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A MATHEMATICAL MODEL FOR PHILOSOPHY

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1. INTRODUCTION

In his recent book *Dreams of a Final Theory*, Steven Weinberg[1], one of the most reputed contemporary physicists, claims that philosophy did not have the slightest influence on modern physics. Refering to Wigner's famous assertion concerning the "unreasonable efficiency of mathematics in physics", he alludes to the *unreasonable inefficiency of philosophy*.

Is philosophy in crisis?

Obviously, one may observe many questionable aspects in contemporary philosophy. They refer less to the failure of philosophy, when confronted with the human being (still a largely unknown "entity"). They refer particulary to the failure of philosophy when confronted with modern science, as pertinently noted by Weinberg.

The majority of classic philosophical systems appear obsolete in the context of subsequent scientific discoveries. Since any Metaphysics is based on its contemporary Physics, when physics changes (by revolution or by evolution), some of the previous metaphysics principles may lose their validity. Even the still valid conclusions in the respective metaphysics are questioned, regardless of the formal recognition for the false $\rightarrow$ truth implication validity.

The philosophical discourse presents an excessive semantic and semiotic variety. The lack of a universal language, rigorous and invariant in space and time, has generated many misunderstandings, interpretations and sterile disputes. Translations from one language to another, from one

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[1] S. Weinberg, *Dreams of a Final Theory*, Vintage Books, 1994.

epoch to another, from one culture to another as well as from psychic-to-word-to-psychic, have altered information[2].

The philosophical discourse presents an excessive fragmentation, both on personal level and on philosophical school level. This fragmentation has largely exceeded science division, that appeared through hyperspecialization. As remarked by R. Thom[3], from the viewpoint of culture and sociology one cannot speak of a philosophical community at international level, or of an unanimously accepted hierarchy of values, as in the case of science.

In our opinion, all these aspects have a common ground: the profound contradiction between the global, holistic, non-linear claims of Philosophy, and its local, particular and linear discourse. Analytical philosophy has noted this incongruence and tried to introduce the only general and universally accepted language, invariant to translations, that is mathematics. Unfortunately, they used techniques (mathematical logic, set theory, theory of categories, formal languages) which are specific only for algorithmic, discrete and linear models. This may account for the fact that analytical philosophy did not contribute in a significant manner to any of the major (fundamental) problems of Philosophy[4].

We present in the following a mathematical model for the material and the ideatic universes, inspired from Aristotle's "geometric way", reformulated in modern topological language by Rene Thom, which might be an adequate tool for solving some of nowaday contradictions in Philosophy[5]. The main new idea is to make use of other mathematical theo-

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[2] For example, Pitagora's theorem (but for some latest generalizations) has the same "absolute" meaning today as it had two thousand years ago. In contrast, Aristotelian philosophy (for example) has been frequently interpreted and reinterpreted, thought and re-thought.

[3] R. Thom, "Leaving Mathematics for Philosophy", in *Mathematical Research Today and Tomorow*, Springer Verlag, Berlin,1992

[4] Maybe some of our assertions stroke the philosophical-oriented readers; we apologize if they sound as dogmatic criticism. As scientists, we are quite aliens in "philosophicaland", and we do not intend to introduce here a new dogma (there are a lot of them!), or to contribute to internal controversies. All we hope is to be offered an opportunity to expose our sincere (and maybe naive) impressions and to propose a tool.

[5] We first projected our model for explaining facts from Cognitive Sciences, Molecular Biology and Neuro-biology, and in this form it was communicated since 1992 at several meetings: Costa Rica (International Congress of Mathematical Biology, 1993);

ries, better adapted for the topic: differential topology and geometry, and Lie groups. All the mathematical objects we deal with are well known in the scientific community, and were successfully utilized in many applications, especially in theoretical physics. It is a mistery for us why they have not been used in the humanistic disciplines yet; one possible explanation would be the lack of a credible dictionary between the mathematical side and the humanistic side. But it is very difficult to "translate" from one "language" (mathematics) to a wide set of "idioms" (humanistic disciplines and, inside each one, a myriad of —not necessarily disjoint or complementary— opinions). The key of our tentative is to construct a space to unify the humanistic ideas, to find the invariants that govern them and to construct an "invariant language" (framework) for the humanistic side. A new kind of dictionnary emerges; does this mean that some of the old philosophical problems will automatically be solved? In no case! The unique advantage would be a new perspective for each (and all) of them.

2. THE MATID-UNIVERSE

It is a truism to say that the way we *see* influences the way we *think*. For ages, man's sight was Euclidean-like[6]. In the last century, new geometries were constructed, particularly for the need of new physics (general relativity, gauge theories ...). These new, abstract and non-intuitive geometries forced people to extend their intuition to other spaces; but these spaces were postulated only as *physical spaces*. Nevertheless, Philosophy followed the scientific thought and interpreted these spaces from its own perspective, but still as physical spaces; none of them was constructed and/or used *solely* for Philosophy. Recently, a series of philosophers observed this inadequacy, stressing the need for alternative representations of philosophical concepts[7].

Chile (University Mayor, Santiago de Chile, 1992); Argentina (University of Buenos Aires, 1992, 1993, 1994, 1995).

Now we think its applicability is broader, and we want to test it *in vivo*, in philosophy, as one of the most sensitive disciplines.

[6] All representations from our (five?) senses were Euclidean, and we think that this was true also in our "animal" philogeny.

[7] G. Merlich, "How Euclidean Geometry has Mislead Metaphysics", *J. Philos.*, 4, 169, 1991.

In this context, we suggest a new space for philosophy, which we denote the MATID-Universe: a physical space *and* a metaphysical space, interacting in a *common* geometrical space.

2.1 A Large Scale Model

Mathematical "metaphors"[8]: a *manifold* is a set, together with an *atlas* of *charts*[9] which overlap "smoothly", each of them modelling diffeomorphically[10] a patch on the manifold by an open set of the same numerical space.

In a very particular case, the manifold may be imagined as a surface (a sphere, a torus, a cylinder ...) manufactured from sheets of paper, glued on some common (overlapping) border. A chart (function) depicts a piece of the manifold, on a piece of plane paper. Of course, as it happens with geographic charts, the pictures are not identical with the "originals"; some distorsions usually appear (not only translations, rotations, but also scaling, twisting and so on). Geographical charts were the prototype of this (by now) abstract notion; it is interesting to note how they evolved, how their precision increased, from antiquity to present days. In mathematical terms, this evolution is due to the discovery of some "better" chart diffeomorphisms.

