Gurdjieff's Philosophy of Nature

Basarab Nicolescu

A particle-physicist's bold, rigorous exploration of the relationship between Gurdjieff's cosmological mythos and leading theories in physics and cosmology.

It is becoming very fashionable almost everywhere to find parallels between modern science and this or that teaching, this or that philosophical system, this or that religion. The more or less hidden sociological root of such a tendency is quite obvious: the contemporary all-powerful "god" of technoscience is evoked as evidence of the "seriousness" of another field of knowledge.

Even if the intentions of certain seekers (and I include here those few who are drawn toward the relationship between science and the Gurdjieff teaching) are not tied to this sociological motivation, there is still a huge misunderstanding. The methodology and perspective of a teaching, a system of philosophy, or a religion are very different from the methodology and aim of modern science. To compare results or ideas judged to be similar can only lead to the worst illusions, to analogies that are soft and devoid of meaning, and, in the best of cases, to resonances that are felt as "poetic."

Nevertheless, the search for a real relationship between science and such fields of study would, in our opinion, be worthwhile. Such a relationship could be established if the teaching, the philosophical system, or the religion in question derives from a philosophy of nature.[1]

The fact that Gurdjieff's teaching contains a philosophy of nature is obvious, and the present study will attempt to support that affirmation. The hypothesis of a correspondence between man and nature is formulated without ambiguity by Gurdjieff:

> It is impossible to study a system of the universe without studying man. At the same time, it is impossible to study man without studying the universe. Man is an image of the world. He was created by the same laws which created the whole of the world. By knowing and understanding himself, he will know and understand the whole world, all the laws that create and govern the world. And at the same time, by studying the world and the laws that govern the world, he will learn and understand the laws which govern him. . . . The study of the world and the study of man must therefore run parallel, the one helping the other.[2]

The comparison between modern science and this type of philosophy goes beyond an intellectual exercise. In the first place, some great scientific discoveries have been guided by ideas from a philosophy of nature. For example, the role that German ***Naturphilosophie*** played in the discovery of electromagnetism in 1820 by Oersted is well known. Such cases are rare, but it is their existence, not their number, that is highly significant. These cases show that there is an intrinsic relationship, which is not devoid of meaning, between nature and a "realistic" philosophy of nature.

A second aspect seems still more important. The absence of meaning, above all the absence of a value system guiding technoscience, is perhaps the characteristic trait of our epoch. It is just in this context that we are going to examine Gurdjieff's philosophy of nature.

THE PRINCIPLE OF DISCONTINUITY AND QUANTUM DISCONTINUITY

One of the most surprising aspects of Gurdjieff's philosophy of nature is the central role which it gives to discontinuity, with a direct critical reference, moreover, to contemporary physics.

Indeed, with rare exceptions, continuity is a constant in human thought. It is probably based on the evidence provided by our sense organs: continuity of our own body, continuity of the environment, continuity of memory. It belongs to the visible domain, to the domain of constant forms (or forms evolving in a constant way), to the domain of objects. Death, natural cataclysms, mutations were, until just recently, considered more as manifestations of accident, chance, or impenetrable mystery. Science needs a mathematical apparatus for its development. Newton and Leibniz discovered such a tool based on continuity: infinitesimal calculus. For centuries, scientific thought has been nourished by the idea of continuity.

Gurdjieff, however, clearly affirms the essential role of discontinuity in nature:

> It is necessary to regard the universe ***as consisting of vibrations***. These vibrations proceed in all kinds, aspects, and densities of the matter which constitutes the universe, from the finest to the coarsest . . . . So that one of the fundamental propositions of our physics is the ***continuity of vibrations***, although this has never been precisely formulated because it has never been opposed. In certain of the newest theories this proposition is beginning to be shaken.
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> In this instance the view of ancient knowledge is opposed to that of contemporary science, because at the base of the understanding of vibrations ancient knowledge places the principle of the ***discontinuity of vibrations***.
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> The principle of the discontinuity of vibrations means the definite and necessary characteristic of all vibrations in nature, whether ascending or descending, to develop not uniformly but with periodical accelerations and retardations.[3]

These considerations of Gurdjieff's were formulated in about 1915, in front of a St. Petersburg group. The date is important.*

Gurdjieff himself was aware of these scientific discoveries, or at least one of the numerous intellectuals among his groups in Moscow and St. Petersburg—Ouspensky in all likelihood—had informed him of the existence of these discoveries. The allusion in these texts to "certain most recent theories" may thus be explained. According to this hypothesis, Gurdjieff, speaking of "contemporary science," would have been referring rather to what we would today call "classical science." But beyond questions of vocabulary, what seems important to us is that Gurdjieff sees the epistemological and philosophical stake of science in discontinuity.[4]

In evoking this work developed in 1900, Max Planck writes: "After a few weeks, which were certainly filled by the most intense work of my life, I had a flash of light in the darkness in which I was debating with myself, and unexpected perspectives were opened."[5] This "flash of light in the darkness" revealed to him a concept—the elementary quantum of action ("action" is a physical quantity corresponding to energy multiplied by time)—which was going to revolutionize all of physics and profoundly change our vision of the world. This quantum is expressed by a universal constant (the "Planck constant") which has a well-determined value and occurs by integer multiples.

The Planck quantum introduces a discrete, discontinuous structure of energy. Planck was fully conscious that in breaking down the old all-powerful concept of continuity, the very foundation of classical realism was thus being put in question: "This quantum represented.... something absolutely new, unsuspected until then, and seemed destined to revolutionize a theoretical physics based on continuity, inherent in all causal relations since the discovery of infinitesimal calculus by Leibniz and Newton."[6]

It is important to take into account that the "discontinuity" we are speaking of (whether in regard to quantum theory or in regard to the cosmology of Gurdjieff) is a pure and firm discontinuity which has nothing in common with the popular usage of this word (the fork of a road, for example). To try to grasp the full strangeness of the idea of discontinuity, let us imagine a bird jumping from one branch to another without passing through any intermediary point: it would be as if the bird were to suddenly materialize on one branch, then on another. Evidently, confronting such a possibility, our habitual imagination is blocked. But mathematics can treat this sort of situation rigorously.

Quantum discontinuity is an infinitely less rich concept than discontinuity in the sense in which it is used in the cosmology of Gurdjieff. There it is presented as the fundamental aspect of one of the two laws regulating all worlds (the law of seven). The "obligatory-gap-aspects-of-the-unbroken-flowing-of-the-whole"[7] conditions the interpenetration of the different worlds, one within another. It is discontinuity which permits unity to exist in diversity and diversity within unity. It is discontinuity which permits evolution and involution. It is discontinuity which permits the coexistence of global causality and local causality. And, in the end, it is discontinuity which assures the dignity of man and gives meaning to his life. We are therefore very far from quantum discontinuity.

MATTER AND DEGREES OF MATERIALITY

Gurdjieff affirms unambiguously the materialistic character of his teaching: "Everything in the Universe is material: ***therefore the Great Knowledge is more materialistic than materialism***."[8] And he adds: "Everything in this universe can be weighed and measured. The Absolute is as material, as weighable and measurable, as the moon, or as man."[9] Here is something to scandalize a good many spiritualists and devotees of Tradition and something to placate some scientists (let us forget for the moment the word "Absolute").

This trenchant affirmation, however, reveals its full meaning only at the moment Gurdjieff introduces the distinction between "matter" and "degree of materiality."

