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Mind and Cosmology, Searching for a "Third Way"

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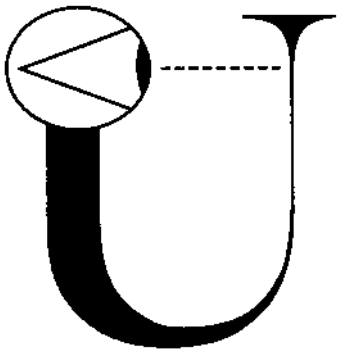

John A. Wheeler’s “Self-Observing Universe”

1. “Fine tuning” and the Anthropic Cosmological Principle

Founded on the “standard” model of the beginning and development of the universe from a very dense and hot initial condition, popularly called “the Big Bang”, modern cosmology has by now collected enough evidence to state that our universe has been “fine-tuned” – either actually or just apparently – from tiny fractions of its first second on. If the initial physical parameters had been just a little different, life could not have emerged. Furthermore, neither planets nor stars nor galaxies could have developed out of the primordial “fireball” and, worse still, elementary particles would not be such as to enable complex chemical and biological molecules and higher structures. For example, if the expansion rate after the first second had been just one part of a million slower, the universe would have re-collapsed already before the “decoupling period”, i.e., before it became transparent for the radiation of photons (about half a million years after the Big Bang) and, conversely, if the expansion had been one part of a million quicker, it would have prevented gravitation from forming galaxies and stars. Some problems of the standard cosmological model, especially the “flatness problem” and the “horizon problem”, which also seem to suggest some kind of initial fine-tuning, are considered to be solved by the “inflation” hypothesis (Alan Guth, 1981, see Bibliography below this text); however, in this case the physical laws of inflation themselves seem to be fine-tuned.

One might argue that in these and other similar cases the stated fine-tuning is bound to the standard cosmological *model*, which in itself has not been definitely verified yet, particularly in its supplementary hypotheses like inflation and others. However, many examples of the fine-tuning of nature are independent of cosmology, being just facts within particle physics, for instance, the difference between the mass of a proton and a neutron (equivalent approximately to the masses of two electrons): if this difference were not so fine-tuned, the existence of stable elements would not be possible, i.e., most elements would be radioactive, so that large molecules, on which life is based, could not be formed from atoms. And this is just one piece of a much larger puzzle: the values of basic *physical constants* (the gravitational constant *G*, the velocity of light *c*, Planck’s constant *h* etc.) are not derived from the physical theories where they occur, but are in *our* universe just measured to be such – this means they are not necessary but contingent, at least as long as we do not have some “Final Theory” from which we might deduce them.

In contemporary cosmological literature we can find several more or less equivalent definitions of “fine-tuning”, so let us take the definition of Robin Collins from his paper “Evidence for Fine-Tuning”:

> As a first approximation, we can think of the claim that a parameter of physics is ‘fine-tuned’ as the claim that the range of values, r, of the parameter that is life-permitting is very small compared with some non-arbitrarily chosen theoretically ‘possible’ range of values R. The degree of fine-tuning could then be defined as the ratio of the width of the life-permitting region to the comparison region (Collins, 2003: 179).

However, in order that this definition is applicable to concrete cases, the following epistemological criterion is assumed: “[T]he strength of a particular case of purported fine-

tuning is primarily based on how secure the physical calculations or types of reasoning are behind the case of fine-tuning in question" (*ibid*., 178). On the basis of his definition and epistemological criterion, Collins lists the six most "solid" cases of fine-tuning:

- cosmological constant Λ: its actual smallness compared with theoretical expectations;
- ratio between the strong force and electromagnetic force, on which the stability of elements depends;
- amount of carbon and oxygen production in stars, for the stability and long lives of stars;
- proton vs. neutron mass difference, for the existence of stars *et al*.;
- strength of the weak force for the production of heavier than helium elements in stars;
- strength of gravity for the stability of three-dimensional complex structures.

After having stated the fine-tuning (although maybe just apparent) of our universe, we have to ask: How is it possible that the universe, the whole nature is so fine-tuned? Why? How come? There are many more other possibilities for the values of the basic physical parameters that would yield neither life nor our own existence as observers of the universe we live in. Is it not a deep mystery that out of a huge number of unfavorable possibilities exactly the right ones were "chosen"? Or is it just a happy coincidence? But we are unwilling to accept such incredible coincidences without some sufficient reason. So, generally speaking, we have three possible ways to explain this "mysterious" fine-tuning of our universe:

I. The *apparent* "fine-tuning" might be scientifically explained in some future by the "*Final Theory*" (or "*Theory of Everything*"), which we have already mentioned. However, this concept has several quite different meanings, at least three, escalating in their ambitions:

   A. The "Final Theory" would be that future theory which would connect (by symmetries, invariances) all four basic physical forces, i.e. strong and weak nuclear interactions, electromagnetic interactions and (beyond the actual quantum theories) – gravitation. This unification of physics was Einstein's "dream" and it is one of the principal goals of his followers. We can say that this dream *might* come true, perhaps in some not so very distant future, although there are many obstacles on the way; "String Theory" (in its variants) has been the most promising candidate for the "Final Theory" during the last three decades, but its main trouble is still the absence of empirical evidence (see, for example, Smolin 2008). Furthermore, it is far from obvious that the accomplished "Final Theory" in the sense (A) could explain the fine-tuning of our universe.

   B. The "Final Theory" would be that future theory which would explain the contingency of all physical constants (the gravitational constant *G*, the velocity of light *c*, Planck's constant *h*, etc.) by deducing them from the "Final Theorems" (the most basic Natural Laws), i.e., by demonstrating the theoretical *necessity* of

all seemingly "free parameters".[1] This was also Einstein's dream: he believed that the ultimate aim of science was to discover God's "thoughts", to know all divine Laws of Nature, since, as Einstein said in his famous dictum against the uncertainty principle of quantum mechanics, "God does not play dice".[2] Furthermore, for achieving the complete explanation as well as the prediction of all natural phenomena, all initial conditions should be known too since without this initial knowledge the "Final Theory" in sense (B) would still be incomplete for some omniscient "Laplace's Demon"… So it is reasonable to say that it is indeed just a dream, not a scientific reality.

C. The "Final Theory" would be literally the final "Theory of Everything" in the sense that it should embrace and explain not only physical phenomena, but give answers to every possible reasonable question, including questions concerning mind–body relations, biological, psychological, sociological issues … simply said, the final scientific theory, in the best case based on the Laws of Physics, should achieve the goal which philosophy has been trying to accomplish from Greek times on: to resolve all the deepest enigmas of being in the final, perfect, all-encompassing System – but this is the most unreal Dream of all scientific "dreams". However, *nota bene*: philosophy *is* always "on the way" to this unattainable *télos* and, in some paradoxical sense, philosophy *is* the actual and only possible "Final Theory". And *if* there is some answer to the question where the "fine-tuning" of the universe ultimately comes from, philosophy is more appropriate to give it than physics or science in general. But this means: philosophy *with* science, not without science, nor against it.

II. The *apparent* "fine-tuning" of our universe might be (meta)scientifically explained with the "Observational Selection Effect", expressed by the "*Anthropic Cosmological Principle*". We will discuss this originally *non*-teleological and in principle atheistic explanation in the following pages of this chapter. However, this explanation has to be supported by the "Many-Worlds Hypothesis" which postulates many other universes beside our universe (i.e., beside *the* universe that evolved from "our big bang"). Our universe is supposed to be a member of a vast "multiverse". We will discuss this quite speculative hypothesis in the next chapter.

III. The *actual* fine-tuning can be argued for with some variant of the "*Design Hypothesis*", classical or modern – however, this explanation is *eo ipso* teleological,

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[1] Steven Weinberg in his book *Dreams of a Final Theory* wrote: "As an extreme possibility, it is possible that there is only one logically isolated theory, with *no* undetermined constants, that is consistent with the existence of intelligent beings capable of wondering about the final theory. If this could be shown, then we would be as close as anyone could hope to a satisfactory explanation of why the world is the way it is." (Weinberg, 1993: 191)

[2] The philosopher John Leslie, author of the book *Universes*, wrote ironically: "God would need to be careful which physics he chose" (Leslie, 1989: 63). Leslie himself is not a theist (neither Einstein was), he declares himself a sort of pantheist or "Neo-Platonist".

and implicitly also theological, so that most "hard scientists" are not sympathetic with it. This solution has, again generally speaking, two possible ways to follow: a) *theistic* way: Designer's transcendence beyond the universe, i.e. demiurge, creator, God; or b) *pantheistic* way: immanent design *in* the universe, or holistic self-organization of nature itself or, if we say inversely, development of mind *in* nature.

The latter variant (IIIb) is the author's preferred option, which is what is meant by the "third way" in the title of this part of the book, but before developing it in the later chapters, let us first examine the other options. If we leave out of account the variant (I), since its mode (IA) is more a physical than a philosophical topic, and it is also not clear why should the unification of the four main physical interactions solve the problem of fine-tuning while its modes (IB) and (IC), although they could, at least in principle, solve this enigma, are too utopian from the epistemological point of view – then we have to consider the remaining two variants: in this chapter and partly also in Chapters 2 and 3 we will extensively discuss the variant (II), the "Anthropic Cosmological Principle" combined with the "Multiverse Hypothesis", and in Chapter 4 the variant (IIIa), i.e. the theistic conception of the "Intelligent Design". In Chapters 5, 6 and 7 we will try to argue for the variant (IIIb).