One of the main ideas justifying the use of such a complex machinery is *the principle of covariance*: the notions and the properties must not depend on the local system of coordinates, so they must be chart independent (*invariant*). The search for invariants[11] is the only way towards

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[8] The needed technical notions will only be sketched and strongly vulgarized in common sense descriptions; the interested reader may find more details in any advanced book on Differential Geometry; for example, S.Kobayashi and K.Nomizu, *Foundations of Differential Geometry*, Interscience, N.Y., vol. I (1963), vol. II (1966).

[9] The geographical resonance of these notions is not fortuitous.

[10] A diffeomorphism is a one-to-one differentiable function, which admits an inverse differentiable. By such a function, we can transport the differential calculus from open sets in numerical spaces (the classical setting) to more general sets. By "gluing" all these "local" differential calculi, we obtain a global one on the entire manifold.

[11] "Invariant" means something what does not change, when all world around changes. By his Erlangen program (1872), F.Klein made a big step toward modifying the classical paradigm of Geometry: this discipline, thought until then as a collections of heteroclyte facts, mixing projective, affine and euclidean notions, became since the study of "*geometries*": theories for the search of notions and properties, *invariant* under

classification results, and for a deeper understanding of the underlying natural phenomena.

In each point of the manifold M, tangents of all curves passing through this point form a vector space, termed *tangent space*. A smooth function which assigns to a point of the manifold a tangent vector is called a *vector field*. In this context, a *spacetime* is the assignment of a manifold, together with a (Lorentzian) metric γ and a vector field which gives the temporal orientation (the "time arrow")[12]. Spacetime is the standard framework for one of the most successful domains of theoretical physics: the general theory of relativity.

This is why we choose our *material Universe* to be a spacetime (M,g), with an (implicitely fixed) temporal vector field. A point p of the material universe M is called a (*material*) *event* and models an individual being (man, animal...). A *world line* is a curve γ on M, such that its tangent lies forever into the light cone (γ is called a non-spatial curve). So, in a first approximation, we ignore the "material" features of the being (size, form, complexity...), reducing him at a point and recording only his space-time evolution (reflected in his image $Im\gamma$).

Consider now another manifold I, termed the *ideatic Universe*. A point q of the ideatic universe I is called a *pure idea*. For the moment, I is only a mathematical abstraction, without any a priori connections with the material Universe M; its interpretation is close to the Platonic viewpoint: the pure ideas of Plato were thought to have an independent existence, to be immutable essences, outside (common sense) space and time, and governed by a supreme principle of divine nature. For us, points of the ideatic universe I also have independent existence (with respect to the "material" existence in M), are immutable essences, are outside (material) spacetime M and are governed by mathematical (differential geometric) invariant laws.

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some given group of transformations (for example, the projective group, the affine group, the group of isometries...).

Mutatis mutandis, "EYE" has an invariant "meaning", and also invariant representations (modulo translations), within human collectivities (from any place in space and in time); by contrast, "FOOD" has an invariant "meaning", but not invariant representations.

[12] We may depict a vector field on a manifold as a hairy head: in "each" point grows a hair, tangent ("close") to the head.

Each philosophical system has special terms which correspond to our "pure ideas" (of course, with different ontological and gnoseological interpretations). In general, they are viewed as "fixed points" which transcend common sense ideas, invariant for a long period of time and with large geographical spread. Of course, implicitly or explicitly one recognizes that they are difficult to reach and "understand". Our deep feeling is that one of the fundamental problems of human thought is *the discovery of the structure and the invariants of I.*

Let now M be the material Universe and I the ideatic Universe. We call MATID *Universe* (matter-ideatic Universe) a differentiable fibre bundle (S, π, M, I, G, A), where S is termed *the total space*, M *is the base*, I is *the standard fiber*, π is the projection from S to M, G is a Lie group[13] (called *the structural group*) and acting effectively on I), and A is a bundle atlas[14] (termed *gnoseopattern* or *psy-pattern*). The notion of fibre bundle is quite complicated; in particular, the reader may imagine the trivial case (when S is the cartesian product of the "base" M and the "fiber" I) as a "vertical" cylinder: the base is a "circle" and the fiber is a "straight line". Of course, we may reverse the cylinder and interpret the line as a base, and the circle as a fiber (for a general fibre bundle, this symmetry reversion is not possible).

By the definition of the fibre bundle, each point *s* of the total space S has a neighborhood W, diffeomorphic to a product U × V of two "patches" on the base M and the standard fiber I respectively (fig. 1A). Such a point *s* is called *idea* (or *psy-event*), and represents the "brick" of psychic activity at conscious, subconscious or unconscious levels[15]. Thus we distinguish three disjoint subsets *C, S* and *U* in S, such that above

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[13] A Lie group is a manifold with a group structure, compatible with the differentiable structure. When acting upon another manifold, a Lie group measures, in some sense, this manifold's internal symmetries. For example, the Standard Model in particle physics is strongly based on symmetries of some low-dimensional Lie groups.

[14] On each manifold M, I and G we have an atlas of charts, which models locally the differential calculus. There is a canonical way to build such a collection *A* of charts also on S, starting with charts from M and I. In particular, one may suppose that the new charts are cartesian product of charts in M with charts in I.

[15] Our notion of "idea" is an abstractisation of the common sense "idea", similar to the "material point" in physics. From a neurophysiological viewpoint, it is similar to Eccles' "psychon";[20] the difference consists in the extension of this concept, from the (rational) "thinking" , to the more general acceptance of "psychic activity", conceived as the sum of conscious, subconscious and unconscious ideas, on a psychic trajectory (path).

each point p in M, the respective fiber S_p intersects each of the sets C, S and U (fig. 1B). These are the *conscience*, the *subconscience* and the *unconscience* zones, respectively.

A *psy-line* is a curve $\tilde{\gamma}$ in S, such that its projection γ is a world line in the material universe M. When a particle p (event) moves in M along the trajectory $\tilde{\gamma}$, its "mind" would "think" along "ideas" in $Im\tilde{\gamma}$ (fig. 2). The psy-line $\tilde{\gamma}$ looks like a string above some "head" (γ), recording its "ideas" in a big "recorder" space S.

The parametrization of the psychic activity at subconscience and unconscience zones is related to the "physical" time, though the phenomena appear more complex. We advance for this interaction a kind of "indeterminist principle": when the activity in S and U moves in the conscience zone C, it becomes "particle-like" (corpuscular) and the "wave-like" activity (suggested for S and U) stops. A psy-line $\tilde{\gamma}$ in S may access C, S and U alternatively, with a high frequency, which may give the (misleading) sensation of a *continous* conscious activity. By some interpolation, the three types of psychic activity might be modeled by three independent curves in S (replacing $\tilde{\gamma}$) parametrized with the same parameter. Unfortunately, this reductionist approach (by "parallel processing") may loose the subtle (causal) connections between the components.