Like every man of science, Gurdjieff is convinced that "***matter*** is everywhere the same...."[10] But he introduces the notion of the degree of materiality, linked to energy: "It is true that matter is the same, but materiality is different. And different degrees of materiality depend directly upon the qualities and properties of the energy manifested at a given point." [11]

For a physicist of the nineteenth century, the idea of "degrees of materiality" would not have meant very much. It takes on real substance with the discovery of the quantum world, where laws are radically different from those of the macrophysical world. It is the study of the infinitely small which reveals a degree of materiality different from that of the macrophysical world.

This is not the place to discuss quantum laws. But allow us to cite briefly a relevant example.

Classical physics recognizes two kinds of objects that are quite distinct: corpuscles** and waves. Classical corpuscles are discrete entities, clearly localized in space and characterized, from a dynamic point of view, by their energy and their momentum. Corpuscles could easily be visualized as billiard-balls traveling continuously in space and time, and describing a very precise trajectory. As for waves, they were conceived as occupying all of space, in a continuum. A wave phenomenon can be described as a superpositioning of periodic waves characterized by a spatial period (wave-length) and by a temporal period. In the same way, a wave can be characterized by its "frequencies": a "frequency of vibration" (the inverse of the period of oscillation) and a "wave number" (the inverse of the wave-length). Waves can thus be readily visualized.

Quantum mechanics brought about the complete overturning of this view. Quantum particles are corpuscles and waves at the same time. Their dynamic characteristics are connected by the formulas of Einstein-Planck (1900–1905) and de Broglie (1924): the energy is proportional to the temporal frequency (the Einstein-Planck formula), and the momentum is proportional to the wave number (the de Broglie formula). The factor of proportionality, in both cases, is precisely Planck's constant.

This representation of a quantum particle defies all attempts to represent it by forms in space and time, for it is obviously impossible to represent something mentally that would be simultaneously corpuscle and wave. At the same time, the energy is changing in a discontinuous way. The concepts of continuity and discontinuity are reunited by nature.

It must be well understood that the quantum particle is a completely new entity that cannot be reduced to classical representations; the quantum particle is not a simple juxtaposition of corpuscle and wave.

We can understand the quantum particle as being a unity of contradictories. It would be more correct to affirm that this particle is neither a corpuscle nor a wave. The unity of contradictories is more than the simple sum of its classical parts, a summation which is contradictory (from the classical point of view) and approximate (from the quantum point of view).

When Gurdjieff affirms, "The world consists of vibrations and matter, or of matter in a state of vibration, of vibrating matter," [12] and when we remember the role he gives to the frequency of vibrations, to energy, to discontinuity, it is tempting to think of the new quantum entities. Let us be very clear: we are not affirming that quantum particles can be identified with the "vibrations" Gurdjieff speaks about (which would in any case be absurd), but that they appear to be their materialization in the quantum world. At the same time, it is indisputable that the discovery of the quantum world gives rational, scientific sense to the notion of "degree of materiality." Gurdjieff associates the fineness of matter with the frequency of vibrations: "The expression 'density of vibrations' corresponds to 'frequency of vibrations' and is used as the opposite of 'density of matter'.... Therefore the finest matter corresponds to the greatest 'density of vibrations.'" [13] Indeed, what conceivable relation is there between a chair and a neutrino (a particle with no mass and no electrical charge which penetrates our macrophysical matter without impediment)? It is clear that it is a question of two different worlds—of two different levels of reality, governed by different laws—and that the degree of fineness of matter is very different when passing from one level to another.

The existence of different degrees of matter allows us to see that there are different kinds of matter, defined exactly in terms of their degree of materiality. Gurdjieff is not the only contemporary thinker who has conceived of the existence of several kinds of matter. Stephane Lupasco (1900–1988), whose philosophy takes quantum mechanics as its point of departure, deduced, as a consequence of his logic of energetic antagonism, three types of matter-energy. [14]

With regard to the number of types of matter, Gurdjieff made two apparently contradictory affirmations. In the collection of his talks recalled by his students, *Views From the Real World***,** he says, "Unity consists of three matters,"[15] whereas in *In Search of the Miraculous***,** he affirms that there are twelve categories of matter."[16]

In fact, there is no contradiction. When Gurdjieff, like Lupasco, speaks of three types of matter, he is referring explicitly to the law of three, which gives structure to all the phenomena of reality. In this sense, there is no question of a coincidence between the numbers advanced by Gurdjieff and Lupasco; to the degree that Lupasco's conclusion is based on a ternary logic—the included middle—the correspondence with the law of three is obvious. Finally, considering the idea of materiality in relation to the structure of the universe, Gurdjieff, in his cosmology, deduced that there must necessarily be twelve categories of matter. This will give scientists work for several centuries.

The existence of two matters—macrophysical matter and microphysical matter—even if it is not unanimously accepted (or recognized as such) does not unleash fierce opposition either. On the other hand, to speak of "biological matter" or "psychic matter" is enough to bring to a boil a scientific world still dominated by reductionism. Likewise, not everyone is ready as yet to accept the affirmation of Lupasco (who, as we will see, is close to the ideas of Gurdjieff) that every system includes an aspect that is, at one and the same time, macrophysical, biological, and psychic.

For Gurdjieff, there is nothing completely inert in nature; everything is in movement: "The speed of vibrations of a matter shows the degree of intelligence of the given matter. You must remember that there is nothing dead or inanimate in nature. Everything in its own way is alive, everything in its own way is intelligent and conscious." [17]

Though this assertion is, at first sight, astonishing, it is in accord with what we observe at the scale of the infinitely small. "Inert matter" is an expression of classical science which has been completely emptied of meaning today. Microphysical matter is everything but "inert matter." At the level of the infinitely small, there is a boiling activity, an infinite number of processes, a perpetual transformation between energy and matter, a continuous creation of particles and anti-particles. The stupefying quantity of information and the increasing density of energy that one finds in the quantum world show that it is practically impossible to trace a boundary between the living and the non-living. It is quite conceivable that a quantum particle possesses its own subjectivity, its own intelligence, in complex relations of perpetual combat and of continual creation and annihilation taking place with all the other particles.

Gurdjieff often comes back to the problem of the intelligence of matter: "In addition to its cosmic properties, every substance also possesses psychic properties, that is, a certain degree of intelligence."[18] This explains why certain

substances can contribute to the evolution of man, an evolution which is, after all, at the very heart of the Gurdjieff teaching.

For Gurdjieff, there is no separation among matters: "The finer matters permeate the coarser ones."[19] An example of this is microphysical matter, which penetrates macrophysical matter. Protons, neutrons, electrons, the quantum vacuum are in us, even if our behavior is far from being identical to that of the quantum world.

Gurdjieff goes even further in affirming that all the matters of the universe are found in man: "We have in us the matter of all other worlds. Man is, in the full sense of the term, a 'miniature universe'; in him are all the matters of which the universe consists;"[20] We can interpret this as meaning that what is being described is the Gurdjieffian version of the mystery of the Eucharist.

As we can see, the materialism of the Gurdjieff teaching is very complex, and we have only touched on the most superficial fringe of it—its relation to modern science. But make no mistake about it: Gurdjieff's "matters" have multiple aspects, most of which totally escape the methodology of modern science since they concern, rather, the inner alchemy of man.

THE LAW OF THREE AND THE NECESSITY FOR A NEW LOGIC

Since the dawn of time, binary thought, that of "yes" and "no," has dominated man's activity. Aristotelian logic has reigned for centuries and continues to this day. Certain traditional teachings (and in particular, Christian theology) had the potential for a new logic, but the potential stayed in the hands of a small number of initiates. Gurdjieff's teaching on the law of three is related to this new logic, which also manifests itself in quantum physics.