The Anthropic (Cosmological) Principle was introduced in cosmology by Brandon Carter in 1974. In a way he set it up against the general trend of modern astronomy and/or cosmology expressed by the "Copernican Principle", which states that our location in the universe is not exceptional: we are not in the center of the World, as the ancients believed, we are not privileged at all in our location on planet Earth, in the Solar system, in the Milky Way galaxy… Although Carter does not reject the Copernican Principle in its original meaning, i.e., that we are not privileged in our simple spatial location (that is, he does not return to geocentricism), he states the privilege of our human, "anthropic" location in some other sense: in the vastness of space we are privileged by our capacity of being *observers*, the capacity of seeing and thinking about our universe, in our wondering how and why it is so fine-tuned that it has yielded our birth as observers… By using this epistemological "strange loop", Carter states that "what we can expect to observe must be restricted by the conditions necessary for our presence as observers" (Carter, 1998: 132), and in brackets he adds: "Although our situation is not necessarily *central*, it is inevitably privileged to some extent" (*ibid*.). In its original formulation, Carter's Anthropic Principle has two versions, *Weak Anthropic Principle* (WAP) and *Strong Anthropic Principle* (SAP):

> (WAP): [W]e must be prepared to take account of the fact that our location in the universe is *necessarily* privileged to the extent of being compatible with our existence as observers (Carter, 1998, 133).

> (SAP): [T]he Universe (and hence the fundamental parameters on which it depends) must be such as to admit the creation of observers within it at some stage. To paraphrase Descartes, *Cogito ergo mundus talis est* (*ibid*., 135).

Most cosmologists accept the validity of (WAP), although many consider it as simply a tautology which does not have any proper explicative value; on the other hand, opinions differ concerning (SAP) because of different interpretations (and also some misunderstandings) of the necessity expressed in the modal phrase "must be such that…", as

well as because of the ambiguity of the term "the Universe" – should it be understood as *our* actual universe, or as the unity of all "possible universes", or even as *every* universe? I think that the last of these three interpretations is wrong. How could "the Universe" mean every universe? However, some well-known interpreters have understood (SAP) exactly in this way (as we shall see later), and this misunderstanding has led them to the claim that Carter's Anthropic Principle implies cosmological teleology.

Let us consider first the weak variant of the Anthropic Principle. (WAP) speaks about our *location* in the universe – the spatial as well as the temporal location, which enables us to observe, and this is our privilege. We may ask whether such a principle can explain anything at all, and we might be surprised when reading that some of its advocates believe that WAP gives, for instance, an explanation *why* our universe is so enormous (even the Hubble horizon, which is not the physical, but only the optical limit, is more than 13 billion light-years away from us). The proposed "anthropic reasoning" deduces the reason for this vastness of the universe via its required age and the constant velocity of light: that is, the universe *must* be at least so many billion years old in order that heavier elements, which constitute our bodies, would have enough time to be produced in the cores of stars that exploded as supernovas long ago, scattering heavy elements into space where they gathered again to form our bodies; and since light has a limited and constant velocity, our cosmic horizon has already receded more than 13 billion light-years away from us. John Barrow & Frank Tipler, authors of the well-known book *The Anthropic Cosmological Principle*, which is classical in this field, add to this reasoning the following curious comment:

> No one should be surprised to find the Universe to be as large as it is. We could not exist in one that was significantly smaller. Moreover, the argument that the Universe should be teeming with civilizations on account of its vastness loses much of its persuasiveness: the Universe has to be as big as it is in order to support just one lonely outpost of life (Barrow & Tipler, 1986: 18).

A very bold hypothesis, indeed! However, we feel that something is missing in this anthropic explanation of the size of the universe. It is so different from explanations that are common in science, so we cannot help thinking of teleology – we cannot avoid asking the question: Is the universe so huge *because of us*? Here we have to be careful. If we understand properly the genuine Anthropic Principle, either (WAP) or (SAP), we see that an anthropic explanation of some cosmic phenomenon does not give its teleological cause (*causa finalis*), but only its epistemo-*logical* reason. But even having assumed this, something is still missing in such an argumentation. For example, in the above case we may ask why lives of stars could not be shorter, why heavy elements could not be produced in some other way, why – after all – the constant velocity of light could not have a different value etc. We do not have any *comparison* with some other universe to be justified in saying that our universe is necessary in some of its properties and contingent in others. Indeed, the Anthropic Principle has its full sense only if we presuppose *many universes*, which remain just hypothetical, of course, since we do not have any access to them, being "closed" inside our own universe. Only if the domain of the Anthropic Principle is an ensemble of universes or a "multiverse", and if within this domain some parameters are fixed while other are variable, only then can

we apply this principle to the explanation of the fine-tuning of our universe for us, observers – but without the presupposition of the multiverse the Anthropic Principle is indeed an empty tautology, as some of its opponents claim. In order to understand better this crucial point let us consider again, for example, the fine-tuned expansion rate after the first second of the cosmological time: the anthropic explanation of this "incredible" precise fine-tuning, which counterfactually says that *if the universe had not been so fine-tuned at its very beginning, then we, observers, would not be here*, but since we obviously are here, the universe *must* have been fine-tuned – this explanation is effective (when teleology is excluded) only if it presupposes many universes, most of them without observers since they have not been fine-tuned for them, and so nobody can put the question of their fine-tuning. The anthropic explanation is founded on the "observational selection effect", and the latter presupposes *many universes*, not necessarily an infinite set of them, but at least a very large number. Leslie compares this observational selection effect with what may be called "a lottery selection effect", saying that "in the cosmological case a queer kind of observational selection effect guarantees that a 'non-winning ticket' – a lifeless universe – will never be seen by anyone" (Leslie, 1989: 13). In order to illustrate this point he tells some stories, among them the following:

> The Firing Squad Story can help us to see the correctness of the last point. When the fifty sharpshooters all miss me, 'If they hadn't all missed then I shouldn't be considering the affair' is not an adequate response. What the situation demands is, 'I'm popular with the sharpshooters – unless, perhaps, immensely many firing squads are at work and I'm among the very rare survivors' (Leslie, 1989: 13-14).

The main point here is that the observational selection effect is effective only if many other universes where other firing squads are at work *exist*, i.e. are real, not just possible universes. Leslie comments his firing squad and other similar stories:

> The proposed observational selection effect which inspires these stories – namely that the universe which we observe must be in the class of life-permitting universes since how otherwise could we living beings be observing it? – cannot operate unless there is *more than one actual universe*. (No Observational Selection Effect without Actual Things from Which to Select! …) But equally, a multiplicity of actual universes cannot help us much *unless the observational effect is joined to it*… [since] any universe which wasn't life-containing could not be 'our universe' to anybody (Leslie, 1989: 14).

However, there is an important difference between the Firing Squad Story and the cosmological 'story' of the universe which "admits the creation of observers within it": our experience tells us that there is actually not only one firing squad in the world (alas!) while we could not have any experience of some other universe since if we had such an experience, that universe would be in principle just a part or a region of our own. But if so – how can we conceive other universes at all? We will discuss this question in the second chapter.

Now let us consider the epistemology of Carter's Anthropic Principle more closely. Some critics say that its weak version is just an empty tautology that cannot explain anything. Its tautological nature is supposed to be evident from the following variant of (WAP): "Every

thinking being which exists can find himself or herself (or even itself) only where a thinking life is possible." This formulation is tautological from the formal point of view, however, it is not meaningless, on the contrary, it expresses some important meta-law, concerning the connection between some 'objective' experience of the world and 'subjective' thinking about it. In this sense (WAP) is by its epistemological structure similar to the basic tenet of Kant's transcendental analytic, which claims that the conditions of every possible *experience* are the same as conditions of the possibility of the *objects* of experience. Kant's synthetic a priori principles of knowledge, limited by "possible experience", are the same as the principles which "constitute" objects themselves – this is the main point of Kant's transcendental "Copernican Turn". And by analogy we can say that Carter's Anthropic Principle is the synthetic a priori principle of cosmology which "constitutes" the conditions for the universe itself, of course *for us*, not "*an sich*". Carter's main move is a 'physicalization' of Kantian transcendentalism, the Anthropic Principle preserving an a priori status – and this apriority has been objected and rejected by several scientific critics (for example, Heinz Pagels said that the Anthropic Principle was "a loafer's approach to science"). To my mind, the reproach of tautology would be justified just in the case of only *one* existing universe – in this case the Anthropic Principle indeed has no relevant explanatory value.

Carter knew that the explicative power of (WAP) is quite weak, and that is why he proposed (SAP) as a stronger version. Let us remind that (SAP) claims "that the Universe must be such as to admit the creation of observers within it at some stage". Barrow & Tipler in their already mentioned famous monograph on the Anthropic Principle offer three possible interpretations of (SAP):

a) There exists one possible Universe 'designed' with the goal of generating and sustaining 'observers'.

b) Observers are necessary to bring the Universe into being.

c) An ensemble of other different universes is necessary for the existence of our Universe (Barrow & Tipler, 1986: 22).