In the material universe M, the spacetime structure demands movements within the interior of the light cones. A similar spacetime structure may be induced on S, such that the future on γ might be future on $\tilde{\gamma}$ and conversely[16]. The problem of the "observer" (absolute or relative) led in physics to the discovery of the theory of (special and general) relativity, via the relativization of the "absolute" frame of Euclidian geometry. Mutatis mutandis, in the total space S of the MATID-Universe, we have moving frames and a similar relativity of frames (observers), like in the material universe M; by analogy, a maximal velocity might be postulated in S, that of "thought", interpreted as the faster psychic activity; of course, it may depend on the gnoseo-pattern involved (that is, it may differ for distinct species).

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[16] In all physically plausible spacetimes M, geometric conditions forbid (because of subsequent paradoxes) back-in-time travel. In S such constraints do not exist (for the moment), so a kind of *psychic* back-in-time travel (premonition) would be in principle possible (in S and *not* in M).

Until now, we saw how ideas from the general theory of relativity inspired our model. But the main construction (the fiber bundle) is specific to gauge theories from physics. There, over a spacetime M as a basis, lies a bundle of (physical) observables; in particular, over each world line γ in M, lies a curve $\tilde{\gamma}$ of measurements along γ (velocity, acceleration, pressure, temperature...). Hidden in the stuff of natural phenomena, the structure of M is governed by some (invariant) laws, with some "absolute" and "dictatorial" action (like the universal constants). By analogy, in our model, over a world line γ lies, in the bundle of psychic observables S, a curve $\tilde{\gamma}$ which records (like a giant video-tape), all of γ's emotions, feelings, rational thoughts, dreams, memories, etc. It is natural to imagine the action of some invariant laws on the space of ideas S; part of them correspond to laws in the material universe M, but maybe there are also some due to laws on the ideatic universe I. In each point, the maximal potential set of ideas reachable by a subject is the fiber in S, through the respective point; this fiber is diffeomorphic to I (so, it coincides with I, modulo a quite complex —but controlable— distorsion).

Given the material universe M, the ideatic universe I and a (symmetry) Lie group G, they are "linked and mixed" together by charts of the atlas A, which models the gnoseologic pattern of, say, a species. If one chooses another species, one obtains another atlas with different translations between M, I and G. In the framework of a given psy-pattern A, there still appear different translations: the same idea *s* of S may be translated by different "people" *p* and *q* of M into different pure ideas *i*, *j* of I, by different charts (fig. 3). This explains the difficulty (or even the impossibility) to communicate without ambiguity, not only between species, but often also within the same species: *all misunderstanding is nothing but bad translation!*

In this context, a solution would be to transcend our limits of being in M and thinking in S, and to access to the "truth" in I. Present knowledge does not provide a direct access for studying the ideatic universe I. Our model suggests an indirect way: to compare different gnoseopatterns A, and, in the framework of a given gnoseopattern to compare different bundle charts, and, thus, to obtain invariants. These invariants might then suggest invariants of I. The construction of the atlases of A within science is still at its beginning. Nevertheless, sophisticated neurobiological experiments are already developed for translating and quantifying psy-events for several species (man included). Likewise, different charts of

the brain started to appear, but we are still lacking charts of S and of I. In this context we suggested[17] a metric theory, combining topological, differential and geometrical tools for measuring "distances" between ideas (points in S), with some possibilities of extension also in I.

Warning! To construct the MATID-Universe, we must know (or postulate) the material universe M, the ideatic universe I and the group G. Conversely, in order to understand I, we must be in the framework of the MATID-Universe, to get information from M, S and G. Apparently, there is a vicious circle. At a closer look, the situation doesn't differ too much from the general scientific paradigm: the modelization is a permanent process of fitting hypothesis and conclusions, by direct and inverse methods, towards the optimization of the response at some specific requirements. The same feed-back method permits us to work with arbitrary I and S, for the general setting; then, for specific cases, we may consider special manifolds S and I, to test some particular results.

Actually, we have a similar situation in modelling the material Universe M: although one agrees that M must be a "general" (generic) spacetime, in specific problems the spacetime is chosen in a very particular form, adapted to the given framework (large scale cosmology, vicinity of a heavy celestial body, quantum gravity...). So, through the multitude of particular realizations, the general paradigm of theoretical physics holds true. We suggest a similar approach for our model.

2.2 Gnoseological Relevance. Psy-path vs. *Language*

Consider a MATID-Universe, γ a world line in the material universe M (modelling the movement of an individual being) and $\tilde{\gamma}$ his psy-line in S (reproducing his whole psychic activity). Then, at the individual level, "knowledge" as a process (K_p) is modeled by $\tilde{\gamma}$ considered as a *parametrical curve*; "knowledge" as a result (K_p) is modeled by $\tilde{\gamma}$, considered as a non-*parametrical curve* and "knowledge", as globally considered, is modeled by Im$\tilde{\gamma}$[18]. Since in our model (refered in the sequel as the PC-

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[17] G.T. Pripoae and S. Comorosan, A Mathematical Model for a Unified Material and Ideatic Universe, *7-th Internat. Congress of Biomathematics*, Buenos Aires, 1995.

[18] A *parametrical curve* is a triplet: a source, a law of correspondence and a target. Two curves are equivalent if one is obtained from the other by a change of the parameter. An equivalence class is called a *non-parametrical curve*. The "image" (Im) is an invariant within an equivalence class.

model) $\tilde{\gamma}$ passes through all conscience, subconscience and unconscience zones, "knowledge" means here the whole rational, irrational ("unrational"), intuitive and sensorial baggage (fig 4A). Then, besides the analytic and geometric properties of each curve $\tilde{\gamma}$ (separately), on the collective level one may consider (and find) global invariants of all curves $\tilde{\gamma}$, that is, knowledge on the collective level should provide invariants of S, and conversely. Until now, the tentatives to model the thinking activity used only the (individual) path approach; it's time to try to compare different such psy-lines, and to extract the invariant "knowledge".

The topology of Im$\tilde{\gamma}$ (which may pass through *C, S* and *U* at closely related moments) might be sophisticated and highly "nonlinear". When γ communicates its thoughts ($\tilde{\gamma}$) through verbal language, a lot of information is lost, since language, as a *result* of psy-activity is a linear sequencial approximation of a non-linear phenomenon. Written messages are even poorer (due to the lack of pronunciation ...). The power of the "word" is in ourselves, enhanced in the geometry of the total space S of the MATID-Universe. The way language acts as a "Procustian bed" for the mental activity is represented in fig. 4B. In any communication process, we may distinguish two operations of translation (at source and at target), and a vector (written word, spoken word ...). In a certain manner, all are random (with possible noise), information-loosers and misunderstanding-makers. Some forms of messengers are easier to "understand" (i.e. easier to attain by $\tilde{\gamma}$) due to their nonlinear dynamics, like music, and in a sense also poetry. Even if the message is not decodified in the conscience zone *C,* it may influence the subconscience zone *S* and the unconscience zone *U* and later, through internal paths (a kind of feed-back), might influence *C* as well.