According to Gurdjieff, the law of three is "the fundamental law that creates all phenomena in all the diversity of unity of all universes."

> This is the "Law of Three" or the law of the ***three principles*** or the ***three forces***. It consists of the fact that every phenomenon.... is the result of the combination or the meeting of three different and opposing forces. Contemporary thought realizes the existence of two forces and the necessity of these two forces for the production of a phenomenon.... No question has ever been raised as to the third, or if it has been raised it has scarcely been heard.... The first force may be called active or positive; the second, passive or negative; the third, neutralizing. But these are ***merely names***, for in reality all three forces are equally active and appear as active, passive, and neutralizing, only at their meeting points, that is to say, ***only in relation to one another at a given moment***. [21]

Before discussing the special character of the third principle, let us, for a moment, emphasize the character of the opposition (or as Lupasco calls it, the "antagonistic contradiction") between the three principles, to which Gurdjieff constantly returns. In *Beelzebub's Tales to His Grandson***,** he describes the law of three as "a law which always flows into a consequence and becomes the cause of subsequent consequences, and always functions by three independent and quite opposite characteristic manifestations, latent within it, in properties neither seen nor sensed."[22] This other aspect is worth mentioning: the latent character, invisible and ungraspable, of the three principles. Manifestation can only take place by means of the interaction between the law of three and the law of seven.

The opposition between the three principles is a veritable "contradiction," in the philosophical sense of the term: something which, far from self-destructing, builds itself through antagonistic struggle.

It is relatively easy to imagine a contradiction between two terms, but practically impossible (except by a formal mathematical construction) to conceive of a contradiction between three terms. Two of three terms lose, by the inclusion of a third term, their own identity. In this sense, we can understand the expression "included middle." Paradoxically, in the logic of the "included middle," notions of "true" and "false," far from losing their value, are considerably expanded, embracing a number of phenomena which are much more important than those of binary logic.

An example taken from quantum physics will illustrate the preceding points simply.

In an experiment made, quite obviously, in the world of macrophysics, a quantum particle manifests either as wave or as corpuscle, that is to say as one of two contradictory and antagonistic entities. If we want to use the usual word "complementarity," it is more the expression "antagonistic complementarity" which governs, because the properties of waves and corpuscles are mutually exclusive. Now, at its proper level of reality in the quantum world, the quantum particle appears as a third term, neither wave nor corpuscle, but which, at the macrophysical level, is capable of manifesting as a wave or a corpuscle. In this sense, it is a reconciling force between the wave and the corpuscle. But, at the same time, being neither wave nor corpuscle and manifesting at another level of reality, it is clearly in contradiction with the wave or the corpuscle.

It should be noted that Ouspensky—one of the most famous disciples of Gurdjieff—in his book ***Tertium Organum***, published in 1912 in Russia,[23] was the

first modern thinker to have affirmed the importance of the principle of the included middle as the fundamental logic of the new science. Deeply enamored at the same time by both science and tradition, Ouspensky wrote other books inspired by science, of which ***The Fourth Dimension***, which appeared in 1909 in St. Petersburg, had, among others, a considerable influence upon Russian futurism, and Malevitch.

Earlier I gave as an example of the third term the quantum particle in its own world: the quantum world. But do we really see this particle? Have we a direct access to the quantum world? Our ways of measuring are always macrophysical and we do not really see the quantum particle. In our accelerators we will reconstruct it, for example, by its traces. Our own macrophysical constitution prevents us from traveling freely in the quantum world and from going to "see" what happens there.

To understand this third term would require a conceptual revolution. A relatively recent development in particle physics throws an unexpected light on the third force. The unification of all the physical interactions seems to require a space-time whose number of dimensions goes far beyond the number of dimensions of our own space-time (three dimensions of space and one dimension of time). It doesn't matter that this unification could happen only at fabulous levels of energy, never achievable in our accelerators. What matters is that such a large number of dimensions could be reunited by the coherence of physical laws. Is the manifestation of the third force this large space-time? Would this third force be the source of discontinuity, of nonseparability and of nonlocality?

In relation to this large space-time, we, poor beings living in four dimensions, are a bit like the two-dimensional beings of Edward A. Abbott's conceptual universe, ***Flatland***[24], in relation to the miraculous beings coming from a world of three dimensions. But we can understand this third force precisely if we, as Gurdjieff said, go beyond the limitations of "the fundamental categories of our perception of the world of phenomena," that is to say, if we go beyond our sensation of space and time. Gurdjieff's insistence, in his philosophy of nature, on the scientific notions of "dimensions" and "space" and "time" seems to us neither accidental nor a simple coquettishness of language. In particular, to distinguish the different cosmoses by the different number of their dimensions of space-time[25] is extremely significant.

The "Okidanokh" is a marvelous Gurdjieffian symbol of the ternary dynamics and of its manifestation. It is conceived as the "Omnipresent-Active-Element,"[26] as the "'Unique-Active-Element' the particularities of which are the chief cause of

everything existing in the Universe".[27] It "obtains its prime arising.... from the three Holy sources of the sacred Theomertmalogos, that is, from the emanation of the Most Holy Sun Absolute.... [It is] the fundamental cause of most of the cosmic phenomena."[28]

Directly linked to the three principles of the law of three, it is thus normal that "no results of any kind normally obtained from the processes occurring through this Omnipresent World-substance can ever be perceived by beings or sensed by them."[29] But how to reconcile the ungraspable character of the three principles of the law of three with the fact that the Okidanokh is, all the same, a substance capable of penetrating all cosmic formations? Indeed, "immediately on entering as a whole into any cosmic unit, there immediately occurs in it what is called 'Djartklom,' that is to say, it is dispersed into the three fundamental sources from which it obtained its prime arising."[30] The three principles are thus universally present. But what is it that confers on the Okidanokh the character of substance? It is certainly not the three principles. So Gurdjieff invents a symbol of ***etherokrilno***, "that prime-source substance with which the whole Universe is filled, and.... is the basis for the arising and maintenance of everything existing"[31]. It is exactly this fourth element of Okidanokh which confers on it the character of substance "the proportion of the pure—that is, absolutely unblended—Etherokrilno, which unfailingly enters into all cosmic formations and there serves, as it were, for connecting all the active elements of these formations; and afterwards when its three fundamental parts reblend then the said proportion of Etherokrilno is re-established."[32]

The symbol of Okidanokh, let it be said in passing, creates an interesting relationship between the "three" and the "four": the "three" represents the latent invisible and ungraspable characteristic of the three principles, whereas the "four" represents the manifestation of the three principles on the plane of matter-energy.

A phonetic resemblance can make us think of a possible relation between "etherokrilno" and "ether," especially as Gurdjieff speaks of "the prime-source substance with which the whole Universe is filled." But there is no such true relationship. Ether is a sort of reference absolute, unmovable, a universal system of reference. Etherokrilno, in its relation with Okidanokh, is linked to movement, to transformation, to energetic transmission.

We can imagine Okidanokh as a field filling all the cosmoses and whose vibrations will transmute the law of three in material manifestations. If the "natural" man seems sensitive to duality, the universe, as far as it is concerned, certainly needs the three.