It is curious that *neither* of these interpretations fits the original Carter's intention in formulating (SAP). Point (a) is obviously teleological and as such makes the Anthropic Principle redundant since teleology can explain fine-tuning without it. Point (b) comes from John Wheeler's "participatory" interpretation of quantum mechanics and, according to Barrow & Tipler, leads to some sort of subjective idealism. They favor point (c), connecting it with Hugh Everett's "many-worlds interpretation" of quantum mechanics and even claim "that this version of the (SAP) has consequences which are potentially testable" (*ibid*., 23). It is not clear why other universes should be necessary for the *existence* of our universe. Carter's (SAP) does not say anything about the cause of existence of our universe, but only claims that our universe might be *explained* in its fine-tuning without teleology via the "observational selection effect", which presupposes other real universes – the proposed anthropic reasoning is not ontological but epistemological.

In the early discussions about the relation between the Anthropic Principle and teleology, as well as concerning the difference between (WAP) and (SAP), Leslie's interpretation was quite close to Carter's original intention. Leslie's two main points are the

following: (1) that neither (WAP) nor (SAP) imply any teleology of nature (although they might be compatible with it) since they give just epistemo-*logical* reasons for the fine-tuning of our universe; (2) that there is no essential difference between (WAP) and (SAP) since the difference between these two variants is only extensional, i.e., it is dependent on how we define the terms 'location', 'region' (or 'domain') and 'universe'.[3] But the crucial point is (1): Leslie tried in his *Universes* (1989) to overcome and correct the most common misunderstanding of Carter's Anthropic Principle – which unfortunately had been suggested also by Barrow & Tipler's influential book three years before – i.e., the wrong opinion that anthropic explanations are essentially teleological. In a later paper, included in the collection of essays *Modern Cosmology and Philosophy* (1998), which he himself edited, Leslie repeated and elaborated his point:

> [T]he anthropic principle, as Carter intended it to be understood, has nothing to do with teleology or theism. Not even Carter's strong principle says that God ensured that the universe's properties permitted or necessitated the evolution of intelligent life. Again, Carter's anthropic principle in no way declares, idealistically, that *to be* is the same as *to be observed*, either for philosophical or for quantum-physical reasons. […] Nevertheless one must remember that the evidence of fine tuning could well be interpreted teleologically or theistically (or maybe even idealistically) instead of being explained in terms of many, very diverse universes and 'anthropic' observational selection (Leslie, 1998: 296).

The conjunction *ergo* (therefore) in Carter's paraphrase of Descartes, *Cogito ergo mundus talis est* (I think therefore the world is such as it is) has an analogous meaning as in the original Descartes' dictum *Cogito ergo sum*: the 'relation' between *cogito* and *sum* is not ontological in the sense that *cogito* created its own existence. Descartes was not a solipsist like George Berkeley, neither a subjective idealist like Johann G. Fichte, and he did *not* think that the world was indeed created by *cogito*; for Descartes, *cogito* is (with God's help) just the epistemological basis of world's reality and/or for the objectivity of knowledge, it is not the 'creator' of the world. By analogy, Carter's Anthropic Principle does not mean that a universe *must* be as it is *in order that* observers are born in it (i.e. *for them* to be born) since observers do *not* create their respective universes. The necessity which is present in both original versions of the Anthropic Principle is the epistemo-*logical* necessity: our world *must* be such-and-such (fine-tuned for us), because if it were not such-and-such, we would not be here – but we *are* here, *ergo mundus talis est*. The features of my universe are epistemological *consequences* of me here, being as observer. The Anthropic Principle does not tell us anything about *causes* for the existence of our universe, it states only *reasons* for its suchness. And in this sense there is also no essential difference between WAP and SAP, as

[3] "Some, while agreeing that WAP has obvious scientific importance, are none the less bitterly hostile to SAP. This is odd indeed since the two principles shade into one another. SAP concerns *our universe*; WAP, *our region or location*; but as we have made clear there just is no single correct way of counting universes and thus of distinguishing them from mere regions or locations. And when one's speakers universe is another's large spatio-temporal region, the first's SAP matter can be the second's WAP affair." (Leslie, 1989: 135)

Leslie pointed out. The most questionable tenet of the Anthropic Principle is not its presumed teleology, as many opponents think, since its aim is simply *not teleological* – its real problem is the postulate of *many universes* which is unavoidable if we want that the "observational selection effect" plays its role in anthropic explanations. We can say that the Anthropic Principle stands or falls with its proponent's belief that many universes, separated from our universe, *really* exist. For if the set of other universes is only *possible* (let us say, "counterfactually"), then again some universal *télos* is needed, some conscious or unconscious agent who would choose among many possibilities exactly our fine-tuned universe (even if it is not "the best possible world" in Leibniz's sense). Otherwise said, the real existence of some kind of multiverse is a necessary condition for any non-teleological "anthropic" explanation of the observed "fine-tuning" if the latter is considered as only apparent. But it is hard to believe scientifically in the existence of a multiverse or even many multiverses, and still harder to give evidence for that very speculative hypothesis.

2. Multiverse(s)

The multiverse is quite a popular idea in contemporary physics and cosmology, and it has many adherents also among philosophers. There are two main motives for introducing the multiverse into scientific physical theories: 1) the problem of interpretation of quantum states, mathematically described with Schrödinger's "wave function", that is to eliminate the "mysterious" collapse of a multiplicity of "parallel" quantum states by measurement into just one "classical" state of a physical system; and 2) the problem of cosmological "fine-tuning", outlined at the beginning of this part of the book. (Both problems converge in "quantum cosmology", which is still in its formative phase of development.) – In philosophy the "multiverse" is actually an old idea, although it was expressed with other terms, usually as the idea of "many worlds". The thought that our world (i.e. our universe) is indeed not the only and unique world can be found in several materialistically or naturalistically orientated philosophies (Democritus, Lucretius, Giordano Bruno, Denis Diderot *et al*.) while in some theistically orientated philosophies, especially in Leibniz's metaphysics, the plurality of worlds means the logical (modal) as well as metaphysical *space of possibilities*, variants how our actual world *could* be different. But neither classical "materialists" nor "idealists" equated the domains of possibilities and actualities; Leibniz, following Aristotle in this point, conceived "possible worlds" as unrealized *possibilia*, nowadays we could say as "counterfactual" sets of worlds/universes or their "set-ups".

It is interesting to compare "many universes" in cosmology and "many worlds" in modal logic. The most obvious common feature of cosmological universes and modal worlds is their emergence from *counterfactuals*. The Anthropic Principle states: "*If* the universe was different, we would not be here" – but the universe (*our* universe) is *not* different, so we are here. On the other hand, in modal logic we are familiar with counterfactuals of the type: "*If* the weather was fine, we would go for a walk" – but the weather is actually not fine, so we stay at home. From the formal point of view these two counterfactuals have the same structure, but from the epistemological point of view there is an important difference between

them: in the case of weather we know what *another* kind of weather is like, we have already experienced fine weather, so we can wait till it returns; in the case of the universe we do not know any *other* universe next to our actual universe, and hence the meaning of the sentence "*if* the universe was different" is not quite clear. Of course, we can construct some theoretical models of *other* different universes by varying basic physical constants etc., but there is no way to know if such models indeed represent some other *actual* universes.

As it is well known, some tens of years ago there was a lot of discussion on the "metaphysics of modality" among several ontological positions concerning the reality of "possible worlds". We may call two principal tenets in this discussion "actualism" and "possibilism" – represented by Saul Kripke and David Lewis, respectively. Kripke's modal "actualism" claims that only our *actual world* is real in the proper sense while "possible-worlds" which occur in formal modal semantics (actually discovered by Kripke himself) are to be conceived only as hypothetical, abstract replicas of this actual world, as possible counterfactual situations (or states or histories), which form an open logical and also cognitive space by describing how the world *could* be different. Needless to say, in spite of their ontological unreality "possible worlds" have a very important epistemological role in our actual world, because our intellect is able to operate only if it has a realm of possibilities at its disposal. However, Lewis's modal "possibilism", i.e. modal realism, claims that the realm of possibilities is not only an intellectual domain, and that *every possible world is real* as an ontological entity: other worlds are real "somewhere", not in the spatial but in the "metaphysical" sense of the word. – In order to connect the topics of modal logic and cosmology, let us draw our attention to two passages taken from two already classical books of modern modal metaphysics: Kripke's *Naming and Necessity* (1972) and Lewis's *On the Plurality of Worlds* (1986), respectively. When discussing the ontological status of "possible worlds", Kripke writes:

> I will say something briefly about 'possible worlds'. (I hope to elaborate elsewhere.) In the present monograph I argued against those misuses of the concept that regard possible worlds as something like distant planets, like our own surroundings but somehow existing in a different dimension, or that lead to spurious problems of 'transworld identification'. Further, if one wishes to avoid the *Weltangst* and philosophical confusions that many philosophers have associated with the 'worlds' terminology, I recommended that 'possible state (or history) of the world', or 'counterfactual situation' might be better. One should even remind oneself that the 'worlds' terminology can often be replaced by modal talk – 'It is possible that…' But I do not wish to leave any exaggerated impression that I repudiate possible worlds altogether, or even that I regard them as a mere formal device (Kripke, 1980: 15-16).