All philosophical systems rely on language in an unappropriate way: frequently, words are taken from everyday language and loaded with some specific philosophical meaning (which usually differs from one system to another). There appears nowaday a growing need for new nonlinear systems of conscious thinking and communication (non-verbal, complex-verbal ...). This is why the PC-model suggests some new

ideas[19]. It is interesting to remark, in the same context, the brilliant intuition of Hermann Hesse, who imagined around '30, a superb metaphor, *The Glass Bead Game*, describing with literary tools an alternative type of complex communication for human ideas.

2.3 A Medium Scale Model

In this second model, the points p of the material universe M and s of the total space S of the MATID-Universe are "blown-up" to a submanifold of M and of S respectively. For example, a point on a sphere "blows-up" to a circle (a submanifold) on the sphere; a point on a cylinder may "blow-up" to a helix on the cylinder. Thus we may introduce the "shape" and other "qualitative" properties of p and s, as well as their life-story recorded as submanifolds p' and s' , of greater dimension, with p a subset of p' (both included in the material universe M) and s a subset of s' (both included in S) (fig. 5). Now, to a morphogenetic development p' of an "individual being" p in M, corresponds a development s' of his thought s in S.

For the living species on Earth, the geometry and topology of p' in the material universe M are determined by the respective *genome*, as a realization of a potentiality (*genetic code*). In our detalied mathematical paper, we have suggested a plausible analogue for S: the geometry and the topology of s' in S might be determined by the *psynome*, a general pattern, inherited through a *psy-code* as a source of inheritance hidden at psy-level, its ontogeny repeating (in some potential sense) its philogeny. Obviously, the psynome concept springs from mathematical considerations, as a symmetry required by our model , but several evidences of medical, genetical and psychological nature for its existence were also provided.

The "knowledge" process, treated in the preceeding paragraph, may be reformulated in terms of submanifold theory, the distinction between the individual and the collective levels still operating. Nevertheless, the technical difficulties grow and the search for invariants now becomes an effort in a realy bushy mathematical "jungle".

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[19] In this respect, this system of notes is a kind of primitive, rudimentary parallel communication system.

Applications of the PC-Model

Remarks on the Fundamental Problem of Philosophy

Explicitly or implicitly present in any philosophical system, the relationship between matter and consciousness, between the material world and the world of ideas (and, in particular, the mind/body relevance), is considered the main problem. Its solution, in current philosophy, always represents an *axiomatic choice*, choice which determines all subsequent questions and possible answers. Generally, pre-eminence of matter over consciousness leads to materialistic (or realistic) systems, whereas pre-eminence of consciousness leads to idealistic systems.

In the PC-model, the material Universe M and the ideatic universe I are independent, which precludes any determination of one by the other. Only in the process of structuring the MATID-Universe, S (in which the construction of the gnoseo-pattern A is fundamental) comes into play, locally (as individual species, socio-cultural group ...), introducing additional axioms.

Matter → consciousness or consciousness → matter determination are thus postulated *a posteriori*, at the S-level, and, as any local postulate, it may not be unanimously accepted. From the ontological viewpoint, M and I exist independently; the space S also exists in (some) real way, but the matter → idea determination is subordinated to the gnoseopattern A, with all its local characteristics. From the gnoseological viewpoint, "knowledge" (K_p, K_r) is always partial, at the level of S; the only invariant knowledge ("absolute knowledge") would be at the I-level.

There are, of course, dualist systems, which tend to reconciliate the realist and the idealist viewpoints; our model does not suggest a kind of psychophysical parallelism (in the sense of the psychologist G.T. Fechner), that is, an independent existence of the physiological and psychic phenomena, without causal relationship between them. Our "dualism" refers to material events vs. pure ideas. In what concerns the common psychic activity, our model looks for causality from *both* M and I, through S.

In our opinion, the actual fundamental problem of Philosophy must be reformulated: it is of little interest to know the primordiality between events in M and events in S; the more interesting problem is the exis-

tence of possible causal relations between M and I (because S is a "by-product" of M and I). Our model conjectures a negative answer.

Connections with the Popper-Eccles Model

K. Popper and J. Eccles have elaborated a philosophical system[20], comprising three "worlds", intended to cover all forms of existence and experience: world 1, of "material states" (human brain included); world 2, of "subjective knowledge" (consciousness states and experiences at individual level); and world 3, of "objective knowledge" (the cultural world created by man).

Translated into our framework, world 1 would correspond to the material universe M, and worlds 2 and 3 to subsets of the total space of the MATID-Universe S (submanifolds included in the conscience zone C and the subconscience zone S, but disjoint with respect to the unconscience zone U), modelling only the conscious activity (only the dreams are included in world 2 and the art in world 3). In the PC-model, worlds 2 and 3 form a whole, represented in the same geometrical space, displaying a morphogenesis (geometry) and an evolution (ontogeny and phylogeny), similar to the organism in world 1. Moreover, our space S contains, in addition, the subconscious and the unconscious activities record.

Eccles suggests a quantum neurophysiological hypothesis, for an interaction "psychon-dendron", as a basis for the informational flux. The PC-model presents a similar argument through its "psynome", but additionally offers a reason for the *psychic evolution* (the philogeny and the ontogeny of the psychic). In this context, Eccles "psychon" could be viewed as the punctual "idea" in S, at the moment of its access by the curve $\tilde{\gamma}$, in the point $\tilde{\gamma}$ (t). The psynome, in the PC-model, represents also a driving force of psychic and cultural evolution, through its replication and transmission mechanisms, evolution considered nowaday as influenced only by the "cultural patrons" (books, educational systems ...).

The PC-model makes also a clear distinction between the individual and the collective levels concerning the access to worlds 1, 2 and 3, distinction lacking in the Popper-Eccles model. And not only we deal simultaneously with these two degrees of generality, but we can do it

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[20] J. Eccles, *Evolution du cerveau et création de la conscience*, Fayard, Paris, 1992.

"covariantly", and within different gnoseo-patterns (at species or at "population" levels).

The three worlds "partition" is an attempt to structurate our Universe, but only in the framework of the naive set theory; by contrast, our sets (M, S, I, G) have a richer structure, and are interconnected by quite controlable functions.