NATURE: UNITY IN DIVERSITY

For Gurdjieff, God was constrained to create the world:

> There came to our Creator All-Maintainer the forced need to create our present existing Megalocosmos, i.e., our World.... Our Creator Omnipotent once ascertained that this same Sun Absolute.... was, although almost imperceptibly yet nevertheless gradually, diminishing in volume.... [The] cause of this gradual diminishing of the volume of the Sun Absolute was merely the Heropass, that is, the flow of time itself.[33]

Such an assertion might appear, at first glance, a manifestation of Gurdjieff's celebrated humor. But the role attributed to time is intriguing and makes us think of a similar idea which appeared in the cosmology of Jakob Boehme (1575–1624). With Boehme, God also created the universe by constraint—that of his imperious desire to know himself. Thus, he dies to himself in order to be born, by submitting himself to the cycle of time. The "birth of God" is a fundamental aspect of Boehme's doctrine.

A number of important resemblances can be found between the philosophy of Gurdjieff and that of Boehme[34]: the law of three and the law of seven as the basis of their cosmologies, the role of discontinuity, the universal exchange of substances, living nature. With Gurdjieff, as with Boehme, there are two meanings of the word "nature": a "creaturely nature" and a "divine nature". The idea of nature—which encompasses both divine nature and creaturely nature—refers to the interaction among all levels of reality. So, with Gurdjieff as with Boehme, materialism and spiritualism are two faces of one and the same reality.

It is striking that, from among the innumerable books and studies dedicated to the teaching of Gurdjieff, no one has studied these resemblances between Boehme's and Gurdjieff's ideas. This is not to suggest that Gurdjieff took the work of Boehme as his source of inspiration. Their philosophies of nature are clearly different and there are even differences in their similarities (for example, in the dynamic functioning of the law of three and the law of seven.) But what is clear is the persistence across the centuries of certain fundamental ideas in the different philosophies of nature, a fact which seems to us to be most important to note today, to the degree that the world is in search of a new philosophy of nature, in harmony with the discoveries of modern science.

At any rate, to return to Gurdjieff's view of Creation: it was necessary to save the divine world from the action of time. Thus, the universe was created, an unending chain of systems bound by universal interdependence, which escapes

the action of time in this way. Gurdjieff calls this universal interdependence "the Most Great cosmic Trogoautoegocrat.... the true Savior from the law-conformable action of the merciless Heropass,"[35] or "the Trogoautoegocratic process.... in order that.... "the exchange of substances" or the "Reciprocal feeding" of everything that exists, might proceed in the Universe and thereby that the merciless "Heropass" might not have its maleficent effect on the Sun Absolute."[36]

The Trogoautoegocratic Process and Bootstrap: The principle of universal interdependence is certainly not found only in the teaching of Gurdjieff. It appears in many traditional teachings. But his convincing exposition of it is indisputably original.

A generalized nonseparability characterizes the universe of Gurdjieff: "Everything is dependent on everything else, everything is connected, nothing is separate."[37]

Systems on different scales have their own autonomy, for according to the terminology of Gurdjieff, the Absolute only intervenes directly at the creation of the first cosmos. The other cosmoses formed themselves freely by self-organizing principles—always, however, in submission to the law of three and the law of seven. In this way the diversity of the universe is assured. On the other hand, the interaction of the different cosmoses by means of the universal exchange of energy-substances assures unity in diversity. Life itself appears not as an accident, but as a necessity in this universe of universal interdependence. In Gurdjieff's account, a "learned being" named Atarnakh put forward the following hypothesis: "In all probability, there exists in the World some law of the reciprocal maintenance of everything existing. Obviously our lives serve also for maintaining something great or small in the World."[38]

Gurdjieff's universe is not a static universe, but a universe in perpetual movement and change, not only on the physical plane, but also on the biological and psychic planes. Evolution and involution are always at work in the different worlds. And when we consider the important number of different matters characterized by different degrees of materiality, we can understand the essential role of the universal exchange of substances in evolution and involution:

> Thanks just to these processes of "evolution" and "involution" inherent in the sacred Heptaparaparshinokh, there also began to be crystallized and decrystallized in the presences of all the greatest and smallest cosmic concentrations, all kinds of definite cosmic substances with their own inherent subjective properties, and which objective science calls "active

elements." And all the results of the "evolution" and "involution" of these active elements, actualizing the Trogoautoegocratic principle of existence of everything existing in the Universe by means of reciprocal feeding and maintaining each other's existence, produce the said common-cosmic process "Iraniranumange", or, as I have already said, what objective science calls "common-cosmic-exchange-of-substances."[39]

The trogoautoegocratic process of Gurdjieff presents a remarkable correspondence to the "bootstrap" principle formulated in physics around 1960 by the American physicist, Geoffrey Chew.[40] This word "bootstrap" also implies "to pull yourself up by your own bootstraps." The closest equivalent in the scientific context would be "self-consistency."

The bootstrap theory appeared as a natural reaction to classical realism and to the idea closely associated with it of the necessity for motion equations in space-time. In proposing the radical renunciation of all motion equations, bootstrap theory implies the absence of all fundamental "building blocks" of physical reality. According to bootstrap, the quantum particle has three different roles: (1) a role as constituent of compound wholes, (2) a role as mediator of the force responsible for the cohesion of the compound whole, and (3) a role as the compound system.

So, in the bootstrap theory, the part appears at the same time as the whole. What is put in question in bootstrap theory is the very notion of a particle's identity: it substitutes instead the notion of the relationship between "events." It is the relations between events which are responsible for the appearance of what we call a particle. There is no object in itself, possessing its own identity, that we could define in a separate or distinct manner from the other particles. A particle is what it is because all the other particles exist at the same time: the attributes of a determined physical entity are the results of interactions with all the other particles. According to bootstrap, there really is a "law of reciprocal maintenance" of all quantum particles. Also, as in the trogoautoegocratic process, a system is what it is because all the other systems exist at the same time. The role of self-consistency in the construction of reality should be emphasized—a self-consistency which assures the coherence of the All.

There are different degrees of generality in the formulation of the bootstrap principle. So the English physicist, Paul Davies, does not hesitate to speak of a "cosmic bootstrap."[41]

Under this general form, bootstrap theory tries to respond to the question: How does the universe work? Is it a sort of machine, certainly marvelous, but

nonetheless a machine, made up of practically independent systems, mechanically interrelated? Or rather does there exist an underlying unity, maintained by a dynamic intelligence, in permanent evolution, at work at every level of nature? Is a level of nature what it is because all the other levels exist at the same time? Are there laws which apply to all levels of nature (particles, atoms, planets), immutable laws which, however, as Gurdjieff had thought, produce different effects according to the level on which they act? In other words, is there a sort of "reciprocal feeding" or "reciprocal maintenance" between different levels of nature? Or, rather, is the universe a sad machine, where each level is destined, by the continual growth of disorder, of entropy, for destruction and death?

A universe seems capable of self-creation and self-organization, without any "external" intervention. It is precisely the whole process of self-creation and self-organization of the universe which Paul Davies baptized "cosmic bootstrap": "The universe fills itself exclusively from within its own physical nature with all the energy necessary to create and animate matter, thus channeling its own explosive origin. That is cosmic bootstrap. We owe our own existence to its astonishing power."[42] It seems evident that self-creation and self-organization only have meaning in a universe made up of an infinite chain of systems regulated by universal interdependence. Unity in diversity and diversity through unity are the conditions for self-creation and self-organization. Otherwise there is nothing but the law of accident which can act.