In the last sentence of this passage Kripke outlines an ontological position which may be called "moderate realism" (Read, 1995: 119). On the other hand, David Lewis advocates the "extreme modal realism" by taking possible worlds at face value:

> There are ever so many ways that a world might be; and one of this ways is the way that this world is. Are there other worlds that are other ways? I say there are. I advocate a thesis of plurality of worlds, or *modal realism*, which holds that our world

> is but one world among many. There are countless other worlds, other very inclusive things. […] The worlds are something like remote planets; except that most of them are much bigger than mere planets, and they are not remote. Neither they are nearby. They are not at any spatial distance whatever from here. They are not far in the past or future, nor for that matter near; they are not at any temporal distance whatever from now. They are isolated: there are no spatiotemporal relations at all between things that belong to different worlds. Nor does anything that happens at one world cause anything to happen at another. Nor do they overlap […] There are so many other worlds, in fact, that absolutely *every* way that a world could possibly be is a way that some world *is* (Lewis, 1986: 2).

We may ask, how can anyone who nevertheless wants to keep the ontological and epistemic distinction between possibility and actuality vindicate the classical "Principle of Plenitude" in its modern extreme form, i.e., to claim "that absolutely *every* way that a world could possibly be is a way that some world *is*"? It seems to me that this tenet cannot be taken seriously, not even as a working philosophical hypothesis. Surely, this kind of blurring the distinction between actual and possible worlds can be very amusing and also inspiring in *fiction*: indeed, we may say that the stories of Jorge Luis Borges, for example, as well as many other fancy masterpieces, are more interesting than "stories" of philosophers about the *reality* of other worlds. Lewis's pragmatic arguments for such a "baroque" ontology, that is his claims that his "modal realism" is the best and "cheapest" solution for epistemic problems of modal logic, for the theory of propositions etc., are too short in comparison with ignoring Ockham's razor on the ontological level. – To be precise, in cosmology the hypothesis of the plurality of universes does not claim that *every* possible universe is "somewhere" actual, neither that an infinite number of other universes is needed in order that the anthropic explanation could be effective. Nevertheless, the set of universes for establishing an epistemologically effective multiverse has to be *very large* in order to be an adequate domain for the "observational selection effect", since there are so many theoretical possibilities for the values of the basic natural constants, which are considered as "free parameters". So, in spite of some important differences between many-universes theories in cosmology and many-worlds in modal metaphysics, we agree with Kripke's note in *Naming and Necessity* that "it would also be interesting to compare Lewis's views with the Wheeler-Everett interpretation of quantum mechanics. I suspect that this view of physics may suffer from philosophical problems analogous to Lewis's counterpart theory; it is certainly very similar in spirit" (Kripke, 1980: 45, fn. 13).

If Hugh Everett's "many worlds interpretation" of quantum mechanics (1957) is applied to cosmology, for instance by John A. Wheeler's & Bryce DeWitt's "universal wave function" (1967), in order to support with "parallel" universes the anthropic explanations of fine tuning, then we have to state that the anthropic cosmological reasoning, in comparison with modal logic, suffers from a heavier "philosophical problem": in cosmological anthropic arguments modal "actualism" (or "moderate realism") is useless since they require "modal realism" in order to avoid being empty tautologies. I have already pointed out this problem in the first chapter by quoting John Leslie, who states that the "observational selection effect", which is a necessary condition for anthropic explanations in cosmology, "cannot operate

unless there is *more than one actual universe*" (Leslie, 1989: 14, see above). This point may be further elucidated by a comparison between the observational selection effect in cosmology and natural selection in Darwin's evolution theory. Both theories try to avoid teleological explanations, and in this endeavor they share an important requirement: just as Darwin's arguments require the material reality of fossils of extinct living beings, of those species which lost their battle during natural selection, in order to explain the evolution of present living beings – in the same manner anthropic cosmology requires the *reality* of other universes, among which many were not fine-tuned for the lives of some observers, in order to explain the fine-tuning of our universe. The retreat to some kind of modal "actualism" is useless here since the mere idea that in other *possible* (but possibly not actual) worlds living species and/or universes *might* have a different evolution, the idea that they *could* be different from what they actually are here-and-now is simply not a sufficient argument for explaining the evolution of our species and/or our universe. Darwin knew this well, and he found in his travels to Galapagos and all around the world empirical arguments for his theory. However, even if there are *other universes* "somewhere", we cannot in principle travel to them (since in this case they would be just some other regions of our Universe), and this is an essential difference between Darwinism and anthropic cosmology. Even worse, we do not have any "fossils" from other universes here, in our universe, as we have fossils from the past of our present universe. In the case of the multiverse-hypothesis we have only several theoretical scenarios how other universes might have come into being, but this is not enough for the conclusion that they *really* are "out there". So, the essential premise of *non*-teleological anthropic explanations in cosmology, namely the *existence of many universes*, i.e. of a real "multiverse", is supported only by an *analogy* with "possible worlds" in modal logic and/or with many possible branches of evolution in biology – but such arguments are far too weak to justify the very speculative claim that there is a very large number of other universes next to our own Universe. I repeat: this point – and not teleology – is the main problem of Carter's Anthropic Principle.

We have mentioned Hugh Everett's many-worlds interpretation of parallel quantum states as a possible scenario for generating a very "populated" multiverse. Brandon Carter himself, at the end of his famous article, endorsed Everett's theory, by saying: "This doctrine would fit very naturally with the world ensemble philosophy that I have tried to describe" (Carter, 1998: 139). Among Everett's followers David Deutsch has an important role in recent discussions of "quantum multiverses" (see Deutsch, 1997 and later). – But are there some other physical scenarios for generating multiverse(s)? Yes, there are, although they are all more or less connected with quantum physics, except the already classical Einstein's cognition that some light-cones of cosmological space-time do not overlap, but in this case it is more appropriate to speak about separated regions or domains of the universe than of several different universes. Let us just mention three other theoretical scenarios for multiverses: 1. the plurality of universes could originate from different breakings of symmetries in the "eternal inflation" (Andrei Linde, Alexander Vilenkin, Martin Rees and others); 2. universes (as many as $\sim 10^{500}$) populate the "Cosmic Landscape", derived from string-theories (Leonard Susskind, Steven Weinberg *et al.*); 3. universes are divided and separated in time because of cyclic repetitions of "big bangs" (theory of the early John A.

Wheeler, recently modified by Paul Steinhardt & Neil Turok). Martin Rees in his popular book *Before the Beginning – our Universe and Others* summed up various scenarios for the generation of multiverse(s) in the following lines:

> The many-worlds version of quantum mechanics offers one approach to the multiverse concept. The idea of 'eternal inflation', though still very speculative, suggests another context in which other universes could exist. […] Inflation may lead to separate universes – separate domains within a multiverse – which cooled down differently, ending up governed by different laws. Complex evolution would occur only in 'oases' where the constants had propitious values. Our oasis must then be at least ten billion light-years across because the physical laws seem the same everywhere we can observe. But the 'desert' beyond it could come into view in the remote future, when, maybe 10^{12} years or more from now, light from the edges of our domain has had time to reach us (Rees, 1997: 248).

Our main topic here is a philosophical reflection of fine-tuning and of the relation between mind and cosmos in general, so we cannot go into details of the above mentioned specific cosmological theories; they are available in scientific literature and also in several for a non-physicist more accessible presentations of contemporary cosmology (Linde, 2007; Susskind, 2006; Steinhardt & Turok, 2007; *et al.*). Nevertheless, we can state, from the philosophical point of view, that one of their common features and aims is the search of a scientifically adequate explanation of *our* universe, of its "fine-tuning" etc. The scientific "mainstream" can take for this purpose into account only *non*-teleological models, because the "Galilean Paradigm" is still prevailing in modern science. – So, following these scientific theories, we consider the existence of the multiverse at least as a relevant philosophical "working hypothesis", not going so far to accept the extreme formulation of the "Principle of Plenitude" which equalizes *possibilia* and *actualia*. Personally, I am quite skeptical concerning the reasonableness of some recent theoretical hypotheses, which have introduced such "high-potential" multiverses as, for example, Leonard Susskind's "megaverse", a huge multiverse of ~10^{500} universes (I doubt that he says anything new by introducing a new term), especially if we try to conceive more into detail what such a hypothesis means: *inter alia* it implies that there are my exact "counterparts" somewhere, in some other universe(s), maybe even an infinite number of them if we go in these speculations "to the end", namely to the infinite multiverse. But also if we stay in the finite realm, the "googol" number 10^{500} is 10^{420} times bigger than the number of all protons inside our cosmic horizon, within the "Hubble sphere" (~10^{80}), so that in Susskind's "megaverse" I would have many such counterparts who would differ from me only in one proton. This sounds crazy, and we hardly resist to call such speculations with Hegel's term "bad infinity". – But on the other hand, we have to remember Lucretius or Giordano Bruno: in their times, the hypothesis that there are other "earths" in the sky seemed crazy as well. I admire Bruno very much, not only because he stood with his ideas to the end, to the stake, but also because of the far reach of his cosmology: his belief in the infiniteness of the universe is closer to modern cosmological discoveries than the conceptions of his more scientifically orientated and nowadays more famous contemporaries (Copernicus, Kepler, Galileo). However, when we call Bruno in mind, we have to pay

attention to an important philosophical difference between Bruno's "infinite worlds" and up-to-date universes in the putative multiverse(s): the former are supposed by Bruno to be infinite by number, but for him the *Uni*verse is still *one*, its unity is founded and guaranteed in the cosmic Mind (in this sense Bruno followed the Neo-Platonic tradition, which was strong in the Renaissance period), while the latter, namely modern universes and their "ensembles", i.e. multiverses, do not have – at least from the scientific point of view – any "highest Unity". We will discuss more this point in the next chapter.

