rightarrow, k=1,2,...\}$, g=1,2,...m, m finite.

Then a relative description D/G,œ$_G$,V/ from MRC becomes in C$_{MRC}$. a complete-description-arrow   [CD$\rightarrow$=CD=d$\rightarrow$oDA$\rightarrow$oDAa$\rightarrow$oG$\rightarrow$oV$\rightarrow$]   where   G$\rightarrow$oV$\rightarrow$ is indexed:

   $(R_G, \text{œ}_G) \rightarrow$ o $(\text{œ}_G, \{gk\}) \rightarrow$,   k=1,2,...},   g=1,2,...m,   m finite

C$_{MRC}$ *versus quantum mechanics*

We consider the Hilbert-Dirac formalism of quantum mechanics. The Hilbert-space H of the state-ket-vectors $|\psi>$ of the studied microsystem corresponds to the C$_{MRC}$-site S$_\text{œ}$ where are lodged mathematical representations of the considered class of object-entities. The set $\{|\psi>\}$ of state-ket-vectors $|\psi>$ from H corresponds to the evolving set $\{\text{œ}_G\}$ from S$_\text{œ}$. *The vector-space structure assigned in quantum mechanics to $\{|\psi>\}$ is a particular feature entailed by the principle of superposition posited for quantum states, a principle justified by the **wave-like** features manifested by what is called quantum state*s. So *in general* such a structure has no semantical counterpart, so it will have to be dropped.

> *The C$_{MRC}$ generation arrows $(R_G, \text{œ}_G) \rightarrow$ have no **general** correspondent in the quantum mechanical formalism : they are represented only in the particular case of microstate-generation by a measurement process.*

This is a striking lacuna (which is suppressed in meta[quantum mechanics)].

The quantum mechanical (in general) non-commuting linear differential "dynamical" operators defined on H correspond to the C$_{MRC}$-aspect-view arrows $(\text{œ}_G, \{gk\}) \rightarrow$, k=1,2,....

The quantum mechanical representation of a state-ket $|\psi>$ with respect to the basis of eigenvectors introduced by a given quantum mechanical operator A, namely as a column-matrix of which the elements are calculated with the help of $|\psi>$ and the considered eigenvectors, corresponds to a *basic transferred* description D$^{(o)}$/G$^{(o)}$,œ$^{(o)}$,V$_g^{(o)}$/ from S$_D$ created for a basic object-entity œ$^{(o)}$ by a basic aspect-view-arrow $(\text{œ}_G, \{gk\}) \rightarrow$, k=1,2,.... (that can be re-written $(\text{œ}^{(o)}, \{gk^{(o)}\}) \rightarrow$, k=1,2,....).

The set of all the column-matrix representations of a given state-ket |ψ> with respect to all the bases of eigenvectors introduced by all the quantum mechanical dynamical operators, corresponds in C_{MRC} to a complete-description-arrow

$$CD\rightarrow=CD=d\rightarrow_o DA\rightarrow_o DAa\rightarrow_o G\rightarrow_o V\rightarrow$$

(with $G\rightarrow_o V\rightarrow$ indexed : $(R_G, \text{œ}_G)\rightarrow_o(\text{œ}_G, \{gk\})\rightarrow$, k=1,2,...}, g=1,2,...m, m finite).

So it will be possible to attempt a systematic transposition of the Hilbert-Dirac formulation of quantum mechanics, in terms of the theory of categories, *via* MRC with its central concept of basic transferred description.

It is of course obvious from the start on that the explicit C_{MRC}-representations of reality and of the consciousness-functionings have no correspondent in quantum mechanics where not even the actions of object-entity generation are represented mathematically, nor are they at least conceptually and verbally clearly distinguished from the *qualifying* actions *via* measurements. By comparison with C_{MRC} quantum mechanics appears as flawed by very flattening lacunae.

Nevertheless, once the main relations C_{MRC}-(quantum mechanics) have been established, the quantum mechanical formalism becomes a precious guide for a subsequent development of C_{MRC} (any non-necessary restriction suggested by the – particular – case of quantum mechanics having to be carefully avoided). One first important step in the mentioned direction will be the identification of the individualized *MRC-meaning* of Dirac's dual space of linear functionals defined on the Hilbert space of state-ket-vectors, and of the various sorts of scalar products from the Hilbert-Dirac formulation of quantum mechanics. Then the C_{MRC}-transposition of these, as well as the *individualized* C_{MRC}-transposition, will have to be conveniently achieved.

Concluding comment on C_{MRC}

The outline indicated above needs development. For instance, the condition $S_R \supset [(Ob(C_{MRC})+Ar(C_{MRC})]$ imposed by MRC entails reflexive characters that might raise difficult syntactical problems connected with the definition of the categorial concept of a sub-object. The postulate, the principles and the propositions from MRC must systematically acquire inside C_{MRC} mathematical expressions, and the MRC-propositions should furthermore acquire mathematical proofs. Etc.

V. ILLUSTRATIONS OF THE FUNCTIONING OF MRC

In this section we illustrate by examples the functioning of MRC, thereby also developing the method. We shall first consider logic and then probabilities.

V.1. Classical Logic [37] *versus* the MRC-logic of Relative Classes of Cognitive Actions

Because logic is so particularly important when a method of conceptualization is proposed, we shall, by a brief sequence of remarks, try to convey a notion concerning the relations, and the gap, between MRC and classical logic. We shall then very briefly indicate along what lines an MRC-logic can be constructed and what novelties it introduces. It will appear that the MRC-logic achieves an explicit connection between physical factuality and formal structure, and that it disconnects the question of the consistency of a formal system, from the question of decidability (completeness) considered in Gödel's basic theorem, on which it yields a different perspective.

V.1.1. Critical remarks on Frege's basic definitions

Insufficiencies of the concept of Frege-class of a predicate

The logic of classes and predicates has first been developed by Frege. The starting remark is that a predicate "determines" a class of objects, namely those that partake of the meaning (sense, comprehension) of the considered predicate and hence constitute its extension. In order to identify these objects, first *(a)* it is remarked that a predicate, by itself, is neither true nor false, but that *(b)* its assertion concerning a given object-entity *can* be true or false *if* the predicate is "pertinent" concerning this object-entity. Then *(c)* for each predicate P a propositional function $f_P(x)$ is introduced where f_P represents the predicate and x is an *object-variable* :

«The expressions which .....include letters **'x'**, **'y'**, **'z'**, and are such that they become true or false propositions as soon as the objects designated by these letters are specified, are called propositional functions (J-B. Grize, ref. 10, p. 150)».

And *(d)* it is posited by definition that ***any*** *value of the object-variable x* for which $f_P(x)$ is *true*, belongs to the class determined by P. In short :

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[37] Grize J-B., (1967) *Logique des classes et des propositions*, dans *Logique et Connaissance Scientifique*, Encyclopédie de la Pléiade, Gallimard.

The class of P is the set of values of the object-variable x for which $f_P(x)$ is true.

From the standpoint of MRC these very first steps call forth already the following remarks.

* In the first place, we are in presence of a qualification [38] of an object-entity – «the class of P» – of which the generator G is of a particular and so a restrictive type, namely a "generator G(V) of a view V" (cf. final general comments on D14 and V.1.2) : V is supposed to act first in the role of a generator G(V) that selects as object-entity the whole field of perceptibility of V ("any value of an object-variable..."), and then it furthermore acts in the role of a view, by qualifying isolately the "values of the object-variable" from this field of perceptibility, but qualifying them from inside the metapredicate "P is true" (cf. the sequel). This very particular sort G(V) of generator of object-entity produces either conceptual object-entities – i.e. already previously achieved descriptions – or basic object-entities that transfer directly on the sensitive biological apparatuses of the human beings, marks called "impressions", without being (notably) changed thereby. It has been already remarked that this last sort of cognitive situation produces basic transferred descriptions that are spontaneously and implicitly metaconceptualized during the very first period of a man's life, and are reduced to intrinsic models (D19.3) that seem to pre-exist independently of observation, "out there", available for examinations of [truths of P's].

Both sorts of descriptions mentioned above, perpetuate a full ignorance of the rooting of conceptualization, in physical factuality.

* In the second place, the qualification «x is P» and the metaqualification of empirical truth of this first qualification, are combined in a sort of coalescence where fundamental MRC-conditions get lost. Indeed from the point of view of MRC the qualification «x is P» is just a piece of meaning, no matter whether true or false, and possibly not even that, if *a posteriori* it reveals no descriptional stability or if it appears that no view of empirical truth can be constructed which exist in the sense of D7 with respect to the assertion «x is P». Whereas in Frege's approach such reservations are

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[38] I say "qualification", *not* "description", because no condition of stability of the qualificational result with respect to repetitions of the process of qualification, is required here, as it is in the set of all the definitions D14, starting with D14.1 (with the unique exception of relative testimonies D14.2.2) (cf. the comments on the generalization of D14.1).

totally absent. Moreover the qualification «x is P» is first introduced in a quasi subliminal way, and then it comes into stable being together with, and indistinctly from the metaqualification «it is true (or false) that (x is P)». This conveys the illusory assumption that a truth-qualification is always possible for any qualification «x is P», whatever its semantic content. Which of course is not the case, as Tarski claimed much later («the snow is white » is true iff the snow is white).

* In the third place, the involved predicate P, considered separately, is neither endowed with some structure, nor is it subjected to any conditions of effectivity of the examination which P is supposed to perform on x : a sort of ghost-predicate (compare with an aspect-view D5.1 or a view D5.2). Furthermore, as just mentioned, the so feebly formed significance of what is called a predicate P is immediately dissolved in the metapredicate of [truth of P]. While for the metapredicate of [truth of P], again, no structure whatever is specified, nor some condition of relative existence and of effectivity.

In sum, on the one hand, a predicate P and its truth qualifications are assigned the fundamental logical role of producing always, automatically, a proposition, i.e. the tentative assertion of a description, that can be found, *via* some definite procedure, to be true or false. But on the other hand :

> The classical predicates "P" are reduced to no more than shadows of *undefined* intensive extracts from factuality, just verbal labels which, while they are hypostatized, are also smuggled away by an immediate translation in terms of a purely extensive domain of correlates "x" inside the realm of object-entities on which they act, this correlation being subjected to another *undefined* meta-intension called truth. A vague but dense knot.

* Consider now the «values of x» in general – not only those selected in «classes of P» – and notice that these are the equivalents of MRC-object-entities $œ_G$. Now, no genesis whatever is specified for the «values of x». They are simply posited to always be "out there", passively waiting to fall inside the field of perceptibility of the predicates P.

> ***Classical logic implies in its foundations a hypothesis of universal actuality***. *The Boolean algebra of classes and predicates is constructed for the already actualized.*

(This, by isomorphy, holds also concerning the nowadays set-calculus on which classical mathematics are founded). Fundamentally, the modal dimension of existence (not to be identified with the "logical" modalities of necessity or possibility) along which potential existence is transformed into actualities by processes of actualization, remains exterior to the classical calculus of classes and predicates. When needed, this dimension has to be superposed by *a posteriori* manipulations. This is not disturbing in the usual language where everything is plethoric, contextual, minimally structured, which for the specific aims of current language is optimal. But in a fundamental formalized representation of thought operations, like logic, the absence of the modal dimension of existence is an imprisoning poverty comparable to what the absence of techniques for the representation of perspective must have been in painting. Only addiction to the traditional methods can hinder to perceive to what a degree such a lacuna is amputating, and that, in particular, it is an obstacle in the way of a basic and explicit connection of logic, to conceptual geneses, to aims (finality), to praxis.

 * The fact that no genesis is specified for the «values of x» (the MRC-object-entities œ$_G$) has also another consequence, a radical one :

The generators G of the object-entities œ$_G$ themselves (not the generators P of the [classes of some P]) are simply not considered.

This absence of an explicitly defined object-entity generator G, *and* required to be in general independent of any qualification and permitted to be physical-operational, restricts *a priori* and arbitrarily the domain of object-entities to which the classical logic can be applied :

In classical logic all the basic physical object-entities that have to be first generated by deliberate physical operations of object-entity-generation, independently of any subsequent qualification, and then might have to be transformed in order to draw from them observable manifestations, are simply eliminated from consideration *a priori*. Indeed "predicates", i.e. linguistic-conceptual qualificators, cannot "determine classes" among *basic* object-entities in the sense of MRC. They cannot act upon such only factually singularized object-entities, *because they are not homogeneous in nature with these.*

Since the cognitive situation tied with basic physical object-entities, however, is endowed with a certain universality of principle (III.3), we are in presence here of a huge arbitrary amputation. Namely the massive amputation of the whole stratum of conceptualization where the structure of its rooting in physical factuality is specified. In such conditions one can, in particular, well understand why, for classical rationality, quantum mechanics seems unintelligible. Indeed one of the fundamental features of quantum mechanics is precisely the liberation (in general) of any view, of the operation of generation of object-entity. And it is by this liberation that MRC transpierces the armoured platform of language and succeeds to build a representation of the processes of conceptualization that is rooted in physical factuality. But, and this comes as a surprise, not *exclusively* basic physical object-entities are eliminated because the object-entity generators are not explicitly considered. All the *conceptual* entities which are first constructed independently of any qualification and are only afterwards qualified – like many mathematical systems and formal systems of logic itself ! – are equally eliminated. This leads to *false* problems, and to enormous unnecessary efforts to solve them (V.1.2). An amputation of such an extent, and which concerns logic itself, is not acceptable in a fundamental discipline like logic.

Let us make now a second step. By definition :

Two classes of object-entities α and β are *equal* iff all the elements of α are elements of β and vice versa (iff α and β hold the same elements).

Two propositional functions f_α et f_β that determine two classes α and β are *equivalent* if the classes α and β are equal (cf. op. cit., in continuation) [39].

This calls forth a new critical remark.

* How can one know, for instance, whether yes or not for any value of an x for which it is true that it is red, it is equally true that it is spherical ? It is implicitly supposed that the answer to such questions can always be given. But this supposition is founded upon the same restrictive hypothesis identified above that any value of any object-variable x pre-exists out there, already accomplished, ready to be pointed toward with

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[39] Hervé Barreau remarked that precisely these definitions have already been the object of basic criticisms opposed to Frege's logic. This might somehow be related to the remarks that follow in the main text. However here Frege's approach is examined exclusively by confrontation with MRC, and on a level of principle where technical features do not appear.

one's finger, certainly available for examination *via* the metapredicate [truth of P's], equally always available. But this time it is furthermore implied that a P-examination of a value of an x *never* changes the considered value of that x : if it did, *this* value of the considered x, after having been examined by P$\equiv\alpha$, would in general *cease* to stay available for an examination also by P$\equiv\beta$. Thereby, again but otherwise, are eliminated all the basic transferred descriptions that are so deeply rooted in physical factuality that they have to be changed in order draw from them observable manifestations. Now, in the constructive outline from V.1.2 it will be shown that the basic descriptions, precisely because in general they have to allow for changes of the involved basic object-entity during its processes of qualification, entail certain consequences of strict physical singularity, on logical *form*. But when the rooting of logic in the as yet unknown physical factuality is obtruded, these consequences remain hidden with it, which restricts *a priori* our perception of logical form, to exclusively its plural, statistical aspects.

* This radical occultation, in classical logic, of the features tied with strict physical individuality, is what permitted to claim that logic *is* just formal structure ; more, to *require* logic, for the sake of "maximal generality", to be a "pure" syntax, freed of any intension, cut from any semantic matter.

But in fact this severance is illusory. It has been possible to imagine it to be realizable precisely because the way in which unspeakable factuality loaded with semantic potentialities is drawn into descriptions at each local relative zero-point of a descriptional chain, remained so completely ignored. As soon as one becomes aware that any local zero-point contributing to the foundation of descriptional chains, consists of a (more or less canonical) *transferred* description, the illusion of the possibility of a complete elimination from a syntax, of any semantic content, is dissolved. It becomes clear that any syntax stems from numerous bulks of physical factuality, which is the prime matter for phenomenal appearances. It is out of these bulks that are drawn the observable manifestations of which the phenomenal appearances consist, while the whole conceptualization is founded on phenomenal appearances. Through these phenomenal appearances, semantic matter goes over into language-and-conceptualization, by primary codings, and then it irrepressibly diffuses up into all the levels of abstraction and complexification. Language is a circulatory-system *for* factual, semantizable prime matter. It emerged and got form in *order* to carry from mind to mind information about factuality, about semantics. If this were not so the societies of men would not have lasted.

They would not even have started being. Our minds work with intensions. These, adduced inside language by the roots of language, have then osmotically impregnated with semantic contents all the levels of abstraction. So, unavoidably, they have infused into logic also, where they generate its natural forms [40], those which, more or less implicitly, command in real circumstances our choices, methods, and actions. If on the other hand in the theoretical formalized logic any connection between syntactical form and semantic content is first refused, this instils there by reaction lacunae and awkward features as well as difficult fictitious problems, like for instance those of the *a posteriori* connectivity of modern formal logic with modern semantics. (Try to first design *in abstracto* the human circulatory system, strictly without using as a guide the condition that *blood* has to circulate in it in *such* a way as to nourish every tiny volume of living tissue : what is the chance afterward to find the natural scheme ?).

Critics on the classical logical void Ø : the semantic relativities of Ø

A trivial but striking example of the way in which ignorance of semantic aspects induces syntactic insufficiencies, is that of equality of all the void classes.

In consequence of the extensive (set-theoretic) definition of the class determined by a predicate, all the void classes are equal because they all contain "the same element", namely the null element Ø. So, if it is true that no immortal man exists, and it is equally true that no symphony shorter than one minute exists, then the class of immortal men and that of symphonies shorter than one minute, are equal. This argument induces a feeling of artifice, of twisting of what one would be prepared to accept as "meaningful". One feels a gliding. The trajectory of this gliding can be retraced :

When one wants to determine quantity, extension, number of elements, starting from only the quality – the predicate – that qualifies, a ground for ambiguity is surreptitiously inserted. So long that a class in the sense of Frege is not void, the quality specific of this class – that one expressed by the predicate P that determines the class – is present, it is held by each element of the class. But at the limit where the class becomes void, the specific quality P that characterizes the class is discontinuously transmuted into pure, qualitatively indistinct quantity, into a purely numerical zero. This transmutation has been instilled as follows. The mathematicians, when they defined the number zero, in fact have extrapolated into nothingness a certain quality, namely the degree of

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[40] Cf. note 34.

"numericity" N of any (finite) number, so the predicate P'≡N of which mathematics studies the manifestations *via* the object-entities called "numbers", of which a quite general property is to be able to "measure", to quantify. It is the prolongation into material nothingness of numericity, of this particular predicate P'≡N, which, by definition, has been called "the number zero". Whereas the logicians, while they make use of numbers in order to measure by use of P'≡N the quantity of supports of a given quality P≠P' – this time *any* quality P whatever, any predicate –, did *not* take care to prolong into nothingness *also* this quality P, in order to dispose of a veil of quality P, specifically, to be co-extended, together with the mathematician's zero-of-numericity, over the void encountered at the limit where the *quantity of carriers* of this quality P comes to an end. So at that limit they are left with only a zero-of-numericity, uncovered, stripped of quality P. While the other numbers of carriers, 5, 100, etc., were *all* tied with also the quality P characteristic of the considered class : at this limiting point, the conservation of the way of representing a class breaks down, a *solution of continuity* inside the way of representing a class has been surreptitiously introduced. This is a heavy methodological error, comparable, for instance, to a dimensional inhomogeneity inside an equation. The non homogeneity of conceptual treatment inside a closed conceptual system is always the source of very slippery problems. Any two void classes are considered to be "equal" on the basis of a purely *extensive* estimation of the null content of a concept that has been first characterized in an exclusively *intensive* way, even if this characterization possessed also an extensive counterpart : a predicate P is *only* quality, and, by definition, it is P *alone* that determines the corresponding class f_P, not also the quantity of carriers of the quality P. It is then inconsistent, if one distinguishes clearly between quality and [quantity of supports of this quality] (between views V and object-entities $œ_G$ that exist in the sense of D7 with respect to this view), to permit the *defining* quality to disappear "because" all its *supports* disappeared, while *the class itself, defined by the quality, is still maintained*. The predicate P that defines the class f_P should subsist with the class, in spite of the vanishing-support-of-quality-P, i.e. when the set of numbers that label the supports reduces to the number 0. It is inconstant to end up in such a materialist idolatrous manner when one has begun by adoring an abstract God. One should act like the mathematicians, or like Lewis Carrol who leaves us with smile-of-cat-without-cat when the smiling-cat vanishes completely.

The logical void Ø – which is an element of the "purely" syntactical system called the classical logic of classes and predicates – is subjected to *semantic relativities* that require *a **specific** syntactical expression* : the asserted possibility of a radical separation between syntaxis and semantics is obviously contradicted in the case of the logical void.

Ferdinand Gonseth said that «logic is the physics of any object». But any given object has some semantic content, and the types of semantic content have to be mutually distinguished in a thoroughly worked out formal representation of safe derivational vehiculations of our knowledge concerning empirical truth-valuations involving "any" object.

Global critical conclusion

The classical logic of classes and predicates, which founds the whole modern classical logic, floats above language, inside the stratum of the already pre-verbalized-conceptualized. The rooting of the processes of conceptualization, in physical factuality, the creative cognitive actions which produce object-entities and qualificators of these, the modal dimension of existence, remain hidden to it. By occultation of the genetic stages from the processes of conceptualization and by substitution to these of false hypostatizing absolutizations, it introduces arbitrarily restricted conceptual platforms that cannot withstand artificial and inadequate formal representations.

Only when all the involved descriptional geneses, with the descriptional relativities entailed by them, are explicitly taken into account, is it possible to dominate from a formal point of view any descriptional situation, whatever its complexity. This can be better understood *per a contrario* and on examples.

For instance, inside MRC where any descriptional relativity is taken into account explicitly as soon as it comes into play, the treatment of the logical void is preorganized in consequence of the way in which the very first levels of general conceptualization are structured. As soon as one considers an (independently defined) object-entity $œ_G$ and a view V (D4 and D5), the test of their mutual existence in the sense of D7 is methodologically required, *before* trying to perform the corresponding relative description. If this test is negative one finds oneself precisely in the case that can be designated as «the void class determined by V inside the set of object-entities $œ_G$», which

means «absence of object-entities $œ_G$ admitting of the qualification V», i.e. absence of the possibility of a meaning generated by the pair (G,V). So a conceptual void, doubly relativized to the semantic features involved by the considered pair (G,V), comes into being *ab initio*. Later, once the possibility of meaning has been insured by mutual existence in the sense of D7 and then a first descriptional level has been insured by the existence of some stability of the qualifications in the sense of D14.1, comes furthermore into consideration, in its turn, the question of empirical truth : given an already achieved description in the sense of one of the definitions D14, is this description a proposition, i.e. does a it exist in the sense of D7 with respect to some view of empirical truth that can be effectively exhibited ? The still higher and more particular level of "logical" characterizations concerns object-entities consisting of systems of propositions. A proposition from a formal system of propositions S, can be described by the logical views of provability inside S of decidability inside S, while the system itself considered as a whole can be examined by the logical views of completeness and of formal consistency. All the mentioned sorts of logical description are related with the previously developed relativized conceptual-semantic voids. Indeed these *entail* the definibility of syntactical, calculational relativized voids (V.1.2) and thus they go over into the logical descriptions. So in this specific case it is clear that, and how, inside MRC the semantic contents determine progressively aspects of logical form. And these, the calculational relativized logical voids, preserve from a whole category of false problems. Indeed the absolutization of the logical void is one of the most prolific sources of illusory problems. (Even in nowadays quantum logic there subsists much confusion concerning complementations tied with the logical void [41] (cf. also ref. 16 as well as V.1.2)).

When instead of a system of propositions, a formal system in the most abstract sense is considered, either any connection between semantics and syntax has deliberately been suppressed by the process of conceptualization (which is difficult) and then one obtains just a Wittgensteinian "game" that resists any non distorting and useful interpretation in terms of some domain of natural facts, or some connections between semantics and the constructed formal system have been deliberately preserved, and then precisely these insure possibilities of useful interpretations of this system.

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[41] Hadjisavvas N., Thieffine F., Mugur-Schächter M., (1980) *Study of Piron's System of Questions and Propositions*, Found. of Physics, Vol. 10, No 9/10.

The corpus of relativizations required by MRC does not only insure a controlled penetration of semantics into the logical descriptions, it also exerts another crucial sort of control which classical logic cannot exert systematically because of the artificial separation between semantics and syntax. Namely it insures automatically all the types of descriptional "homogeneity" consisting of the conservation of the method of representation inside a closed descriptional universe, i.e. throughout the work accomplished with a given epistemic referential. While the principle of separation P15 regulates the passages from one set of homogeneous descriptional contents, whatever their type, to another one. This is important. Indeed the creation of sense, in all its stages, is ruled by the implicit imposition of methodological principles of homogeneity : physical operations can change only physical entities, concepts can change only concepts and can be localized only inside nets of concepts; in an equation the semantic dimensions from the first member must be the same as the semantic dimensions from the second member; statistical-probabilistic qualifications do not exist in the sense of D7 with respect to individual events, nor with respect to only statistical distributions of events, they exist only with respect to statistical-probabilistic distributions of events ; and *vice versa*, individual qualifications do not exist in the sense of D7 with respect to statistical-probabilistic distributions, they are blind with respect to these; etc. When no matter which one among these various sorts of implicit principles of homogeneity is violated, paradoxes or false problems emerge. Inside MRC this is always expressed as a consequence of a violation of the principle of separation P15, i.e. of a non explicit modification of the epistemic referential which is made use of.

The false absolutizations that flaw the classical logic of classes and predicates have prolongations in many domains of modern science, in particular in the theory of sets. Indeed the elements of a set are always supposed to somehow pre-exist already realized, and this, just like in the definition of the equality of two classes and of the equivalence of two propositional functions, entails arbitrary *a priori* restrictions. But the most noteworthy consequence might consist of the fact that *classical logic, because of its lack of explicit connection with strictly singular physical factuality, remains unaware of the space-time specificities of the descriptions of natural physical object-entities*. This has favoured a surreptitious gliding

conceptualization→natural logic→formal logic→calculus→computation

whereby, in computational simulations of physical processes, understanding disappears into mere doing.

V.1.2. Outline of an MRC relativized genetic logic

The preceding critical considerations entail by contrast a constructive approach of which what follows conveys only an extremely synthetic notion. The aim is, inside MRC, to explicate the consequences upon logical descriptions, of the relativization to the cognitive actions from which these logical descriptions stem, so also to the semantic contents introduced by these cognitive actions. The main step is the introduction of the concept of genetic class.

Double extremity genetic classes

Let us recall that inside MRC what is called "object-entity" is just a descriptional role (final comment on the general concept D14 of a relative description). No entity never pre-exists *as an object-entity*. It always has to be introduced in the role of object-entity by the explicit action of a definite operation G which either radically creates – physically or conceptually – an actor for this role, or only recruits some pre-existing entity for acting in this role. This, in general, is done independently of any pre-established qualification of, specifically, the object-entity introduced by the chosen operation G, so also independently of any "predicate P" (cf. comment on D14.3.1). Only after having been thus put, via G, in the role of object-entity, becomes the involved entity available for the action on it of a view (D5.1, D5.2) – any one – which, in its own turn, is chosen for acting in the role of a view. The necessity of an apparently so redundant and intricate way of saying can be best understood when the chosen epistemic referential has the particular degenerate form (G(V),V) where G(V) is the "generator of the view V" (cf. the general final comment on D14 ; V denotes here indistinctly an aspect-view or a view while if specifically an aspect-view is meant, we write V_g) which is precisely the form presupposed implicitly by the whole classical logic. Indeed in this case the view symbolized by V, though from the beginning on it is structured accordingly to the definitions D5.1, D5.2 of qualificators, nevertheless acts first in the role denoted G(V) of generator of object-entity. Namely it acts first either by selecting as object-entity its own field of perceptibility, or by radically creating this field, like for instance in the case of the generation of a microstate by a quantum mechanical measurement process. And afterward, on the product of this first action accomplished by itself but in the role G(V) of

generator of object-entity, V can furthermore act also in the role of a view or an aspect-view, for which its initial definition has been specifically intended. Let us also recall that what is structured as an aspect-view or a view in the sense of D5.1 or D5.2 respectively, can be selected for the role of object-entity, by a convenient generator (here a conceptual selector) (cf. the final general comment on D14). The existence of situations like those mentioned above requires indeed ways of speaking that distinguish clearly between the general descriptional roles, and the specific actors to which the roles are assigned. This distinction is quite essential because according to MRC, in order to describe, both the role G and the role V have always to be acted, even if in a reduced or a degenerate way and which reflects also the characteristics of the particular actor put to hold the role. So inside MRC it would be neither necessary nor sufficient to consider, as it might seem natural at a first sight, that the equivalent of a "predicate P" is just an aspect-view V_g. In order to achieve qualifications, MRC requires to make systematically use, instead of just a "predicate P", of some definite *succession* $[G.V_g]$ or $[G.V]$ of an actor put in the role G followed by an actor put in the role V.