Criticism of Artificial Intelligence Models

Artificial intelligence (AI) is a complex interdisciplinary domain, comprising sophisticated computer modelling, coupled with advanced research of neurophysiological and psychological nature. Recent studies of this discipline suggest the following "strong" claim: AI is close to the goal of creating a machine (hardware) endowed with a program (software), capable of "human" thought. In other words, human mental activity is nothing but a sequence of well defined (mathematical) operations, denoted by the generic term "algorithm".

This "strong" claim has raised numerous controversies and disputes. Serious arguments against this claim have been put forward by J. Searle[21] in philosophy (known for his famous "chinese room" experiment), by J. Eccles[22] in biology and by R. Penrose[23] in physics and mathematics. The PC-model suggests a series of theoretical arguments along the same line, that is rejection of the AI-strong claim.

Our discussion is also connected to another "strong" claim, of the same type, suggested from genetics: the imminent genome clasification would make it possible to reproduce a human organism (the "hardware") not only *in vitro*, but also *ex nihilo*. Then, the coupling of the AI conjecture to this genetics conjecture might result in an artificial human creation.

Remarks. –At a closer analysis, one observes that the artificial genetic "reproduction" would imply *only* a realization of a "human biological format", but in no way *also* the simultaneous aquisition of a psychic activity.

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[21] J. Searle, *The Rediscovery of the Mind*, The MIT Press, Cambridge, 1994.

[22] J. Eccles, *Evolution du cerveau et création de la conscience*, Fayard, Paris, 1992.

[23] R. Penrose, *Shadows of the Mind*, Oxford Univ. Press, 1994.

–In the AI-controversy, human mind *vs.* machine, one compares an entity (computer) endowed with two components (hardware and software), with an entity (human being) endowed with only one "component" (build by the genome). This is why the PC-model suggests for the human design a "psynome" counterpart, thus allowing a discussion of the "human/machine analogy" from a position of indispensable symmetry.

We can summarize through a series of problems and conjectures:

PROBLEM 1. May a genome be conceived without a psynome?

CONJECTURE 1. Yes, but the result would be a machine, connected only to the material Universe M, and lacking connections with the ideatic universe I (a kind of Golem).

PROBLEM 2. May a psynome be conceived without a genome?

CONJECTURE 2. No, with the remark that in S (only!) one might (theoretically) imagine some "para-psychic" entities, a kind of ghosts (like "echoes" from the material world).

PROBLEM 3. May both a genome and a psynome be simultaneously created, in a unique entity? (This is the modern formulation for the ancestral problem of Creation).

CONJECTURE 3. Theoretically, yes. Suppose that the problem of the genome reproduction has been solved. The psynome concept has been constructed with two specific elements (ingredients) alien to the AI: *heredity* and *history*. In this context, the AI-argument on self reproducing programs is not relevant, since it is not at all clear whether this self reproduction actually models effectively a "real" evolutionary (biological) process. As for history ... computers still have some millenia to go.

Accordingly, the PC-model suggests that, even if some artificial entities will be constructed in the future, from artificial genome and artificial psynome, it will be outside a gnoseo-pattern of the human type. The intelligence of such entities might be measured by invariants of an adapted matter-ideatic space S. Of course, their ideas might be compared with some human ideas, after "transporting" them in the same ideatic space I. (As we have already pointed out, this is a general procedure, which is accesible even in the present scientific framework, for comparing the human, the animal and —possibly— the extraterrestrial gnoseopatterns.

3.4 Comparison with the Thom Model and with the Penrose Model

Rene Thom has provided a unique and powerful approach to philosophy[24], based on his theory of structural stability and morphogenesis[25]. He used techniques of differential topology, that allow a "global" modelling of phenomena. Accordingly, his models may catch the "non-linearity" of the problems, thus leading to deep invariants, conceived as "verities of superior order".

Thom suggests an "intelligible ontology", as a manifold that allows the analysis of closed sets with non-empty interiors (called "formes saillantes"), between which non-localized entities (called "pregnances") are emitted. Reflected at the psychic level, these entities may conduct to discrete "forms", the step from psychic to psychic having only individual and local relevance.

The PC-model (at the medium scale) catches the dynamics of *both* "physical" and "psychic" forms, allowing more over a global study of thinking phenomena at the collective level. As far as terminology is concerned, the PC-model works with the fundamental category of "idea", which allows nuances and senses more appropriately than the category of "form".

R. Penrose, in an extensive physico-mathematical argumentation, also suggests a model with three worlds: the Physical world, the Mental world and the Platonic world. His physical world is similar to the material universe M, in our model. In the mental world, the elements are not structurally defined, whereas in our model, the "quanta" in S represents the "idea" (the point, respectively the submanifold). Moreover, it is not clear whether the mental world refers to an individual or to humanity, a distinction made very clear in the PC-model.

The Platonic world contains some pure ideas, like the mathematical abstractions. Translated in our language,we may interpret it as a subset of the ideatic universe I.

A more clear-cut difference concerns the relationships between the three worlds: in Penrose's model, surjective functions generate one world from another one (starting from a "patch" of the "source" world). The PC-model allows reciprocal spacetime interactions between the three

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[24] R. Thom, *Apologie du logos*, Hachette, Paris, 1990.

[25] R. Thom, *Esquisse d'une semiophysique*, Interéditions, Paris, 1988.

spaces S , M , and I , using local diffeomorphisms ("charts"), much more flexible than Penrose's functions.

A main difference from the above two models is represented by the *covariance* of the PC-model. This characteristic may explain human thought invariance (i.e. the appearance of "universals"), as well as the dependence on the individual and the local levels. Even if the Thom model and the Penrose model brought a superior geometrization, when compared with the Popper-Eccles model, we think that it is not enough; so, we tried to imagine not only the topology and the differential structure of the "components", but also the manner the known *geometrical* invariants could appropriately model (and measure!) the essence of the human thought.

In our opinion, the PC-model presented in this paper might offer a new perspective to tackle the nowaday main contradiction of philosophy, that is *globalism versus tribalism*, from a "Sunday Philosophy" viewpoint.