Let us return to the "working hypothesis" that in spite of all difficulties to conceive it some kind of multiverse yet exists. Then this question follows: What kind of multiverse should it be, and how far the diversity of its members-universes as well as their difference towards our universe should go? In the recent literature on this topic, the most quoted classification of multiverses was proposed by Max Tegmark is his paper "The Multiverse Hierarchy" (2003), which has been reprinted in the representative, comprehensive and interdisciplinary (especially between physics and philosophy) collection of essays *Universe or Multiverse?*, edited by Bernard Carr (2007). Tegmark classifies multiverses into a four-level hierarchy, which progressively yields greater diversity of universes:

> Level I: A generic prediction of cosmological inflation is an infinite 'ergodic' space, which contains Hubble volumes realizing all initial conditions – including one with an identical copy of you about 10 on 10^{29} power meters away.
> Level II: Given the *fundamental* laws of physics that physicists one day hope to capture with equations on a T-shirt, different regions of space can exhibit different *effective* laws of physics (physical constants, dimensionality, particle content, etc.), corresponding to different local minima in a landscape of possibilities.
> Level III: In unitary quantum mechanics, other branches of the wave-function add nothing qualitatively new, which is ironic given that this level has historically been the most controversial.
> Level IV: Other mathematical structures give different fundamental equations of physics for that T-shirt (Tegmark, 2007: 99–100).

If we resume, rather more simply: the multiverse on Level I derives from Linde's theory of "eternal inflation", which yields *different initial conditions*; universes of the multiverse on Level II have not only different initial conditions, but also *different "effective" physical laws* (including different constants etc.), like the "megaverse" in Susskind's "Cosmic Landscape"; the multiverse on Level III corresponds to Everett's *et al*. *"parallel" universes of quantum mechanics*; Level IV yields different fundamental equations of physics, and it means also *different "underlying" mathematical structures* (topologies, symmetries, groups etc.). – For Tegmark "[t]he key question is therefore not *whether* there is a multiverse (since Level I is the rather uncontroversial cosmological concordance model), but rather *how many* levels it has" (*ibid*., 100). Concerning the highest Level IV, the level of mathematical variations in natural laws, Tegmark quaintly remarks that the multiverse could not be seen more simply from this "bird's-eye view"; this remark comes from his idea of "complete mathematical democracy", which means that "a mathematical structure and the physical world are in some sense identical" (*ibid*., 116), i.e., Tegmark argues for *isomorphism* between

(all) mathematical structures and physical entities, saying that "each physical entity [has] a unique counterpart in the mathematical structure and vice versa" (*ibid*., 117). That is an interesting idea, but if its "simplicity" is pointed out, a skeptical philosopher might ask, *who* (or what) is that "bird" which sees the whole infinitely complicated multiverse picture as so simple? It is maybe simple in God's view, but from the human perspective it is certainly not. Regarding the issue of simplicity, Tegmark's epistemological (in)version of Ockham's razor is quite typical for the proponents of the multiverse(s):

> A common feature of all four multiverse levels is that the simplest and arguably most elegant theory involves parallel universes by default. To deny the existence of those universes, one needs to complicate the theory by adding experimentally unsupported processes and ad hoc postulates: finite space, wave-function collapse, ontological asymmetry, etc. Our judgment therefore comes down to which we find more wasteful and inelegant: many worlds or many words. Perhaps we will gradually become used to the weird ways of our cosmos, and even find its strangeness to be part of its charm (Tegmark, 2007: 123-25).

Perhaps. But is it not a little strange that science is more concerned with "many words" than with "many worlds"? After all, what is science about? About words or about worlds? This dilemma might be false, of course, but Tegmark's "provocation" calls for a reasonable and justified answer. From the beginnings of modern science, we are used and inclined to think that in empirical sciences, among which physics has the principal place and role, hypotheses should be verified or at least falsified with observation and experiments in a reasonable period of time. So, let us shortly check how things stand with empirical evidence just for the "simplest" case of multiverse, let us say, the multiverse which contains only one other universe next to our (grown from "our big bang") – could this modest multiverse hypothesis be somehow empirically tested? Probably it could, but it has not been yet. Strictly speaking, we do not have any evidence that *another* universe exists since everything we empirically know in cosmology (and we know surprisingly a lot: red shifts, background radiation etc.) comes from *our* Universe. Nevertheless, some proposals how some other universe(s) might be *indirectly* detected are taken into account in recent cosmological investigations, grounded by the "brane-world scenarios". If our cosmic space-time is a three-dimensional (3D) brane, "floating" in space-times with more dimensions (up to 10+1 in the "M-theory"), then photons are (following this theory) *open* strings, i.e. their endpoints are "glued" to our brane so they – light – cannot leave it while gravitons, the presumed particles of gravitation, are *closed* strings with no endpoints and so not trapped within particular branes. This feature of gravitons might be empirically tested, in similarity with "Kazimir's effect" (decreasing of fluctuations between two metal plates – in the case of gravity, between two "parallel" 3D-branes), and the positive result of such an experiment could explain why gravitation is so weak in comparison with the other basic long-ranging force, the electro-magnetic force. Brian Greene comments this issue in his well-known book *The Fabric of the Cosmos*: "Through the gravitational force, we could both influence and be influenced by extra dimensions. Gravity, in such a scenario, would provide our sole means for interacting beyond our three space dimensions" (Greene, 2005: 394). Yes, we can agree that *if* there are

other physical dimensions, then the implication to at least *some* other universe(s) is more likely. However, against this implication, i.e., against its too strong consequences, there are at least two objections: 1) gravitons have *not* been discovered yet, and M-theory is still hypothetical; 2) the step from the discovery of some other space-time dimensions and/or *some* other universe(s) to a vast variety of universes and multiverses, outlined by Max Tegmark, still remains *very* speculative, even with the expected positive results of such empirical investigations.

Some proponents of the multiverse hypothesis, among them Steven Weinberg, who acknowledged the importance and value of "anthropic reasoning" in science not until some years ago, maintain that *indirect*, statistical testing of the existence of the multiverse is already possible, based on the available empirical data. The most investigated parameter in this manner is the "cosmological constant" (Λ), the actual value of which is $\sim 10^{120}$ times smaller than its theoretically expected value, and this is hardly just a "happy coincidence". But according to "anthropic reasoning" and statistical expectations, following the "normal distribution", the actual value of Λ should *not* be far below *the highest value which still permits life* (since if it were far below, this fact would probably be due to some other, non-anthropic, unknown reason) – and this is *actually* the case: the value of Λ is *quite near* the highest value which still permits life. The point here is that this prediction might have been already statistically falsified – but it has not been by any relevant recent measurements.

One of the proponents of the multiverse hypothesis, Don N. Page comments: "One objection that is often raised against the multiverse is that it is unobservable […] but one can test a theory that makes use of unobservable entities to explain and predict the observable ones" (Page, 2007: 412–413). Of course this is true, since also the best scientific theories postulate unobservables whose existence is inferred from observables, for example quarks in the Standard Model of particle physics, and even the most obvious particles, for instance protons or electrons, are "seen" only indirectly, from their effects or tracks. – However, in the case of indirect evidence for the multiverse, the promising statistical strategy of argumentation for the "anthropic" fine-tuning of Λ is undermined by the question: How high the "highest value which still permits life" (and/or observers) has to be posed? This limit is obviously determined by the definition (or domain) of "possible observers" – but who (or even what) is to be included among them? When we think about this philosophical (or psychological) problem, which obviously cannot be solved within physical cosmology, such questions are raised: Must conscious observers be made of carbonic molecules? My tentative answer is: presumably not. Furthermore: Must they be made of fermions (particles of matter), not only of bosons (particles of energy)? My even more tentative answer would be: probably yes, at least from the scientific point of view (by putting aside angels etc.). However, the question of the definition/domain of possible observers is far from being solved in general, although its solution is essential for any useful anthropic reasoning. Namely, if the domain of possible observers is too large, then almost anything (every value of physical parameters etc.) can be explained by anthropic reasoning, so it is cognitively useless. But even if we restrict the domain of possible observers, let us say to the carbon-based life, another question, which is even more queer, is raised: Are the so-called "freak observers" (for instance, the "naked brains", i.e. just brains without bodies) more numerous in a such restricted domain in

comparison with the "normal observers" (embodied humans or some "humanoid aliens" *et al*.)? From the statistical point of view, if every individual is composed of some large number of elementary particles, the answer to this latter question should be: yes, "freaks" are among all "possible observers" more numerous than the "normals". But this conclusion is almost the *reductio ad absurdum* of the multiverse hypothesis. – In order to avoid this "freaky" problem, the "Principle of Mediocrity" was suggested by Garriga & Vilenkin (2003), which postulates that "our civilization is typical in the ensemble of all civilizations in the universe" (see Carr, 2007: 345). This principle seems to some people too speculative (maybe also too "chauvinistic" towards "non-humanoid aliens"), so that another, methodologically similar principle has been suggested by Nick Bostrom, the "Self-Sampling Assumption": "One should reason as if one were a random sample from the set of all observers in one's reference class" (Bostrom, 2002: 57). By this principle, which is actually a more sophisticated variant of the "Observational Selection Effect" (featuring in the "Anthropic Principle", see above, Chapter 1), the unwelcome "freak observers" are not quite abolished, but they are excluded from the statistically *relevant* part of the domain of all possible observers.