Finally, it is logically conceivable to postulate a still more general form than the bootstrap principle, which would include the quantum world, the macrophysical world, the universe, life, and consciousness. In this very general form, the bootstrap principle, in the present state of knowledge, appears clothed in a nonscientific character. Whatever the destiny of bootstrap theory in particle physics (the reigning theory in the decade of 1960–70 but now replaced by the quantum field theory), its methodological and epistemological interest remains considerable. More than a new ***thêma*** in physics, it is rather a matter of a symbol—a symbol determining the emergence of a vision of the unity of the world. This symbol, while remaining precise, is inexhaustible. Its richness includes manifestation in the domain of natural systems. Indeed, there is a "total bootstrap," which constitutes a vision of the world, and a "partial bootstrap," which corresponds to a scientific theory. The one without the other remains poor and, in the end, sterile. The double aspect of the bootstrap principle as symbol and scientific notion explains why it allows a profound rapprochement between science and the philosophy of nature.

Cosmic Dimensions and the Unification of Physical Interactions: Let us come back to the notion of "dimensions" and its implications. Gurdjieff's philosophy of nature is centered on the idea of "cosmoses": "Science and philosophy, in the true meaning of these terms, begin with the idea of cosmoses."[43] "The ray of creation" includes seven cosmoses contained one within the other: the Absolute, All Worlds, All Suns (the Milky Way), the Sun, All Planets, Earth, Moon. The names given to these worlds must not distract us. For example, the heavenly bodies possess, apart from their habitual physical properties, other properties which explain why the number of dimensions of space is different from the number of dimensions of our world:

> Each cosmos is a living being which lives, breathes, thinks, feels, is born, and dies. All cosmoses result from the action of the same forces and the same laws. Laws are the same everywhere. But they manifest themselves in a different, or at least, in not quite the same way on different planes of the universe, that is, on different levels.[44]

It is interesting to mention the way in which Gurdjieff conceives the notion of "All Worlds":

> We may say that "All Worlds" must form some, for us, incomprehensible and unknown ***Whole*** or ***One***.... This Whole, or One, or ***All***, which may be called the "Absolute" or the "Independent" because, including everything within itself, it is not dependent upon anything, is "world" for "all worlds."[45]

Here we have a good example of contradictory thought, which alone can introduce us to the world of symbols. It is also interesting to note that, according to Gurdjieff, "Man lives in all these worlds, but in different ways. This means that he is first of all influenced by the ***nearest*** world, the one immediate to him, of which he forms a part."[46] In other words, in spite of his three-dimensional structure, man potentially has difficult, but not impossible, access to other dimensions.

But what is the sense of "seven independent dimensions"[47] (of space, of course, because in the Gurdjieffian cosmology there is only one dimension of time)? Is the word "dimension" used, as we have been led to understand, in its mathematical, scientific sense (of a space-time dimension), or does it rather convey a vague and ambiguous meaning, closer to that of ordinary language? The answer seems unequivocal: it is the scientific sense that Gurdjieff uses. First of all, Ouspensky presented Gurdjieff with an interpretation of the consequences of these seven dimensions, based on the scientific meaning of the word dimension, and Gurdjieff agreed with it.[48] On the other hand, Gurdjieff himself

made several clear reflections on this subject. He says, for example: "The interrelation of the cosmoses is permanent and always the same. That is to say, one cosmos is related to another as ***zero to infinity***.[49] But the relation between "zero and infinity" is exactly that which characterizes the relation between a space of a certain number of dimensions and a space of a higher number of dimensions (for example, the relation of a point to a line, of a line to a surface). It is exactly this relation of "zero to infinity" which inspired Edwin Abbott in his wonderful book Flatland, where he describes the joys and the sufferings of two-dimensional beings confronted by the strangeness and the miracles of a three-dimensional world. Further, this brings to mind a remark of Gurdjieff concerning mystical experience and ecstatic states: the intellectual, emotional, and moving centers "transmit in worldly three-dimensional forms things which pass completely beyond the limits of worldly measurements."[50] The fact that it is the scientific meaning of the word "dimension" which is used here appears clear.

The universe of Gurdjieff possesses a great number of dimensions in its totality. But as the different worlds have not only physical properties, does it not mean that the physical universe itself must be described by a space-time with a large number of dimensions?

Certain theories of unification make reference to a space in which the number of dimensions is larger than that of the world in which we live. Evidently, it is not possible to visualize additional dimensions of space, because our sense organs are built to correspond to a three-dimensional reality. However, the unification of all the interactions appears to require the physical existence of these strange spaces. In a certain sense, the symmetries leading to unification are associated with seven additional dimensions of space. These seven dimensions were probably "compacted" at 10^{-43} seconds after the Big Bang; i.e., they were hidden in an extremely small region of space (10^{-33} centimeters). The unification of all the physical interactions, the additional dimensions of space, the necessary relation between the particle and the universe (which implies a truly cosmic genesis): do they just happen to coincide with the implications of Gurdjieff's philosophy of nature?

The Quantum Vacuum and the Nothing: I would like to close this discussion with a theoretical speculation which could appear questionable.

For Gurdjieff, the ray of creation ends with Nothing. Up to that point, this is not a remarkable idea because, after all, it is normal to link an "end" with "Nothing." But things become complicated when we learn that according to him, "Nothing" means the Absolute under its aspect of "Holy the Firm":

> Between All and Nothing passes the ray of creation. You know the prayer "Holy God, Holy the Firm, Holy the Immortal." ... ***Holy God*** means the ***Absolute*** or ***All. Holy the Firm*** also means the Absolute or Nothing. ***Holy the Immortal*** signifies that which is between them, that is, the six notes of the ray of creation, with organic life. All three taken together make one. This is the coexistent and indivisible Trinity.[51]

In the light of what we have come to up to now, it is tempting to establish a relation between "Nothing" and the quantum vacuum. So I would certainly not wish to affirm a relation of identity between "Nothing" and the quantum vacuum (that would be ridiculous), but to suggest that the quantum vacuum could be, on the physical plane, one of the facets of "Nothing." The plausibility of such a relation is justified by the affirmation of Gurdjieff himself. His description of the ray of creation gives the impression that, in descending, matter becomes more and more dense, less and less intelligent, subject to more and more laws. And here, then, at the end of the ray of creation, we find the Absolute, thus rejoining the very beginning of this ray. The apparently linear aspect of the ray of creation is transformed into a circle. The universe becomes a loop enclosing an indeterminate number of systems in perpetual interaction. So we understand better the meaning of the trogoautoegocratic process.

The "quantum vacuum" is that which is furthest from the accepted meaning of the word vacuum in current usage. When we study a smaller and smaller region of space we find a greater and greater activity, a sign of perpetual movement. The key for understanding this paradoxical situation is provided by Heisenberg's uncertainty principle. A very small region of space corresponds, by definition, to a very short time, and thus, conforming to Heisenberg's principle, to a very wide spectrum of energy. So the "quantum fluctuations of the vacuum determine the sudden appearance of "virtual" particle-antiparticle pairs which then annihilate each other reciprocally, this process taking place in very short intervals of time. Everything is vibration: according to quantum physics, we cannot conceive of a single point in the world which is inert, immobile, and not animated by movement. At the quantum level the vacuum is full; it is the seat of spontaneous creation and annihilation of particles and anti-particles. Quantum particles have a certain mass and so, according to the theory of relativity, they need a certain energy to materialize. In furnishing the energy to the quantum vacuum, we can help it to materialize these potentialities. It is exactly what we do in constructing particle accelerators (an amusing dialectic between the "visible" and the "invisible" is thus set up: in order to detect infinitesimal particles we have to build immense accelerators).