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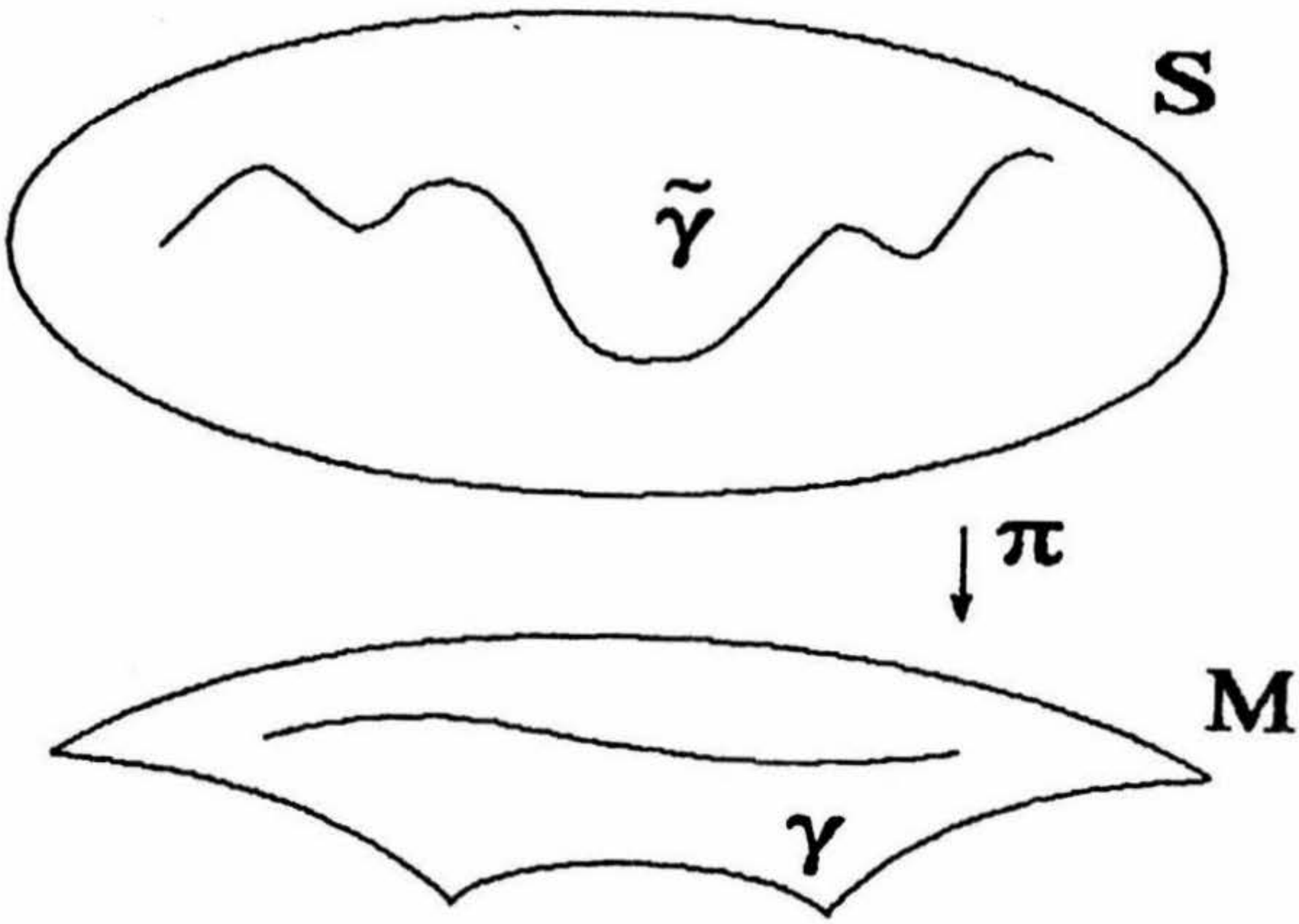
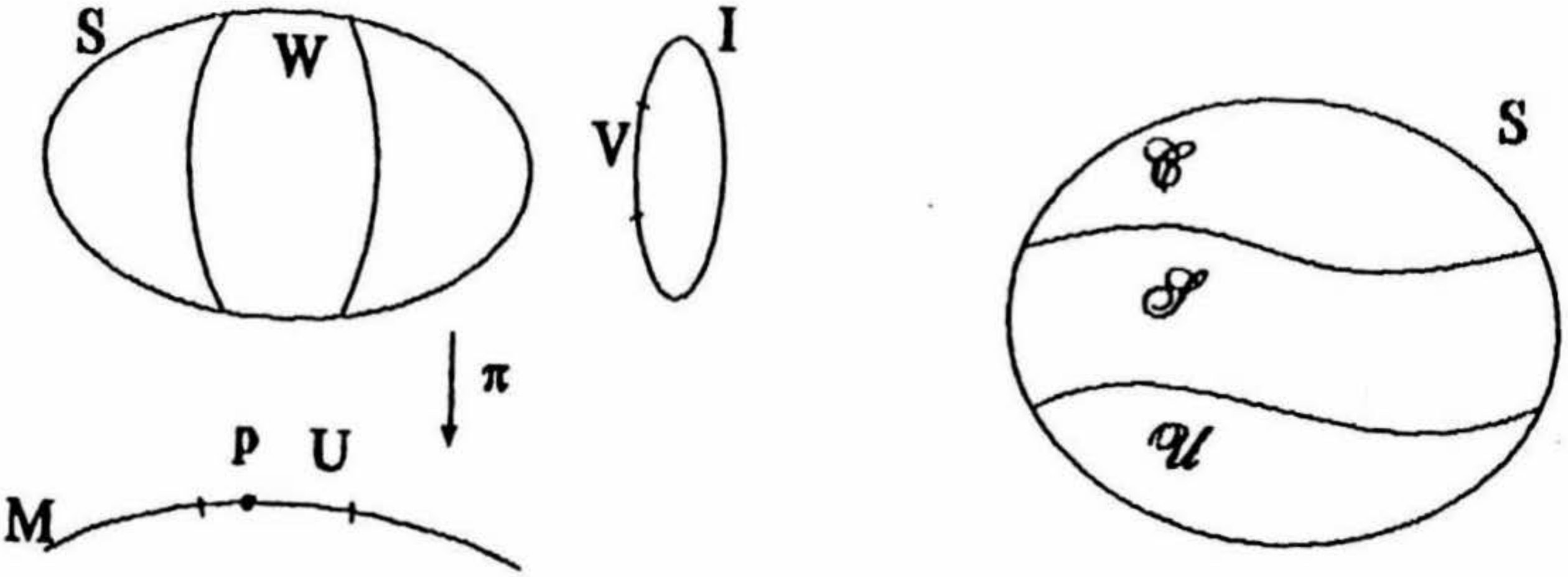