So far the relative description $D/G,œ_G,V/$ produced by an epistemic referential (G,V), once obtained accordingly to one of the definitions D14, has been considered separately from its genesis. By the following definition DL.1 (L : logical) we shall now introduce a synthetic concept that takes systematically into explicit account, together with a given description, also the whole genesis involved by it.

DL.1. *Double-extremity genetic class.* Consider an epistemic referential (G,V) where V is a view containing in general several aspect-views and which exists in the sense of D7 with respect to the generator G of object-entity.

DL.1.1. *Double-extremity genetic class involving a physical object-entity*. Suppose that (G,V) introduces a physical object-entity and that it does produce a relative description $D/G,œ_G,V/$ of it in the sense of the definition D14.1, individual or probabilistic. Then the repetitions of the succession $[G.V]$ of pairs of cognitive actions, constitute **[**the class of all the operational processes of gk-valuations involved by $D/G,œ_G,V/$**]** (in this context the term "operational" is intended to stress that no model whatever is asserted. The class specified above will be called a *double extremity genetic class involving a physical object-entity*, in short a physical genetic class, and will be labelled $C_{ph}[G.V]$.

If V consists of only one aspect-view V_g an aspect-description $D/G,œ_G,V_g/$ is obtained, and the succession $[G.V_g]$ produces [the class of all the operational processes of gk-valuations involved by $D/G,œ_G,V_g/$]. We name this a *one aspect double-extremity genetic class involving a physical object-entity*, in short a one aspect physical genetic class, and we label it $C_{ph}[G.V_g]$.

When a basic referential $(G^{(o)},V^{(o)})$ is considered, a basic transferred description $D^{(o)}/G^{(o)},œ^{(o)}_G,V^{(o)}/$ is obtained, and the corresponding genetic class will be called a *basic genetic class* ; such a class will be denoted $C[G^{(o)}.V^{(o)}]$. This is [the class of all the operational basic processes of gk-valuations involved by $D^{(o)}/G^{(o)},œ^{(o)}_G,V^{(o)}/$].

DL.1.2. *Genetic class involving a non physical public object-entity*. Suppose that (G,V) introduces a non physical public object-entity and that it does produce a relative description $NPP.D/G,œ_G,V/$ of it in the sense of D14.2.1. Then the repetitions of the succession $[G.V]$ constitute [the class of all the processes of gk-valuations involved by $NPP.D/G,œ_G,V/$]. The class specified above will be called a *genetic class involving a non physical public object-entity*, in short a non physical public class, and will be labelled $C_{NPP}[G.V]$. In particular V can consist of only one aspect-view V_g and then we have a class $C_{NPP}[G.V_g]$.

DL.1.3. *Testimonial double-extremity genetic class*. Suppose that (G,V) does not insure the possibility to realize arbitrarily many repetitions of the successions $[G.V_g]$, for all the aspect-views V_g from V. So it produces an only testimonial description $\theta/G,œ_G,V/$ in the sense of D14.2.2. Nevertheless according to MRC in this case also a certain set of known or unknown implicit qualifying processes $[G.V_g]$ have necessarily been involved : if not, there would be no qualification at all (cf. general comments on the definitions D14). These will be said to constitute *the double-extremity genetic class of the testimony* θ. Such a class will be indicated by the notation $C_\theta(G,V)$ where only the involved epistemic referential is specified.

Comment. The general concept of a genetic class is posited here as the MRC-equivalent of the Frege-class of a predicate P.

The distinction between a relative description $D/G,œ_G,V/$ (or a relative testimony) – i.e. exclusively the final global result of the processes of qualification produced with the

considered epistemic referential (G,V) – and the corresponding genetic class, draws attention upon the absence, in the classical logic of classes and predicates, of any reference to the epistemic actions involved by an "object-variable x" or a "predicate P". Thereby is brought into full light the contrast between the active conception on knowledge involved by MRC, and the passive, hypostatizing and absolutizing implications of classical logic.

In a genetic class the undefined, hypostatic shadow-predicates P are replaced by the views V founded upon aspect-views V_g obeying the definition D5.1, which consist of effective operations and tests incorporated to a definite conceptual-operational structure. While the hypostatic object-variable x is replaced by a definite operation of generation G *associated* with the object-entity $œ_G$ produced by it, an operational-conceptual pair $(G,œ_G)$ that opens up the possibility to grasp and to draw up into conceptualization bulks of physical factuality of which the semantic matter nourishes with meaning all the levels and sorts of description, the logical one included. Any unnecessary absolutization is suppressed by the fact that a view is explicitly allowed to act in the role of generator of object-entity (labelled G(V)) while both views and generators are allowed to play in other descriptions the role $œ_G$ of object-entity. The specificity of the concept of generator introduced by the definition D4 is not in the least diminished by this absence of strict solidarity with the descriptional role G, nor is the specificity of the concept of a view V as defined by D5.1 and D5.2, diminished by the absence of a strict solidarity with the role of view. So inside a double-extremity genetic class, the classical object-variables and predicates – abstract, vague, hypostatic, absolute, as if out of reach of human action – transmute into a quite definite and complex operational-conceptual whole of relativized and constructive epistemic action.

The concept of genetic class C[G.V] obliges to start by considering first a set of qualifications obtained on the product $œ_G$ of only *one* definite generator G of an object-entity. But this restriction appears just below to be suppressible *a posteriori* as much as one wants.

Outlook on a calculus with double-extremity genetic classes
In what follows we consider exclusively genetic classes involving stable relative descriptions in the sense of the definitions D14.1, D14.2.1, or D14.3.1 (the genetic

classes of testimonial descriptions are too vaguely defined to be included in a calculus). Furthermore we drop the lower indexes P or NPP and write uniformly C[G.V].

The logical operations, sum, intersection, complementation, must all be redefined step by step for the case of genetic classes, in a way fully relativized to the involved generator G and to the whole content of the acting view V. The reconstruction requires the definition of *laws of composition* of object-entity generators G, of object-entities œ_G, of views V, and of descriptions D (accordingly to P8 and P10), and it has to be carried out for all the possible *sorts* of compositions of genetic classes C[G.V] (two classes with both G and V different, or with the same G and different V, or with different G's and the same V, or a basic class $C[G^{(o)}.V^{(o)}]$ and a non-basic one, or two basic classes, or two non-basic classes (of same order or of different orders), or an aspect-class $C[G.V_g]$ and a general one C[G.V], etc.). For instance :

Consider the two genetic classes generated by the successions $[G_1.V_1]$ and $[G_2.V_2]$, both not basic. Then the involved object-entities œ_{G1} and œ_{G2} are conceptual (previously achieved descriptions, or intrinsic metaconceptualizations, or intrinsic models) while the final global results are two descriptions D_1 and D_2. Suppose now $(G_1 \equiv G_2) = G$ and $V_1 \neq V_2$. Then only one object-entity œ_G is involved and the intersection $[C[G.V_1] \cap C[G.V_2]]$ leads to an (absolutely) void result if V_1 and V_2 involve no common aspects ; while if V_1 and V_2 do involve common aspects this intersection yields a description containing the qualifications present in both D_1 and D_2, so one can pertinently say that the resulting description is the intersection (or product) $D_1 \cap D_2$ of D_1 and D_2 which can be denoted $D_{\cap 12}$. In the same conditions the union $[C[G.V_1] \cup C[G.V_2]]$ produces a final description that can also be pertinently called the sum of D_1 and D_2 and can be denoted $D_{\cup 12}$. Suppose now on the contrary $G_1 \neq G_2$ and $(V_1 \equiv V_2) = V$. Then according to the nucleus of MRC the view V yields a (meta)description of the metaobject-entity $\text{œ}_{G1} \cup \text{œ}_{G2}$ where all the qualifications from D_1 and all those from D_2 are contained, so one could speak, for instance, of the description of an *object-sum* and introduce the notation $D_{\cup\text{œ}12}$ with $D_{\cup\text{œ}12} \equiv D^{(2)}/G^{(2)}, \text{œ}_G^{(2)}, V^{(2)}/$ where $G^{(2)}$ selects the sum-object-entity $\text{œ}_G^{(2)} \equiv \text{œ}_{G1} \cup \text{œ}_{G2}$ and $V^{(2)} \equiv V$. Etc.

The last example entails that the classical definition of the class of a predicate P can be progressively approached inside the MRC-logic by composing additively an increasing number of genetic classes with distinct generators G of object-entity and identical views V.

In *any* case the global result of a permitted composition of genetic classes C[G.V] is just a relative description.

Each class C[G.V] introduces various semantically relativized voids tied with corresponding semantically relativized complements.

Given a qualification (gk) from C[G.V], it introduces its own relative void – let us label it [Ø/(gk)] – that sends to the corresponding relative complement consisting of the set {(gk)'}, (gk)'≠(gk), of all the other qualifications from C[G.V] ; analogously an aspect-view $V_g \in V$ introduces the relative void $[\text{Ø}/V_g]$ that sends to the complement consisting of the set {g'], g'≠g, of all the other aspects from V, so to the set of all the qualifications g'k from C[G.V] produced by the aspect-views from V that are different from V_g. These were examples of relative voids internal to the genetic class C/[G.V], i.e. which send to complements contained in C[G.V]. If now G and V are regarded as wholes, the genetic class C[G.V] introduces three relativized metavoids [Ø/G], [Ø/V] and [Ø/G,V] which send to complements from the outside of C[G.V], namely to the three exterior metacomplements with respect to, respectively, G, or V as a whole, or the referential (G,V) as a whole (there is no difficulty to characterize these metacomplements by words).

So a genetic class C[G.V] introduces a hierarchical organization of relative voids and of corresponding relative complements sending into definite domains of observation or epistemic action. We are already far from the connection between a hypostatized "object-variable x" and a hypostatized predicate P – always just a conceptual selector – *associated with only one absolute void*. Now, the qualifications gk, the aspect-views V_g, and the generators G, are all semantic descriptional elements which determine semantic relative voids and the corresponding semantic complements ; but, *via* the symbols that represent them, these semantic relative voids and complements go into the calculus with genetic classes where they become "logical" voids and complements that imprint their mark upon a syntax.

We are in presence here of an example in which one can see how semantic features gain access toward a specific syntactical expression. What appears on the horizon is a syntax of the extraction and elaboration of semantic matter, a syntax of conceptualization, where the artificial and illusory frontier between semantics and syntax is transcended.

The calculus with genetic classes it not yet elaborated, but nothing hinders to elaborate it. It will have to be worked out in compatibility with the whole content of the nucleus of MRC. In particular all the restrictions or methodological rules involved by the frame principle P8, the principle P10 of individualizing mutual exclusion, and the principle of separation P15 with the concept of relative metadescription D16 entailed by it, will have to be taken into account systematically. Inside the enlarged framework created by this calculus, the concept of proof will require reconstruction.

These brief indications suffice for conveying a first notion concerning the content and the degree of novelty and complexity of the calculus with genetic classes.

Views of empirical truth. Relative proposition

Consider a genetic class C[G.V]. It involves as its final global result a corresponding relative description $D/G,\text{œ}_G,V/$, i.e. some *specified* structure of space-time-gk-values (where one or both frame-aspects of space and time can be absent), the aspect-index g running over the aspect-views $V_g \in V$. Now, following Tarski in this respect, we note that the mere assertion of the description $D/G,\text{œ}_G,V/$ is not itself what is called a proposition. It generates a proposition if and only if $D/G,\text{œ}_G,V/$ *can* be asserted to be empiricall, true (this is the MRC way of saying like Tarski that [«the snow is white» is true iff the snow is white]). Indeed only a *previously* constituted description can be empirically true or false. *Or it cannot* (think of the description of a minotaur). For instance, a basic object-entity cannot *exist* in the sense of D7 with respect to an aspect of empirical truth, because it does not exist with respect to *any* view of comparison (π18.1) while an aspect-view of empirical truth is an aspect-view of comparison. Indeed it must somehow compare the mere assertion of the considered description, with some perceptions of empirical facts to which this assertion refers ; it must somehow be a view of "verification" able to establish identities or non-identities concerning, on the one hand the *assertion*, for a definite object-entity, of definite aspect-values gk of definite aspects

g, and on the other hand the *effective emergence* for that object entity, of precisely those asserted gk-values, when it is examined *via* that aspect g.

So, quite essentially, each aspect of empirical truth is a meta-aspect which is *relative* to an aspect g involved in the description that has to be "verified". Like in any identity-valuation, the (two) meta-(aspect)-values of a meta-aspect of empirical truth, namely "true" or "not true" (false), are *inconceivable* in an absolute sense, they can be imagined only relatively to some definite gk-value of a definite aspect g. If $D/G,\text{œ}_G,V/$ is an individual description, then one can desire to establish for each gk-value asserted by $D/G,\text{œ}_G,V/$ whether it is true or false ; and if $D/G,\text{œ}_G,V/$ is a probabilistic description one can desire to establish whether the probabilistic distribution asserted by it for the values gk of the aspect g is true or false ; so one can also ask : "is $D/G,\text{œ}_G,V/$ true with respect to all the gk-values or all the distributions of gk-values asserted by it ?". But to research a valuation of empirical truth of $D/G,\text{œ}_G,V/$ concerning no specified gk-value or distribution of gk-values, would obviously be meaningless. So we introduce the following definition :

DL.2. *Meta[aspect-view] or view of empirical truth*. Consider a meta[aspect-view] consisting of one meta-aspect $(\text{e}\tau/g)$ which is relative to an aspect g in the sense of D5.1. Let us designate it by $[V^{(2)}_{(\text{e}\tau)}/g]$. The meta-aspect $(\text{e}\tau/g)$ from $[V^{(2)}_{(\text{e}\tau)}/g]$ is posited to contain only two aspect-values, namely $(\text{e}\tau/g)1\equiv$"true with respect to g" and $(\text{e}\tau/g)2\equiv$"false with respect to g". Accordingly to the general definition D5.1 of an aspect-view – which concerns any aspect of any order – each meta-aspect $(\text{e}\tau)/g$ must introduce a *definite* and *effective* corresponding operation of $(\text{e}\tau)/g$-examination, as well as an explicit *coding rule* for deciding which results of the $(\text{e}\tau)/g$-examination are to be coded "true with respect to g" and which ones are to be coded "false with respect to g". A meta[aspect-view] of the specified sort will be called *a meta[aspect-view] of relative empirical truth* ($\text{e}\tau$: empirical truth). A view containing two or more meta[aspect-views] of relative empirical truth will be called *a metaview of empirical relative truth* and will be symbolized by $V^{(2)}_{(\text{e}\tau)}$.

Comment. Consider a previously achieved description $D/G,\text{œ}_G,V/$ and a metaview of relative empirical truth $V^{(2)}_{(\text{e}\tau)}$. If $V_g{\in}V$ and $V^{(2)}_{\text{e}\tau}$ contains a meta-aspect-view $[V^{(2)}_{(\text{e}\tau)}/g]$ of empirical truth relative to g *that is effective with respect to* œ_G, then

D/G,œ$_G$,V/ and V$^{(2)}_{e\tau}$ do mutually exist in the sense of D7 with respect to g. In this case V$^{(2)}_{e\tau}$ is able to qualify the empirical truth of D/G,œ$_G$,V/ with respect to that aspect g. If this is not the case, then with respect to that g the description D/G,œ$_G$,V/ and the metaview V$^{(2)}_{e\tau}$ do not mutually exist in the sense of D7 and V$^{(2)}_{e\tau}$ is not able to qualify the empirical truth of D/G,œ$_G$,V/ with respect to g. If D/G,œ$_G$,V/ and V$^{(2)}_{e\tau}$ do mutually exist in the sense of D7 with respect to all the aspects g involved by V, then V$^{(2)}_{e\tau}$ can yield for D/G,œ$_G$,V/ a *complete* valuation of empirical truth.

It follows that according to MRC the concept of empirical truth possesses some *meaning* relatively to D/G,œ$_G$,V/ only if it is possible to construct at least one metaview V$^{(2)}_{e\tau}$ of empirical truth which exists in the sense of D7 with respect to D/G,œ$_G$,V/. But this condition is far from being always insured (as it often seems to be implied). It is a rather restrictive condition, because of the requirements of definiteness, effectivity and codability entailed for any eτ-examination by the general definition D5.1. Indeed, of what can an (eτ)/g-examination consist ? One possibility is that it consists of a mere repetition of the V$_g$-examination itself which inside the genetic class C[G.V] leads to this or that aspect-value gk, or this or that probabilistic distribution of gk-values asserted by D/G,œ$_G$,V, followed by a comparison between the result obtained in the re-production and the result asserted by D/G,œ$_G$,V/ (the aim of the condition of re-producibility currently imposed in the "exact" experimental sciences like experimental physics, chemistry, molecular biology, is precisely to insure possibility of (eτ)/g-examinations of the type specified above). But re-producibility is relatively rare, even for descriptions of physical facts [42], and even for descriptions of physical facts that belong to what is called an exact natural science. In history, palaeontology, human biology, police researches, current life, etc., one is in presence of just testimonial qualifications in the sense of D14.2.2 with respect to which other sorts of definite, effective and codable (eτ)/g-examinations must be invented, and in many cases this simply is not possible. As for religious, metaphysical, mythical, poetical testimonial qualifications, the meaninglessness

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[42] For instance if the verbal expression of D/G,œ$_G$,V/ is «yesterday at 14h35' a grain of dust carrying on it a germ X has left my pillow» it seems highly improbable to be able to construct for it some meta[aspect-view] of empirical truth founded on reproducibility. In experimental physics, in chemistry, biology, etc., the specification of metaviews of empirical truth founded upon reproducibility, that be acceptable from all the points of view, constitutes a basic part of the research.

of any relative metaview of empirical truth is entailed by the very content of the testimonies.

Consider now a description $D/G,œ_G,V/$ for which a complete metaview $V^{(2)}_{eτ}$ of empirical truth has been constructed. Then the valuations of empirical truth of $D/G,œ_G,V/$ achieved *via* the $(eτ)/g$-examinations involved by $V^{(2)}_{eτ}$ are in a non removable way relative to these particular examinations. In general $V^{(2)}_{eτ}$ is not unique, and with another metaview $V^{(2)}_{eτ}$ involving other $(eτ)/g$-examinations one obtains in general other truth-valuations.

In consequence of the relativizations specified above, the questions of empirical truth become precise and they admit of definite but only relative solutions. *This stands in polar opposition with relativism.*

The view exposed above can rather obviously shown to be in essential agreement with K. Popper's concept of "relativity of truth to theory", as well as with H. Putnam's views. While Quine, Kuhn, and many other important thinkers, put less or no accent on the definiteness and effectivity required for an $(eτ)/g$-examination, so in their writings the question of empirical truth, like that of reference, seems to involve a general and irrepressible doom to relativism.

We can now define a relativized concept of proposition :

DL.3. *Relative proposition*. Consider a description $D/G,œ_G,V/$ for which it has been possible to construct a complete metaview $V^{(2)}_{eτ}$ of relative empirical truth. Consider the metadescription $D^{(2)}/G^2),œ^{(2)},V_{eτ}^{(2)}/$ where : the metaobject-entity is $œ^{(2)}≡D/G,œ_G,V/$ (introduced by a corresponding meta-generator $G^{(2)}$, namely a conceptual selector) ; $V_{eτ}^{(2)}$ is a metaview of empirical truth that exists in the sense of D7 with respect to $D/G,œ_G,V/$, the results of all the involved $(eτ)/g$-examinations being *a priori* asserted – *tentatively* – to consist only of the relative truth-values "*true* with respect to the aspect g" for all the $V_g∈V$, which remains to be validated or invalidated *a posteriori* by the effective realization of all the $(eτ)/g$-examinations involved by $D^{(2)}/G^2),œ^{(2)},V_{eτ}^{(2)}/$. Because the specified tentative assertion is a "proposition" in the etymological sense, $D^{(2)}/G^2),œ^{(2)},V_{eτ}^{(2)}/$ will be called a *proposition relative to*

D/G,œ$_G$,V/ and to V$^{(2)}_{e\tau}$. and will be labelled p(D). It can consist either of the global, integrated formulation «D/G,œ$_G$,V/ is true (or false) with respect to V$^{(2)}_{e\tau}$» or of the set of all the analyzed formulations «D/G,œ$_G$,V/ is true (or false) relatively to V$^{(2)}_{e\tau}$ in its assertion concerning that value gk of that aspect g (or relatively to its assertion of the distribution of gk-values of g».

Comment. *Via* the MRC-concepts of metaview of empirical truth and of relative proposition, the calculus of genetic classes C[G.V] leads to a corresponding relativized calculus of propositions, where the truth-value of the final description produced by a composition of genetic classes C[G.V] has to be established as a function of : the nature of the composition ; the involved metaviews of empirical truth ; the values of empirical truth assigned *via* these, to the descriptions produced by the classes involved in the considered composition of classes. So, while in the classical approach a truth-valuation is from the beginning on involved in the definition of the class of a predicate P, in the MRC genetic logic the genetic classes are clearly separated from the corresponding propositions, of which the truth-valuations require different, explicit, analyzed, non-trivial relative specifications. This, at a first sight, might seem to be a huge complication, to be avoided at any price. But in fact it is a complexification of the treatment that can determine with any desired precision the configuration of the channels along which semantic matter is adduced into logical syntax.

A non-classical logical stratum concerning strictly singular physical factuality

Consider a basic genetic class C[G$^{(o)}$.V$^{(o)}$]. Even if the basic description D$^{(o)}$/G$^{(o)}$,œ$^{(o)}$,V$^{(o)}$/ involved by this class is called "individual", in consequence of the condition of stability from the general definition D14.1 and its particularization D14.3.1, it involves nevertheless a big number of repetitions of the realization of each succession [G$^{(o)}$.V$^{(o)}$].

> *The epistemic **action** leading to D$^{(o)}$/G$^{(o)}$,œ$^{(o)}$,V$^{(o)}$/ as a whole, no matter whether D$^{(o)}$ is individual or probabilistic, isalways directly placed on the level of **statistics***.

However, by penetrating *inside* D$^{(o)}$ and taking into account only two distinct successions [G$^{(o)}$.V$_{g1}^{(o)}$] and [G$^{(o)}$.V$_{g2}^{(o)}$], it is possible, by use of the concept D14.2.2 of testimonial description, to dig down to the level of the strictly individual qualifications, and to define

for these a *semantical* character which determines a certain corresponding *logical form*. This is an innovation with respect to classical logic. We proceed as follows.

Consider two successions $[G^{(o)}.V_g^{(o)}]$ and $[G^{(o)}.V_{g'}^{(o)}]$ that have been realized either with $g' \equiv g$ or with $g' \neq g$, no matter, but have led to two different aspect-values $gk \neq gk'$ or $gk \neq g'k'$, respectively. These two successions – with their outcomes included – do not insure a test of descriptional stability as required by D14.1 or D14.3.1. So they are not descriptions in the sense of the mentioned definitions, they are just two testimonies in the sense of D14.2.2, say $\theta 1$ and $\theta 2$. Now, *because $\theta 1$ and $\theta 2$ involve by hypothesis two **distinct** registered aspect-values, each one of these testimonial descriptions requires its own realization of a replica of the object-entity $\text{œ}^{(o)}$ produced by $G^{(o)}$*. So, if we label $\text{œ}_j^{(o)}$ **one** given realization of a replica of the basic object-entity $\text{œ}^{(o)}$, the two testimonies $\theta 1(\text{œ}_j^{(o)})$ and $\theta 2(\text{œ}_j^{(o)})$ are mutually incompatible.

As soon as a restriction to only *one* definite **replica** $\text{œ}_j^{(o)}$ of a basic object-entity $\text{œ}^{(o)}$ is posited – not only restriction to no matter how many replicas of one sort of basic object-entity $\text{œ}^{(o)}$ as defined by a given operation $G^{(o)}$, but furthermore restriction also to only one replica of that sort of basic object-entity –, there arises a mutual incompatibility between the factual realizability of $\theta 1(\text{œ}_j^{(o)})$ and that of $\theta 2(\text{œ}_j^{(o)})$. *This holds even if the qualifications involved by $\theta 1$ and $\theta 2$ concern both one same basic aspect g.*

This is a mutual exclusion of a semantical nature. But *via* the concept of empirical truth it entails a logical consequence. To show this we proceed as follows. To begin with, we define :

DL.4. *Basic relative testimonial proposition*. We call *basic relative testimonial proposition* and we label $p(\theta^{(o)})$ the tentative assertion of the empirical truth of a relative basic testimony $\theta/G^{(o)},\text{œ}^{(o)},V_g^{(o)}/$ (with respect to some definite view of empirical truth $[V^{(2)}_{(e\tau)}/g^{(o)}]$ supposed to have been constructed) ; which tentative assertion remains to be validated or invalidated *via* the $(e\tau)/g^{(o)}$-examinations involved by $[V^{(2)}_{(e\tau)}/g^{(o)}]$.

Comment. A basic aspect of empirical truth concerning a basic testimony $\theta/G^{(o)},\text{œ}^{(o)},V_g^{(o)}/$ can consist, for instance, of the consensus concerning the genesis and

the outcome of the testimony θ, among an arbitrarily big number of observers that have watched and witnessed together these non repeatable phenomena.

So to the two testimonies $\theta 1(œ_j^{(o)})$ and $\theta 2(œ_j^{(o)})$ there correspond two testimonial propositions $p_1[\theta 1(œ_j^{(o)})]$ and $p_2[\theta 2(œ_j^{(o)})]$. Now since $\theta 1(œ_j^{(o)})$ and $\theta 2(œ_j^{(o)})$ cannot be both realized because they involve by hypothesis one same replica $œ_j^{(o)}$ of the involved basic object-entity $œ^{(o)}$, *a fortiori* $p_1[\theta 1(œ_j^{(o)})]$ and $p_2[\theta 2(œ_j^{(o)})]$ cannot be both true. So:

A logical conjunction of $p[\theta 1(œ_j^{(o)})]$ and $p[\theta 2(œ_j^{(o)})]$ is *devoid of factual counterpart*. It cannot be defined, which is a case different from that in which it can be defined but comes out to be false.

This can be better understood by the help of truth-tables : Given two propositions p and q, their logical product p∧q is defined by :

p	q	p∧q
T	T	T
T	F	F
F	T	F
F	F	F

What happens if $p \equiv p_1[\theta 1(œ_j^{(o)})]$ and $q \equiv p_2[\theta 2(œ_j^{(o)})]$? In this case the top line "TTT" represents a combination which, factually, is *systematically impossible*. The factually possible cases are only

p	q	p∧q
T	F	F
F	T	F
F	F	F

> *But what this last set of possibilities claims, is that the logical product p∧q simply does not "exist", factually, since it **never** is factually true* [43].