But such "philosophizing" is, after all, a kind of neo-scholasticism which can neither demonstrate nor refute the physical existence of the multiverse(s). In my opinion, some much more important and relevant philosophical questions are raised, when we ask which and where is the *limit* of the ascending hierarchy of universes and/or multiverses – does it rise up to *infinity*? After all, infinity is much "simpler" in Tegmark's sense than some specific "googol number". So why should we stop adding higher and higher levels of universes/multiverses at some specific point? Tegmark's Level IV is conceived from "mathematical democracy", and in this conceptual horizon it seems to be unavoidable to consider also "transfinite multiverses", *per analogiam* with Cantor's "transfinite numbers".[4] Furthermore, what is the relation between mathematical and physical infinity if "structural isomorphism" between mathematics and physics obtains, as Tegmark claims. And, if we drive our thoughts up "to the top", does metaphysical and/or theological infinity transcend physical and mathematical infinity? We will try to consider some philosophical aspects of these great questions in the following chapter.

3. Paradoxes of transfinite cosmology

The question of infinity vs. finiteness of the universe in space and time (or in space-time, after Einstein), which was articulated with all sharpness in Kant's first antinomy of pure reason, has not been solved yet, however, for *our* universe, i.e. for space-time which emerged from "our big-bang", it *could* be in principle answered scientifically, contrary to Kant's philosophical judgment that this question leads to an insolvable antinomy. Kant's main point concerning antinomies was that they show how pure reason transcends "all possible

[4] Tegmark might object here that his 4-level hierarchy is a *meta*-hierarchy of *multiverses*, not the hierarchy of universes themselves, so that the former could be finite, even if the latter were infinite. We agree, but this objection does not solve the problem of infinite hierarchical *regressus* of universes and their "sets", i.e. multiverses.

experience", and therefore yields just "ideas" which cannot be verified. The first antinomy is based on the idea of absolute *wholeness* of space and time, which is never given in our actual experience neither can it be given in some possible future experience. Kant was in principle right, however – and just this we will argue in this chapter – in modern cosmology his point has to be shifted from the universe to multiverse(s). Concerning *our* universe, we have got some important empirical facts which refer to the *whole* of it: *first*, Edwin Hubble's discovery in the 1920s of the *universal* red-shifts of spectral lines, observed in the light from all galaxies alike and dependent only of their distance (more accurately, with a few exceptions due to the local movements of some galaxies), which reveal the expansion of the universe; *second*, the *universal* distribution of matter (mostly hydrogen and helium) in all observable space; *third*, Penzias & Wilson's discovery in the 1960s of *universal* or cosmic background radiation etc. On the basis of these important empirical discoveries cosmology has become a natural *science*, in spite of Kant's conviction that this could never be the case. Furthermore, new cosmological models, based on Einstein's discovery of curved space-times and developed by Alexander Friedmann and others, have surmounted the sharpness of Kant's antinomy by showing that space-time could be finite *and* unbounded (such are, for instance, Riemann's spaces). The conjunction of finiteness and unboundedness, which reminds us of the "hermetic" statement of Nicholas Cusanus (15th century) that the universe is "like the sphere which has its centre everywhere and its boundary nowhere", is impossible in Euclidean geometry with "open" topology, i.e. in the classical conception of space, which was the only "shape of space" considered by Kant as the *a priori* transcendental form of our "outer experiences".

Nevertheless, as I have said, the dilemma between finiteness vs. infiniteness of *our* universe has not been solved yet, although it might be someday. In contemporary cosmology, this dilemma is rather substituted with another formulation of the problem –which is connected with Kant's antinomy, yet not equivalent with it – expressed by the question: Is the space of our universe "open" or "closed"? For instance, the classical Euclidean space is open, Riemann's spaces are closed. Some "shape of space" is outlined by a certain cosmological model, and the adequacy of a chosen model has to be verified by empirical observations. Recent observations (of supernovas in other galaxies etc.) show that the space of our universe is probably open and that it is "flat" (i.e. that its curvature is near to the zero-value); otherwise said, the value of the density parameter $\Omega \approx 1$ means that the cosmic space is Euclidean or just slightly curved (we may wonder if this is also a result of "fine-tuning"). Does it *eo ipso* mean that the space of our universe is infinite? Not necessarily, since the "openness" or "closeness" of some space is dependent not only on its geometry (curvature), but also on its topology ("deeper" shape). There are spaces which are "flat" (Euclidean, with zero curvature), but nevertheless finite or – better said – "closed"; such is, for example, the shape of space named "three-dimensional Euclidean torus": it is similar to a two-dimensional flat surface which has its edges "glued" together, so that a traveler who reaches, let us say, the left "edge" of the surface finds himself at the same moment on its right "edge", continuing his journey without any boundary (similarly as on the surface of the classical sphere, only that in the case of the Euclidean torus its surface is *flat*), and such a type of

closed space has *no* edges or boundaries in spite of its finiteness.[5] An interesting, rather more sophisticated than the Euclidean 3D-torus, yet theoretically very elegant model of a closed, topologically "compact" cosmic space in the shape of slightly spherical hyper-*dodecahedron* was proposed by Jean-Pierre Luminet (see Luminet, 2008); such a "multiply connected" space implies that the objects in it (galaxies etc.) are seen by some late observer (like us) in several "replicas", which are images of the *same* object, coming from different times of its evolution; this fascinating possibility could in principle be verified, but present instruments (orbital probes etc.) are still far from being precise enough for that purpose. We may state that Luminet's model is beautiful, it has been inspired by Plato's *Timaeus*, however, its empirical verisimilitude is not very high at the moment.

If we introduce the multiverse(s) into cosmology, the scientific and philosophical answer to the classical Kantian dilemma between finiteness and infinity is shifted a large step further – in the direction of infinity, although the *actual* infinity of the multiverse is no less problematic than the actual infinity of our universe. The question whether our universe is finite or infinite, becomes additionally complicated, as John D. Barrow clearly shows us with the following hypothetical scenario: let us assume that we accept Linde's theory of "eternal inflation", in which "bubble" universes are created, among them our universe (in this case Tegmark's Level I suffices); due to random quantum fluctuations in the primary inflationary field the value of Ω in our universe (our "bubble" in the multiverse) is $\Omega \leq 1$ (or, as measurements suggest, $\Omega \approx 1$), thus our universe is – if we leave aside the possibility of some "compact topology" – *infinite* (at least potentially); but it could be the case that our "bubble" universe lies *inside* a larger "bubble", in which $\Omega > 1$ would hold, thus such a Universe, larger than our supposedly infinite universe, would be *finite*, and within it our own as well! Barrow explains: "We may think we are living in a universe of sub-critical density when we just inhabit an underdense "bubble" inside a Universe of super-critical density" (Barrow, 2005: 145). But this and similar problems with infinity in the multiverse (and of the multiverse itself) are only "symptoms", only "the peak of the iceberg", because if we thoroughly consider the *concept of the multiverse*, the concept of the cosmological "manifold", we soon notice that beside various scientific-physical problems, some of which we have mentioned in the previous chapter, further and deeper *methodological* problems emerge in the very conceptual apparatus of *pro et contra* discussions concerning the multiverse(s).

When Roger Penrose in Chapter 16 of *The Road to Reality*, titled "The Ladder of Infinity", discusses Cantor's transfinite set theory, he concludes that its influence on contemporary physics has been utterly small, in fact negligible in comparison to the influence of other basic mathematical disciplines (functional analysis, non-Euclidean geometries, theory of groups etc.):

[5] Joseph Silk in his book *The Infinite Cosmos* says: "An important myth to overcome is the inference that a flat or even a negatively curved universe is infinite. This issue of size must be the core of cosmological tests. How can we make a hard scientific appraisal of whether the universe is infinite? It turns out that the question of whether or not the universe is nearly infinite can be experientially tested. The universe can be very large indeed, compared to the visible scale, yet its size can, in principle, be measurable" (Silk, 2006: 183).

> It is perhaps remarkable, in view of the relationship between mathematics and physics, that issues of such basic importance in mathematics as transfinite set theory and computability have as yet had a very limited impact on our description of the physical world. It is my own personal opinion that we shall find that computability issues will eventually be found to have a deep relevance to future physical theory, but only very little use of these ideas has so far been made in mathematical physics (Penrose, 2005: 378).