Fig. 2



A B

Fig. 1

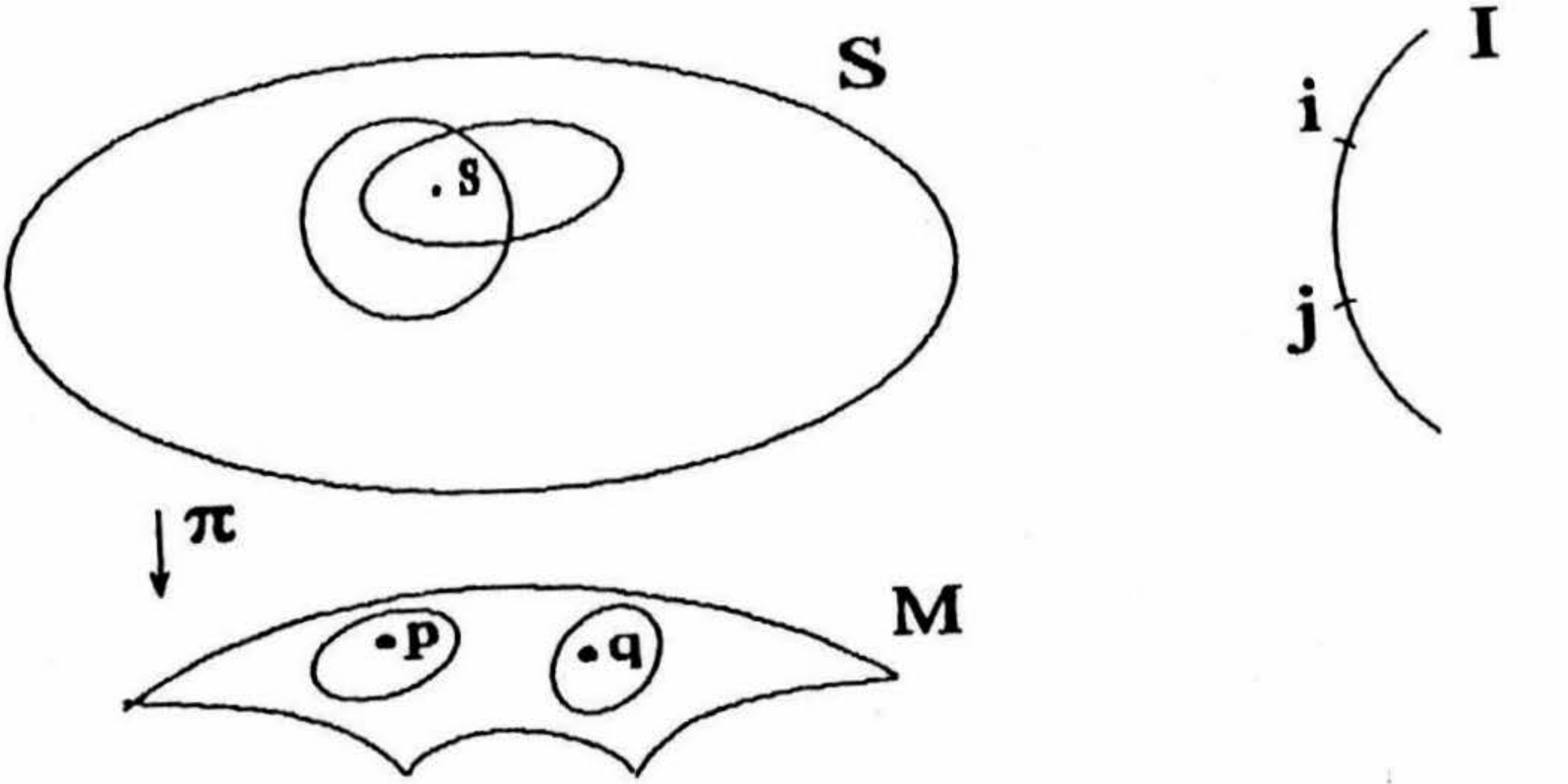
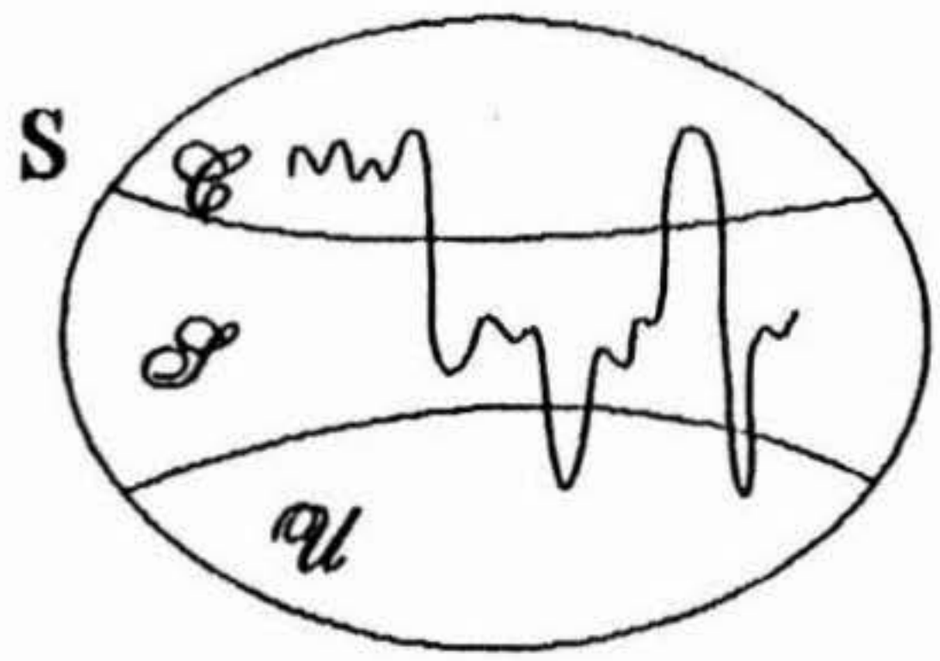
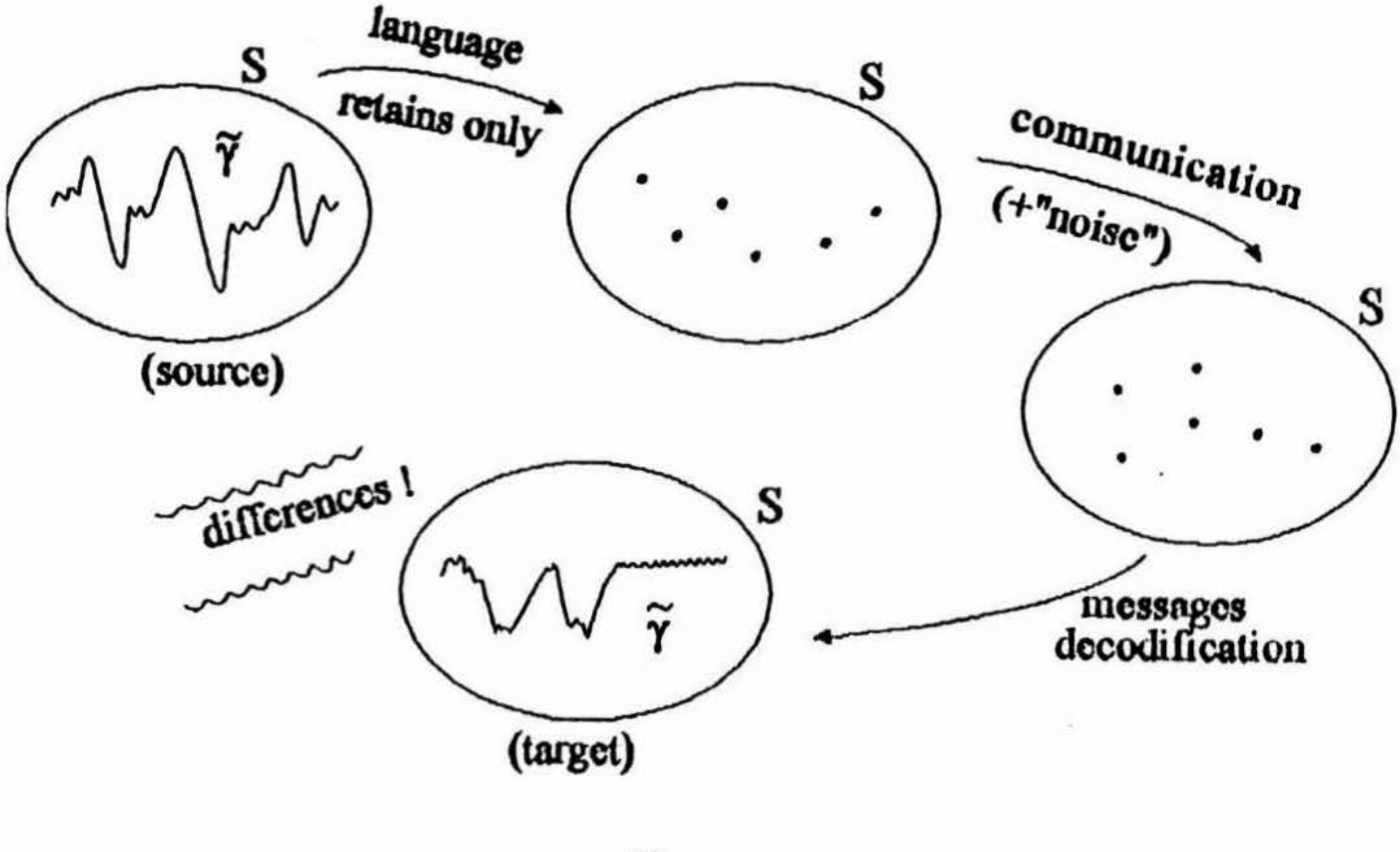