It claims this in the amputating "purely syntactical" language of classical logic. But what is thus claimed is not a purely syntactical matter, it is a matter of syntax which directly expresses a matter of *fact*. If $p \equiv p_1[\theta 1(\text{œ}_j^{(o)})]$ and $q \equiv p_2[\theta 2(\text{œ}_j^{(o)})]$, the logical product p∧q considered above is meaningless with respect to the value "true" of *any* aspect g of any constructible view of empirical truth with respect to which both p or/and q do exist in the sense of D7. This is so in consequence, not of the falsity of either p or q considered separately, but in consequence of the fact **prior** to such a falsity, that the realizability of the testimony $\theta 1(\text{œ}_j^{(o)})$ is incompatible with that of the testimony $\theta 2(\text{œ}_j^{(o)}$, so that p and q *cannot coexist*. To represent this new sort of situation by still saying in an inertial and non specific way that p∧q is "false" – exactly as we say in the cases when p and q *can* coexist but one of them is false –, amounts to a too loose formalization-and-language which by construction is unable to express the specificities of a whole definite category of cases. Obviously the aim of maximal formal "generality" cannot justify such a categorial non-specificity. In a well-adjusted logical formalization the situation from the

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[43] Wittgenstein (*Remarks on Logical Form*, Aristotelian Society, 1929) made an analogous analysis related with another sort of factual mutual space-time exclusion :

«I have said elsewhere that a proposition "reaches up to reality", and by this I meant that the forms of the entities are contained in the form of the proposition which is about these entities. For the sentence, together with the mode of projection which projects reality into the sentence, determines the logical form of the entities.......For if the proposition contains the form of an entity which it is about, then it is possible that two propositions should collide in this very form. The propositions "Brown now sits in this chair" and "Jones now sits in this chair" each, in a sense, try to set their subject term on the chair. But the logical product of these propositions will put them both there at once, and this leads to a collision, a mutual exclusion of these terms.......It is, of course, a deficiency of our notation that it does not prevent the formation of such nonsensical constructions, and a perfect notation will have to exclude such structures by definite rules of syntax. These will have to tell us that in the case of certain kinds of atomic propositions described in terms of definite symbolic features certain combinations of the T's and F's must be left out (T : true ; F : false). Such rules, however, cannot be laid down until we have actually reached the ultimate analysis of the phenomena in question. This, as we all know, has not yet been achieved».

Wittgenstein's propositions "Brown now sits in this chair" and "Jones now sits in this chair" are related with a *dual* space-time mutual exclusion (two distinct sorts of object-entities are involved, not only one) and furthermore a space-time mutual exclusion that can happen or *not* (if in the second proposition, instead of Jones, we set "Brown's bacterian flora" there is no exclusion any more). Therefore this kind of dual space-time mutual exclusion cannot be expressed by a *principle* like P10. But it is very striking indeed that – without benefiting of guidance by quantum mechanics, which in the present work led toward "the ultimate analysis of the phenomena in question" – Wittgenstein has remarked as early as 1929 that "a proposition contains the form of an entity which it is about", and that he identified the decisive *individualizing* role played by space-time in the factual mutual exclusions of two propositions (he labels propositions like those considered above by the group of letters PT where P means place and T means time). It is also striking that, notwithstanding Wittgenstein's work quoted above, the illusory belief of independence of syntax, on semantics, still is so strong up to this very day.

last table requires an own syntactical sign that shall prevent void writings of logical products p∧q that are *a priori* impossible factually.

This is the usually so fuzzily understood core of what is called "quantum logic", reflected there in such a truncated and distorting fashion [44].

But as soon as two or more replicas of a given object-entity are allowed (so *a fortiori* if also two or more sorts of object-entities are allowed) the mutual exclusions founded on the unicity of the involved replica of object-entity vanish, and a factual counterpart can be defined for the logical conjunction of *any* two successions $[G^{(o)}.V^{(o)}]$, *even if they correspond to mutually **incompatible** basic views*. Then, however, one finds oneself already in the realm of statistics, and there, *grosso modo*, the "Boolean" logic, so the algebras from the classical probability spaces, *do* operate (cf. note 44).

The assertion of a non restricted possibility of logical conjunction *presupposes statisticity*. The classical Boolean logic is quasi systematically statistical. It overlooks the specificities of strict individuality.

By its "universals" (at least) classical logic usually begins above the level of strict individuality and then keeps floating over it, loose and dead, cut away from its unknown roots implanted in strict factual individuality. While **only** *a level of logical conceptualization where strict individuality is explicitly characterized can contain a common foundation for classical logic and classical probabilities* (cf. V2).

For the particular case of quantum mechanics (ref. 16) I have already introduced a logical conjunction restricted by a syntactical sign of factual mutual exclusion between two propositions reflecting *exclusively* the unicity of the involved replica of object-entity. This permits to deal with the question of quantum logic in a much deeper way than the usual one. Now, the mentioned approach can be individualized to any two testimonial propositions $\theta 1(\text{œ}_j^{(o)})$ and $\theta 2(\text{œ}_j^{(o)})$. When this is done it becomes possible to effectively construct an MRC-calculus with testimonial propositions which connects the level of strict factual individuality, with the statistical level of logic, *via* a very first stratum of logical form where the conjunction is not universally permitted.

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[44] In quantum mechanics the distinction between the individual level of description and the statistical one is not sufficiently clear, so the ways of speaking often seem to involve that qualifications by two mutually incompatible observables are *always* mutually exclusive, while qualifications by two compatible observables are never mutually exclusive : the decisive, the **exclusive** role of the restriction, or not, to only *one* **replica** of the involved object-entity $\text{œ}_j^{(o)}$, is not recognized.

Like the relativization to semantic features of the syntactical logical void, the dependence of the domain of pertinence of the logical conjunction, on semantic features (the mutual incompatibility of two testimonial propositions $\theta_1(\text{œ}_j^{(o)})$ and $\theta_2(\text{œ}_j^{(o)})$ and so the mutual factual exclusion of the corresponding propositions $p_1[\theta_1(\text{œ}_j^{(o)})]$ and $p_2[\theta_2(\text{œ}_j^{(o)})]$), illustrates again how factuality, semantics, can determine logical form.

The MRC-status of the "objects" of the classical logic of classes and predicates

Inside the general category of genetic classes, the classical concept of class is re-obtained in only the following two cases.

(a). A basic genetic class of the type $C[G^{(o)}(V^{(o)}).V^{(o)}]$ is involved, where $V^{(o)}$ denotes a human biological sensorial view. In this case the generator $G^{(o)}(V^{(o)})$ – i.e. $V^{(o)}$ *itself* but in the *role* of generator of object-entity –, even though it is basic, is not explicitly perceived to create out of the physical reality the corresponding object-entity, namely the field of sensitivity of $V^{(o)}$; while the basic view $V^{(o)}$, again the view involved in the description but which now also plays the *role* of a view, can be assumed without inner contradiction to qualify the created object-entity without changing it. This particular sort of basic transferred description produces a very simplified sort of basic description $D^{(o)}$ that can be, and indeed is, spontaneously metaconceptualized intrinsically, by an implicit process ; and then is furthermore immediately reduced implicitly to the corresponding intrinsic model $M(\text{œ}^{(o)})/[V^{(o)},V_I^{(1)}]$, where the relativities to the basic view $V^{(o)}$ and to the intrisizing view $V_I^{(1)}$ remain hidden, only the model $M(\text{œ}^{(o)})$ itself is perceived, and so it is taken to be absolute. This model is what is illusively felt to somehow exist eternally and immutably, independently of any observer, in an abstract Platonian space where it stays available for passive perceptions of [truth's of P's] (cf. D19.1, and D19.2 with their comments, and V.1.1). This – the models $M(\text{œ}^{(o)})$ cut from their relativizing ties with the basic transferred descriptions wherefrom they stem – is the basis of the Platonian realism (in the scholastic sense), which down to the present day grasps the minds with irresistible force. The logicians and mathematicians are particularly exposed to this force because they have found methods to distil consistent systems of very abstract models $M(\text{œ}^{(o)})$ which are so perfect that *a posteriori* they seem to be endowed with divine pre-existence and supreme intelligibility.

(b). A basic genetic class of the type $C[G^{(o)}(V^{(o)}).V^{(o)}]$ is involved where $V^{(o)}$ denotes *extensions* by apparatuses of the domain of human biological sensorial aspect-views. All the preceding remarks are valid for this case also. The intrinsic models elaborated in this somewhat enlarged framework belong to the realm of exact classical sciences (think of what is called atomic spectra, and the corresponding intrinsic models of atoms) to most of which the classical logic still applies.

In both cases mentioned above the *content* of the epistemic operator playing the *role* G, identifies with the content of the view V which plays the role of a view, and furthermore this view V is reduced to an undefined and structureless abstract "predicate P". So $G \equiv V \equiv P$, all the involved descriptional actors being identified to P. This point-like degeneration is what entails the loss of awareness of the ineluctable action, in any description and so in any proposition, of also a generator G of object-entity. Correlatively the "direction of conceptualization" defined by a double-extremity genetic class C[G.V], gets lost also. The classical definition of a class determined by (the truth of) exclusively a predicate P is just tangential to the superficial level of the already verbalized-conceptualized intrinsic models represented by "object-variables x", a definition which is loose like the needle of a compass.

So we have recovered here in analyzed terms a conclusion already asserted in the preliminary critical comments from V.1.1 :

> Inside MRC the domain of "objects" directly considered in the classical logic is found to consist of exclusively intrinsic models $M(\text{œ}^{(o)})/[V^{(o)}, V_I^{(1)}]$, always conceptual constructs extracted from spontaneously achieved implicit intrinsic metaconceptualizations of degenerate transferred descriptions $D^{(o)}$ produced by successions of the particular type $[G^{(o)}(V^{(o)}).V^{(o)}]$ where the human biological apparatuses cumulate the roles of generator of object-entity and the role of view.

These "objects" never disclose the fragments of as yet non conceptualized physical factuality from their cores, wherefrom any conceptualization stems *via* basic transferred descriptions. The connection between an intrinsic model $M(\text{œ}^{(o)})/[V^{(o)}, V_I^{(1)}]$ and the corresponding basic description $D^{(o)}/G^{(o)}, \text{œ}^{(o)}{}_G, V^{(o)}/$ remain ignored because both the basic view $V^{(o)}$ and the intrinsizing metaview $V_I^{(1)}$ are wired into the morphology and the reflex functioning of our bodies, so the relativities to this pair of views $(V^{(o)}, V_I^{(1)})$

remain hidden to the immediate natural perception of the human mind. The neurobiologists and the cognitivists are now studying them intensively from a psycho-biological standpoint. But among the sciences of non-biological domains of the physical reality, only quantum mechanics has succeeded to get down to these cores of a-conceptual physical factuality hidden inside the classical models, and it has *represented* their extraction as well as their very first transposition in communicable terms, by basic transferred descriptions. It has represented all this indeed, but *only cryptically*, mathematically from the start on, and without being able to formulate their descriptional status, nor to accomplish also the subsequent descriptional phase of intrinsic metaconceptualization. The integral conceptual trajectory that leads from the basic transferred descriptions to classical models $M(œ^{(o)})$, remained hidden to quantum mechanics also, and in consequence of this the universal significance of quantum mechanics itself remained hidden. So the possibility – always – of at least a minimal intrinsic model in the sense of D19.3, has not been pointed out, and the *universal* rooting of any model, in physical factuality, remained non perceived. And now, when eventually all this becomes apparent and so a general law of growth of the processes of conceptualization is brought forth, it will be tried for some time, no doubt, to ignore or even to deny it, because a positivistic philosophy has had time to constitute and to consolidate itself, and so now it opposes its own inertial resistance.

In sum, in classical logic we circulate swiftly on an aerial net of smooth highways for deduction, erected out of models drawn from a thick stratum of unsuspected hidden conceptualization that keeps us far from the ground of as yet non-conceptualized physical reality. The MRC genetic logical approach explicates the presence of this stratum and its whole morpho-functional structure into which the classical models $M(œ^{(o)})$ are fixed by innumerable genetic threads. This offers now this stratum, as well as the models, to control and deliberate use.

Formal systems **versus** *genetic classes*

It might now seem that the integral domain of the MRC-logic of double-extremity genetic classes, can be obtained by simply adding to the sub-domain corresponding to classical logic as specified above, the domain of basic double-extremity genetic classes $C[G^{(o)}.V^{(o)}]$ with $G^{(o)} \neq V^{(o)}$ and where in general $V^{(o)}$ changes to a significant degree the object-entity created by $G^{(o)}$. But in fact such a juxtaposition would not exhaust the domain of the genetic classes $C[G.V]$. Indeed it would leave out all the double-extremity

genetic classes produced by a conceptual epistemic referential (degenerate or not) that is creative and yields stable relative descriptions of type D14.2.1. While the natural representations, and even the scientific ones, *quite currently* do involve double-extremity creative conceptual genetic classes, notwithstanding that classical logic does not define them.

This is a paradoxical situation of which a massive illustration can be found in mathematics *as well as in the modern formal logic itself !* The central concept in these disciplines is that of a *formal system* S. A finite formal system consists of a finite list of *primitive symbols*, a finite list of *terms* formed with primitive symbols, a finite list of *well-formed expressions*, a sub-set of well-formed expressions called *axioms*, and a finite list of *rules of transformation* of a given well-formed expression, in another one. In a non finite formal system the list of primitive symbols can be indefinitely enlarged (like in Peano's arithmetic). The well-known concept of formal system needs no further specification in order to be reconsidered inside MRC, so we do not introduce a specifically MRC-definition. Let us simply note that a formal system is generated by the conceptor's mind *via* a generator of object-entity, say G_S, that consists of an epistemic action upon the zone of "reality" (in the sense of D2) consisting of the "conceptual reality" from the conceptor's mind, his knowledge included, say R_C (cf. D4). The process of generation of this object-entity is quite essentially creative.

We now try to specify what a *formal description* is accordingly to MRC.

Once constructed a formal system S, this system can be regarded as the abstract zone or domain from "reality" in the sense of D4 where all the formal descriptions permitted by S are carried out. It is a sort of conceptual platform, smooth, stable and solid, conceived in order to be able to achieve on it particularly precise descriptional trajectories. So S itself has to be constructed in the first place ; afterward one can elaborate also descriptions "in" S. This preliminary condition for the achievement of a formal description will have to be somehow explicitly expressed in the specification of the notations that characterize a description in S.

In all the mathematical or logical treatments it is assumed more or less implicitly that as soon as the formal system S is given, *ipso facto* one knows how to work with it because the rules are incorporated. But inside MRC one is obliged by method to always specify explicitly the epistemic referential (G,V) inside which a (relative) description $D/G,\text{œ}_G,V/$ is attempted, as well as the involved object-entity œ_G. So we ask : of what

does a formal description consist, what plays in it the role of generator of object-entity, what plays the role of object-entity, and what plays the role of view ?

A formal description from a given formal system S is a finite proof carried out inside S. Let us call it here a *proof-description* and label it D^S_j where j is an index that distinguishes between the various proof-descriptions from S. By classical definition, a proof-description D^S_j consists of a finite sequence of n well-formed expressions that are all permitted in S in consequence of the fact that the sequence always starts with an axiom or a well-formed expression known to follow from the axioms from S (theorem) which then, in a sequence of n descriptional steps D^S_{jk}, k=1,2...n, is progressively transformed by the combined use of rules of transformation from S and of "lateral" introductions of other axioms from S or of already proven theorems from S, the end of the sequence being reached when an "interesting" well-formed expression emerges which previously was not known to follow from the axioms of S and which now is listed as a new theorem in S [45].

Let us denote by $œ_j$ this final well-formed expression from S : it can be regarded – at least *a posteriori* – as the object-entity of the considered proof-description D^S_j.

So the involved generator of object-entity is by definition that which generates $œ_j$. For this the generator must dispose of S. Therefore it is pertinent to posit for the notation of the generator of $œ_j$ the form of a product of two successive operations of generation, say $G^S_j=G_jG_S$ where : G_S acts first on the zone R_C from reality consisting of the conceptor's mind, thereby producing the zone R_S of "reality" consisting of the formal system S ; G_j acts subsequently, on $R_S \equiv S$, thereby producing the well-formed expression $œ_j$ to be proven. (Of course this analysis is only notational. Once S has been created by the epistemic action labelled G_S it remains indefinitely available, and there is no need to effectively re-produce its generation for each object-entity $œ_j$: only G_j has to be chosen and acted with in each case).

The aim of D^S_j is to establish whether yes or not $œ_j$ is provable inside S. So $œ_j$ has to be examined by a formal view of provability inside S. (Retroactively it is always

[45] Since a given theorem is the result of a definite proof, it might seem inconvenient to mix the definitions of distinct proofs by making use in the definition of a proof A, of theorems established in other proofs. But the use in A of a theorem established in another proof is just a short-hand for the - equivalent - introduction of that whole other proof. So the definitions of the various proofs are separable.

possible to represent the proof-process in this way, though in fact most often $œ_j$ emerges constructively together with its proof). We introduce now an explicit MRC-definition of the view that acts in a proof-description :

DL.5. *View of demonstrability in S* [46]. Consider a formal system S. From the classical definitions of S and of the proof-descriptions D^S_j from S it follows that the view which acts in D^S_j must be able to qualify the object-entity $œ_j$ in terms of the aspect-values of two aspects g1 and g2, namely : *(a)* an aspect of *form* inside S, $g1 \equiv \Phi$, endowed with two aspect-values, say, respectively, Φ-yes (well-formed inside S), Φ-no (not well-formed inside S) ; and *(b)* an aspect of *transformation* inside S, say $g2 \equiv \Theta$, equally endowed with two aspect-values, say Θ-yes (correctly transformed inside S), Θ-no (not correctly transformed inside S). The view consisting of these two aspects is a formal view relative to S that will be called a *view of demonstrability* in S. It will be labelled V^S_d.

Comment. The upper index S stresses that the formal view V^S_d is extracted from S (remember that according to MRC this dependence between V^S_d and S, so also between V^S_d and G_S (which is involved as a factor in the global generator $G^S_j = G_j G_S$) is a *restriction* with respect to the most general situation of mutual in-dependence between the generation operatos and the acting view). The aspect Φ from V^S_d qualifies accordingly to the list of well-formed expressions posited in S, and its aspect Θ qualifies accordingly to the transformation-rules posited in S. So in fact what V^S_d is able to ascertain for any expression from a proof-chain, is just that it is formally consistent with the requirements of well-formedness and of ways of transformation from S.

> V^S_d is – exclusively – a yes-no filter concerning well-formedness in S and transformation in S. Nothing else.

The fundamental but often obscure problems concerning the relations between demonstrability in S and "truth", will be discussed in the next paragraph. For the moment, in what follows immediately we speak *only* of demonstrability.

So the epistemic referential corresponding to D^S_j is $(G^S_j, V^S_d) \equiv (G_j G_S, V^S_d)$.

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[46] We choose the word demonstrability only in order to index by d : the word provability would require the index p that might lead to confusion with indexes concerning the concepts of proposition or of probability.

Now, how can we represent the emergence of a proof-description $D^S_j/G^S_j,œ_j,V^S_d/$? Can it be conceived as the resuly *directly* produced by a corresponding genetic class $C[G^S_j.V^S_d]$, i.e. as the result of re-productions of a set of successions $[G^S_j.V^S_d]$ defined *from the start on* ? The structure posited for a proof-description D^S_j shows immediately that the answer is *negative*. Indeed in the course of the elaboration of D^S_j the view V^S_d does not work constantly on one same object-entity, namely the object-entity $œ_j$ generated by G^S_j which has to be proven in S. V^S_d works on *other* intermediary well-formed expressions produced by other generators that become possible progressively while the proof-description D^S_j is developing. So a more analyzed answer is needed here. It can be established as follows.

We have noted before that the integral description D^S_j emerges by n successive mutually different descriptional steps. Let us denote by D^S_{jk}, k=1,2...n the k-th step. This is a one-step "elementary" proof-description $D^S_{jk}/G^S_{jk},œ_{jk},V^S_d/$. It involves a generator of object-entity $G^S_{jk}=G_{jk}G_S$ which is *different* from the generator $G^S_j=G_jG_S$ from the epistemic referential (G^S_j, V^S_d) corresponding to the integral proof D^S_j and produces a "local" object-entity $œ_{jk}$ that is *different* from the object-entity $œ_j$ from $D^S_j/G^S_j,œ_j,V^S_d/$ (the index j which has been conserved in the notations D_{jk} and $œ_{jk}$ reminds that the designata of these notations are both referred to the object-entity $œ_j$). In the first descriptional step $D^S_{j1}/G^S_{j1},œ_{j1},V^S_d/$ the object-entity $œ_{j1}$ with which D^S_{j1} *ends* (which had to be ascertained) is produced by a generator G^S_{j1} which still acted on the zone from the conceptual reality consisting of *S itself*, like in the case of the global generator G^S_j from the integral proof-description D^S_j, but nevertheless this is already *another* generator because it produces the object-entity $œ_{j1}{\neq}œ_j$. And for k>1 the corresponding generator G^S_{jk} does not even work on S any more. It works on $[S{\cup}\{œ_{jm}\}]$, m=1,2...k-1 where $\{œ_{jm}\}$ is the set of well-formed expressions of which the demonstrability in S has been established by the sequence $D^S_{j1}D^S_{j2}... D^S_{jk-1}$ of the previously accomplished elementary descriptional steps. (The set $\{œ_{jm}\}$, m=1,2...k-1 has to be added to S because now it is explicitly available in the conceptor's mind and the k-th choice of an object-entity $œ_{jk}$ takes support on this set also, not only on S any more). So the integral proof-description

D^S_j emerges by an "additive composition in succession" of the n elementary step-descriptions D^S_{jk}, k=1,2...n where the generator of object-entity and the corresponding object-entity *change* – in a way that is *not* prescribed by S – while the view remains the same. In these conditions we can show that :

πL6. *Proposition. A proof-description D^S_j is produced by a non-degenerate double-extremity and **creative** genetic class.*

"Proof". A one-step description D^S_{jk}, for any k between 1 and n, can be non trivially regarded as the result of the corresponding double-extremity genetic class $C[G^S_{jk}.V^S_d]$. Indeed the succession of epistemic operations $[G^S_{jk}.V^S_d]$ is indefinitely repeatable and its result stays unchanged, namely it is the k-th final well-formed expression $œ_{jk}$ that has been shown to be provable. So we are strictly in agreement with the concept of an individual conceptual description produced by a double-extremity genetic class, as formed by the definitions D14.1, D14.2.1 and DL1.2. Furthermore, the *ordered* juxtaposition in succession of the elementary proof-descriptions D^S_{jk} brought forth by the elementary genetic classes $C[G^S_{jk}.V^S_d]$ with k=1,2.....n, yields a definite new description in the sense of D14.2.1, namely precisely the integral proof-description D^S_j as defined from the start on. So we can write

$$D^S_j/G^S_j,œ_j,V^S_d/ \equiv \Sigma_k D^S_{jk}/G^S_{jk},œ_{jk},V^S_d/, \qquad k=1,2.....n$$

where in the last descriptional step $D^S_{jn}/G^S_{jn},œ_{jn},V^S_d/$ the object-entity $œ_{jn}$ has the same content as $œ_j$ but is generated by the generator G^S_{jn} – heuristically different from G^S_j – which acts on $[S \cup \{œ_{jm}\}]$, m=1,2...n-1, not exclusively on S like the (in general fictitious) generator G^S_j. This establishes πL6 [47].

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[47] It is noteworthy that in a certain sense the structure found for the process of emergence of a proof-description presents certain similitudes with the way in which the basic transferred quantum mechanical description of a microstate is brought forth. Indeed the quantum mechanical measurement-evolutions draw into the realm of the observable and communicable, aspects of the studied microstate that can be conceived *a posteriori* as relative potentialities possessed *ab initio* by the studied microstate which have been actualized by the measurement evolutions. While the provability in S of the studied well-formed expression $œ_j$ can also be conceived *a posteriori* as a potentiality of $œ_j$ that has been actualized by the proof-description $D^S_j/G^S_j,œ_j,V^S_d/$. The visibility of all the intermediary steps D^S_{jk} - devoid of equivalent in the quantum mechanical case - stems from the fact that here the cognitive situation is different, the object-entity as well

Comment. In the first place, the fact that $œ_{jn}$ has the same content as $œ_j$ while on the other hand $G^S_{jn} \neq G^S_j$, might seem to contradict the one-one relation G-$œ_G$ posited in D4. But in fact G^S_{jn} working on $[S \cup \{œ_{jm}\}]$, m=1,2...n-1 amounts to an effective and explicit explicit representation of precisely the global generator G^S_j , *iff* the proof of $œ_j$ succeeds (if not, the very concept of what is denoted G^S_j is discarded).So the effective expression of G^S_j is given by the definition $D^S_j/G^S_j,œ_j,V^S_d/ \equiv \sum_k D^S_{jk}/G^S_{jk},œ_{jk},V^S_d/$, k=1,2.....n, itself. What appears here is that, as already remarked, the *a priori* operation of generation G^S_j of the well-formed expression $œ_j$ to be proven is in general just an *a posteriori* fiction, that in fact $œ_j$ is obtained progressively, constructively, by trial and error, while $D^S_j/G^S_j,œ_j,V^S_d/ \equiv \sum_k D^S_{jk}/G^S_{jk},œ_{jk},V^S_d/$,   k=1,2.....n, is being sedimented. And once $œ_j$ and G^S_j have been settled – together – the one-one relation between them *is* insured : I postulate that two different proofs never have identical results, they can imply a same result, but each one has also specific entailments.

In the second place, the definition $D^S_j/G^S_j,œ_j,V^S_d/ \equiv \sum_k D^S_{jk}/G^S_{jk},œ_{jk},V^S_d/$, k=1,2.....n, obtained above suggests that the to-be-established calculus with genetic classes will include a *general* definition of "composition in succession" of certain types of genetic classes. (Such a definition can appear to be important in an attempt at a formalization of MRC).

In the third place :

While a formal system S itself is an object-entity generated by a *creative* abstract generator, i.e. it does not pre-exist like a "value" of a classical "object-variable x", furthermore the concept of formal proof inside S, in its turn, appears to have the nature of a relative description produced by *genetic* classes, not by pre-existing shadow-"predicates P" : the concepts that are the very core of the modern classical logic stem from epistemic actions that are *not defined* inside modern classical logic.

This paradoxical situation illustrates strikingly how we currently act inside conceptual volumes that are not included in our explicit representations.

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as the whole descriptional process being conceptual, which permits a uniform perceptibility that cannot be realized for a physical microprocess.

We sum up. The whole set of the researched MRC-terms concerning a proof-description is this. The object-entity generator $G^S_j = G_j G_S$ is a fundamentally creative generator consisting of, first the construction of the stable formal "ground" consisting of S itself, and then, out of S, of the choice or the construction of the object-entity $œ_j$ to be proven in S. The view is the formal view V^S_d of demonstrability in S, extracted from S, so a view that depends on S (or, equivalently, on G_S, so on G^S_j). So the epistemic referential where any proof-description D^S_j is achieved is (G^S_j, V^S_d). The explicit structure of a proof-description in S is $D^S_j/G^S_j, œ_j, V^S_d/ \equiv \sum_k D^S_{jk}/G^S_{jk}, œ_{jk}, V^S_d/$, k=1,2.....n, $œ_{jn} \equiv œ_j$, $G^S_{jn} \neq G^S_j$

The MRC-relations between empirical truth and demonstrability

We have shown that a view of demonstrability V^S_d in the sense of DL.5 has nothing to do with empirical truth as ascertained by a metaview DL.2. However it is quite currently said of an expression which has been proven in S *via* V^S_d that it has been shown to be "true". Those who want to be more specific make sometimes use of the expression "formally true" in S. Furthermore a well-formed expression that has been proven in S, is often referred to as a "proposition" which, "because" it has been proven in S, necessarily is also "true", not in S this time, just true in the sense of "empirical mathematical truth". Whereas inside the MRC-logic a (relative) proposition in the sense of DL.3 is a concept quite different from a well-formed expression from a formal system (which is consistent with the axioms from S *via* the transformation rules from S), it concerns empirical truth, not consistency. In fact all the formulations of the above mentioned sort, where the word true is made use of, are related with the supposition that the axioms from S are empirically true. If this is not made clear it might entail much confusion. So below I shall now explicate the MRC-relations between propositions tied with empirical truth, axioms, and demonstrability inside a formal system. For the logicians and mathematicians such specification are certainly trivial : I apologize for this.