It is rather striking that almost none of the physical theories seems to need to go beyond the cardinality of the real-number system, states Penrose (let me just mention here that he himself went mathematically further with his physical theory of "twistors", see *ibid*., Chapter 33). Penrose's conclusion certainly holds for the application of the *results* of transfinite set theory, but it is less justified regarding the *type of thinking* itself, i.e. regarding the conceptual apparatus (also the concealed one) employed in some extreme, highly "speculative" physical theories, which in particular holds for the theories of the multiverse; yet, it is true that the main protagonists of the theories of multiverses (Susskind, Linde, Rees etc.), who are eminent physicists and/or cosmologists, have so far not concerned themselves much – as far as I know – with the conceptual, "meta-theoretical" grounds of their theories. It is mainly critics who engage in this, but gradually more distinctive logical-analytic approaches have established themselves on "both sides" in debates about the multiverse, which we can notice also in the already quoted Carr's collection *Universe or Multiverse?* (especially in the articles by George Ellis, Anthony Aguirre and Lee Smolin). There is neither a unanimous nor a uniform answer to the question whether the physical multiverse requires an *infinite* set of universes or not,[6] however, we may state that some kind of *transfinite cosmology* in analogy to Cantor's transfinite set theory is gradually emerging, because in more analytical approaches universes figure as elements of the multiverse set (or "manifold"), which in principle allows for iteration, namely for multiverses as elements of the Multiverse of the second order and so on … *ad infinitum*? The question correlative to this

[6] Leonard Susskind, whom we have mentioned already in the previous chapter, gives the megagugol number $\sim 10^{500}$ of possible universes, that is, "inhabitable valleys" (or local *vacua*) in the virtual "Cosmic Landscape", derived from string theory. This number expresses the "lower limit" of different Calabi-Yau spaces in ten dimensions, geometrical and topological forms of "compact" (hidden, "curled") hyper-dimensions which determine the characteristics of strings and with this also the values of physical parameters in the "normal" three dimensions. Susskind adopts the number $\sim 10^{500}$ by R. Bousso & J. Polchinski, who named such kind of number "discretum" or "practical continuum". In order to at least try to imagine how big such a number is Susskind gives the following comparison: if we tried to arrange points (of null dimension) in an equidistant fashion with intervals of Planck's length (10^{-33} cm), the number of these points from us to the cosmic horizon, the Hubble sphere, would be "just" 10^{60}, which is still *very* very far from 10^{500} (see Susskind, 2006: 291). A hindrance in this picture is also our incapability to imagine how *very* very small Planck's length is – not only from our perspective but also from the "perspective" of atoms this "length" is almost "less than nothing". Despite this the density of the "discretum" is still very very far, *infinitely* far from the density (continuity) of the mathematical continuum ($\aleph_1$). But on the other hand, when there is talk about the number of possible variations of physical parameters, from which different universes in the multiverse are supposedly created, why could not a possible domain of these variations be (for example for the "cosmological constant" Λ) – just the continuum? We could in principle think of reasons why physical values could not be placed into the mathematical continuum, for example, if space-time is discrete, i.e. "quantized", as in the theory of "loop quantum gravity", however, these suppositions are far from physical confirmation.

one is the question about physical laws, which vary in the universes (on Tegmark's Level II and higher), sets of "effective by-laws" becoming thus elements of the set of Laws of the second order (laws of laws or "meta-laws") … also *ad infinitum*? It is necessary to stop somewhere and say: no, *regressus ad infinitum* is a logical mistake, in this point Aristotle (and many logicians after him) had it right – and when we are confronted with infinite regress, we have to look for different solutions so that the potentially infinite series of ever higher and higher multiverses, as well as their laws, finally end somewhere, maybe by reaching completion in the ultimate "whole" – in the Universe? But what does this mean?

The role of mathematical sets in physical theories of multiverses can be well understood in the article "Multiverses and Cosmology: Philosophical Issues" by authors William Stoeger, George Ellis and Uli Kirchner. They state in the introduction that for the anthropic explanation of the "fine tuning" of our universe a conceptually possible multiverse does not suffice – what we have already pointed in our first chapter – since we need "universes which actually exist, along with mechanisms which generate their existence" (S. & E. & K. 2006: 4); thus, it is necessary first to *define* a set M, whose elements are all *possible* universes m, then to determine a "distribution function" $f(m)$, that selects within M actually *existent* universes, and finally a criterion (also a function) that determines the *anthropic* subset among existent universes. But we get stuck already by the question of how to define M:

> What determines M ? Where does this structure come from? What is the meta-cause, or ground, that delimits this set of possibilities? Why is there a uniform structure across all universes m in M ? (Stoeger & Ellis & Kirchner, 2006: 7)

Because if M really encompasses all the possibilities of universes, we have to know how to decide *which* are "all" the possibilities or where are the *limits* of these possibilities, but "these questions cannot be answered scientifically, though scientific input is necessary for doing so. How can we answer them philosophically?" (*ibid.*).[7] This first difficulty is followed by others, from the question of how to define the function $f(m)$ to the question of how to conceive of the *anthropos* in the Anthropic Principle (problem of "freaks" vs. "normal observers" etc.), about which we have already spoken. The three authors especially warn about problems with infinity:

> When speaking of multiverses or ensembles of universes – possible or realized – the issue of infinity inevitably crops up. Researchers often envision an infinite set of universes, in which all possibilities are realized. Can there be an infinite set of really

[7] Compare also the following fragment from Ellis' article in Carr's collection *Universe or Multiverse?*: "How wide a variation of properties are we prepared to consider in our class of multiverses? Are we prepared to consider: universes with quite different physics […]; universes with different kinds of logic and perhaps alternative forms of mathematics; universes allowing magic, such as envisaged in the Harry Potter novels by J. K. Rowling? – If we are not prepared to allow such situations, what is the rationale for this? If the underlying principle is that "all that can happen does happen", then there should conceivably be universes of all these kinds, as well as theistic and non-theistic ones, universes based in beauty and ethereal vibrations rather than physics, etc. Science fiction provides a fruitful source of such ideas. […] If any such possibilities are to be excluded, we have to be given both a meta-principle excluding them and a justification as to why that meta-principle should apply in the ensemble. Only philosophy can justify such a choice." (Ellis, in Carr, 2007: 394-95)

> existing universes? We suggest that the answer may very well be 'No' (Stoeger & Ellis & Kirchner, 2006: 13).

Beside some general methodological reasons against an infinite multiverse irresolvable problems crop up when we try to carry some well defined concepts of infinity from mathematics, where they have formed in a long and careful development of formal systems (*cf.* in the Zermelo-Fraenkl axiomatic set theory), to the field of physics, that is, to transform *mathematical* infinity into *physical* infinity. The three authors quote David Hilbert's thought that "the presumed existence of the actually infinite directly or indirectly leads to well-recognized unsolvable contradictions in set theory" (*ibid*., 14). We are dealing, of course, with the famous Russell's paradox of "the set of all sets which do not contain themselves" and its variants, among which it is appropriate to mention in our present context the Burali-Forti paradox of "the highest ordinal number".[8] This kind of "syntactical paradoxes", as Russell named them, are not solvable directly, but they can be avoided with a careful selection of mathematical axioms, definitions etc. However, if we apply Cantor's "real" (actual) infinity of transfinite numbers to *physical* models of multiverses as infinite sets of universes, we do not have any possibility of "control" over the selection of the axioms, because "boundary conditions" are dictated by physical reality, cosmological laws, they are not "free mathematical constructions" (in Cantor's sense), which are limited only by logical consistency. For instance, Russell's "axiom of infinity" cannot simply be carried over to physics and cosmology. The above quoted three authors stress that:

> [T]he problem with a realized infinity is not primarily physical in the usual sense – it is primarily a conceptual or philosophical problem. 'Infinity' as it is mathematically conceived and used, is not the sort of property that can be physically realized in an entity, an object, or a system, like a definite number can. It is indeterminately large, and really refers to a process rather than to an entity […] And the process it refers to has no term or completion specified. No physically meaningful parameter really possesses an infinite value (Stoeger & Ellis & Kirchner, 2006: 17).

The paradoxes of set theory point to the problem that emerges if we put some "existent" (in the mathematical sense: non-contradictory, at least seemingly) entity on the top of the hierarchical pyramid, for example in the Burali-Forti paradox the *largest* ordinal number, that is, the ordinal number of *all* ordinal numbers. But *analogue* paradoxes appear in physical models of multiverses if we allow for their boundless ascent "upwards" to the supposedly "highest" Multiverse. That is, with which arguments should we reject the existence of this cosmological "maximum" if the very "logic" of construction of multiverses (the variation of physical parameters, laws, dimensions, topologies etc.) leads to this "real"

[8] Ordinal numbers or "ordinals", i.e. numbers which denote the "order" of a set, themselves form, according to Cantor's definition, a "well-ordered set" (or series). The Burali-Forti paradox, named by Russell in 1902 after the Italian mathematician who discovered it, derives from the question which is the largest (or highest) ordinal of *all* ordinals that contains all ordinals. Let us call it with the Greek letter Ω, and express the paradox shortly: "If Ω exists, then it has a well-ordering, so there must be an ordinal which acts as a measure of how long this well-ordering is. But obviously none of the ordinals *in* Ω is itself big enough to do this. So Ω cannot after all contain all the ordinals" (see Moore, 1990: 126).

but unavoidably paradoxical Entity? If we want to stay *within science*, we have to define this supposedly "highest" Multiverse with some Laws, but in doing so we cannot leave out of account some even higher Laws, which sanction those Laws "below" them … and so we get caught into a cosmological variant of the Burali-Forti (and/or Russell's) paradox. The only way to re-solve this paradox is a "breakthrough" to some other "sphere" of meaning which *transcends* scientific, physical cosmology. It is useful to reconsider how Cantor himself looked on the paradoxes of set theory, disclosed by Russell and others. Why didn't they move him so much as they did Russell and especially Frege? The answer is simple and instructive: because Cantor in his "highest" mathematical thoughts *transcended* mathematics! Let us have a look at how this is possible.