The full quantum vacuum contains in itself potentially all particles, whether they have already been observed or not. It is we who have drawn most existing particles from nothingness in building our accelerators and other experimental apparatuses, whereas the "natural" world is much more "economical": the proton, the neutron, and the electron are sufficient for constructing almost the whole of our "visible" universe. We are, in this sense also, participants in a reality which embraces us, our particles, and our universe.

The quantum vacuum is, then, a marvelous facet of reality. The quanta, the vibrations, be they real or virtual, are everywhere. The void is full of vibrations. It contains potentially all reality. The entire universe is perhaps being drawn from nothingness by a "gigantic fluctuation of the void, which we know today under the name of 'big bang.'"[52] So, would there not be a relation between the quantum vacuum and Nothing, in its character as Holy the Firm?

LIFE, GAIA, AND THE ANTHROPIC PRINCIPLE

With rare exceptions, contemporary philosophy considers that life and man are accidents, the products of chance. It is by chance that we appeared one day on a small planet in orbit around a certain star, in the remote suburbs of a galaxy which is nothing out of the ordinary. This sad and dismal vision is propagated with joy and conviction by our philosophers.

Gurdjieff's point of view in regard to this is completely opposed to that of contemporary philosophy. For him, life and man are products of a cosmic necessity—life cannot exist without the universe and the universe cannot exist without life: "Thus organic life is an indispensable link in the chain of the worlds which cannot exist without it just as it cannot exist without them."[53] According to the Gurdjieffian cosmology, life appeared as a necessary discontinuity to fill, in conformity with the law of seven, one of the intervals of a cosmic octave: "The conditions to insure the passage of forces are created by the arrangement of a special mechanical contrivance between the planets and the earth. This mechanical contrivance, this 'transmitting station of forces' is ***organic life on earth***."[54]

This point of view on the necessity of life is paradoxically being reinforced, not by philosophy, but by science. Here we wish to speak of the celebrated "anthropic principle" ("anthropic" comes from the Greek word ***anthropos***, which means man). There exists a very rich literature on this subject.[55] We shall limit ourselves to discussing a few of its aspects in relation to Gurdjieff's cosmology.

The anthropic principle was introduced by Robert H. Dicke in 1961. Its utility was being demonstrated by the works of Brandon Carter, Stephen Hawking, John Barrow, Frank Tipler, and other researchers.

The anthropic principle is presented today under different formulations. In spite of this diversity, we can recognize a common idea which goes through them all: the existence of a correlation between the appearance of man, "intelligent" life in the cosmos—and so on earth, our only point of reference for this "intelligent" life—and the physical conditions which regulate the evolution of our universe. This correlation seems to be under very strong constraints: if the value of certain physical constants or that of parameters appearing in certain laws varies even slightly, then the physical, chemical, and biological conditions which permit the appearance of man on earth are no longer brought together. "The big surprise," writes Hubert Reeves, "is that the quasi-totality of fictional universes that can be elaborated on computers by physicists will be extremely different from our own. In particular, they will be absolutely unsuited to engender living beings [of biochemical structure]."[56] Brandon Carter has underlined the importance of the gravitational coupling constant, which must be close to the experimentally observed value so that planets can exist for a sufficiently long time that life can appear on them. Too strong or too weak a gravitation leads either to ephemeral planets or quite simply to the impossibility of their being formed. The coupling constant characterizing strong interactions—acting in the quantum world—is here again, very precise: "If the force was a little bit less strong than it is.... there would be no more hydrogen available to form stars of the first importance.... If, on the contrary, it were much weaker, complex atoms like carbon could not exist."[57]

A vast self-consistency thus seems to regulate the evolution of the universe, self-consistency concerning physical interactions as well as the phenomena of life. Galaxies, stars, planets, man, atom, the quantum world thus seem united by one and the same self-consistency. In this sense, the anthropic principle can be considered as a special case of bootstrap and as an illustration of the trogoautoegocratic process.

We should not confuse the self-consistency of the anthropic principle with simple coherence. We could think that, from the simple fact that the universe exists, that it "stands," it must necessarily be coherent, and that, in this sense, the anthropic principle is only a trivial affirmation. But the coherence of our universe is of a very special nature. From the point of view of physics, nothing prevents the same physical laws, by varying the constants and the parameters applicable to these laws, from creating different universes where life would be present.

Now the extraordinary fact shown by astrophysical studies is that, in order for life to appear, the numerical values of these constants and of these parameters must pass through extremely narrow windows. The anthropic principle, therefore, implicitly poses the dizzying question of the uniqueness of this world.

In any case, the fact that, for life to appear on a little planet, an entire galaxy at least had to be created, opens large perspectives on the philosophic and poetic plane. In his groups in St. Petersburg and Moscow, Gurdjieff insisted on the fact that life did not appear by the accidental creation on earth of certain molecular structures, but that it came from "Above," from the world of celestial bodies. Ouspensky comments: "Organic life.... began in the sun. This last was the most important point because once more.... it contradicted the usual modern idea of life having originated so to speak from below. In his explanations life came from above."[58] This point of view is completely in accord with the anthropic principle: at least a galaxy had to be present for life to appear, so in this sense, life has a celestial origin. We are the children of the stars.

If the origin of life is celestial, it is interesting to clarify the relationship between life and the earth. For Gurdjieff, life is "the earth's organ of perception."[59] For him as for Kepler, the earth is a living being.[60] He even speaks of the "degree of intelligence" which the earth possesses.[61] On the scientific plane, such a point of view may appear completely unrealistic (if not surrealistic). But here too the surprise comes from science itself. After thorough research, the very serious scientist James Lovelock formulated the Gaia hypothesis[62]: the earth operates like a living organism. So the biosphere appears as a self-regulating entity, controlling the physical and chemical environment so as to insure the conditions of life. (The name of Gaia—goddess of the earth among the Greeks—given to this hypothesis, was suggested by the writer William Golding.)

Even if the notions of "life" or "intelligence" of the earth are richer in meaning in Gurdjieff's philosophy of nature than in the Gaia hypothesis, a relation between them can nevertheless be established.

Gurdjieff's philosophy of nature, by the relation that it establishes between life and the earth, succeeds in linking two scientific hypotheses which are quite different and which appear in very different domains: the anthropic principle and the Gaia hypothesis.

GURDJIEFF AND SYSTEMS THEORY

A surprising kinship also can be found between Gurdjieff's thought and systems theory, which was born some decades after the formulation of his teaching. It

should be noted, incidentally, that the word "system" appears in Gurdjieff's vocabulary when he speaks of the "Common-system-harmonious-movement"[63], "common-system-harmony,"[64] or the "common systematic movement."[65]

Contemporary systems theory appeared as a rejection of classical realism, which was not in conformity with the data of modern science, and as an attempt to bring about order in the complexity which is manifest in every domain of reality and, in particular, physics. Systems approaches derive from such diverse domains as biology, economics, chemistry, ecology and physics. Of course, we are not referring here to the technical or mathematical aspects of the different systems theories but to systems theory as a vision of the world.

Implicitly, we have made allusion to the parallels between Gurdjieff's philosophy of nature and systems theory.