To begin with, a relative description $D/G, œ_G, V/$ is a piece of meaning, of elaborated semantics. And a view $V^{(2)}_{eτ}$ of empirical truth (DL.2) is a metaview which can exist in the sense of D7 only with respect to a previously achieved relative description $D/G, œ_G, V/$. So *a priori* only a piece of meaning that has been elaborated previously, independently of any question of truth, can afterward be found to be

empirically true or false ; and this, if it can happen at all, can happen only with respect to a *specified* metaview $V^{(2)}_{e\tau}$ of empirical truth. An absolute assertion of empirical truth is rejected inside MRC as devoid of significance. This is why the MRC-concept of proposition defined in DL.3 is a metaconcept, and is relative. It must involve an independently constructed description and a metaview of empirical truth constructed for definite aspects.

A view V^S_d of demonstrability in a formal system S (DL.5) can exist in the sense of D7 only with respect to well-formed expressions from S. Though inside another formal system which is a metasystem with respect to S it might also be possible to construct a metaview of demonstrability in S, V^S_d is not *quintessentially* a metaview.

Now, in general a relative description D/G,œ$_G$,V/ is not a well-formed expression from a formal system S, so in general it does not exist in the sense of D7 with respect to a view of demonstrability V^S_d ; in general well-formedness and correction of transformation inside some formal system have no relevance with respect to a relative description. And *vice versa*, in general a well-formed expression from S is not a relative description, it is just a sequences of signs permitted inside S, expressly posited to have been purified of any semantics, of any meaning ; it is by construction "invisible" to the views of empirical truth which consist of procedures for testing assertions of values of empirically perceivable aspects g. So the relative descriptions, the metaviews of empirical truth and the propositions, form a group of essentially semantical concepts which simply have nothing to do with the well-formed expressions and the view of demonstrability from a "purely" formal system.

In these conditions, what is the reason why provability and truth are so readily coalesced with one another ?

The main reason is the current assertion that the axioms from a formal system S are posited to be true. But in fact no formal system at all is – *stricto sensu* –concerned by this way of speaking. The axioms are posited to be true only in the *interpretations* of a formal system S, if these exist, or in the deliberate formalizations of this or that theory of a domain of empirical facts (physical or abstract) that has first been constructed quite independently of any formal system and afterward has been axiomatized, and finally formalized. In both these cases the "axioms" are well-formed expressions from the formal system obtained in this way, which are explicitly constructed so as to translate relative propositions p(D) posited to obtain the empirical-truth-value "true" when the description

D involved by p(D) is examined *via* the metaview $V^{(2)}_{e\tau}$ of empirical truth relatively to which p(D) is defined (the form required by DL.3 can always be achieved). So in these cases the axioms are double-faced. On one face they are just a-semantical well-formed expressions from the considered formalized system, and on the other face they are meaningful propositions concerning empirical facts and posited to be true.

Now, one of the theories of a domain of empirical facts, namely deductions, is logic. Logic establishes *logical laws*, "tautological propositions" that are always true in virtue of their mere form : a composed proposition where the atomic propositions are laws of physics, can have a form *such* that exclusively the value 1 ("true") is contained in its truth-table, which entails that the composed proposition can be true even if all or some of the physical laws asserted by the atomic propositions, or some of these, are false. In this sense the tautological logical axioms are *closed* with respect to non-logical domains of facts ; they are isolated from the truth-qualifications of the atomic propositions which concern factual domains different from the logical one ; they are endowed with an immutable truth-value "true" which concerns exclusively *logical* empirical truth, "logical form", being devoid of reference to any view of empirical truth different from the view of "logical empirical truth" (if such an expression is permitted). B Russell wrote [48] :

> «All the propositions that are demonstrable in any admissible logical system must share with the premises the property of being true in virtue of their logical form ; and all propositions that are true in virtue of their logical form ought to be included in any adequate logic».

(here "premises" stands for "axioms"). But a formalization of logic can introduce also axioms that are *not* tautologies (the axiom of infinity, the axiom of choice), whereby empirical truth of non-logical essence can be also injected into a formalization of logic : this, in Russell's view, is a *problem*. Anyhow the essential point in this context is that even the logical laws which by their tautological form express *logical* empirical truth, have been constructed such by man, with the deliberate aim to codify in a performing and method-offering way the domain of facts consisting of human deductive reasoning. So *logical systems are not purely formal systems, they are formalizations of a theory which legalizes, normalizes a domain of facts*. They build methods for the conservation and vehiculation of the empirical truth captured in the axioms, which can be realized with various degrees of excellence. *In any acceptable formalization of logic this basic aim*

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[48] Russell, B., Principles of Mathematics, (1948) George Allen &Unwin LTD.

entails intimate relations between logical empirical truth and demonstrability (still a rather unexplored domain). One of the most remarkable among these is the fundamental logical theorem – to be insured by any acceptable formalization of logic – according to which *a provable universal proposition is true*, but not also *vice versa*.

The preceding remarks hold also for the logico-mathematical systems. These are constructed as formalizations of this or that domain of spontaneously formed intrinsic mathematical models (the integer numbers, the geometrical objects, etc.). By insertion into such a formalization these models are much purified, accordingly to various requirements, and are organized in relational structures endowed with a strict formal coherence. The result is endowed with a power of rigorous deductive re-expression of the essential features of the initial spontaneous models wherefrom it stems, which often is so remarkable that it is perceived as if miraculous.

But in a genuinely "pure", non-interpreted formal system, the axioms are *not* also relative propositions, they are exclusively well-formed expressions from S selected among those by which a proof-description is permitted to *start* : this is the formal specificity of an axiom from a strictly formal system, *not* truth (think of formal games or of certain mathematical systems). The axioms from a non interpreted formal system are simply not connected with the concept of empirical truth. This, however, is simply forgotten in the current ways of speaking, because formal systems which are neither interpreted, nor interpretable, nor obtained from a theory of a domain of empirical facts by axiomatization and formalization, are devoid of interest. So the double-faced [axioms-propositions] are present in the mind as soon as one thinks of an interesting case, and therefore it is continued to think and speak in terms of truth of the axioms. So, given that formal proofs start with axioms, furthermore the intermediary well-formed expressions are often called propositions, and the theorems, having been proven, are *ipso facto* considered to be also true. Which amounts to a surreptitious fading away of the case of exclusively formal characters, and a fallacious substitution to these, of *semantic*-deductive characters.

Inside MRC this sort of gliding is refused by method. We are in possession of an explicit definition of each one of the involved concepts : *a priori* possibility of relative meaning in the sense of D7, piece of elaborated relative meaning in the sense of one or the other of the definitions D14, relative view of empirical truth in the sense of DL.2, relative proposition in the sense of DL.3, formal system S, view of demonstrability inside S in the sense of DL.5, proof-description inside S. We shall never say that the axioms

from a purely formal system S are posited to be true ; nor shall we say that a theorem from S is a well-formed expression that has been proven to be true in S, we shall only say that it has been proven to follow from the axioms in the way required in S. And we shall distinguish sharply between a formal system and the formalization, logical or logico-mathematical, of a theory of a domain of physical or conceptual facts, logic itself included.

These distinctions do by no means exclude the pertinence of the concept of empirical truth concerning the work with "formal facts". The metaviews of empirical truth are here recognized to have the major role in the construction of formalizations of a theory of a domain of facts – logic included – as well as in the construction of complex proof-descriptions. For instance, one can want to prove inside arithmetic that given any prime number there always exists a bigger one. The above expression of this assertion in terms of usual language can be without difficulty put in the canonical form of a relative proposition in the sense of DL.3, defined relatively to a specified metaview of "mathematical empirical truth" that introduces a case by case examination of truth-value consisting in each case of the exhibition of an example. With respect to this metaview of mathematical empirical truth one might then find that the assertion has never been found false in any of the examined cases. This sort of empirical research develops in the conceptor's mind the preliminary intuitions necessary for becoming able to attempt a proof-description inside, say, Peano's formalized arithmetic (how to start, what deductive trajectories to imagine tentatively, etc.). But this preliminary empirical work is not the researched formal proof itself, and this proof, if it can be achieved, *cannot* make an explicit, declared use of the metaviews of mathematical empirical truth that generated the intuitive knowledge of the conceptual situation : there is no *place*, in a formalized proof, for such metaviews.

Gödel's proofs versus *MRC*

Let us now consider the properties of completeness or decidability of a *formalized* system S (not a purely formal one), and of consistency of this system [49]. This leads to

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[49] *Completeness* (or decidability) of S : the (presumed) property of S according to which any expression that one can exhibit, which is well-formed according to S, is decidable *in S*, i.e. either this expression or its negation can be proven in S. *Consistency* of S : the (required) property of S according to which, for any well-formed expression from S that can be exhibited, it is not possible to prove in S both this expression and its negation.

Gödel's famous proofs [50]. These proofs establish that *(a)* if Peano's first order formalization of arithmetic, A_P say, is posited to be representable inside the formalization of logic achieved by Russell and Whitehead [51] in Principia Matematica (PM), then A_P is found not to be complete ; and *(b)* from this first conclusion of non-decidability of A_P it follows (with a slight generalization of PM) that the consistency of A_P cannot be proven inside A either. These results hold for a large class of other formalized systems and other formalizations of logical thought.

We shall now show that MRC throws a new light on the questions of consistency and completeness. In the first place, it entails – quite *independently* of the question of completeness – that in general the consistency of a formal system cannot be formally examined inside this system. The same impossibility holds concerning the completeness of the system, this time quasi without reservations. This shows that both consistency and completeness, but independently of one another, require the specification of a metasystem and are then relative to the utilized metasystem, not just properties of the studied formal system itself. In the second place, MRC suggests *to require by method* that a "good" metasystem, offering an optimized formalization of the logico-mathematical thinking, *shall not permit inside itself undecidable expressions that can be treated like propositions* (which PM does permit). Thereby MRC displaces the accent from a deductive point of view centered upon the studied formal system, to a constructive methodological point of view concerning the acceptable metasystems.

We begin by reproducing the section 1 from Gödel's work [52].

«ON FORMALLY UNDECIDABLE PROPOSITIONS OF PRINCIPIA MATEMATICA AND REIATED SYSTEMS [1]

by Kurt Gödel, Vienna

[50]   Gödel, K., *Über formal unentsheidbare Sätze der Principia Matematica und verwandter Systeme*, Monatshefte f˙r Mathematik und Physik 38 (1931), 173-198.

[51] Whitehead, A. and Russell, B., *Principia Matematica*, 2nd. edition (1925, Cambridge.

[52] Lacking the German original, the English translation, found on the web, has been verified with the French one as published in Nagel, E., Newman, J. R., Gödel K., Girard, J-Y, *Le théorème de Gödel*, (1989), Seuil. Taking into account both the significance of the word and its French translation, we have substituted the word "true" to the word "correct", which in the English translation available to us introduced confusion. Gödel's notes are all reproduced - with their own numbering - after the quotation from his main text, in order to avoid confusion with our own notes. Those among Gödel's notes that are irrelevant here (bibliography) are not reproduced, only their existence is indicated, followed by dots. *Our* notes concerning the quotation from Gödel's text are inserted in the general series of our notes, but their numbers are written with Arial Black characters.

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The development of mathematics in the direction of greater exactness has – as is well-known – led to large tracts of it being formalized, so that proofs can be carried out according to a few mathematical rules. The most comprehensive formal systems yet set up are, on the one hand, the system of Principia Matematica (PM) ^{2} and, on the other, the axiom system for set theory of Zermello-Fraenkel (later extended by J. v. Neumann ^{3}. These two systems are so extensive that all methods of proof used in mathematics today have been formalized in them, i.e. reduced to a few axioms and rules of inference. It may therefore be surmised that these axioms and rules of inference are also sufficient to decide *all* mathematical questions which can in any way at all be expressed formally in the systems concerned. It is shown below that this is not the case, and that in both the systems mentioned **53** there are in fact relatively simple problems in the theory of ordinary whole numbers ^{4} which cannot be decided from the axioms. This situation is not due in some way to the special nature of the systems set up, but holds for a very extensive class of formal systems, including, in particular, all those arising from the addition of a finite number of axioms to the two systems mentioned, ^{5} provided that thereby no false propositions **54** of the type described in footnote 4 become provable.

Before going into details, we shall first indicate the main lines of the proof, naturally without laying claim to exactness. The formulae of a formal system – we restrict ourselves here to the system PM – are, looked at from outside, finite series of basic signs (variables, logical constants and brackets or separation points), and it is easy to state precisely just which series of basic signs are meaningful formulae and which are not ^{6,} **55**. Proofs, from the formal standpoint, are likewise nothing but finite series of formulae (with certain specifiable characteristics). For metamathematical purposes it is of course immaterial what objects are taken as basic signs, and we propose to use natural numbers ^{7} for them. Accordingly then, a formula is a finite series of natural numbers, ^{8} and a particular proof-schema is a finite series of finite series of natural numbers. Metamathematical concepts and propositions thereby become concepts and propositions concerning natural numbers, or series of them, ^{9,} **56** and therefore at least partially expressible in the symbols of the system PM

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53 These are (essentially) formalizations of logic, so involving meaning and empirical truth.

54 G). though he employs the word "false", Gödel means here *apparent* propositions, not untrue ones, as his note 4 shows : he explicitly says here that if the "false" propositions from the metasystem became provable – so (by opposition) he specifies that the "false" (apparent) propositions from the metasystem are *undecidable* – *his proof of undecidability of the studied system would not work any more*. But he continues to make use of the word "proposition", eventhough he says that "false" propositions are brought in. Though in the explicit conclusion of his proof as presented in the above-quoted section 1, Gödel did not assign a role to this fact, let us note that it was present to his mind. It will appear below that this fact is the crucial feature for understanding the MRC-significance of Gödel's work.

55 Later in his proof Gödel re-expresses the meaningful sequences of signs which he wants to make use of, in terms of *defined* notations that point briefly toward the logical meaning of the considered sequence of signs (variable, proof-sequence, provable, etc.).

56 "Isomorphic" means that the logico-mathematical meanings and the truth valuations are preserved.

itself. In particular it can be shown that the concepts "formula", proof-schema", "provable formula" are definable in the system PM [57], i.e. one can give [10] a formula F(v) of PM – for example with one free variable v (of the type of a series of numbers), such that F(v) – interpreted as to its content - states : v is a provable formula. We now obtain an undecidable proposition of the system PM, i.e. a proposition A, for which neither A nor *not* -A are provable, in the following manner.

A formula of PM with just one free variable, and that of the type of the natural numbers (class of classes), we shall designate a *class sign*. We think of the class signs as being somehow arranged in a series,[11] and denote the n-th one by R(n) ; and we note that the concept "class-sign" as well as the ordering relation R are definable in the system PM. Let α be any class-sign ; by [α ; n] we designate that formula which is derived on replacing the free variable in the class-sign α by the sign for the natural number n. The three-term relation x=[y;x] also proves to be definable in PM. We now define a class K of natural numbers, as follows :

$$n \in K = \sim (\text{Bew } [R(n); n]) \quad {}^{11a} \qquad\qquad (1)$$

(where Bew x means : x is a provable formula). Since the concepts which appear in the definiens are all definable in PM, so too is the concept K which is constituted from them, i.e. there is a class-sign S [12] such that the formula [S; n] – interpreted as to its content – states that the number n belongs to K. S, being a class-sign, is identical with some determinate R(q), i.e.

$$S = R(q)$$

holds for some determinate natural number q. We now show that the proposition [R(q); q] [13] is undecidable in PM. For supposing the proposition [R(q); q] were provable, it would also be true [58] ; but that, on the basis of what precedes, means that q would belong to K, i.e. according to (1), $\sim$ (Bew [R(q); q]) would hold good, in contradiction of our initial assumption. If, on the contrary, the negation of [R(q); q] were provable, then $\sim$ (n$\in$K) would hold good. [R(q); q] would thus be provable at the same time as its negation, which again is impossible [59].

The analogy between this result and Richard's antinomy leaps to the eye [60] ; there also is a close relationship with the "liar" antinomy, [14],[61] since the undecidable proposition states precisely

[57] For instance, according to the PM definition no. 20, "x is an elementary formula" is the meaning of the writing $\text{Elf}(x) \int (\exists y,z,n)[y,z,n \leq x \, \& \, \text{Typ}_{n+1}(z) \, \& \, x = z = \text{Typ}_n(y)$, and "x is a provable formula" is the meaning of the writing (in the german original) Bew(x) = (Ey)yBx from the definition no. 46.

[58] This distinction is essential. It takes support on the logical theorem according to which a provable universal proposition is true (Gödel's proposition [R(q) ; q] is a universal).

[59] PM is *supposed* here to be consistent.

[60] According to PM, Richard's antinomy is vitiated by the confusion between distinct logical types in the sense of Russell's theory of logical types, while Gödel's proof respects the Russellian stratification of distinct types.

[61] Again the connection (epistemological antinomy)-(undecidability) on which our note [54] draws attention.

that q belongs to K, i.e. according to (1), that it is not provable. We are therefore confronted with a proposition which asserts its own unprovability. [15, 62] The method of proof just exhibited can clearly be applied to any formal system having the following features [63] : firstly, interpreted as to its content, it disposes of sufficient means of expression to define the concepts occurring in the above argument (in particular the concept "provable formula") ; secondly, every provable formula in it is also true as regards its content [64]. The exact statement of the above proof, which now follows, will have among others the task of substituting for the second of these assumptions a purely formal and much weaker one.

From the remark that [R(q); q] asserts its own unprovability, it follows at once that [R(q); q] is true, since [R(q); q] certainly is unprovable (because undecidable). So the proposition which is undecidable *in the system PM* yet turns out to be decided by metamathematical considerations. The close analysis of this remarkable circumstance leads to surprising results concerning proofs of consistency of formal systems, which are dealt with in more detail in section 4 (Proposition XI).

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[1] ......

[2] ......

[3] ......

[4] I.e., more precisely, there are undecidable propositions in which, besides the logical constants ~ (not), ∕ (or),) (x) (for all) and = (identical with), there are no other concepts beyond + (addition) and **.** (multiplication), both referred to natural numbers, and where the prefixes (x) can also be referred only to natural numbers.

[5] In this connection, only those axioms in PM are counted as distinct as do not arise from each other only by change of type.

[6] Here and in what follows we shall always understand the term "formula of PM" to mean a formula written without abbreviations (i.e. without definitions). Definitions serve only to abridge the written text and are therefore in principle superfluous.

[7] I.e. we map the basic signs in one-one fashion on the natural numbers (as is actually done on page 179).

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[62] Gödel's *note 15* is remarkably curious. It concerns exclusively the process of construction ("projection" in Peano's arithmetic) of the ("false") "proposition" [R(q);q], and of identification of the meaning imparted to it by this formal construction, while the original *content*, inside PM, of this "proposition", is not criticized. The process of construction of [R(q);q] indeed is not circular, it respects Russell's requirement of stratification of the logical types, etc.. But the proposition itself, by its original content, *is* "antinomic". Gödel's note 14 and his own expression "false propositions" (to which our note [54] refers) testify that he was fully aware of this and that he *researched* precisely such an antinomic structure, in order to be able, by taking support on it to reject its decidability in terms of *empirical truth* and therefrom to infer also an undecidability in terms of a formal proof inside Peano's arithmetic. But, eventhough he starts by announcing a general critical attitude with respect to the metasystem PM, it remains cryptic in his subsequent formulations whether, specifically, he considered acceptable the possibility of "antinomic propositions" inside PM ; and correlatively, whether he considered to have indicated a way for constructing better metasystems than PM, or to have definitively established that Peano's arithmetic is not decidable, if it is consistent (as it seems to be involved by the current ways of speaking).

[63] What follows in the text shows that "formal system" means here a formalization of logic, or more generally a metamathematical system intended to be able to include and to rule mathematical systems or questions. It does not mean Peano's arithmetic.

[64] See our note 58.

[8] I.e. a covering of a section of the number series by natural numbers. (Numbers cannot in fact be put in a spatial order).

[9] In other words, the above-described procedure provides an isomorphic image of the system PM in the domain of arithmetic, and all metamathematical arguments can equally well be conducted in this isomorphic image. This occurs in the following outline proof, i.e. "formula", "proposition", "variable", etc. *are always to be understood as the corresponding objects in the isomorphic image*.

[10] It would be very simple (though laborious) actually to write out this formula.

[11] Perhaps according to the increasing sums of their terms and, for equal sums, in alphabetical order.

[11a] The bar-sign indicates negation (Replaced with ~.).

[12] Again there is not the slightest difficulty in actually writing out the formula S.

[13] Note that "[R(q); q]" (or – what comes to the same thing "[S; q]" – is merely a metamathematical description of the undecidable proposition. But as soon as one has ascertained the formula S, one can naturally also determine the number q, and thereby effectively write out the undecidable proposition itself.

[14] Every epistemological antinomy can likewise be used for a similar undecidability proof.

[15] In spite of appearances, there is nothing circular about such a proposition, since it begins by asserting the unprovability of a wholly determinate formula (namely the q-th in the alphabetical arrangement with a definite substitution) and only subsequently (and in some way by accident) does it emerge that this formula is precisely that by which the proposition was itself expressed.»

Let us comment on this inside MRC (see, as an introduction, the final global comment on the definitions D14 of a relative description). For the sake of clarity we continue to proceed by sequences Proposition-"Proof". We begin by an assertion related with the last paragraph from the above quotation, concerning consistency.

πL.7. *Proposition on consistency*. According to MRC the question of the consistency of a formal system S cannot, in general, be settled inside S, for reasons that are *independent* of any assumption concerning the completeness of S. In general this question can be settled only by formal examination inside a conveniently constructed metasystem MS. Then the solution established inside MS is relative to MS.

"Proof". The consistency of S is by definition the (required) property of S according to which, for any well-formed expression from S that can be exhibited, it is not possible to prove inside S both this well-formed expression and its negation (note 49).

Now, the *whole* qualificational power defined inside S, is concentrated in the view of demonstrability V^S_d from the proof-descriptions $D^S_j/G^S_j,\text{œ}_j,V^S_d/$. In each one of these the object-entity œ_j consists by definition of just one well-formed expression from S : V^S_d does not exist in the sense of D7 with respect to "any well-formed expression from S that can be exhibited" – a potential meta-entity with respect to those, œ_j, from the achieved proof-descriptions $D^S_j/G^S_j,\text{œ}_j,V^S_d/$ – so V^S_d cannot qualify this meta-object-entity *as a whole*. However, though S says nothing concerning the way in which one may

"exhibit" well-formed expressions different from those enumerated *ab initio* in the definition of S, otherwise than by achieving proof-descriptions D^S_j, it might happen that somehow – by the help of projections from some metasystem MS, or by empirical research – a well-formed expression from S be found that can be proven inside S, *via* the view of demonstrability V^S_d, as well as its negation. Thereby the in-consistency of S would be proven inside S, by construction, and the question would be closed. But this is a particular circumstance which may stay indefinitely non realized ; and as long as a proof of inconsistency by construction has not been produced, the question of the consistency of S stays open. Or otherwise, in the case of certain trivial finite systems S, it can be possible to produce one by one all the well-formed expressions permitted by S, and to study them by corresponding proof-descriptions $D^S_j/G^S_j,œ_j,V^S_d/$, thus concluding inside S concerning the consistency of S. But in general an assertion of consistency of S cannot be founded on a sequential production of well-formed expressions from S. In general such a process is not efficient because there is no way for ascertaining that the production is finished, nor that, while it continues, inconsistency will never be found. So according to MRC the question of the consistency of S cannot – in general – be settled inside S. It follows that only a formal examination *of S as a whole,* achieved from the outside of S, could settle this question.

But this, according to MRC, requires *another* sort of description than the proof-descriptions $D^S_j/G^S_j,œ_j,V^S_d/$ *from* S, where *not* [S-as-a-whole] is the object-entity. Indeed the principle of separation P15 asserts that «Since any one relative description $D/G,œ_G,V/$, whatever its complexity, involves by construction one generator of object-entity, one object-entity, and one view, all well defined, as soon as some change is introduced in the content or the role designated by a term from the triad $G,œ_G,V$, *another* description is considered». And, by method, P15 posits that «this other description must be treated *separately*».

Now, since a formal proof is researched, it must be achieved inside some formal system, namely some convenient metasystem MS inside which S be somehow embeddable.

Suppose then that such a metasystem has been found and that inside it a proof of the consistency or the inconsistency of S has been achieved. Then nothing excludes that with another metasystem (MS)'$\neq$MS the conclusion of this proof be contradicted : though inconsistency *can* in principle happen to be provable inside S by an example – i.e. in an

absolute way –, in general a proof concerning the consistency of S is relative to some metasystem MS.

So πL.7 is entirely established.

Comment. The fact that in general a proof of consistency of a formal system, requires a metasystem, is well-known. The new element here is only that (and how) this follows inside MRC, and quite independently of considerations concerning the completeness of the studied system.

We consider now Gödel's proof of undecidability.

πL.8. ***Proposition about the expression [R(q);q]***. *According to MRC the well-formed expression [R(q);q], by construction, is not a proposition, so it cannot be true or false. So Gödel's* reductio *becomes impossible and aimless.*

"Proof". According to MRC, a relative description $D/G,œ_G,V/$ is a piece of elaborated meaning where the three roles G, $œ_G$, and V have *all* to be defined, and played accordingly to their definitions, by some definite epistemic actors [65]. Furthermore a relative proposition involves a definite relative description $D/G,œ_G,V/$ that has been previously established independently, and afterward is subjected to valuation by the truth-values of some definite metaview of empirical truth that exists with respect to $D/G,œ_G,V/$, in the sense of D7 (DL.3).

The metasystem PM dwells with well-formed expressions that can be "interpreted as to their contents" (meanings) and with respect to these can be *a priori* awaited to be found to be empirically true or false. So, implicitly, descriptions and propositions are involved in PM. Then, according to MRC, what is the descriptional status of the formula [R(q);q] from PM ?

[R(q);q] is not a relative description $D/G,œ_G,V/$. Indeed [R(q); q] is first constructed by a succession of syntactical steps. Once obtained in this way, it is «interpreted as to its content» (cf. Gödel's note 15) and found to assert its own unprovability. But semantically, *[R(q); q] consists **exclusively** of this self-qualifying*

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[65] Even if in a degenerate way (i.e. two roles are held by one same actor) and/or without radicality (the generator G does not radically create the object-entity $œ_G$, the view V does not radically change this object-entity while qualifying it) (cf. the final general comment of the definitions D14).

assertion. The roles of generator of object-entity and of object-entity are not defined, so they are not played. In «I am not provable» of what does «I» consist ? [R(q);q] asserts the unprovability of nothing definite. The fact that [R(q);q] has been constructed in full agreement with all the syntactical requirements from PM (the stratification of distinct types included), does not change this.

Now, inside MRC the definition D14 of a relative description (cf. the final global comment) banishes explicitly self-referential constructs, on semantic-methodological grounds, whatever their grammatical or logico-mathematical correctness. So according to MRC there is no description corresponding to [R(q);q]. *A fortiori* [R(q); q] is not a relative proposition in the sense of DL.3 either [66]. It is not even a proposition in the loose sense of the classical logic, (i.e. [(an assertion) (that can be true or false)]), since the first element, an assertion, *in its own right*, is lacking). As Gödel himself says, it is a false (apparent) proposition (cf. the end of the first paragraph from our quotation of Gödel's text, and our note 54 on Gödel's note 4). In these conditions, [R(q);q] is doomed not to be provable in PM : *there is no way to prove the truth of something that is not a proposition*.

So Gödel's *reductio* becomes impossible (and aimless). The hypothesis «supposing the proposition [R(q); q] were provable, it would also be true» is known *a priori* to be impossible, by construction, which dissolves the *reductio*.