Fig. 3


S

A


S
language
retains only
S
communication
(+"noise")
S
(source)
differences !
S
messages
decodification
(target)

B

Fig. 4

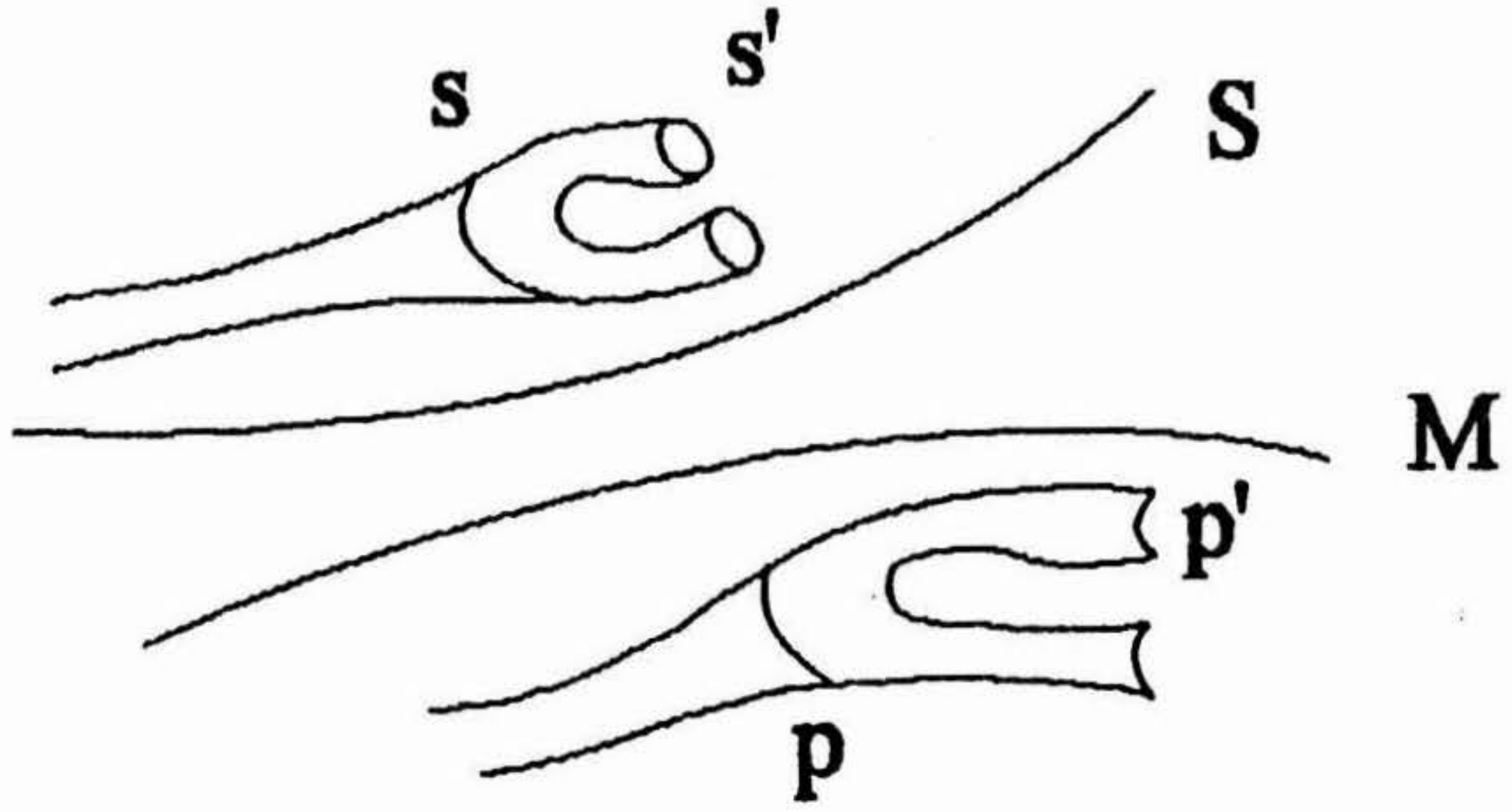


Fig. 5