Let us sum up these parallels, before broaching the differences, which are just as interesting:

1. We can conceive of the universe as a great whole, a vast cosmic matrix where everything is in perpetual movement and energetic formation. This All is regulated by universal interdependence. With Gurdjieff, this interdependence is brought about by the action of discontinuity, a characteristic of the law of seven or the law of the octave: "The law of octaves connects all processes of the Universe."[66] This unity is not static; it implies differentiation, diversity, the appearance of hierarchical levels, of relatively independent systems, of "objects" taken as local configurations of energy. With Gurdjieff, it is the existence of different matter-energies and the action of the law of three, with its logic of the included middle, which assures the emergence of these properties.

2. It is the opening of the system, by interaction with other systems, which prevents its degeneration, its death, through the inevitable degradation of energy, through increasing disorder. The "system of systems" could thus be so constituted as to establish the diversity of the world, in a perpetual and universal energetic exchange, in a vast and unceasing nonseparability, a veritable safeguard of the "life" of systems. In the cosmology of Gurdjieff, as presented by Ouspensky, the opening is created by the complex action of the law of seven. We note simply two characteristics bound to opening: (1) "Any note of any octave may at the same time be any note of any other octave passing through it"[67]; and (2) "Each note of any octave can be regarded as an octave on another plane. Each note of these inner octaves again contains a whole octave."[68] This second property gives the chain of systems a tree-like character.

3. As distinct from reductionism, which explains diversity by a substance common to different systems, systems theory, like Gurdjieff's thought, envisages a common organization. This common organization is of an energetic nature, the energy appearing as a unifying concept of "substance"—a "crystallized" form of energy—and to "information"—a "coded" form of energy. In Gurdjieff's cosmology, the common organization is due to the joint action of the law of three and the law of seven. These laws assure the invariance of the energetic structure and by the same token, the stability of natural systems.

4. Natural systems are formed from themselves; they create themselves in time. Natural systems avoid an equilibrium which is equivalent to degeneration and death, by choosing, through opening toward other systems, stability in a state of disequilibrium. So fluctuations become the source of evolution and creation. Self-organization and self-creativity of natural systems are the indubitable signs of freedom, but this freedom operates within the limits of its conformity, of its compatibility with the necessary dynamics of the All.

These characteristics are found also in the cosmology of Gurdjieff. Determinism and indeterminism coexist in the universe of Gurdjieff. The different cycles of seven can evolve or involve; they can interconnect with themselves in many ways. Self-organization and self-creativity of different systems depend on these interconnections. So systems can "rise" or "fall" in relation to other systems. Finally, the role of fluctuations is explicitly evoked:

> The law of octaves explains many phenomena in our lives which are incomprehensible. First is the principle of the deviation of forces. Second is the fact that nothing in the world stays at the same place, or remains what it was, everything moves, everything is going somewhere, is changing, and inevitably either develops or goes down, weakens or degenerates, that is to say, it moves along either an ascending or descending line of octaves. And third, that in the actual development itself of both ascending and descending octaves, fluctuations, rises and falls are constantly taking place.[69]

As we have already stated, if the parallels between systems theory and Gurdjieff's thought are interesting, their differences are also highly instructive:

1. If systems theory is fascinating in many respects, it nevertheless remains vague and ambiguous when it comes to the dynamic description of unity in diversity, and of diversity in unity, which it allows. On the other hand, according to Gurdjieff, "The number of fundamental laws which govern all processes both in the world and in man is very small."[70] This hypothetico-deductive method, foreshadowed by Kepler, is found in science even today. We postulate a certain

number of laws, often very abstract, mathematical, and therefore far from directly observable reality; we deduce the consequences of these laws and then we compare these consequences to the experimental data. The fundamental laws of the universe, in Gurdjieff's cosmology, are the law of three and the law of seven (or of octaves). These laws confer a truly axiomatic character on his philosophy of nature. The different writings of Gurdjieff and Ouspensky bear witness to the fruitfulness of such an approach. It is the absence of an axiomatic character which remains, in our opinion, the main weakness of contemporary systems theory.

2. When systems theory speaks of exchange" (of substance, energy, or information), it very obviously means a horizontal exchange which takes place between systems belonging to one and the same level (the level of particles, the human level, the level of planets). But in the Gurdjieffian universe, the vertical exchange which takes place between systems belonging to different levels is equally conceivable, because these levels possess common matter-energy; there exist not one but several matter-energies. The fact that the laws governing different levels are different explains why vertical exchanges are, nevertheless, so rare and why they are associated with results of extreme fineness. We can replace the word "level" with the word "cosmos" and propose the same considerations, in adding to it the notion of supplementary dimension of space. But systems theory does not envisage the existence of several cosmoses.

3. For systems theory, time has no characteristic which is special in relation to its usual physical properties, whereas Gurdjieff introduces a subtle distinction between time and space. For him, time is the "Ideally-Unique-Subjective-Phenomenon":

> Time in itself does not exist; there is only the totality of the results ensuing from all the cosmic phenomena present in a given place. Time itself, no being can either understand by reason or sense by any outer or inner being-function. It cannot even be sensed by any gradation of instinct.… It is possible to judge Time only if one compares real cosmic phenomena which proceed in the same place and under the same conditions, where Time is being constated and considered.… Only Time alone has no sense of objectivity because it is not the result of the fractioning of any definite cosmic phenomena. And it does not issue from anything, but blends always with everything, and becomes self-sufficiently independent; therefore, in the whole of the Universe, it alone can be called and extolled as the "Ideally-Unique-Subjective-Phenomenon."[71]

These propositions by Gurdjieff introduce an interesting dialectic between time and nontime, between time and the abolition of time.

Considered in isolation, this space-time continuum appears as a sort of approximation, as a subjective phenomenon linked to a subsystem. Each subsystem, corresponding to a certain degree of materiality, possesses its own space-time. Time associated with a subsystem will be therefore a "breath,"[72] characterizing the individuality of this subsystem in the unity of the universe.

On the other hand, according to Gurdjieff's definition of time, if we consider all phenomena in all places in the universe, time ceases to exist. The unity of the endless linkage of systems escapes the action of time; it is outside time.

4. In spite of the interaction between systems and the endless linkage of systems, systems theory gives no particular significance to the place of this system in the whole of all systems and to the relation of this system with this whole. For Gurdjieff, on the other hand, these aspects are essential. To study them, he introduces a principle of relativity:

> The study of the relation of laws to the planes on which they are manifested brings us to the study of relativity.... But before anything else it is necessary to understand the relativity of each thing and of each manifestation according to the place it occupies in the cosmic order.[73]

The choice of the word "relativity" may be surprising. Gurdjieff probably knew Einstein's theory of relativity.[74] Did he choose this word ironically? But, exactly as in Einstein's theory, the diversity of phenomena in different systems of reference coexists with the invariance of the laws of physics in all systems of reference. Likewise, in Gurdjieff's cosmology, the great diversity of phenomena bound to their places in different cosmoses coexists with the invariance of the great cosmic laws, the law of three and the law of seven. Gurdjieff insisted on the necessity of the study of phenomena of one cosmos as if we were observing them from the point of view of the laws of another cosmos. Likewise, if we consider the change of one system of reference to another system of reference, according to Einstein's relativity theory, we demonstrate—by the diversity of these transformations—the dynamic aspect of the laws of invariance.

Gurdjieff speaks of an "exact language" whose structure should be based on the principle of relativity.[75] All the ideas of this new language concentrate around a single idea: that of evolution. "The place in the cosmic order" considered by Gurdjieff in his definition of the principle of relativity is, in fact, the "place in the evolutionary ladder."[76]

It is perhaps in keeping with the principle of relativity, with all its implications, that we can note the most important difference between systems theory and Gurdjieff's philosophy of nature.