Comment. In so far that one is *aware*, as it does happen inside MRC, that a linguistic construct like [R(q); q] does not exist in the sense of D7 with respect to any view $(V_{e\tau})^{(2)}$ of empirical truth, Gödel's *reductio* is settled in advance and acquires the character of a game of play pretend.[67]

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[66] In order for $R(q); q]$ to be a proposition in the sense of DL.3 it would have been necessary to *first* specify inside PM a well-formed expression, say X_{PM}, which, interpreted as to its content, be a definite description D/G,œ$_G$,V/ ; and *then*, in order to "propose" tentatively that the meaning (the content) carried by X_{PM} is true, to construct $[R(q); q]$ as a genuine (universal) proposition, i.e. such that, considered itself now as to its content, it be found to be a metadescription $D^{(2)}/G^{2)},œ^{(2)},(V_{e\tau})^{(2)}/$ with $œ^{(2)} \equiv$ D/G,œ$_G$,V/ and $(V_{e\tau})^{(2)}$ a metaview of empirical (logico-mathematical) truth.

[67] Girard, J-Y., *Le champ du signe ou la faillite du réductionnisme* (in Le théorème de Gödel, by Nagel E., Newman, R, Gödel K., Girard, J-Y., (1989), Seuil), writes :
«Si l'on dégage les idées profondément novatrices - essentiellement la distinction vrai/provable - autour desquelles se charpente le théorème, la démonstration résulte d'une suite impitoyable de truismes - ou de "prouvismes"».

*πL9. **On the MRC-significance of Gödel's proof***. According to MRC, the main previously unknown result established by Gödel's proof is that the metasystem PM permits inside it well-formed expressions that are not decidable, so are not propositions, and that can be injected into Peano's arithmetic A_P by isomorphic projection. There, *via* examinations monitored by PM, they reproduce their non decidability.

"Proof". Obvious from Gödel's proof and the preceding "proof".

Comment. Strictly expressed, according to MRC Gödel's proof establishes a conclusion about the metasystem PM+A_P, not about Peano's arithmetic A_P considered independently of PM. The undecidability proven by Gödel is relative to the Russell-Whitehead metasystem PM. So the propositions πL.8 displace the accent from the studied formal system, on the metasystem which is made use of for the study. But thereby one is led to a further quite general question, analogous to the question concerning consistency examined in πL.7 : is it conceivable to study the completeness of a formal system S from inside S ?

*πL.10. **Proposition on completeness***. According to MRC, in general the question of the completeness of a formal system S cannot be settled inside the system. It requires the use of a convenient metasystem MS. This entails that the result is relative to MS.

"Proof". Completeness of a formal system S is the (presumed) property of S according to which any expression that one can exhibit, which is well-formed according to S, is decidable *in S*, i.e. either this expression or its negation can be proven in S.
The argument from the "proof" of πL.7 can be transposed in an obvious way.

Comment. In these conditions, speaking of "the" completeness of S as if it were an absolute property of S, is in general misleading. In general the property of completeness of a formal system is radically dependent on the metasystem that is made use of for establishing its existence.

This leads to ask whether the features of a metasystem MS, which permit to induce in a studied formal system S, undecidable well-formed expressions, are indeed *unavoidable* features. The statement πL.8 seems to indicate a negative answer. Indeed, since MRC – a non formalized method – *does* avoid the emergence of "undecidable false

propositions", *a fortiori* it should be possible to build also a formalization of logic which avoids such emergences (as well as any other features that can generate undecidability).

The pertinent question, in this respect, seems to consist of the specification of methodological rules for constructing "good" metasystems.

The above (very rapid and quasi informal) examination of the questions of consistency and completeness of a formal system illustrates well the fundamental difference between classical logic and MRC. In classical logic all the creative epistemological features are occulted by storage in the absolutized and hypostatized concepts of "values of an object-variable x" and of a shadow-predicate "P". The involved descriptional relativities are not apparent, hence their consequences also remain hidden, so they cannot avoid false problems, nor show the way toward the natural solution when problems do creep in. Whereas inside MRC the double-extremity genetic classes expose explicitly all the involved cognitive actions, so the relativizing consequences of these upon the produced qualifications are obvious. Furthermore, the limitations entailed by the descriptional relativities are explicitly tied with a methodological obligation to interrupt the current descriptional process and to take a new start on a metalevel, which organizes in cells the conceptual progression and keeps it under control.

V.1.3. Conclusion on the MRC-logic

It is remarkable that MRC, such as it has been constructed by taking initial support exclusively on quantum mechanics, leads to the outline of a logical approach that is relevant not only for the basic, the physical creative genetic classes $C[G^{(o)}.V^{(o)}]$ of the type of those involved in quantum mechanics, but also for *conceptual* creative genetic classes $C[G.V]$ found to be involved in formal systems.

The quantum mechanical cognitive strategy, individualized inside MRC, has opened up a way of conceptualization that is not mute with respect to the most fundamental questions of nowadays abstract mathematical and logical thinking.

This is so because the canonical descriptional mould $(G, \text{œ}_G, V)$ drawn from quantum mechanics has been constructed at the lowest level of conceptualization which human mind has been able to reach, possibly the final one. There the most severe conditions that can be encountered in a process of conceptualization, are all active. So a basic structure of labelled receptacles for conceptualization which is constructed to fit these conditions, is sufficiently comprehensive for harbouring any descriptional possibility that might occur. Inside this structure, semantics and cognitive actions – which always involve *aims* – combine with the syntactic features, and this induces both intelligibility and control.

V.2. MRC *versus* Probabilities

One of the major successes of MRC is the representation of a deeper general concept of probability, which contains and explains the so cryptic quantum mechanical probabilities (refs. 15-18). Indeed, when Kolmogorov's classical concept of a probability space is examined inside MRC, the limitations and the absolutizations which flaw this concept come into striking evidence. By suppressing them, the concept of probability expands to the limits of its whole natural volume which rests on the most basic level of transferred conceptualization and extends up to very high descriptional levels.

Throughout the process of construction of the MRC-concept of probability, the methodological principle of separation P15 plays a key role. Therefore this process can also be regarded as a succession of illustrations of the very peculiar way in which the principle of separation works.

V.2.1. Komogorov's Classical Definition of a Probability Space

The fundamental concept of the nowadays theory of probabilities - in Kolmogorov's formulation [68] - is a probability space $[U, \tau, p(\tau)]$: $U=\{e_i\}$ (with $i \in I$ and I an index set) is a *universe of elementary events* e_i (a set) generated by the repetition of an "identically" reproducible *procedure* P (called also an experiment) which, notwithstanding the posited identity between all its realizations, nevertheless brings forth elementary events e_i that *vary* in general from one realization of P to another one ; τ is an *algebra of events* built on U [69], an event, let us denote it e, being a subset of U and being posited to have occurred each time that any elementary event e_i from e has occurred ; $p(\tau)$ is a *probability measure* defined on the algebra of events τ [70]. A pair $[P,U]$ containing an identically reproducible procedure P and the corresponding universe of elementary events U is called a *random phenomenon*.

On a given universe U, one can define various algebras τ of events . So it is possible to form different associations [[random phenomenon]˷[a corresponding probability space]], all stemming from the same pair $[P,U]$.

With respect to the previous representations Bernoulli, von Mises, etc.) – where only a concept of "probability law" (or "probability measure") was defined mathematically – Kolmogorov's concept of a probability *space* $[U, \tau, p(\tau)]$ has marked a huge complexifying progress.

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[68] Kolmogorov, A.N., (1950) *Foundations of the Theory of Probabilities*, Chelsea Publishing Company (translation of the original German monography (1933) *Grundbegriffe der Wahrscheinlichkeitrechnung*, Ergebnisse der Mathematik.

[69] An algebra built on a set S is a set of subsets of S – S itself and Ø being always included – which is such that if it contains the subsets A and B, then it also contains A∪B and A-B.

[70] A probability measure defined on τ consists of a set of real numbers p(A), each one associated to an event A from τ, such that : $0 \leq p(A) \leq 1$, $p(U)=1$ (normation), $p(\emptyset)=0$, and $p(A \cup B) \leq p(A)+p(B)$ where the equality obtains iff A and B are "independent" in the sense of probabilities i.e. iff they have no elementary event e_i in common ($A \cap B=\emptyset$). The number p(A) yields the value of the limit – supposed to exist – toward which the relative frequency n(A)/N converges when the number N of realizations of the involved repeatable procedure P is increased toward infinity (n(A) being the number of outcomes of A when P is repeated N times).

V.2.2. Critical emarks

In Kolmogorov's classical theory of probabilities, the procedure P is neither formally defined, nor symbolized or otherwise represented. This theory contains no symbolic location reserved for the procedure P, so *a fortiori* the random phenomena [P,U] as a whole is not represented. The consequence is that the structure of the connection between the considered probability space [U,τ,p(τ)], with the substratum wherefrom it is generated, is very rarely explicitly surveyed. Usually nothing whatever is asserted concerning the way in which the elementary events from the universe U do emerge by the procedure P.

> The channel for the adduction of semantic substance from the "pool of reality" (in the sense of D2) into the considered probability space [U, τ, p(τ)], is undefined and unexplored. It is only alluded to by mere words.

In each application of the abstract theory of probabilities, to some specific problem, the corresponding semantic substance is injected into the studied probability spaces in an intuitive unruly way. It might be argued that this is an intentional non-determination which endows the formalism with a maximal generality (interpretability). However the absence of any formal mould for the expression of a probabilistic concept as basic as the random phenomenon that generates the considered probability space, cannot be claimed to maximise the generality of the formalization. It clearly is just a lacuna.

Furthermore, from the standpoint of MRC the definitions of the elements from the probability space [U,τ,p(τ)] are lacking precision. For instance :

- What is the descriptional status of the procedure P ? Is it an operation of generation of an object-entity ? Is it an operation which only somehow involves an already previously generated object-entity ? Or is it some *association* between an operation of creation or of only manipulation of a pre-existing object-entity, and an operation of examination of the result, by some view ? It seems obvious that also some view is acting inside the procedure P, since it is asserted that, notwithstanding the "identity" between all its realizations, the procedure brings forth "different" elementary events e_i. But "different" in what a sense ? With respect to which view ? In the absence of *any* view the elementary events cannot be perceived. They even cannot be imagined.

So *a fortiori* they cannot be compared and mutually distinguished. So the content of the procedure P is obscure ; it has to be elucidated.

- Furthermore, supposing now that indeed a view is found to be involved in what is called an elementary event, the unique index i for distinguishing between the elementary events e_i is not sufficient for cutting out a conceptual receptacle able to contain the full specification of the qualifications produced by this view. Even in the simplest case of a view with only one aspect, the definition D5.1 requires already two indexes, an aspect-index g and an index k of value of this aspect. The symbolic framework necessary for the expressibility of the qualifications of an object-entity, *via* the MRC concept of a view, is absent from Kolmogorov's representation. *The Kolmogorov concept of elementary event cannot be clearly referred to MRC-views ; it even cannot be clearly referred to classical predicates*. The involved "properties" or "specificities" are just alluded to, but neither their logical status (or even only the grammatical or the descriptional one), nor their contents, are defined. Thereby *it is an a-logical concept*.

- This circumstance becomes clearer by its consequences upon the events e from the algebra τ constructed on the universe U of elementary events. An event e is by definition "a subset of elementary events from the universe U". But – in general – this subset is not regarded as a class determined by some predicate. So it cannot be directly connected with syllogisms which are essentially tied to classes of predicates (all the men are mortal ; Socrate is a man; so Socrate is mortal). This is one of the main reasons why classical probabilities withstand the attempts at the specification of a general relation with classical logic : the elementary events and the events are introduced in set-theoretical counting terms, not in classical grammatical-logical terms (subject-predicate).

- But the most fundamental question is this. Beyond its formal definition, what is the significance of the probability measure from a probability space ? The semantic involved in the concept of probability measure remains very particularly cryptic. A remarkably complete study on this topic has been made by Fine [71] in 1973, and Karl Popper has made on this subject deep considerations that will be mentioned below [72].

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[71] Fine, T. L., (1973), *Theories of Probability*, Acad. Press. I do not think that meanwhile the situation has much evolved.
[72] Popper, K., *Quantum Mechanics without the Observer*, in *Quantum Theory and Reality*, Mario Bunge ed., (1967), Springer Verlag ; *A World of Propensities*, (1990) Thoemmes.

V.2.3. MRC-Reconstruction of the Concept of Probability

Generalities

In what follows we shall proceed under two conjugated sets of constraints : Kolmogorov's concept of a probability space, and the requirements of MRC.

Each *association* between a given random phenomenon [P,U] and a probability space [U,τ,p(τ)] generated by it will be called a *probability chain* and will be symbolized by the writing

[P,U] $\rightsquigarrow$ [U,τ,p(τ)]

where the sign $\rightsquigarrow$ represents a connection of which the content and the structure have to be specified. According to the principle of separation P15 and the definition D16 of a metadescription, a probability chain involves explicitly a hierarchy of three connected but distinct descriptional levels. Indeed :

*the elementary events e_i are placed on a first descriptional level ;

* the algebra τ of events is placed on a higher descriptional level, since it involves sets e of elementary events e_i from U ;

* the probability measure p(τ) lies on a still higher descriptional level than τ since it qualifies numerically the relative frequencies n(e)/N of the outcomes of the events e from the algebra of events τ.

And – again according to the principle of separation P15 – the process of description achieved on *each* one of these three distinct levels involves its *own* epistemic referential, which has to be specified. So, by confrontation with a Kolmogorov probability space, it appears now strikingly to what a degree the provisional definition of a probabilistic relative description contained in D14.1 (cf. note 27) [73] was insufficient,

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[73] We recall the definition of a *probabilistic relative description of a physical object-entity* contained in D14.1 : Consider an epistemic referential (G,V) where G is a *physical* generator that generates a corresponding *physical* object-entity œ$_G$, and V is a *physical* view with respect to all the aspect-views V_g of which œ$_G$ does exist in the sense of D7 and which - as required by P8 and C9 - contains a space-time view V_{ET} introducing an *ordered* space-time grating (D5.4). Furthermore consider, for *each* V_g from V, a big number N of realizations of the corresponding sequence [G.V_g] - in simultaneity or in succession - the time parameter being set or re-set at the same initial value t_o for each realization of a sequence [G.V_g]….. Suppose now that, when the various successions [G.V_g] with $V_g \in V$ are realized N times, *not* all the successions [G.V_g] are found to reproduce identically one same configuration of gk-E**r**-Tt-values ; that at least for one $V_g \in V$ (not necessarily for all) the corresponding succession [G.V_g] produces a whole set $S_{gi}=\{c_{gi}\}$ of mutually distinct, dispersed configurations c_{gi} of gk-E**r**-Tt-values, (with i$\in$I and I a finite index-set, to preserve the finitistic character of this approach) ; but that, for *any* succession [G.V_g]

and even from the point of view of MRC itself. When this provisional definition has been introduced, the principle of separation and the concept of relative metadescription were not yet defined, nor the concept of a genetic class, and the Kolmogorov concept of a probability space had not yet been introduced as a reference. But in the present stage of development of MRC it is obvious that *the initial epistemic referential (G,V) considered in D14.1, certainly cannot produce all the qualifications required by a probabilistic description able to include the whole – very complex – concept of probability introduced by Kolmogorov*. Other metareferentials certainly have to be brought in.

The following thorough elaboration of the content of a probability chain will suppress the initial lacunae. The results will permit to understand in a more concrete way the powers of systematic descriptional relativizations.

We shall proceed in three stages. In a first stage we shall develop the MRC concept of probability tree of a basic epistemic referential, inside which a unification between relativized logic and relativized probabilities will find place. In a second stage, by intrinsic metaconceptualization, we shall obtain a minimal space-time model for the random phenomenon which constitutes the physical ground of the probability tree of a basic epistemic referential ; this model introduces a new sort of set called a genetic set (genset), that opens up the way toward a genetic relativized set-theory. In a last third stage we shall specify the MRC significance of a probability measure.

First stage. Probability tree of a basic epistemic referential

Elementary event from a basic probability chain. Consider a probabilistic description of a physical object-entity which moreover is a *basic* transferred description $D^{(o)}/G^{(o)}, œ^{(o)}, V^{(o)}/$ [74]. The corresponding epistemic referential is $(G^{(o)}, V^{(o)})$. One

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which produces dispersed results, when N is increased toward infinity, the relative frequency $n(c_{gi})/N$ of occurrence of *each* configuration $c_{gi} \in S_{gi}$ converges toward a corresponding probability p_{gi}. In these conditions each configuration $c_{gi} \in S_{gi}$ will be called an *elementary-event-description* corresponding to the succession $[G.V_g]$ with $V_g \in V$ and it will be denoted $D_{p(gi)}/G, œ_G, V_g/$. The epistemic referential (G,V) will be said to produce *a probabilistic relative description* of the physical object-entity $œ_G$, which will be denoted $D_p/G, œ_G, V/$.

So in D14.1 the concept of probability space was not explicated. For the algebra of events τ there is not even an implicit equivalent, while the distinction between the descriptional level where the elementary events are placed, and the level where the probability measure can be placed, remains obscure.

[74] We recall also the definition D14.1.3 of *a basic transferred relative description* : - The generator consists of a physical operation and it produces a physical object-entity that cannot be perceived directly by man. Such a generator will be called a *basic generator* and will be denoted $G^{(o)}$. - The object-entity produced by a basic generator $G^{(o)}$ will be called a *basic object-entity* and will be denoted $œ^{(o)}$. - The

observable mark contributing to $D^{(o)}/G^{(o)},\text{œ}^{(o)},V^{(o)}/$ is produced by one realization of a succession $[G^{(o)}.V_g^{(o)}]$ with $V^{(o)}{}_g \in V^{(o)}$, and obviously *it has here the probabilistic status of what is called an elementary event* : when a succession $[G^{(o)}.V_g^{(o)}])$ is repeated a big number of times, a whole dispersed set {gk, k=1,2,…K} (a universe) of values gk of $V^{(o)}{}_g$ is obtained (K a finite index set)).

Let us concentrate upon the fact that in general the global view $V^{(o)}$ contains several aspect-views $V_g^{(o)} \in V^{(o)}$ that are not all mutually compatible in the sense of P10. So, in general, $V^{(o)}$ splits in a finite number n of subsets b=1,2…n which we shall call genetic *branches* (the reason of this denomination will become clear later), such that inside one given branch the aspect-views are all mutually compatible, while two aspect-views from two different genetic branches are mutually incompatible (in the sense of the principle P10 of individualizing mutual exclusion).

Consider then one given branch b. The preceding remarks show that it is convenient to re-note by $V_{bj}^{(o)}$, j=1,2,...m, m≤n, the m mutually compatible basic aspect-views $V_g^{(o)} \in V^{(o)}$ that belong to this same branch b. We can then write $V_b^{(o)} \equiv \cup_j V_{bj}^{(o)}$ where $V_b^{(o)}$ is a global notation for the view that acts in b. How does the branch-view $V_b^{(o)}$ work ? The definition of "incompatible"/"compatible" physical aspect-views introduced in P10 entails that *the aspect-views $V_{bj}^{(o)}$, j=1,2,...m from one same branch differ from*

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view able to draw phenomenal manifestations out of a basic object-entity is necessarily such that the phenomenological content of each gk-value of each involved aspect g, stems (by coding rules) from features of a material device for gk-registrations - biological, or not - but which always is *different from the studied object-entity*, these features emerging in consequence of interactions between the examination-and-registering-device and replicas of the considered basic object-entity. A view of the just specified kind will be called a *basic transfer-view* (in short a basic view) and will be denoted $V^{(o)}$. The aspect-views from $V^{(o)}$ will be called basic aspect-views and will denoted $V_g^{(o)}$. - The epistemic referential $(G^{(o)},V^{(o)})$ will be called a *basic epistemic referential*. - A relative description in the sense of D14.1 - individual or probabilistic - achieved with a basic generator and *one* basic transfer-aspect-view $V_g^{(o)}$, will be called a *basic transferred relative aspect-description* and it will be denoted $D^{(o)}/G^{(o)},\text{œ}^{(o)},V_g^{(o)}/$. - A relative description in the sense of D14.1 - individual or probabilistic - achieved with a basic generator $G^{(o)}$ and a basic transfer-view $V^{(o)}$ involving at least two *mutually incompatible* basic aspect-views $V_{g1}^{(o)}$ and $V_{g2}^{(o)}$, will be called a *basic transferred relative description* (also - in short - a basic description or a transferred description) and it will be denoted $D^{(o)}/G^{(o)},\text{œ}^{(o)},V^{(o)}/$ (in short $D^{(o)}$). - A basic transferred description $D^{(o)}/G^{(o)},\text{œ}^{(o)},V^{(o)}/$ is posited to *characterize* observationally the involved object-entity $\text{œ}^{(o)}$, which means that it is posited that no other operation of generation $(G^{(o)})' \neq G^{(o)}$ can be found which, associated with the same basic view $V^{(o)}$, shall produce the same basic transferred description.

*one another **only conceptually***, in the following sense : they always can be all measured simultaneously on *one* replica of the considered basic object-entity $œ^{(o)}$, by making use of a conveniently conceived common measurement-and-registering device. Let us call such a device a *branch-device*, in short a b-device. One act of examination by this unique b-device yields *one* factual result consisting of only one configuration of observable marks, say bk, where b labels the branch and k the configuration (so k∈K where K is an index set of which the cardinal is equal to the number of all the possible distinct configurations bk). But from the unique factual configuration bk considered above, one can afterward derive, by further *abstract* manipulations, m distinct conceptual interpretations of bk. Indeed the definition D5.1 introduces, for each given aspect-view $V_{bj}{}^{(o)}$, its *own* rules for coding in terms of aspect-values of *that* $V_{bj}{}^{(o)}$, the unique result bk produced by one $V_b{}^{(o)}$-examination : each $V_{bj}{}^{(o)}$ yields its own "interpretation" of the registered configuration of marks bk. In short, each realization of a succession $[G^{(o)}.V_b{}^{(o)}]$ produces one configuration bk of factual marks which is then m-fold qualified in the m different aspect-values-languages introduced by $V_b{}^{(o)} \equiv \cup_j V_{bj}{}^{(o)}$ [75].

This m-fold qualification of one configuration bk of factual marks can be regarded as a certain individual relative description in the sense of D14.1. Namely a *relative description* $D/G',bk,V_{bc}/$ of the configuration of marks bk selected as object-entity by a corresponding conceptual generator G', and then qualified *via* the coding-view extracted from $V_b{}^{(o)}$, i.e. the view, say V_{bc}, of which the aspects consist of the m different coding-rules, say cj, j=1,2,...m, introduced by the theoretical definitions of the m compatible aspects $V_{bj}{}^{(o)}$. This "didactic" descriptional significance is possible because a transferred mark bk, once it has been registered, can be kept indefinitely on the b-device and re-

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[75] We take an example from quantum mechanics. The momentum observable **P** and the observable $p^2/2m=T$ of kinetic energy, are compatible. So they can be measured by a same branch-device (by a method called "time of flight"). This device involves a screen. An examination of one replica of the studied microstate yields two data, namely a mark on this screen and the the time when the mark occured, which constitutes a bk-configuration of two factual "marks". From this unique bk-configuration, one then calculates by rules specified in advance, on the one hand the vector-*eigenvalue* of the observable **P**, and on the other hand the scalar *eigenvalue* of the observable T. Each one of these two calculations "describes" the unique bk-configuration of factual marks, in terms of eigenvalues of one of the involved compatible observables. Together, these two descriptions constitute an elementary-event-description $ee_{bi}{}^{(o)}$.

interpreted accordingly to the "coding-view" V_{bc} as many times as desired : the result will always stay the same, so there will be individual stability of the qualification of bk.

But the result of one realization of a succession $[G^{(o)}.V_b^{(o)}]$ can also be regarded otherwise, namely as a *relative testimony* in the sense of D14.2.2. Indeed one succession $[G^{(o)}.V_b^{(o)}]$, each time that it is globally repeated – the basic, physical $V_b^{(o)}$-examination included, not only the coding-examination of a previously obtained mark bk which then is kept available on the b-device –, produces a unique transferred result bk endowed with a unique global coding in terms of all the m-aspect-coding-view V_{bc} defined above (that is why the description D/G',bk,V_{bc}/ defined above is individual). And in so far that one decides to stay fixed on the level of the individual qualifications (not to pass on higher levels to research statistical and probabilistic distributions), the unique mark bk with its unique global coding manifests the status of just a relative testimony $\theta^{(o)}(G^{(o)},\text{œ}^{(o)},V_b^{(o)})$ concerning a qualification *via* the branch-view $V_b^{(o)} \equiv \cup_j V_{bj}^{(o)}$ (codings included), of the basic object-entity $\text{œ}^{(o)}$ produced by the basic generator $G^{(o)}$. Indeed if the succession $[G^{(o)}.V_b^{(o)}]$ is entirely repeated, in general another mark bk will be obtained : no descriptional stability will be found. But a relative testimony still is a (limiting) form of relative description, since it contains an object-entity produced by a corresponding generator and a view which qualifies this object-entity. So, in *any* case :

> According to MRC each elementary event produced by a basic succession $[G^{(o)}.V_b^{(o)}]$ has the descriptional status of a *relative **description***. So it involves a view (in classical terminology, predicates) which permits classifications [76]. This will appear just below to be crucial for the unification of the probabilistic approach, with the logical one.

Let us denote such an elementary event by

$$ee_{bi}^{(o)} \equiv \theta^{(o)}(G^{(o)},\text{œ}^{(o)},V_b^{(o)}) \quad \text{or} \quad ee_{bi}^{(o)} \equiv D/G',bk,V_{bc}/$$

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[76] This is a detailed reconstruction of the content of the notation $c_{gi} \in S_{gi}$ from the preliminary definition of a probabilistic relative description contained in D14.1 and quoted in the note 73.

where the index i belongs to a (finite) index-set I and labels globally the m-fold qualification of the unique mark bk that has emerged by the one considered basic examination $V_b^{(o)}$. Thereby the question of the MRC-status of a basic elementary event is settled.

The random phenomenon from a basic probability chain. By hypothesis, when a given succession $[G^{(o)}.V_b^{(o)}]$ is repeated a big number of times, the obtained factual results bk are dispersed. Then also the corresponding elementary events are dispersed : a whole branch-universe $U_b^{(o)}$ is produced by the repetitions. So to each branch-view $V_b^{(o)}$ from $V^{(o)}$ there corresponds a *branch-random phenomenon* that can be written as

$$[[G^{(o)}.V_b^{(o)}], U_b^{(o)}]]$$

By identification of terms with the generic expression $[P,U]$, it appears that in this case *the repeatable procedure P consists of the* **succession** *of epistemic operations $[G^{(o)}.V_b^{(o)}]$*. So we have :

$$P_b^{(o)} \equiv [G^{(o)}.V_b^{(o)}], \quad U_b^{(o)} = \{ee_{bi}^{(o)}, i \in I\}, \quad [P_b^{(o)}, U_b^{(o)}] = [[G^{(o)}.V_b^{(o)}], U_b^{(o)}]]$$

This settles also the questions of the MRC-status of a branch-procedure $P_b^{(o)}$ and of the content of a branch-random-phenomenon $[P_b^{(o)}, U_b^{(o)}]$.

The meta[random-phenomenon] produced by a basic epistemic referential Consider now the whole basic epistemic referential $(G^{(o)}, V^{(o)})$. It can be reconstructed additively as a union

$$(G^{(o)}, V^{(o)}) = \cup_b (G^{(o)}, V_b^{(o)}), \quad b = 1, 2, \ldots n$$

of n mutually incompatible basic *branch-referentials* $(G^{(o)}, V_b^{(o)})$ containing all the same basic generator $G^{(o)}$ but different basic views. These, because they are mutually incompatible, produce together a universe of basic elementary events U which is the union of n distinct *branch-universes* of basic elementary events, $U_b^{(o)}$, b=1,2,…n :

$$U^{(o)} = \cup_b U_b^{(o)} = \cup_b \{ee_{bi}^{(o)}, i \in I\}, \quad b = 1, 2, \ldots n$$

So the global random phenomenon produced by a basic epistemic referential $(G^{(o)}.V^{(o)})$ admits of the following sequence of equivalent but increasingly analyzed MRC-representations :

$$[[G^{(o)}.V^{(o)}], U^{(o)}]] = [[P^{(o)}, U^{(o)}]] = \cup_b [P_b^{(o)}, U_b^{(o)}] = \cup_b [[G^{(o)}.V_b^{(o)}], U_b^{(o)}]] =$$

$$\cup_b[[G^{(o)}.V_b^{(o)}], \{ee_{bi}^{(o)}, i \in I\}]]$$

A basic referential $(G^{(o)}.V^{(o)})$ generates a meta[random phenomenon], a whole family of *related* random phenomena, involving all *one same operation of generation of a basic object-entity*, but a (finite) set of distinct mutually incompatible branches brought forth by the mutually incompatible branch-views $V_b^{(o)}$ from $V^{(o)}$.

If in particular $V^{(o)}$ consists of only one branch-view $V_b^{(o)}$], b=1, this family reduces to only one random phenomenon $[P_b^{(o)}, U_b^{(o)}] \equiv [[G^{(o)}.V_b^{(o)}], U_b^{(o)}]]$ like in the classical Kolmogorov probabilities.

This, finally, is a complete, fully explicit and entirely relativized representation of the content of the random phenomena involved by a basic epistemic referential.

The channels for the adduction of semantic substance, from the pool of what is called "physical reality", into a basic probabilistic description, are now entirely ***represented***.

At the same time the powers of representation of the initial basic epistemic referential $(G^{(o)}, V^{(o)})$ are now exhausted. This referential alone cannot produce the whole MRC equivalent of a Komogorov representation of a probabilistic description, nor only a probabilistic description in the more ancient sense, of von Mises, for instance. Indeed $(G^{(o)}, V^{(o)})$ does not contain the descriptional resources necessary for representing the generation of the object-entities and of the qualifications involved by an algebra of events constructed on the universe of basic elementary events $U_b^{(o)}$ produced by $(G^{(o)}, V_b^{(o)})$, nor those, still more complex, involved by a probability measure on this algebra. All that the initial epistemic referential $(G^{(o)}, V^{(o)})$ can produce, in fact, is only the basic transferred descriptions $ee_{bi}^{(o)}$ from $U_b^{(o)}$, b=1,2,…m, so also, at the limit, the m universes $U_b^{(o)}$ themselves.

The algebra of events on a branch-universe U_b. In order to re-define in MRC terms the algebra of events from a Kolmogorov probability space constructed on $U_b{}^{(o)}$, the principle of separation P15 and the definition D16 of a metadescription require to pass now on a higher level of conceptualization (with respect to the initial one) and to form there a convenient new epistemic referential.

Consider first only *one* among the branch random phenomena that contribute to the meta[random phenomenon] $[[G^{(o)}.V^{(o)}], U^{(o)}]]$. Consider the branch-universe $U_b{}^{(o)}$ from this branch-random-phenomenon. The relativized elementary events $e_{bi}{}^{(o)}$ from $U_b{}^{(o)}$ have the MRC status of descriptions involving some definite branch-view $V_b{}^{(o)} \equiv \cup_j V_{bj}{}^{(o)}$. This entails the following consequences.

(a) The insertion into the representation of the MRC concept of *probability*, of the deep level of *logical* conceptualization brought forth in V.1.2, namely the level tied with strict individuality. Indeed we have shown that each occurrence of an elementary event $e_{bi}{}^{(o)}$ can be regarded to possess the descriptional status of a testimonial relative description in the sense of D14.2.2, involving a *given* replica $\mathbf{œ}_j{}^{(o)}$ of the basic object-entity $\mathbf{œ}^{(o)}$; then its tentative assertion is a testimonial proposition $p[\theta 1(\mathbf{œ}_j{}^{(o)})]$ in the sense of DL.4. We are in conditions which, in essence, coincide with those which in V.1.2 have been found to restrict the applicability of the logical conjunction : two testimonial propositions $p[\theta 1(\mathbf{œ}_j{}^{(o)})]$ and $p[\theta 2(\mathbf{œ}_j{}^{(o)})]$ which assert two distinct occurrences of elementary events (descriptions), $ee_{bl}{}^{(o)} \equiv \theta 1(\mathbf{œ}_j{}^{(o)})$ and $ee_{bw}{}^{(o)}) \equiv \theta 2(\mathbf{œ}_j{}^{(o)})$ with $l \neq w$, but which are asserted for a *same* replica $\mathbf{œ}_j{}^{(o)}$ of the basic object-entity $\mathbf{œ}^{(o)}$, cannot be composed by a logical conjunction, such a composition is meaningless because the resulting composed proposition cannot exist factually.

> This "explains logically" why in a Kolmogorov probability space no product is defined for two elementary events, and why, if these elementary events are reconsidered inside the algebra from that space, as one-element sets, it is pertinent with respect to the factual situation that their intersection is systematically void.

It is satisfactory that these "logical explanations" is made available *inside* the concept of probability which is constructed here. This is a first manifestation of the intimate relation which arises inside MRC between probabilities and logic.

(b) A second consequence of the fact that the elementary events $ee_{bi}^{(o)}$ have the status of relative descriptions, is the definibility, on the branch-universe $U_b^{(o)}=\{ee_{bi}^{(o)}, i\in I\}$, of a *classifying* branch-algebra of events involving classes determined on $U_b^{(o)}$ by aspects and values of aspects from the acting branch-view $V_b^{(o)}\equiv\cup_j V_{bj}^{(o)}$, j=1,2,...m. We have already remarked that the Kolmogorov elementary events, introduced by a set-theoretic definition, do not directly offer themselves for classifications, so that classifications can be only super-imposed upon them by an added, entirely exterior descriptional action. Whereas inside MRC the elementary events $ee_{bi}^{(o)}$, because they emerge as relative descriptions, *are* qualifications (predications, in classical terms), so they *incorporate* criteria for future classifications.

Let us take an example. Remember that each elementary event $ee_{bi}^{(o)}$ can be regarded as a description of the object-entity [one observable configuration of marks bk)], *via* the coding-view V_{bc} extracted from $V_b^{(o)}$. Imagine now that the coding-view V_{bc} is such that a description $ee_{bi}^{(o)}$ produced by it consists of some spatial configuration of coloured forms. Suppose that we consider the maximal spatial dimension involved by each form, specified separately, as a characteristic feature of $ee_{bi}^{(o)}$. Then, considering the class of all the $ee_{bi}^{(o)}$ of which the maximal spatial dimension of a form from it, is less that 5 cm, amounts to making abstraction of any other specificity than this last one ; while considering the class of all the red $ee_{bi}^{(o)}$ from $U_b^{(o)}$ amounts to making abstraction of any other specificity of an $ee_{bi}^{(o)}$ apart from being red ; etc. So, by dropping this or that qualification involved by the coding view V_{bc} involved by $V_b^{(o)}$, one can define *classes* on $U_b^{(o)}=\{ee_{bi}^{(o)}\}$, "classifying" metadescriptions of sets of elementary events from $U_b^{(o)}$. In this way it is possible to define on $U_b^{(o)}$ algebras τ_b of classifying metadescriptions of sets of elementary events $ee_{bi}^{(o)}$, *via* metaviews extracted from the coding view V_{bc} involved by $V_b^{(o)}$. An algebra of such metadescriptions will be called a *classifying algebra*. When a classifying algebra on $U_b^{(o)}$ is posited to contain also all the elementary events $ee_{bi}^{(o)}$ themselves, then it becomes the *total* classifying

algebra on $U_b^{(o)}$ [77], which brings in, also, all the purely set-theoretic features of any set of basic elementary-event-descriptions $ee_{bi}^{(o)}$).

Now, syllogisms being constructed with classes of predicates, the classifying algebras defined on $U_b^{(o)}$ permit an immediate embeddability of syllogisms into them (continuing the example given above : all the descriptions $ee_{bi}^{(o)}$ which involve the qualification of being coloured red constitute the class $\{ee_{bi}^{(o)}\}_r$; the description $ee_{bq}^{(o)}$ belongs to the class $\{ee_{bi}^{(o)}\}_r$; hence the description $e_{bq}^{(o)}$ involves the qualification red). So both levels of *logical* conceptualization become embeddable into the MRC concept of *probability*, not only the strictly individual level of logical conceptualization mentioned above – which so far remained entirely hidden outside MRC – but also the usual statistical level of natural logic.

> *Inside MRC, the relativization of any elementary event, to a definite view, entails complete dissolution of the obstacle that stands in the way of an explicit definition of the relations between the classical logic and the classical probabilities.*

Together, the preceding points (a) and (b) indicate already in what a sense the MRC reconstruction of Kolmogorov's concept of probability, entails a deep and organic, as if spontaneous association between the logical conceptualization and the probabilistic one. This however becomes still much clearer when instead of only the basic descriptions $ee_{bi}^{(o)}$ produced by the epistemic referential $(G^{(o)},V^{(o)})$, the whole basic genetic class $C[G^{(o)}.V^{(o)}]$ is considered. Indeed in this case one becomes able to immediately conceive all the possible relations between the to-be-developed calculus with genetic classes indicated in V.1.2, and basic probabilistic descriptions.

Consider now explicitly the question of the epistemic referential involved by an event e from a classifying algebra τ_b defined on $U_b^{(o)}$. Such an event (if it does not coincide with an elementary event $ee_{bi}^{(o)}$) is a metadescription with respect to the descriptions $ee_{bi}^{(o)}$, produced by a new, conceptual, non basic metareferential. This metareferential introduces a metagenerator of object-entity which acts on the zone of reality consisting of the universe $U_b^{(o)}=\{ee_{bi}^{(o)}, i\in I\}$ and consists of just [the field of

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[77] The total algebra on a set S is the algebra on S (cf. note 69) which involves all the subsets of S, including the subsets of only one element from S.

perceptibility of a metaview] extracted from the coding-view V_{bc} by some abstraction, by some dropping of values of aspects or of whole aspects from V_{bc} (consider the examples from the above point b). So it is the generator of a view. Let us denote it $G_{br}^{(1)}(V_{br}^{(1)})$ where $V_{br}^{(1)}$ is the view of abstraction that has been utilized ; the lower index r labels the considered the chosen classifying feature, while the upper index 1 stresses that we are now on a descriptional metalevel with respect to that one labeled by 0. The meta[object-entity] produced by this metagenerator is a class $\{ee_{bi}^{(o)}\}_r$ of elementary descriptions from $U_b^{(o)}$. So the involved epistemic referential is $(G_{br}^{(1)}(V_{br}^{(1)}),V_{br}^{(1)})$. The corresponding relative (meta)description is

$$e_{br}^{\,(1)} \equiv D_{br}^{\,(1)}/(G_{br}^{\,(1)}(V_{br}^{\,(1)}) , \{ee_{bi}^{\,(o)}\}_r^{\,(1)}, V_{br}^{\,(1)}/$$

So the event $e_{br}^{(1)}$ from a classifying algebra $\tau_b^{(1)}$ defined on $U_b^{(o)}$ is a *degenerate* metadescription because it involves the generator *of the acting view $V^{(1)}$*, exactly like the implicitly achieved metadescriptions of which the "objects" from the classical logic consist (cf. V.1.2)). From now on τ_b is renoted $\tau_b^{(1)}$.

Since $e_{br}^{(1)}$ depends on the metaview $V_{br}^{(1)}$ which in its turn depends on the sort of abstraction by which it is extracted from the coding-view V_{bc}, another abstraction will lead to another metaview and another metagenerator, so to another event-description characterized by another lower index r.

The algebra of events $\tau_b^{(1)}$ introduces a whole family of metareferentials of the type $(G_{br}^{(1)}(V_{br}^{(1)}),V_{br}^{(1)})$.

The probability measure on a branch-algebra $\tau_b^{(1)}$. By definition the probability of an event $e_{br}^{(1)}$ from the algebra of events $\tau_b^{(1)}$ constructed on the universe of elementary events $U_b^{(o)}$, say $p(e_{br}^{(1)})=p_{br}$, is the limit – *supposed to exist* – toward which the relative frequency $n(e_{br}^{(1)})/N$ of the realizations of $e_{br}^{(1)}$ (of occurrences of any elementary event $e_{bi}^{(o)}$ from $e_{br}^{(1)}$) converges when N is increased toward infinity : $p_{br} = \lim.N\to\infty[n(e^{(1)})/N]$. And the probability *measure on $\tau^{(1)}_b$* is by definition the set $\{p_{br}\}$ of *all* the probabilities assigned to events from $\tau_b^{(1)}$.

Let us specify the MRC descriptional level of the probabilistic estimations from a branch-probability space. On a level immediately successive to that of $\tau_b^{(1)}$ – so here the

level 2 with respect to the initial level 0 –, a convenient operational-conceptual generator of object-entity generates for each event $e_{br}^{(1)}$ from $\tau_b^{(1)}$ the corresponding relative frequency $[n(e_{br}^{(1)})/N]$ of occurrence of $e_{br}^{(1)}$ in a sequence of N iterations of the considered branch-random-phenomenon $[[G^{(o)}.V_b^{(o)}], U_b^{(o)}]]$; and an *aspect-view of relative frequency* estimates the *numerical values* of the ratios $n(e_{br}^{(1)})/N$ from this sequence of N iterations, which are also the values *in the sense of D5.1* of the aspect-view of relative frequency. Afterward, on a subsequent level - so here the level 3 with respect to the initial level 0 - a convenient operational-conceptual generator of object-entity, say $G_{br}^{(3)}$, selects as meta-meta-object-entity the whole sequence of ratios

$$\sigma_{br}^{(3)} = [n_1(e_{br}^{(1)})/N, n_2(e_{br}^{(1)})/N_2,...n_q(e_{br}^{(1)})/N_q,....]$$

where $e_{br}^{(1)}$ is en event from the algebra of events $\tau_b^{(1)}$, and the number N of iterations of the involved random phenomenon is increased toward infinity *via* some sequence of increasing integers N_q, q=1,2,…. The meta-meta-object-entity $\sigma_{br}^{(3)}$ selected by $G_{br}^{(3)}$ is axamined *via* an *aspect-view of probability* (convergenc, $V_{prb}^{(3)}$ say, which checks for the existence of a convergence in the sequence $\sigma_{br}^{(3)}$ and, if the convergence does exist, estimates the limiting numerical value

$$p_{br}^{(3)} = \lim.N \to \infty \, [n(e_{br}^{(1)})/N]$$

 which also is a value *in the sense of D5.1* of the aspect-view $V_{prb}^{(3)}$). So on this last descriptional level, of relative order 3, the acting epistemic referential is $(G_{br}^{(3)}, V_{prb}^{(3)})$. The meta(metadescription) produced by it is

$$D^{(3)}/ G_{br}^{(3)}, \sigma_{br}^{(3)}, V_{prb}^{(3)}/ \equiv p_{br}^{(3)}$$

So the probability *measure* on the whole algebra of events $\tau_b^{(1)}$, is

$$p_b^{(3)} \equiv p^{(3)}(\tau_b^{(1)}) \equiv \{p_{br}^{(3)}\}$$

where r runs over the whole index-set of events from $\tau_b^{(1)}$. Since $\tau_b^{(1)}$ is a **logical classifying organization** of the elementary events $ee_{bi}^{(o)}$ from $U_b^{(o)}$, the syllogistic constructions embedded in the algebra $\tau_b^{(1)}$ can be quite naturally associated with numerical probabilistic estimations. If furthermore $\tau_b^{(1)}$ is the total algebra on $U_b^{(o)}$, the probability measure $p(\tau_b^{(1)})$ defined on it concerns also the elementary events from $U_b^{(o)}$.

The MRC connection between logic and probabilities is fully achieved.

This connection *starts* on the level of the elementary-event descriptions $ee_{bi}^{(o)}$ where repetitions of the involved random phenomenon are permitted. So – quite satisfactorily – it leaves out, *beneath* it, the strictly individual level of the MRC-logic, concerning testimonial propositions tied with *one replica* of an object-entity of a given sort : the MRC-logic begins at a deeper level than the MRC-probabilties. But the MRC-probabilities end above the MRC-logic and qualify numerically the statistical zone of the MRC-logic, by values of limits of convergent statistical sequences.

The branch-probability chain stemming from a one-branch basic epistemic referential. So a basic branch-probability-chain $[P_b, U_b] \rightsquigarrow [U_b, \tau_b, p(\tau_b)]$ admits of the MRC representation

$$[P_b^{(o)}, U_b^{(o)}] \rightsquigarrow [U_b^{(o)}, \tau_b^{(1)}, p^{(3)}(\tau_b^{(1)})]$$

which can also be written in various other more detailed forms. The elementary-event-descriptions $ee_{bi}^{(o)}$ are achieved inside the epistemic referential $(G^{(o)}, V_b^{(o)})$, each event-descriptions $e_{br}^{(1)}$ from $\tau_b^{(1)}$ introduces its own epistemic metareferential $(G_{br}^{(1)}(V_{br}^{(1)}), V_{br}^{(1)})$, and the probabilistic description $p^{(3)}(\tau_b^{(1)})$ of the algebra of events $\tau_b^{(1)}$ is achieved inside the epistemic meta-metareferential $(G_{br^{(3)}}, V_{prb}^{(3)})$. On these writings one can read the whole essence of the genetic and hierarchical MRC structure of a branch-probability-chain.

A branch-probability-chain as represented above is the MRC equivalent of a classical Kolmogorov probability space for the case that a basic epistemic referential is at work,. This equivalent transcends already a classical probability space. Each one of the elements introduced by it is explicitly relativized to the generator of object-entity and the view introduced by the epistemic referential involved in the generation of that element. The descriptional relativities cannot all be read directly on the final synthetic representations chosen above, but they are all explicitly available, and they can be made manifest in the symbolizations whenever this is wanted. The operational and the conceptual structure of the random phenomenon which founds the space, as well as the hierarchical structure of the space itself, become apparent. Each one of the involved descriptional entities (actions or results of actions) is endowed with an explicit definition and an own symbolization :

*One disposes now of entirely specified moulds for **expressing** the whole genetic and hierarchical structure of a basic branch-probability space.*

A mathematician might perhaps hold that these specifications amputate the generality of Kolmogorov's purely set-theoretic-algebraic representation. But such a criticism would have to be dismissed. Indeed, as shown already, the mathematical generality of the classical concept of probability can also be regarded as a source of lacunae, and the MRC representation dissolves the lacunae without interdicting the use of more synthetic expressions and treatments.

We are now ready to introduce the major novelties produced by MRC inside the probabilistic conceptualization, namely the concept of probability tree and the correlative clarification and complexification on the meaning of what is called probabilistic independence or dependence.

The probability tree of a basic epistemic referential. It follows immediately that the *integral* probabilistic phenomenon which stems from a basic epistemic referential $(G^{(o)}, V^{(o)})$ where $V^{(o)} = \cup_b V_b^{(o)}$, b=1,2,...n, can be represented as follows :

$$[[\mathbb{P}^{(o)}, U^{(o)}]] \rightsquigarrow \cup_b [U_b^{(o)}, \tau_b^{(1)}, p^{(3)}(\tau_b^{(1)})]$$

This representation points toward a new probabilistic metaconstruct. This metaconstruct constitutes *a probabilistic **unity***, in this sense that in all the branches involved by it, the *same* generator $G^{(o)}$ of object-entity acts, creating a common "trunk", namely one same sort of object-entity $œ^{(o)}$ which then plays a key role in the emergence of *all* the n distinct branch-probability-spaces $[U_b^{(o)}, \tau_b^{(1)}, p^{(3)}(\tau_b^{(1)})]$, *connecting them genetically*. This new probabilistic metaconstruct will be called *the probability tree of the basic epistemic referential $(G^{(o)}, V^{(o)})$*. It will be symbolized by $\mathbf{T}(G^{(o)}, V^{(o)})$.

The classical theory of probabilities of Kolmogorov does not define such a construct.

But in quantum mechanics a particular instance of this very construct does manifest itself, implicitly. One operation of quantum-state-generation (playing the role of basic generator $G^{(o)}$) produces one microstate (holding the role of basic object-entity $œ^{(o)}$) and all the quantum mechanical probability measures defined for this unique microstate, but

concerning the outcomes of all the mutually incompatible groups of commuting quantum mechanical observables (holding the role of basic branch-views $V_b^{(o)}$), are calculated from the *unique* state-function ψ and the involved quantum observables. A given group of compatible quantum mechanical observables, produces a universe of factual elementary events (marks registered on a measurement-device) – each one codable in terms of this or that eigenvalue of an observable from that group – which has *no common element* with the universe of factual elementary events produced by another group that is incompatible with the first one ; in this sense the mentioned universes of factual marks are mutually exclusive. So the algebras – *Boleean* algebras – constructed on each one among these mutually exclusive universes of elementary events, are equally mutually exclusive. Hence, by asserting probability measures on these mutually exclusive algebras, one finally obtains a whole set of distinct probability spaces, but *all associated with one same* state-function ψ : in MRC terms, one obtains *a quantum mechanical probability tree* (refs. 15-17, 19, 22). This situation – but in the *absence* of an explicit concept of quantum mechanical probability tree – has been amply discussed (Mackey, Gudder, Suppes, Van Fraassen, and many others) because it is devoid of a corresponding general form in Kolmogorov's abstract theory of probabilities, so it does not yet possess a defined probabilistic status. In particular, various attempts have been made at defining *one* metaprobability measure corresponding to the unique involved state-function and involving somehow the branch-probability measures. But, as far as I know, no consensus has been reached as yet concerning a satisfactory solution. Therefore what is called "quantum probabilities" is still considered to constitute an unsolved problem of the probabilistic conceptualization.

Furthermore, the situation sketched out above has also induced attempts at the examination of the logico-algebraic nature of the *global* algebra consisting of the union of all the mutually exclusive branch-algebras of events tied with one state-function.

And this global algebra has been found *not to be Boolean*. Which constitutes the "problem of quantum logic".

Nowadays quantum-logicians seem to consider to have solved this problem by assigning a lattice-structure to this global algebra. But such a structure appears as indequate as soon as one becomes aware that *(a)* the logical conjunction is not a universal logical connector

(cf. ref. 16 and V.1.2) and that logical complementation is a relative operation (cf. ref. 41 and V.1.2).

In this context, the interest of the general MRC-concept of probability tree, seems clear : it becomes possible to deal with the questions of quantum probabilities and of quantum logic inside quite general and organized framework (it is in this way that meta[quantum mechanics] is developed (cf. the Introduction)).

But independently of this specific perspective, it is remarkable by itself that MRC, where exclusively the fundamental descriptional mould is drawn by generalization from the epistemic strategy practised in quantum mechanics, brings forth at the *top* of its elaboration the metaconstruct of a probability tree, of which the quantum probabilities appear *a posteriori* as a particular realization, and where a corresponding global algebra of events is contained that is by construction open to syllogistic-logical qualifications that are naturally tied with probabilistic qualifications.

On the logic obeyed by the global algebra of events from a probability tree. Consider the union $\cup_b \tau_b^{(1)}$, b=1,2...n of all the algebras of events from all the n distinct branches of a given probability tree $\mathbf{T}(G^{(o)},V^{(o)})$; we denote it by $\tau_{\mathbf{T}}^{(1)}$ and call it the *global algebra from $T(G^{(o)},V^{(o)})$*. How can the logical specificities of $\tau_{\mathbf{T}}^{(1)}$ be pertinently represented? In the present context we make only the following remark.

A probability tree $\mathbf{T}(G^{(o)},V^{(o)})$ is equivalent to the basic genetic class $C[G^{(o)}.V^{(o)}]$, supposed to end up with a probabilistic description of the involved basic object-entity $\text{œ}^{(o)}$. So the principles sketched out in V.1.2 concerning a calculus with genetic classes, conjugated with the characterization of a probability tree achieved above, permit inside MRC a guided, a dominated specification of the logic of a global algebra $\tau_{\mathbf{T}}^{(1)}$, freed from arbitrary assumptions like an *a priori* posited lattice structure, and enriched by an explicit awareness of all the involved descriptional relativities (in particular the relativity of complementation) as well as of the logical consequences of the mutual exclusions that stem from strict factual individuality.

Probability trees* versus *probabilistic dependence. Kolmogorow (ref. 68) wrote :

> "......one of the most important problems in the philosophy of natural sciences is – in addition to the well-known one regarding the essence of the concept of probability itself – to make precise the premises which would make it possible to regard any given real events as independent."

But Kolmogorov's approach is purely mathematical. The criteria for probabilistic independence are researched exclusively and directly as formal criteria working on a directly posited abstract mathematical structure. The specificities of the involved *physical* phenomena are *never* taken into account. If only one probability space is considered, two events A and B from the algebra τ from this space are just posited to be independent if the numerical product p(A)p(B) of their probabilities is equal to the probability p(A∩B) of the product-event A∩B, in the set-theoretical sense. This same definition is generalized to also the case when A belongs to one algebra, and B to another one, but *presupposing* always that the conjoint outcome of A and B is possible, which, in MRC terms, amounts to embeddability of both algebras in one same space, by the definition of a conveniently enriched coding-view for the interpretation of a factual outcome. But the concept of probability tree of a basic transferred probabilistic description brings into evidence that

> *Kolmogorov's definition of probabilistic dependence or independence, is not a general definition.*

The winding line along which this definition fails when two distinct branches of a same probability tree are brought in, can be followed in detail. Let b1 and b2 be two distinct branches of a probability tree $\mathbf{T}(G^{(o)},V^{(o)})$. The product-event A∩B of two events A and B with A from b1 and B from b2, is *systematically* the null-event, because A and B, being produced by different random phenomena, cannot contain common elementary events : they belong to algebras $\tau_{b1}^{(1)} \neq \tau_{b2}^{(1)}$ constructed on two universes of elementary events $U_{b1}^{(o)} \neq U_{b2}^{(o)}$ which are produced by two distinct and *mutually incompatible* branch-examinations $V_{b1}^{(o)} \neq V_{b2}^{(o)}$, and so contain no common elementary events. In these conditions p(A∩B) is always zero. Now, zero is different from the quantity p(A)p(B) as soon as both A and B are possible, so this might mean systematic dependence. Therefore, at a first sight, one might think that finally Kolmogorov's definition works well. But the same reasoning holds for also two events from two branches from two different probability trees, and in this case why should there **always** be dependence ? Obviously the seemingly satisfactory systematic nullity of the quantity p(A∩B) when it is calculated for events A and B from two different branches of a same tree, in fact is just an automatic, meaningless reaction of a formalism, which is exceeded by what is tried to be described by its use.

Kolmogorov's formal definition of probabilistic dependence/independence simply is *alien* to the concept of probability tree. It stems from a classical experiential background where situations like those introduced by probability trees are not taken into account [78].

Such situations have not even been conceived on the basis of the experiential background from which the classical theory of probabilities has been drawn.