THE REASON OF KNOWING AND THE REASON OF UNDERSTANDING IN OUR TIME

The hegemony of technoscience in our societies no longer needs to be demonstrated. It is tied in an undeniable manner to the notion of "power."

But what does knowledge serve? In the name of what does the extraordinary development of technoscience function?

These questions may seem useless, because the association between the words "technoscience" and "progress" is made automatically. The word "progress," unhappily, is one of the most ambiguous and noxious words in our vocabulary.

In the absence of a value system, the development of technoscience follows its own logic: all that can be done will be done. If we reflect for a moment, we can understand that this logic of technoscience is frightening. The disastrous consequences for our species can be innumerable and some of them are already present among us. Several philosophers have not failed to note the dangers of a technoscience which would exclusively follow its own logic.

Thus, a philosopher such as Michel Henry is not afraid to say that technoscience is the cause of a new barbarism: "Life itself is affected, all our values totter, not only the aesthetic, but also the ethical, the sacred—and with them the very possibility of living each day."[77]

For Gurdjieff, the decline and disappearance of civilizations is tied to the "disequilibrium between 'knowing' and 'being'": "In the history of humanity there are known many examples when entire civilizations have perished because knowledge outweighed being or being outweighed knowledge."[78] Are we not in a world where knowing far surpasses being?

Gurdjieff distinguishes in this way "the reason of knowing" and "the reason of understanding": "Knowledge is one thing, understanding is another thing.... Understanding depends on the relation of knowledge to being."[79] Gurdjieff ironically refers to the "scientist of new formation,"[80] who serves only knowing:

> And especially in Western culture, it is considered that a man may possess great knowledge, for example he may be an able scientist, make discoveries, advance science, and at the same time he may be, and has the right to be, a

> petty, egoistic, caviling, mean, envious, vain, naive, and absent-minded man. It seems to be considered here that a professor must always forget his umbrella everywhere.... And they do not understand that a man's knowledge depends on the level of his being. If knowledge gets far ahead of being, it becomes theoretical and abstract and inapplicable to life, or actually harmful, because instead of serving life and helping people the better to struggle with the difficulties they meet, it begins to complicate man's life, brings new difficulties into it, new troubles and calamities which were not there before. The reason for this is that knowledge which is not in accordance with being can never be large enough for, or sufficiently suited to, man's real needs. It will always be a knowledge of ***one thing*** together with ignorance of ***another thing***; a knowledge of the ***detail***, without a knowledge of the ***whole***; a knowledge of the ***form*** without a knowledge of the ***essence***.... A change in the nature of knowledge is possible only with a change in the nature of being.[81]

So we see all the importance of Gurdjieff's philosophy of nature in its definition of "reason of understanding": the relation between the manifestations on the different planes of reality, relation between the part and the whole, the relation between form and structure.

On the other hand, in Gurdjieff's terminology, the content of the word "to be" is very precise. It is linked to evolution—a central aspect of Gurdjieff's oral and written teaching. Gurdjieff was revolted by the modern acceptance of the expression "evolution of man." "Only thought as theoretical and as far removed from fact as modern European thought could have conceived the evolution of man to be possible ***apart from surrounding nature***, or have regarded the evolution of man as a gradual ***conquest of nature***."[82] Moreover, the very idea of the "***conquest of nature***" is absurd and pernicious, and it is this that has led us to the disquieting and dangerous character of technoscience. Man is a part of nature and not the conqueror of a nature outside himself. In this sense, each "conquest of nature" can, potentially and paradoxically, be a defeat for man. We should rather envisage a cooperation between man and nature. But this cooperation necessarily takes place through the "reason of understanding."

In ***Beelzebub's Tales to His Grandson***, Gurdjieff describes in some detail the inner alchemy which leads to the "reason of understanding,"[83] but the full meaning of it requires a complete and effective knowledge of the Gurdjieff teaching. Here it is enough to say that, for Gurdjieff, the "reason of understanding" fuses organically with a man's being, whereas the "reason of knowing" settles in him merely as information. In any case, it is the "reason of understanding" in one form or

another which could help in developing the dialogue between science and meaning.

The contemporary encounter between science and meaning is a major event which, in our view, is probably going to generate the only true revolution of this century.[84] We are perhaps at the threshold of a new Renaissance, one of whose conditions is exactly the dialogue between science and meaning. More and more, science is discovering its own limits, flowing from its own methodology. Science has been able to reveal, in an exemplary way, the signs of nature, but, because of its own methodology, it is incapable of discovering the meaning of these signs. Science carries with it an immense technological development. Technoscience, withdrawn into itself, cut off from philosophy by its dominant position in our society, can only lead to self-destruction. Our self-destruction is necessarily engendered by the ontological incomprehension of the signs of nature, more and more numerous, more and more powerful, and more and more active. This ontological incomprehension leads in its turn to a technological, anarchic development, invariably guided by the concern for efficiency and profit.

We must invent a mediator between science and meaning. This mediator can only be a new philosophy of nature. The point of departure for this new philosophy of nature can only be modern science, but a science which, having arrived at its own limits, tolerates and even cries out for an ontological opening. The discovery of idea-symbols in quantum physics and in other sciences, as well as the interpretation of certain major scientific discoveries, opens a fabulous free space where there arises a trans-disciplinary dialogue between past and present, between science and the philosophies of nature, art, tradition, and other forms of knowledge.

In a realistic way, in the present state of knowledge, and in the actual state of trends in the philosophic, historical, sociological, or religious domains, a return to the ancient philosophy of nature is unthinkable. But the study of certain philosophies of nature, such as that of Gurdjieff, which show deep parallels with modern science, can be a precious guide in the search for a philosophy of nature adapted to our time. Gurdjieff's philosophy of nature is undoubtedly ahead of our time, as it has been ahead on certain aspects of modern science. It can, in any case, help us in our choice between a new barbarism and a new Renaissance. Only the "reason of understanding" can lead us to this new Renaissance.

* Quantum mechanics was born in 1900, with the work of Max Planck on the radiation of the "black body" (a "black body" is a body which completely absorbs electromagnetic radiation). As we shall see, this work gave rise, at the center of the new physics, to the discontinuous structure of energy. Many other discoveries followed, up to about 1915, but it is true that quantum mechanics was not formulated as a theory until about 1920–1930 and, since then, it has been the formal basis of modern particle physics, which extends, and at the same time presupposes, quantum mechanics and Einstein's theory of relativity.

** "Corpuscle" was the term used in the early days of quantum physics.

A specialist in the theory of elementary particle physics, Basarab Nicolescu is the author of more than a hundred articles in leading international scientific journals, has made numerous contributions to science anthologies and participated in several dozen French radio documentaries on science. He has collaborated for many years with G. F. Chew, former Dean of Physics at the University of California at Berkeley and founder of the Bootstrap Theory. They have jointly published several articles on the topological framework of Bootstrap Theory.

He is the author of several books including Science, Meaning, and Evolution-The Cosmology of Jacob Boehme, translated from the French by Rob Baker, winner of the 1992 Benjamin Franklin Award for Best History Book. His latest book, ***Manifesto of Transdisciplinarity*** is published by the State University of New York Press. In it, Nicolescu unifies science and the sacred based on what we've learned from Quantum physics. More information about Nicolescu's work is available from his Trans disciplinary web site:

http://perso.club-internet.fr/nicol/ciret/

http://perso.club-internet.fr/nicol/ciret/biobn/bibnen.htm

E-mail : nicol@club-internet.fr

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