On the other hand, according to the "theory of transformations" from the Hilbert-Dirac formulation of quantum mechanics, given two incompatible quantum mechanical observables X and Y and *one* state-function ψ, the probability $p_\psi(y_i)$ of the occurrence, for the microstate with state function ψ, of (any) one given elementary event y_i consisting of an eigenvalue of the observable Y, is a functional

$$p_\psi(y_i)=F[p_\psi(X)]$$

of the whole probability *measure* $p_\psi(Y)$ concerning the same ψ and the observable X, the form of the functional F being specified by Dirac's calculus. Inside quantum mechanics this formal fact is regarded as just a calculational "rule" concerning the passage from the "representation" of the state-ket $|\psi>$ expressed in the basis (the Hilbert referential) corresponding the observable X, to the representation of $|\psi>$ in the basis introduced by the observable Y : *no specifically probabilistic significance is assigned to the above-mentioned functional relation*. So *a fortiori* no physical significance either has been researched. But when it is reconsidered from the point of view of the MRC concept of a probability tree (cf. 15-17, 19, 22), Dirac's transformation $p_\psi(y_i)=F[p_\psi(X)]$ acquires the significance of a relation of probabilistic *metadependence* which express the physical kinship, the **semantic kinship** *between the contents of all the various branches* : two distinct branches of a same probability tree refer indeed to two different and non commuting quantum mechanical observables, but they concern *one **same** microstate*, generated by a unique operation of state-generation and represented by a unique state-function state-ket $|\psi>$. So it leaps to one's eyes that Dirac's transformations, apart from their formal calculational role, express also an effect of the uniqueness of the considered microstate, upon the nature of the contents from all the distinct branches. And they

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[78] In so far that it is always possible, for any set of correlated spaces, to construct by cartesian multiplication one space that contains all the spaces from this set, the confinement inside one branch holds also for the classical concept of probabilistic *correlation*, not only for that of dependence.

express it, not as a probabilistic dependence in the classical sense, but as a non-classical probabilistic *meta*dependence : *each* elementary probability $p_\psi(y_i)$ from the branch of the tree corresponding to the observable Y, depends, not *individually* on this or that other elementary probability $p_\psi(x_j)$ from the branch corresponding to X, but on the set $\{p_\psi(x_j)\}$ of *all* the elementary probabilities from the branch of X (on the whole probability measure $p_\psi(X)$).

In III.2 it has been shown how quantum mechanics has opened up the way toward the construction of MRC. Now it appears that MRC permits to identitfy a deep probabilistic meaning of Dirac's theory of transformations. We shall complete this process of spiraling double-way mutual influence as follows.

Suppose a probability tree $\mathbf{T}(G^{(o)}, V^{(o)})$ where, in every branch b, the *total* algebra on the involved universe $U_b^{(o)}$ is chosen (which contains also all the elementary events $ee_{bi^{(o)}}$). We make the natural – even inescapable – assumption that the unique generator of object-entity $G^{(o)}$ which contributes to the emergence of all the branches of $\mathbf{T}(G^{(o)}, V^{(o)})$, induces, *via* the corresponding object-entity $\text{œ}^{(o)}$, a semantic kinship between the contents of these branches, at all the three involved levels, the level of elementary events, the level of the algebras of events, and the level of the probability laws. We posit that there exists a "degree of similitude" between the contents placed at the same descriptional level of any two branches (on different levels there cannot be comparability), which is somehow determined by the "angle" between two distinct "b-directions of examination" of the unique basic object-entity $\text{œ}^{(o)}$. So we expect observable manifestations of this kinship. Concerning these – on the basis of the fact that the quantum mechanical probability trees are particular instances of the general MRC-concept of probability tree – we postulate what follows.

> The semantic kinship between the contents of the branches of a probability can be conveniently expressed mathematically on the probabilistic level, by admitting that each probability of an *elementary* event from a branch b_k of $\mathbf{T}(G^{(o)}, V^{(o)})$, depends on the *whole* probability *measure* from any other branch b_q, *via* a functional relation F of which the precise form has to be specified in each case by an experimental-

theoretical approach appropriate to the particular nature of the involved phenomena[79].

Then the *set of all the distinct branch-probability measures from all the distinct branches of T(G$^{(o)}$,V$^{(o)}$)*, **interconnected by the above-posited functional relation**, *constitute together an* **observable** *metaconcept of probability measure that characterizes globally the probability tree* ***T(G$^{(o)}$,V$^{(o)}$)*** (there is no need of a unique metaprobability-measure).

Furthermore, since a probability tree $\mathbf{T}(G^{(o)},V^{(o)})$ of the epistemic referential $(G^{(o)},V^{(o)})$ is equivalent to the basic genetic class $C[G^{(o)}.V^{(o)}]$ of the same referential, the possibility of a logical calculus with whole genetic classes draws attention upon the possibility of a corresponding probabilistic calculus with probability trees considered as *wholes* (for the particular case of quantum mechanincs cf. refs. 15-17). General rules of composability of two or more different trees can be defined, involving *specific* sorts of probabilistic dependence (or correlation, this distinction will have to be re-defined), namely between two distinct trees involving different generators of object-entity but the same branch-views, or *vice versa* the same generator and different branch views, etc. This completes the domain of probabilistic-logical research opened up by MRC.

As for the probabilistic dependence between two events A and B belonging both to the algebra from one same branch b, Kolmogorov's definition holds, of course. But inside MRC it is furthermore "explained" semantically, namely again as a manifestation of a community of nature between any two elementary events or events from a same branch, induced *genetically* by the unique generator of object-entity $G^{(o)}$. This last sort of dependence is certainly stronger than the metadependence postulated above, because it is induced by the conjugated actions of the involved basic generator $G^{(o)}$ *and* the involved basic branch-view $V_b^{(o)}$. Furthermore it is estimated numerically, which is not the case for the probabilistic metadependence between distinct branches. These features explain why the classical probabilistic dependence has been remarked since a long time, while the metadependence brought forth by MRC has not been discerned. So :

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[79] If the sort of basic object-entity that is involved, has not a wave-like nature like in the case of a quantum mechanical microstate, there is no *a priori* reason for admitting a principle of superposition, though such a principle might be found to hold. If it comes out that the principle of superposition is semantically inadequate, the whole mathematical framework of a Hilbert *vector* space, would have to be conveniently modified. A blunt transcription of the quantum mechanical mathematics would be meaningless.

The classical concept of probabilistic dependence, considered so important by Kolmogorov, becomes *intelligible*, and it is included in a larger concept of probabilistic dependence which is organized in zones of dependences of different natures and of different degrees.

A last consequence of the MRC concept of probability tree, and not a minor one, concerns "causality".

The hierarchical and probabilistic dependences brought forth by the concept of probability tree, and their connections as expressed by the to-be-elaborated calculus with whole probability trees, yield a new, very organized framework for the representation of the still so vague concept of *causality*. Inside this framework it might be possible to define precisely mutually distinct concepts of causality, dependence, and correlation, as well as the relations between them.

Second stage. A minimal space-time model of the random phenomenon from a probability tree : genetic set (genset).

We have much stressed before that in consequence of the facts expressed by the frame-principle P8, we are unable to think about physical phenomena outside space-time. Since a basic probability tree is founded upon a physical random phenomenon, as long as an explicit space-time representation is not offered, in some way or other some inexplicit and unruled space-time representation will nevertheless surreptitiously creep in. Which might produce confusion. So let us explicate accordingly to MRC a space-time structure that can be assigned to the random phenomenon involved by a basic probability tree.

The minimal intrinsic metaconceptualization $[\text{min.D}_I^{(1)}/\text{D}^{(o)}]$ (D19.2) of a basic transferred description $\text{D}^{(o)}$ and the minimal model $[\text{min.M}(\text{œ}^{(o)}/\text{V}^{(o)}]$ extracted from it (D19.3), have "explained" the involved basic object-entity $\text{œ}^{(o)}$ in terms of a bulk of potentialities of future and relative observable manifestations located inside a space-time domain $[\partial\mathbf{r}.t_o]$. They also posited that the basic processes of examination of $\text{œ}^{(o)}$ corresponding to the various successions $[\text{G}^{(o)}.\text{V}_g^{(o)}]$ with $\text{V}_g^{(o)}\in\text{V}^{(o)}$, transpose the relative potentialities of observable manifestations confounded inside this bulk $\text{œ}^{(o)}$, into the *actualized* observable marks of which the transferred description $\text{D}^{(o)}$ consists. But the space-time structure of these processes of actualization has been left inexplicit. In the

definitions of the concepts [min.D$_I^{(1)}$/D$^{(o)}$] and [min.M(œ$^{(o)}$/V$^{(o)}$)], the accent has been

placed on the basic object-entity œ$^{(o)}$. However, in consequence of the frame-principle

P8 and of the principle P10 of mutual space-time exclusion, it seems clear that the posited

processes of actualization possess a *tree-like* space-time structure (as have anticipated the

denominations of "trunk", "branches", and "probability tree"). Let us now establish this

assertion. Let us make use of the renotations in terms of branches b introduced at the

beginning of V.2.3. Consider now the repeated realizations of the basic successions

[G$^{(o)}$.V$_b^{(o)}$] with V$_b^{(o)}$∈V$^{(o)}$ which generate the global random phenomenon [P$^{(o)}$,

U$^{(o)}$]] = ∪$_b$ [P$_b^{(o)}$,U$_b^{(o)}$] from a probability tree. *The processes from these successions

are **themselves** physical entities*. So according to the frame-principle P8, each such

process covers some space-time domain. The process of generation by G$^{(o)}$ of a replica

of œ$^{(o)}$, present in any realization of any sequence [G$^{(o)}$.V$_b^{(o)}$], covers always a *same*

space-time domain − with respect to an origin of times renewed each time that an

operation G$^{(o)}$ is *started* −, thus determining a common trunk of the space-time

representation of the random phenomenon. While P10 entails that the space-time domains

covered by incompatible V$^{(o)}_b$-examinations with V$_b^{(o)}$∈V$^{(o)}$ − always started from an

origin of times taken when the creation of a replica of œ$^{(o)}$ has just been *achieved* −

cover *distinct* space-time domains. So, together, all the successions [G$^{(o)}$.V$_b^{(o)}$] with

V$_b^{(o)}$∈V$^{(o)}$ cover indeed a tree-like space-time domain.

What has been said so far concerns any basic transferred description, no matter

whether individual or probabilistic. From now on we concentrate upon the probabilistic

basic transferred descriptions.

We have shown that the initial definition denoted D$^{(o)}$ was insufficient in the case

of a probabilistic basic description, and we have completed it, thereby obtaining the

concept of probability tree **T**(G$^{(o)}$,V$^{(o)}$). So, instead of [min.D$_I^{(1)}$/D$^{(o)}$] we re-write

now [min.D$_I^{(1)}$/**T**$^{(o)}$] where **T**$^{(o)}$ is an abbreviation for **T**(G$^{(o)}$,V$^{(o)}$).

Consider now the set {ee$_{bi}^{(o)}$, i∈I} of elementary events (descriptions) produced in

a given branch b from **T**(G$^{(o)}$,V$^{(o)}$). From a logical point of view, these constitute a *class*

− labelled by b − of observable configurations of factual marks bk, each mark being

coded in terms of only conceptually distinguished values of the various aspects bj from b, whereby an elementary description $ee_{bi}^{(o)}$ is obtained. But from a set-theoretic point of view, the elementary-event-descriptions $ee_{bi}^{(o)}$ constitute a set of such marks. Therefore we shall speak of *the class-set b* of elementary events $ee_{bi}^{(o)}$. Then the elementary events produced in all the distinct branches b from $T(G^{(o)}, V^{(o)})$, constitute the set of class-sets $\cup_b\{ee_{bi}^{(o)}, i \in I\}$, with b=1,2...n. If now we associate to each element from $\{ee_{bi}^{(o)}, i \in I\}$, the space-time representation of its *whole genesis* such as it is posited by the minimal intrinsic metaconceptualization $[\min.D_I^{(1)}/T^{(o)}]$, we obtain a *new* set of class-sets, with a new sort of elements. We call it *the genetic set of class-sets* from $T(G^{(o)}, V^{(o)})$, or the *genset* of the basic epistemic referential $(G^{(o)}, V^{(o)})$, and we symbolize it by **Gen**$[(G^{(o)}, V^{(o)})]$. An element from a genset will be called a *genetic element*, in short a *genelement*. Then the genset **Gen**$[(G^{(o)}, V^{(o)})]$ is the set of all the sets of genelements assignable to the elementary events from $T(G^{(o)}, V^{(o)})$. This endows us with the researched minimal space-time representation of the physical random phenomenon involved by a probability tree $T(G^{(o)}, V^{(o)})$ (the algebras of events $\tau_b^{(1)}$ and the probability measures $p(\tau_b^{(1)})^{(3)}$ on these, with b=1,2....n, are *conceptual* metaconstructs of increasing order, superposed on the physical geneses of the elementary events which constitute the physical support of $T(G^{(o)}, V^{(o)})$).

The concept of probability tree $T(G^{(o)}, V^{(o)})$ leaves imprisoned in the only half-conceived, both the basic object-entity $œ^{(o)}$ and the geneses of the elementary events $\{ee_{bi}^{(o)}, i \in I\}$. The genset **Gen**$[(G^{(o)}, V^{(o)})]$ associated with $T(G^{(o)}, V^{(o)})$ draws them into the clearly conceived and communicable. This is a pragmatic improvement [80].

Consider now a genelement from a genset. It cannot be considered to clearly *belong* to the genset, because it does not entirely *pre*-exist. It possesses three mutually distinct modalities of existence that come into being successively. A genelement is first only abstractly and prospectively distinguishable inside the minimal intrinsic model

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[80] The theory of elementary particles, more or less implicitly, works with gensets. It *associates* to purely predictional probability distributions of the type of those defined in fundamental quantum mechanics, *minimal models* constituting gensets in which the quantum mechanical sets of state-observables and of objectities (cf. note 31) are enriched with other, sub-quantical state-observables and objectities.

$[\min.M(\text{œ}^{(o)}/V^{(o)})]$ assigned to the basic object-entity $\text{œ}^{(o)}$, namely as "one" among the bulk of all the as yet non realized, mutually non individualized relative *potentialities* of which $\text{œ}^{(o)}$ is imagined to consist. This only mentally, prospectively individualized potentiality, undergoes then a *process of actualization*, whereby the previous potential whole labelled $\text{œ}^{(o)}$ is - entirely - consumed. And finally the observable end of this process of actualization, an elementary description $ee_{bi}^{(o)}$, is obtained as a stably *actualized* result, whereby the previous processual state of actualization also becomes in its turn entirely consumed. So there is a passage that leads from an undivided whole labelled $\text{œ}^{(o)}$, to this or that one among all the observable ends $ee_{bi}^{(o)}$, the material trace of the process that led to $e_{bi}^{(o)}$ being each time effaced. This passage brings into play the whole depth of the Aristotelian and Kantian modal dimension which goes from potentiality to actuality, while it also shrinks down the potential undivided whole labelled $\text{œ}^{(o)}$, into this or that *individual*, actualized, phenomenal manifestation labelled $ee_{bi}^{(o)}$.

So saying that a genelement "belongs" to the genset $\mathbf{Gen}[(G^{(o)},V^{(o)})]$ to which it contributes, would amount to a brutal *a posteriori* simplification whereby the differences between the successively involved modalities of being are occulted, duration is eliminated, and instead, a fictitiously fully "present" whole is instated : a sort of surreptitious geometrization harboured by the totalizing word genesis. While in fact, as it will appear below, the temporal and modal characters *act* inside the genset $\mathbf{Gen}[(G^{(o)},V^{(o)})]$, they dictate there their *own* specific logical and probabilistic laws which are incompatible with co-presence. Indeed the fact that it is meaningless to write down the logical conjunction of two propositions concerning two testimonial descriptions that consist of two distinct elementary events asserted for one same replica of the object-entity $\text{œ}^{(o)}$, (V.1.2) is intimately tied with the modal dimension along which a genelement comes into observability ; and the same remark holds concerning the systematic nullity of the product of the probabilities two distinct elementary events.

As far as I can see, the sort of set called here a genset has never before been conceived of and studied in general terms, neither in mathematics nor in logic (Peano's definition of the infinite set N of integers is also genetic, but in another sense). The concept of genset stems from the necessity, at the limit of an exhaustive representation of the very first phase of a chain of conceptualization, to accomplish separately *two*, and

mutually *independent* epistemic operations, first an operation of basic generation of an unknown object-entity, and then a subsequent basic operation of qualification of this basic object-entity. Only physics, only modern microphysics in fact, has been able to reach this limit and thus to bring forth the explicit recognition of the necessity specified above. In mathematics the connections with pure factuality are much too remote to bring into evidence a so highly counterintuitive necessity. Moreover, though instated inside microphysics as an implicit practice, this two-steps cognitive strategy has furthermore had to be recognized to bear the germ of an innovating general descriptional method [81]. And this recognition has then had to be worked out into a fully explicit and general concept of transferred basic description, explicitly connectable with classical logic and probabilities *via* the general concept of intrinsic metaconceptualization of a basic transferred description. A quite peculiar and long way to be gone through. So it is not surprising that the sort of set called here a genset has not yet been considered so far.

The mathematical theory of the gensets – like the calculus with genetic classes, and in relation with it – remains to be elaborated under the guidance of the nucleus of MRC. What operations can be defined between the genelements from one given genset (internal calculus)? What a sort of calculus do obey two or more gensets, considered *globally* (external calculus) ? What are the relations between the classical set theory and the genset theory (what are the *specific* conceptual consequences of the genset theory) ? From the start on, on the basis of the results already brought forth in V.1.2 and in V.2.3, one can assert what follows.

> *The to-be-achieved theory of the gensets is tied with a deep non-classical unification between the epistemological foundations of modern microphysics, set-theory (so mathematics), logic, and probabilities*.

Indeed in so far that mathematics as a whole can indeed be derived from the concept of set, the unification between logic and probabilities achieved by the concept of probability tree, should in its turn be embeddable into a still wider unification, namely between logic and mathematics, as founded on genetic sets.

Inside MRC the classical concept of set can be regarded as a sort of projection of the concept of genset, onto a vault, onto a covering metasurface. A projection that

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[81] The present author is still rather isolated in this recognition.

imprints all the as yet mutually non-individualized potentialities from œ$^{(o)}$, simultaneously and directly, onto the final level of the already individualized-and-actualized, thus smuggling away the peculiarities of strict individuality, the initial status of mere prospective and relative potentiality, and the subsequent processes of actualization with their non removable *relativity* to views. Time is thus eliminated, and an absolutizing totalisation is performed, a "geometrisation" on a surreptitiously introduced metalevel of description. The "problem" of actualized infinities might be intimately related with this kind of hidden conceptual leap. As G. Longo put it [82] : «the classical concept of set is newtonian, a hypostatic concept chained to the thin upper stratum where only technicalities of the superficiality are at work». But the concept of genset might lead to a calculus with sets of *processes* that start at the local, purely factual and strictly individual origin of this or that chain of conceptualization, and then involve the whole modal dimension that leads from potentiality to phenomena. This, probably, would achieve, for the definition of a set, the maximal liberation of *a priori* constraints. Indeed the primitive sets were introduced by pointing toward the elements, one by one. This confined to a finite number of pre-existing and directly perceivable elements. Then Cantor and Frege introduced sets defined by predicates P. This enlarged the concept of set to the case of also an infinite number of elements, material or conceptual, but restricted by the requirement of a *pre-decided* common property. The physical operational definition of the geneses from a genset frees now of also this last restriction : it produces a set of "long elements" where the final observable structure of qualifications appears as the result of a succession $[G^{(o)}.V_b^{(o)}]$ of two operations, so the choice of the succession can be closed *after* the realization of the first fragment, the operation $G^{(o)}$; so the *a priori* constraints on the production of this or that configuration of observable qualifications, are left open as long as possible.

At the bottom of the chains of conceptualization, the MRC-concept of genset knits together physical factuality, and communicable knowledge, by space-time representations of physical operations. Thereby it stabilizes and amplifies the mental perception of the local, strictly individual zero-points of the chains of conceptualization, and incorporates explicitly their unifying consequences. Here, like in the basic transferred descriptions, the seminal action is the generation, out of the depths of pure factuality, of as yet unknown

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[82] During a session of the Center for the Synthesis of a Formalized Epistemology.

object-entities, each one of which is conceivable as a factually specified bulk of non-conceptualized *being*. J. B. Grize, in a private comment on this work [83], called this «une "motte" de *quid*, sémantisable mais encore non-sémantisée». And then, in the representation offered by a genset, one can clearly follow how, out of this initial bulk, *via* appropriate operations of examination and codings of the observable results of these, are drawn phenomenal manifestations that can be incorporated into language-and-knowledge. It becomes clear that the evolutions of this sort, though mute and ignored, can be conceived to *proceed incessantly*, defeating the impossibility, with mere words, to genuinely grasp *being* (Aristotle's *ens*, Spinoza's *substance*, Kant's *thing-in-itself*, Heidegger's triad *Seiende-Dasein-Sein*, Wittgenstein's *unspeakable*), or even to only insure that the surface of *being* is touched, that we do not float far above it in the fluid conceptual substance that surrounds the nets of words. Reference, explicitly rooted into physical factuality, *beneath* language, is tied with a structure of communicable terms which, without saying it, point toward it, thus showing it to the mind (as Wittgenstein would put it).

Third stage. On the significance of a probability measure

Throughout the preceding development it has been supposed that in each branch from a probability tree, the relative frequencies of the outcomes of the events from the algebra do converge toward a corresponding probability law. What is the meaning of this hypothesis ? And what does a probability measure represent, when it exists ?

The answer to the first question has become rather obvious in the course of the elaboration of the nucleus of MRC. Given an epistemic referential (G,V), basic or not, if the generator of object-entity G and the view V do mutually exist in the sense of D7, then they can be usefully conserved only if *furthermore* many repetitions of all the successions $[G.V_g]$ with $V_g \in V$ produce some stable global structure of gk-values, a structure that offers a support for being named, communicated, for being used as a basis for intersubjective knowledge and for action. The existence of a probability amounts to just the existence of a such a stability, namely a "feeble" non-individual one.

The answer to the second question is less straightforward. I introduce it by an example. Imagine a puzzle consisting 100 small squares ; each square is covered by a small coloured form and bears on it a tiny inscription of the values of two space-

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[83] Grize, J.B., in a letter to the present author.

coordinates x=1,2…10 and y=1,2…10. The available forms can be labelled by
j=1,2…m, with m much smaller than 100 so that the same form can occur on several
different squares. If the squares are arranged in the spatial order indicated by the xy-
values, a certain rough picture is obtained, say of a landscape. But let us ignore the xy-
values, mix well the 100 squares, and put them in a bag. We then play the following
"probability game". We draw a square from the bag, we note in j-terms (j-value) what
image we see on it, we put the square back into the bag, and we mix well the squares. We
repeat this procedure a big number of times N, say =1000. What will happen ? A certain
total number m<1000 of distinct "values" j of coloured form will come out, and each one
of these will appear with a certain relative frequency n(j)/1000. If we then increase N
more and more, for instance by choosing first $N=10^6$ and afterward $N=10^6$, etc., what will
happen ? Most among the relative frequencies corresponding to the various notations j,
will manifest a convergence toward the total number $n_L(j)$ (L: landscape) of j-images
from the picture of a landscape on which the puzzle is founded. And if N continues to be
progressively increased, this convergence will progressively appear for *all* the m distinct
notations j, thus determining a probability law {p(j), j=1,2...m} with $p(j)=n_L(j)$ for any j.
It seems clear, I suppose, that this will happen. We are convinced of this. But *why* ?
Because, we think, the picture of a landscape *is in the bag*, parcelled and mixed up,
extracted out of its ordering spatial support, but nevertheless constantly the same before
each new trial as for its content of small-coloured-forms-in-a-square. So eventhough we
do not take into account the xy spatial coordinates to effectively reconstruct the form, this
global form will nevertheless finish by manifesting its stable presence inside the bag,
when N is increased toward infinity. Namely *via* precisely the convergence of the relative
frequencies {n(j)/N, j=1,2...m} toward the limiting probability law {p(j), j=1,2...m} : this
"law", for each value j, connects the relative frequency n(j)/N, to the number $n_L(j)$ which
is a characteristic of the puzzled landscape. So in this case we believe in the existence of
a probability law {p(j), j=1,2...m} *as an expression of the global picture of a landscape,
coded in the parcelling language of relative frequencies of values j of coloured form by
which we have access to this global picture.*

The above example is extremely simplifying. In general, when we perceive events
obeying to a probability law we have no *a priori* knowledge of a global gk-space-values
form associated with the studied random phenomenon. Furthermore the situations similar
to the puzzle are far from being the rule. Indeed the coloured forms on squares, like the
global picture itself, are just intrinsic models extracted implicitly from spontaneously

accomplished intrinsic metaconceptualizations. But we do not always perceive directly results of spontaneously accomplished intrinsic metaconceptualizations, while the corresponding basic transferred descriptions are achieved by reflex processes genetically wired in our automatic neuro-physiological functioning. Often we are *exclusively* in presence of transferred data, as it happens systematically in microphysics and also quite often in biology, medicine, cosmology, etc. Moreover usually *time* comes in also, like in meteorology, in the study of the accidents on highways, and so on. Nevertheless the example provides us with essential clues which permit to integrate the following general conclusion.

Everything which in the physical world can produce communicable knowledge, can produce it *only* as a form of space-time-aspect-values endowed with some stability in the sense of D14.1, i.e. as a description which obeys the frame principle P8. Sometimes, that which in the description plays the role of object-entity is such – with *respect* to what plays the role of view – that the description comes out to be probabilistic, not individual in the sense of D14.1.

> *But then, in the obtained probability law – systematically – certain organizing space-time features get lost*. The existence of the probability law, however, is a sign that these features exist, that also *other* representations involving the semantic content that is brought in by the considered probability law are possible, inside *other* epistemic referentials which bring into play meta-aspects that we have not perceived, and which are essentially *tied to space-time qualifications* (distances, angles, etc.) and therefore lead to a [space-time-aspects-*form*] which "makes a global sense".

Which means *only* that, if it were known, this metaform would "explain" the observed probability measure. For instance : according to the above interpretation the relative frequencies n(gk)/N that characterize the outcomes of events e≡gk from an algebra τ from a probability space, can be regarded as coded "messages" stemming from an unknown meta*form* of g'k'-space-time-values, where g'k' are meta-values of one or several meta-aspects with respect to g, say g', which are indelibly tied with space-time values (space-time *distances* separating gk-values, etc.). By their convergence, the relative frequencies n(gk)/N construct progressively, by parcelled random touches, a gk-coded numerical representation of this unknown metaform. A sort of random and approximate but asymptotic "reading" of this unknown metaform, which offers cryptic reflections of the

global structure of space-time-metavalues-g'k', impoverished and pulverized by the extraction from it of the space-time specifications (so also of the g'k' qualifications which disappear when space-time is projected away). The elementary probabilities $p^{(3)}(gk)$ are the ideal limits toward which the reading of these coded messages tends when N is progressively increased toward infinity. And the whole probability measure $\{p^{(3)}(gk)\}$ is the precise projection of the asymptote itself of this cryptic, impoverished, pulverized, randomized reading in terms of relative frequencies $n(gk)/N$, of the unknown metaform of space-time-metavalues-g'k'.

It is striking to note to what an extent the above specified MRC significance of a probability law is *akin to the Popperian concept of "propensities"* (cf. refs. 23, 72) [84].

Conclusion on the MRC probabilities

By reference to Komogorov's theory of probabilities and to quantum mechanics, the method of relativized conceptualization produces a deepened and enlarged theory of probabilities which is intimately tied with the MRC logic.

A genetic class that leads to a probabilistic description, and the corresponding probability tree, appear as *two faces of one same logico-probabilistic concept*, of which a genset offers a minimal space-time intrinsic model.

Thereby MRC endows with the outline of a deep-rooted and strong unification between probabilities, logic, and set-theory.

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[84] Ref. 72 p. 33 : "Take for example an ordinary symmetrical pin board, so constructed that if we let a number of little balls roll down, they will (ideally) form a normal distribution curve. This curve will represent the *probability distribution* for each single experiment, with each single ball, of reaching a possible resting place. Now let us "kick" this board ; say, by slightly lifting its left side. Then we also kick the propensity, and the probability distribution,.....Or let us, instead, remove *one pin*. This will alter the probability for every single experiment with every single ball, *whether or not the ball actually comes near the place from which we removed the pin*. .....we may ask : "How can the ball 'know' that a pin has been removed if it never comes near the place ? " The answer is : the ball does not "know" ; but the board as a whole "knows", and changes the probability distribution, or the *propensity*, for *every* ball ; a fact that can be tested by statistical tests".

VII. MRC *VERSUS* OBJECTIVITY IN THE SENSE OF THE RELATIVISTIC APPROACHES FROM MODERN PHYSICS

Einstein's theories, which marked the whole thinking of this century, are called theories of relativity. The present exposition of a method of "relativized" conceptualization, cannot be closed without specifying briefly the relations of this method, with the relativistic approaches which, since Einstein's work, keep being so intensively developed in modern physics.

The relativistic approaches are developed quasi exclusively under constraints of formal consistency in the sense of *classical* logic, imposed upon the *mathematical representations* of the objects of study and – above all – of quantities employed for qualifying these objects (the views, in MRC terms). The major aim is to construct representations of the physical reality insuring a maximized degree of inter-subjective consensus. Notwithstanding that Einstein's analyses of the way in which measurements of space-time coordinates or distances are achieved, have played such a basic role for the formulation of the theory of special relativity, *factuality plays no explicit role in the relativistic approaches*. The object-entities are supposed to pre-exist "out there", exactly like in classical logic, while the views are constructed *formally* according to aims of inter-subjective consensus. Thereby the relativistic approaches escape the peculiar sort of semantic control insured by the syntactical structure of fundamental quantum mechanics, where the accent lies upon the *factual* production of the object-entities and of the qualifications of these. From this point of view there subsists a scission inside modern physics as it now stands.

I shall indicate very briefly the main stages of the development of this alternative way of making use of descriptional relativities, referring them explicitly to MRC in order to facilitate the comparisons.

Limiting conditions and laws

Let us go back to the fact that only descriptions can be known in a communicable way. Now, it is obvious that it would be nonsense to wish to describe "all" that "exists" : at any given time the possible object-entities constitute an open and evolving infinity of which the cardinal is bigger than that of the continuum. So the idea of a choice to be made has naturally imposed itself as a non transcendable constraint. It has been tacitly agreed that only regularities can be regarded as an object for scientific description, only

relations endowed with a certain stability, concerning which it is possible to insure a certain consensus, and which permit predictions. Relations of this type were called natural laws.

But according to what criteria, exactly, can one identify what can be object of a natural law ? Up to this day the answer to this question has never ceased reorganizing itself. The main stages of this process can be regarded as fundamental features of the development of scientific thinking. The beginning of the process is relatively recent. It emerged during the epoch that separates Kepler from Newton : Kepler still tried to find, concerning the geometrical dimensions of the planets, laws of the same kind as those that he had formulated concerning the trajectories of the planets. While Newton considered already that the geometrical dimensions of the planets were "inessential" so that one had to isolate them from the researched laws and, if wanted, to introduce them afterward in connection with limiting conditions (space-time values on the frontier of the space-time domain covered by a given physical phenomenon) in order to specify and predict this or that particular manifestation of a law. So, by definition, what is called law is categorial, regular, and generates predictions ; while limiting conditions are singular, accidental, non predictable, just singular data that have to be registered or supposed and have to be used in order to explicate the individual predictions that one wants to draw from a law.

Notice that in this first stage the distinction between law and limiting conditions is introduced as absolute, as intrinsic : this *is* essential, regular, that *is* non-essential, accidental. Just obvious "facts". No criterion is given for distinguishing what is essential and what is not.

"Physical space-time" and space-time referentials **versus** *the frame-principle*

All the representations of physics presuppose space-time. So, if one wants to construct mathematical representations, it is necessary to specify in mathematical terms how space-time features have to be taken into account. This essential question runs straight into metaphysics, whereby the specific competence of a physicist is exceeded. So it is not surprising that the treatment of this question brings in a mist of ambiguous ways of speaking that hinder an acceptable connection of physics, with epistemology and philosophy.

In classical physics it was currently asserted that void "physical space" (without any mass) admits of an *absolute* mathematical representation consisting of a continuous 3-dimensional variety that is indefinitely differentiable, homogeneous (all the points are

equivalent), and isotropic (all the directions are equivalent). It was furthermore admitted that "physical time" [85] can be represented by a continuous 1-dimensional variety that is indefinitely differentiable, homogeneous, and endowed with an arrow (a direction). According to classical physics these two varietis can be pertinently be *juxtaposed* in a unique 4-dimensional variety representing the "physical space-time". But according to the theory of special relativity, the 4-dimensional variety representing the "physical space-time" cannot be separated in a juxtaposition of two representations, as mentioned above : these two representations merge to form an organic whole. This whole, however, is characterized in *integral* mathematical terms, namely by a Eucledian metric. While inside the general theory of relativity, "physical space-time" is represented by a non separable space-time variety which is characterized in *differential* mathematical terms, namely by a Riemannian metric.

In order to give a *communicable* (conventional) mathematical form to the descriptions of physical entities (rigid bodies, fields, physical phenomena [86] in general), a space-time referential (a system of 4 reference-axes, endowed with a centre and with units of space and of time) is immersed in the 4-dimensional variety that represents "physical" space-time. This permits to associate communicable numerical labels – space-time-coordinates – with each point of the space-time variety. These labels can be explicitly combined with the qualifications of the studied physical phenomenon *via* gk-aspect-values where g≠ET (according to the frame principle P8, space-time qualifications alone cannot describe a physical phenomenon, but they do irrepressibly emerge in any description of a physical phenomenon, even if *a posteriori*, if convenient, some or all the space-time qualifications can be eliminated by projection). A space-time referential is distinct from the space-time variety itself in which it is immersed.

We are now redy to specify the ambiguous ways of speaking mentioned above. They concern the expression "physical space-time", and the assertion that what is

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[85] I have achieved a detailed MRC-reconstruction of the concept of time (to be published soon), which leads to the conclusion that, in a certain sense, "physical time" is just a verbal label for a remarkably complex conceptual construct. By this construct, certain basic features from the inner universes of all the (normal) observer-conceptors corresponding to the what is called "inner psychological time", are connected in a definite way with descriptions of physical object-entities, which leads to a family of descriptions called "relative physical changes". In particular, a relative physical change can concern physical object-entities of a category called "clocks". Thereby it becomes possible *to export time-qualifications from inside the inner psychological universes, into the exterior physical world, **and** to import **measure** from the exterior physical world, into the inner psychological universes*. This permits to define a conventional inter-subjective concept of time : "the" time, or "the physical time".

[86] Here the word phenomenon is used in the current sense, not the philosophical one.

indicated by this expression, "possesses" a metric. I hold that from a philosophical point of view such formulations have to be dismissed. Indeed, as posited by Kant, accepted in nowadays philosophy, and re-expressed in the frame principle P8, space-time itself is not a physical entity, it is an " *a priori* form of the intuition" which

(a) *pre-conditions* any description of a physical entity; *(b) contributes* to any description of a physical entity, namely in the role of a space-time frame-view V_{ED} associated with at least one other aspect-view $V_g \neq V_{ED}$; *(c)* space-time *alone*, in the absence of, rigorously, any other sort of effectively perceived or at least imagined aspect $g \neq ET$, cannot generate impressions, nor only conceived impressions.

> **Space-time is not a physical phenomenon**. "Physical space-time" – as such – does not "exist", it is just *an intrinsic model* (in the sense of D19. 2) associated to an *a priori* form of the human intuition. We can call this *a frame-model*.

So – rigorously – one cannot speak of physical space-time, nor, *a fortiori*, of the metric *of* physical space-time. One can only speak of a metric **chosen** for the representation of space-time by a 4-dimensional variety (a mathematical frame-model) endowed with a space-time referential (a view V_{ET} which, in a relative description of some physical entity $œ_G \neq$[space-time], is associated with one or more aspect-views $V_g \neq V_{ET}$ in the construction of a representation-space). The expression "the structure of physical space-time" points in fact toward *structures of results of measurements on object-entities $œ_G$*, measurements of lengths of some aspect $g \neq ET$ with respect to which this or that $œ_G$ exists in the sense of D7 (or distances, or surfaces, or volumes of some aspect $g \neq ET$) and durations of such aspects $g \neq ET$.

Finally notice also that the adequacy of the conditions of continuity and of indefinite differentiability of the 4-dimensional variety by which space-time itself is represented, certainly is not universal (Laurent Nottale [87] has well brought this into evidence). Indeed according to MRC all the relativities involved in descriptions of physical entities have to be systematically taken into account. So in particular one has to take into account also the relativities to *a view of order of magnitude of the presupposed space-time units*. Such a view is always involved in a description of physical phenomena, and it is always *finite*, whereby it entails exclusions by mutual inexistence in the sense of

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[87] Nottale, L., *La relativité dans tous ses états*, (1998), Hachette.

D7 (anything that introduces dimensions of a smaller order of magnitude than the units, is not perceived by the view which acts in the description).

Principles of symmetry and translational invariants. Conservation laws

It is admitted that "space-time is homogeneous" i.e. that all the space-time points are "equivalent", and this is called *the principle of homogeneity of space-time*. This principle amounts to the requirement that, in the descriptions of physical phenomena, what is "essential" be independent of translations of the space-time referential (i.e. changes of *exclusively* the position of the centre of the referential) ; in other terms, the requirement that what is "essential" shall stay invariant when a translation of the space-time referential is performed. According to this requirement, the space-time coordinates (positions) are not essential, while the differences of the coordinates themselves (distances) are essential. Consequently any velocity is essential because, as a ratio of two differences of coordinates, a difference of space-coordinates and a difference of time-coordinates, it is globally invariant with respect to translations of the space-time referential.

So there appears now a formal criterion that permits to distinguish between what is essential and what is not. This criterion brings into evidence a pair of connected concepts. On the one hand, a concept of homogeneity – a "symmetry" – assigned abusively, in current speaking, to "physical space-time" itself, but which in fact designates only an invariance of certain features from descriptions of physical object-entities (cf. the preceding discussion of metrics "of space-time") ; and on the other hand, a correlative class (a group in the mathematical sense) of changes of the state of observation, expressed by changes of the space-time referential, namely by the group of "geometrical" or "static" translations of the referential (called so because exclusivelythe positions of the centre of the referential are changed, in the absence of any rotation and any movement of the referential). So the invariants tied with the principle of homogeneity of space-time, are essential in *this* sense that, when changes of only the position of the centre of the space-time referential are operated, they manifest a descriptional independence with respect to these changes, an indifference, a recurrence of a descriptional form, an in-variance, a *conservation law*. While the coordinates of the physical events, because they do change when the centre of the space-time referential is translated, are regarded as inessential ; this qualification of non-essentially being asserted notwithstanding that it is

absolutely necessary to know the coordinates of the involved events in every particular case in which one wants to be able to make predictions concerning this case.

Analogous considerations are valid concerning the posited equivalence of all the spatial directions, i.e. *the principle of isotropy of space*. In this case other invariants or conservation laws – angular – are involved, tied with the group of spatial rotations of the space-time referential, in the absence of motion.

Note now that velocity, which is by construction fully invariant with respect to translations – the direction as well as the norm –, is not invariant in direction with respect to rotations also. As for the coordinates of the involved events, again they are inessential in *this* new sense that in general they change by a rotation of the referential. So the concept of "essentiality" is now explicitly regarded as relative to the considered group of transformations of the space-time referential i.e. as relative to the corresponding set of observers.

But why are these distinctions and ways of speaking been introduced ? Are they imposed by factuality ? It is quite clear that they are not, that another sort of reason founds them :

For the observer tied with *any* given referential, the time-coordinate of an act of observation of an event keeps changing irrepressibly. As for the space-coordinates, by the very definition of a space-referential they necessarily change by passage from one space referential to another one, so from one observer to another one. These are indeed psycho-conceptual-physical *facts*, not mere free conceptual constructions. So, if one wants to elaborate descriptions endowed with *stability* and able to insure a certain consensus among distinct observers, then one has indeed to find ways of organizing a conceptualization that shall bring forth invariants with respect to the universal and unavoidable changes mentioned above, of the time coordinate and, in another way, of the space-coordinates. While these themselves have to be regarded as non-essential, accidental features : an opposite attitude would be hopeless. So what is obviously impossible from the start on, is renounced. Now the aim might have come out to be impossible nevertheless. It could have appeared that no sort of descriptional stability whatsoever can be found, no matter what strategy is adopted. Then there would have been neither "natural" laws, nor science. In fact however the aim has been found to *be* possible, but only *relatively* to this or that group of transformations of the state of

observation (of the space-time referential), which then selects a corresponding set of invariant descriptional features. This restricted possibility is already very remarkable. But it should be quite clearly understood that such an invariance is never a "physical fact". It is just an abstract artifact involving a whole adequate conceptual network : types of "convenient" space-time varieties and referentials (space-time-frame-views V_{ET}), Cartesian, curb, etc. ; deliberate construction of "convenient quantities" (aspect-views V_g), (velocities, accelerations, angles, total-energies) ; delimitation of "convenient systems" (object-entities œ$_G$) (rigid bodies", "material points", "fields", etc.). All these descriptional elements being conceived in such a way that when the network formed with them is superposed to factuality [88] it leads to descriptions of which certain features stay invariant under this or that group of transformations of this or that aspect of the states of observation, thereby insuring a certain potential of inter-subjective consensus. In order to realize to what a degree this is so, it suffices to consider that the equivalence of all the space-time-points from the 4-dimensional variety representing space-time, where one immerses the space-time referentials, is by no means a physical fact. It is just a posited idealization, an abstraction, a useful strategic abstraction. The water does not boil at the same temperature here or on the Himalaya, and the astronomers know well that the laws evolve throughout the history of the universe. As for the directions from our life-space, they "are" not at all always equivalent either, since a stone falls downward, not *vice-versa* nor from left to right The physicist just posits abstractions by which he obtains the concept of space-time that permits best to construct relative consensuses and corresponding predictions. And a velocity, an energy, even a distance, even a position, are not "facts", they are constructs concerning the representation of certain phenomenal perceptions. Think of the position. Inside a 4-dimensional variety that *represents* space-time, there simply are no "positions", there are only "points" : position is a concept that is definable only if also a referential has been immersed in the variety. And one cannot even assert that inside what is pointed toward by the verbal label "physical space-time" there "is" what we call "place" ; there is only what *we* have in our mind when we utter this word and when we point toward this or that source assigned to a perception *via* some intrinsic model, thus using approximately our own body as a space-referential. Science is just a cognitive strategy in which factuality and phenomenal perceptions are dealt with

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[88] I say factuality, not phenomena, in order to include basic generators of basic object-entities, as well as basic views, which act on as yet non-phenomenal (non-perceived) zones of the physical reality.

under constraints of stable representatability, of intelligibility, of consensus and of predictability.

Let us now go further in the examination of the aims of intersubjective consensuses with respect to which certain descriptional choices are convenient, and others are not.

Principles of relativity and dynamical laws

We have considered above groups of geometrical, static transformations of the state of observation. The different referentials from such groups are considered to be at rest with respect to one another. One can imagine the whole group as immersed in *one* big reference-receptacle containing replicas of itself, with shifted centers, or with axes displaced by rotations : an observer could circulate freely from one of these variants to any other one. Such a view entails no conceptual difficulties.

But one can also imagine referentials that are moving with respect to one another. It is tacitly admitted that in this case each observer is tied to its own referential, even if he can communicate with the others by signals. This is a rule of the conceptualization game which physicists play with one another. What does this rule involve ? Does it still permit to insure a certain inter-subjective consensus? The answer is given by the position of *principles of relativity*, the principle of restricted (or special) relativity, and the principle of general relativity.

* *The principle of special relativity* posits that all the observers tied to *inertial referentials* (moving with respect to one another with constant velocities), perceive identically all the *dynamical laws* of physical phenomena, i.e. all the relations between measurable quantities involving accelerations (changes of velocity), this being indelibly connected with the assertion that, when one passes from the description of a phenomenon achieved in a given referential, to the description of this same phenomenon but achieved in another referential, all the involved space-time coordinates have to be changed accordingly to a definite "law" for the transformation of the coordinates [89] :

> According to the principle of restricted relativity, inside the set of all the observers from a set of mutually inertial referentials, there exists an inter-subjective consensus tied with a definite group of transformations of the space-time

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[89] The admitted law of transformation of the space-time coordinates has first been that proposed by Galileus. In 1905 Einstein has proposed a modified law (the Lorentz-Einstein transformations) that reduces to that of Galileus for velocities that are small with respect to the velocity of light.

coordinates, the corresponding new invariants being this time *the **form** (structure) of the dynamical laws*.

It is noteworthy that the geometrical invariants are not invariants with respect to also the new group of transformations specified above. Though the dynamical laws are expressed by making use of also the quantities precedingly constructed such as to insure geometrical invariants, these quantities in general change when the inertial referential changes, while the asserted law of transformation of the space-time coordinates is applied (such is the case for distance, velocity, mass, energy, etc.). So again, what is regarded as essential changes with the considered group of transformations of the referential. Once more the relativity of essentiality, to the type of the researched consensus, manifests itself. We are now far indeed from the initial notion of an intrinsic essentiality or accidentality of the qualifications.

* *The principle of general relativity* goes still much farther on the direction of the increasing degrees of constructional freedom practised by the modern physicist. According to this principle the dynamical laws "are" invariant [90] with respect to *any* change of the space-time referential, expressed by *any* transformation of the space-time coordinates.

The basic motive that determined Einstein to posit this principle – very stricking indeed – is the fact that there is no way for deciding whether yes or not a given referential is "really-inertial-by-itself". One can only find out whether yes or not a given referential is inertial with respect to another given referential. The qualification of inertiality cannot be assigned a "final" significance, it involves a sort of indefinite regression, of undecidability.

 In such conditions Einstein considered that – for philosophical reasons – it was imperative to transcend the limitation to inertial referentials involved in the principal of restricted relativity.

And he realized this transcendence, but only for the case of gravitational macroscopic interactions. The method elaborated by Einstein in order to achieve this descriptional aim

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[90] Such a way of speaking, though current, is deeply inconsistent with the very essence of the relativistic approaches from modern physics, which are *constructive* : the dynamical laws, like any sort of laws, are built, under deliberately chosen constraints of invariance which then entail the ways in which the qualifying quantities (the views which are made use of) are defined.

is very impressive by the demiurgic degree of liberty taken with respect to the concept of "physical facts". However, paradoxically, it involves the way of speaking in terms of metric "of physical space-time" that was criticized before.

In this context it would be as inappropriate to try to expose this method in only several lines, as to try to expose it thoroughly. So I shall just remark that in this new step, again, the change of the set of observers among which consensus is researched, entails a change of also the object of consensus. Einstein's description is constructed in such a way that the object of consensus, the invariant, becomes the geometrical form, in a convenientnt representation-space, of the trajectory of the studied body : this geometrical form is always a geodesic of the − Riemannian, *differentially* characterized − metric assigned to the variety that represents "physical" space-time (filled with fields and masses). Whereas the invariants relative to the inertial group of transformations of the space-time coordinates cease to be invariants in connection with Einstein's general principle of relativity : the principle is "general" in the sense that it concerns all the conceivable observers, but the corresponding invariant is the form of the dynamical law (the energy also is represented so as to be endowed with a conservation law). And Einstein's general form-invariant is so abstract that its factual semantic content nearly vanishes out of the realm of what can be genuinely imagined. One has the feeling that a sort of law of compensation operates inside the processes of conceptualization of the physical reality, according to which when the extension of the class of consensual observers is increased, the factual semantic content of the object of consensus is correspondingly diminished.

A fundamental question raised by the principle of special relativity, is the status of what is usually called the Einstein-Lorentz transformation "laws" for the coordinates, but also sometimes the transformation *rules*. Indeed, considered in the perspective of the principle general relativity, the status of the principle of special relativity becomes uncertain. According to the principle of general relativity **any** transformation of the coordinates has to be posited to insure the form-invariance of the dynamical laws, in which case there is no "law" of transformation any more. Then what relevance, exactly, the "factual truth" of the special "law" of transformation, would possess? By the passage from the principle of special relativity, to the principle of general relativity, the conceptual status of what is called principle of relativity seems to have surreptitiously undergone a mutation from an assertion believed to express an *empirical truth*, to an

expression treated as a methodological condition for constructing an "acceptable" representation of the physical reality.

Of course, one would like to be assured on explicit grounds of something *else*, namely that there exists a possibility to know with certainty whether yes or not two observers which are not at rest with respect to one another and are each one imprisoned inside his own referential, are indeed considering the *same* event, phenomenon, the same physical situation, whatever this be. It is not obvious that form-invariance of the dynamical laws, alone, entails with necessity a definite answer.

The foundations of both principles of relativity are still hidden in an as yet insufficiently analyzed coalescence of scientific descriptional strategies and of feebly elaborated philosophical decisions, but which entail major descriptional consequences. Indeed, on the level of conceptualization where the modern relativistic approaches are placed, the question of descriptional *method* – so also of descriptional *aims* – which, more or less implicitly, has triggered the beginnings of physics as an independent science, again draws attention on it, this time with a new, imperative power. How *should* we *want* to represent the physical reality? What structure of pragmatic-philosophical criteria should be adopted, and *why*, on the basis of what *reasons*? The relativistic approaches from modern physics have entered a zone of such degree of abstraction of our conceptualization of physical reality, of such vertical distance from physical factuality, that *it becomes now vital for physics to construct explicitly and systematically its own philosophy and its own epistemology*, if it wants to stay deeply true to its own modern aim of maximizing consensus : indeed also a philosophical consensus should be constructed explicitly, not only this or that new particular sort of observational consensus, fabricated accordingly to an inertially followed fashion that has developed roots.

Summarizing considerations

In the relativistic approaches, the search for objectivity has explicitly transmuted into methods for deliberate construction of classes of inter-subjective consensus, each one relative to a definite group of transformations of the state of observation. When the group of transformations changes, the objects of consensus in general change also. For each group, what is qualified as essential is that what is invariant inside that group : *essentiality relative to consensus*. The aim to construct consensus, and inside a class of observers as rich as possible, is given absolute priority, on grounds which first were pragmatical but later coalesced with philosophical requirements. The search of

observational invariants concentrates the attention upon *mathematical representation*. The way of producing the involved object-entities, factually, independently, is left in shadow. The whole approach is mainly marked by requirements of logico-mathematical coherence. These requirements are the instrument for the construction of pairs (group of transformations, corresponding invariants). When the construction is achieved, its experimentally testable consequences – sometimes very rare – in general pledge the theory only globally and, whether for confirmation or falsification, in a way that is more cumulative and diffuse than sudden and definite.

In the development of relativistic approaches, an explicit tie with basic transferred descriptions in the sense of D14.3.1 is very rare if not inexistent. This is why the operation of (independent) generation of object-entities is ignored or at least remains implicit. Like in classical logic, the object-entities are supposed to pre-exist. This is so even when the formal representation of the object-entities is thoroughly reconstructed for reasons of logico-mathematical coherence with previously constructed representations, like in the case of the methods of gauge-invariance, or similarly, like in general relativity. The mathematical representations of the considered object-entities are constructed *via* the views, whereby their factual generation and content are surreptitiously abandoned to arbitrary and uncontrollable restrictions. Notwithstanding that the results of measurements of space-intervals or time-intervals are relativized to the state of observation, the relativistic approaches from modern physics operate wholly inside the realm of *classical* logic which *starts* from the spontaneous intrinsic models offered by the current languages. This situation is a consequence of the fact that the relativistic approaches appeared first inside the classical physics, where an enormously thick layer of preceding theoretical conceptualizations of macroscopic physical phenomena underlie them. In these conditions the canonical structure of a basic transferred description simply did not appear. While the generation of the object-entities that one wanted to study, raised no radically new problems. So it remained unnoticed. *A fortiori* the peculiar characters stemming from the generation of object-entities independently of any subsequent qualification, remained wholly hidden to the eyes of the relativistic approaches.

> The contrast with the case of quantum mechanics, where the main innovation is the role played by the a generation of object-entities independently of any subsequent qualification, is striking, a genuine polarity.

So, since the beginning of this century the construction of objectivity in physics has advanced on two front-lines, in two opposite directions. The front-line created in quantum mechanics roots the construction of objectivity into physical factuality, down to an unprecedented depth. Thereby it permits to explicate in full detail how the conceptualizations incorporate and vehiculate Being, which is the hard core of any observational objectivity. The long-lasting belief in a non-transcendable scission between words and Being, will have to fade away. On the other hand the front-line created by the relativistic approaches erects rigorous abstract representations with a vertiginous degree of descriptional freedom. The connection and unification between these two distinct progressions is not yet worked out inside modern physics. There subsists a scission from this point of view. MRC should permit to develop a unification, since it incorporates the epistemic specificities of quantum mechanics, in a general epistemological method.

VII. FINAL REMARKS

The method of conceptualization exposed in this work is founded upon a descriptional mould that has been drawn from fundamental quantum mechanics and has been generalized, because, by the systematic relativizations to the involved epistemic actions, which it has been found to incorporate, it seemed able to hinder any descriptional ambiguity, false problem or paradox.

Such an approach breaks with a certain tradition. Indeed up to now the processes by which knowledge is created have always been studied from a psychological or a neurobiological point of view. And the studies have always been worked out in a spirit of "neutral submission to the natural facts". Methodological applications have always been left for a later stage, and so far the aims of such applications have been mainly pedagogical, commercial, etc., never to optimize conceptualization itself. The modern cognitive sciences continue this tradition. So it might seem that there is a radical divergence between the method of relativized conceptualization and the cognitivistic approaches. Therefore I want to remark what follows.

The bio-psychological studies of the ways in which knowledge emerges, are *themselves* processes of conceptualization. As such, the method exposed above concerns them. This establishes a zone of necessary superposition. The methodological suggestions hidden there might appear to be particularly fertile. Indeed in both the cognitivistic approaches, and MRC, what is tried to be represented is the generation of knowledge. But

while MRC does not deal with the processes which take place inside the body (of which only the final effects are taken into account), concentrating upon an exterior deliberate cognitive strategy, the cognitive sciences, on the contrary, put the accent quasi exclusively upon the neurobiological reflex processes that take place inside the body. The *encounter* of the results obtained in these two ways, if well characterized inside MRC, might be illuminating. It might bring forth reflexions, upon the exterior epistemic strategy, of known neurobiological processes : what inside MRC is introduced as deliberate methodological choices insuring certain "desired" pragmatic optimalities, might appear to be related with certain neurophysiological characters of the epistemic actions (such is certainly the case concerning the frame principle and the intrinsic metaconceptualizations, but possibly also concerning many other methodological choices, like the principle of separation, the cellular and hierarchical organization of the descriptions, and even the fundamental relativities of any description to a *delimited* object-entity and a filter for qualification). This, *vice versa*, could then suggest pertinent research on neurobilogical features of the processes of conceptualization. Which eventually might yield certain rules of translation. Thereby much intelligibility would be gained.

the terms of usual language. Jean Petitot supported this same opinion and furthermore he conveyed to me strong arguments for attempting a genuinely mathematical formalization. I tried here to follow both these injunctions.

Michel Bitbol, with whom I usually am in remarkable consensus, formulated a strong reservation concerning the necessity of the realist postulate. Jean Louis Le Moigne and Hervé Barreau formulated - in essence - the same reservation. These reactions, while they led to precious explicitations in my mind, finally stabilized my own choices concerning the presentation of the concept of realism.

Jean Louis Le Moigne and Evelyne Andeewsky insisted on the role, in the generation of basic object-entities, of pre-existing conceptualization. This led to quite important clarifications.

Giuseppe Longo, throughout our CeSEF-sessions, has drawn attention as often as possible upon the decisive role, in any formalization, of intuitive perceptions and of "pre-formal" knowledge and reasoning. This has notably strengthened my own positions in this respect, as expressed in MRC.

Francis Bailly, Hervé Barreau, Michel Bitbol, and Giuseppe Longo accepted to read successive forms of MRC and to express very useful questions, informations and remarks. Their various competences have provided me with useful clues. My exchanges with Hervé Barreau have been particularly rich. I am also indebted to Sylvain Fautrat for a thorough reading of an exposition of MRC and for suggestive questions.

Not least, J.B. Grize read two previous expositions of MRC and communicated me precious remarks and agreements.

Georges Yves Kervern manifested a constant interest and agreement with the successive forms of MRC, as well as a deep intuitive understanding of it, and he tries to apply it to the "science of danger".

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