A. W. Moore in his book *The Infinite* conjectures that Cantor was not concerned with the Burali-Forti paradox (and similar "syntactic" paradoxes of set theory) because in constructing transfinite mathematics he presumed that some sets ("wholes") are so disproportionally large that it is impossible to assign any "power" to them (i.e., any cardinal number), as we can assign, for example, to countable infinity ($\aleph_0$) or to the continuum ($\aleph_1$). Such an example is the "whole" of all ordinal numbers: "There was no such set as Ω. And this was enough to dispel the paradox" (Moore, 1990: 127). Cantor named such concepts "inconsistent wholes" that do not belong to the transfinite domain but to the "domain" of *absolute* infinity, or in short – to the Absolute. Something analogous holds for "the set of *all* sets" (with Russell's predicate "that do not contain themselves" or without it): Cantor did not accept such inconsistent wholes in his transfinite arithmetic, and that is why there is no "Cantor's paradox" of the largest cardinal number. We can, of course, object this, especially if we follow Russell's diagnosis of the problems with infinity in mathematics and/or logic and if we accept his "theory of logical types", a very radical therapy for paradoxes. However, this is not the only possible and maybe even not the only correct view of the "paradoxes of set theory".

Shaughan Lavine in his monograph *Understanding the Infinite*, in which the main topic is the analysis of Cantor's transfinite mathematics and its "natural" continuation in the Zermelo-Frankl axiomatic system, observes that – *contrary* to philosophers of mathematics like Frege and Russell and others who followed them – Cantor *did not* accept the Peano-Russell's "Comprehension Principle", which says that "a class may be defined as all the terms satisfying some propositional function" (Lavine, 1994: 63); that is, such a "logistic", functional definition of a class or set unavoidably leads, according to Lavine, to paradoxes (see *ibid*., 66) while Cantor's presumably "naïve" definition of a set avoided them because he – as Lavine says – determined a set as a "combinatorial collection", "defined by the enumeration of its terms" (*ibid*., 77). Combinatorial collections are "more general than [Russell's] logical collections" (*ibid*.), and at the same time such a definition of a set is more restrictive: "Since combinatorial collections are enumerated, some multiplicities may be too large to be gathered into a combinatorial collection" (*ibid*., 78).[9] The way how Cantor avoided Russell's paradox might be seen also from his letter to Jourdain on July 9, 1904:

[9] William W. Tait in his article "Cantor's *Grundlagen* and the Paradoxes of Set Theory" expresses a rather different view from Lavine, by arguing that the Comprehension Principle ("every property determines a set") became problematic only after having been applied to transfinite numbers: "With the introduction of

> Were we now, as Mr. Russell proposes, to replace 𝔐 by an *inconsistent* multiplicity (perhaps by the totality of *all* transfinite ordinal numbers, which you call 𝔚), then a totality corresponding to 𝔊 could *by no means be formed*. The impossibility rests upon this: an inconsistent multiplicity because it cannot be understood as a *whole*, thus as a *thing*, can*not* be used as an *element* of a multiplicity. – Only *complete things* can be taken as *elements* of multiplicity, only *sets*, but not *inconsistent multiplicities*, in whose nature it lies, that they can never be conceived as *complete* and *actually existing* (Cantor, in Lavine, 1994: 99).

It is indeed interesting and inspiring to read how Cantor, the discoverer of transfinite numbers, writes about the conceptual "completion", which was, classically understood, the very opposite of infinity. Following Cantor, Lavine advocates a kind of moderate variant of mathematical constructivism, which contrary to Brouwer's radical intuitionism accepts transfinite sets, but subtly "enumerated" in the ZF-axioms. We philosophers have to leave the final judgment about whether Lavine's interpretation of Cantor against Russell is correct to mathematicians or historians of mathematics. For philosophers it is Cantor's attitude toward the Absolute that is interesting, since it enables him to overcome paradoxes. In the context of his critique of Aristotle's concept of just potential infinity, Cantor wrote in his important treatise *Ueber unendliche, lineare Punktmannichfaltigkeiten* ("About infinite, linear manifolds of points", Part 5 [1883], § 4, note 2) the following, very significant thoughts:

> Die Auffassung Platons vom Unendlichen ist eine ganz andere, wie die des Aristoteles […] Ebenso finde ich für meine Auffassungen Berührungspunkte in der Philosophie des Nicolaus Cusanus. […] Dasselbe bemerke ich in Beziehung auf Giordano Bruno, den Nachfolger des Cusaners. […] Ein wesentlichen Unterschied besteht aber darin, dass ich die verschiedenen Abstufungen des Eigentlich-unendlichen durch die Zahlenclassen (I), (II), (III) u.s.w. ein für allemal dem Begriffe nach fixire und es erst nun als Aufgabe betrachte, die Beziehungen der überendlichen Zahlen nicht nur mathematisch zu untersuchen, sondern auch allüberall, wo sie in der Natur vorkommen, nachzuweisen und zu verfolgen. Dass wir auf dieser Wege immer weiter, niemals an eine unübersteigbare Grenze, aber auch zu keinem auch nur angenäherten Erfassen des Absoluten gelangen werden, unterliegt für mich keinem Zweifel. Das Absolute kann nur anerkannt, aber nie erkannt, auch nicht annähernd erkannt werden (Cantor, 1984: 115).[10]

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transfinite numbers, though, Cantor immediately recognized that the notion of set was problematic, to the extent of understanding that not *every* property of numbers 'unites the objects possessing it into a whole', thereby determining a set. So […] he was not naïve. […] But Pandora's Box is indeed open: Under what conditions *should* we admit the extension of a property of transfinite numbers to be a set – or, equivalently, what transfinite numbers are there" (Tait, 2000: 284). In some other passage of this paper, Tait points out that Cantor distinguished between the "determinate infinities" and the "absolute infinite" (*ibid.*, 275), and just *this* distinction is essential for our present context.

[10] "Plato's concept of infinity is quite different from Aristotle's […] I have found contact points for my conceptions also in the philosophy of Nicholas Cusanus. […] And I notice the same in Giordano Bruno, the follower of Cusanus. […] However, there is an essential distinction, that is, that I have once for all fixed in concept the different degrees of the actual infinite with the classes of numbers (I), (II), (III) etc. [later Cantor named them "cardinal numbers"], and only then have I considered the task to research the infinite numbers not

Cantor refers to Plato with the *transcendence* of the Absolute, to Cusanus with his *symbolic* "recognizing" of the Absolute, to Bruno with his actual *infinity* in the *One*, which, following the Neo-Platonic tradition, "encompasses" by the cosmic Mind all worlds, albeit they are infinitely many. He expresses the symbolic meaning of mathematical infinity in the continuation of the quoted passage: "Die absolute unendliche Zahlenfolge erscheint mir daher in gewissem Sinne als ein geeigneten Symbol des Absoluten" (*ibid*., 116).[11] – Cantor thus discerns *three* levels of infinity: 1. "improper" (although in mathematics indispensable) infinity of "addition" and "division", which Aristotle named potential infinity; 2. "proper" (actual) infinity of transfinite numbers, ordinals and cardinals, which he himself discovered; and 3. transcendent infinity of the Absolute, which is only symbolically recognized in mathematical infinity, but is never conceptually known.[12]

Cantor's conception of absolute infinity is spiritually akin to Kant's philosophy, in spite of the fact that Cantor did not like Kant's philosophy, at least following his letter to Russell in 1911.[13] For Kant, (meta)physical infinity is a *regulative idea* of pure reason <*Vernunft*>, but it is *not* an object-constituting transcendental category of understanding <*Verstand*>. If Kant had been alive to witness Cantor's discovery of "real" (actual) mathematical infinities, he would have probably been surprised, but this would not shake the foundations of his critical philosophy, maybe it would have had an even lesser influence on it than the discovery of non-Euclidean geometries had on Neo-Kantianism, especially on Ernst Cassirer. What deeply links Kant and Cantor is the apprehension that the Absolute can never be given as a *whole*. The whole is always transcendent, also in cosmology, and this is the main lesson of Kant's antinomies, especially of the first one that stems out of the transcendental category of wholeness (or totality) – the antinomy arises if knowledge wants to transcend all possible experience of space and time. The concepts of space and time themselves are not antinomic, because we are always *within* some sequence of ever larger spaces and times, but the "whole" of space as well as time is not given to us *outside* these finite spaces and times, it is not given even within any "possible experience" – that is why it

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only mathematically, but also to track them generally and demonstrate where they occur in nature. I do not doubt that we will go on and on in this way, and that we will never encounter some impassable boundary, but that we shall also not succeed in approaching some merely near comprehension of the Absolute. The Absolute can be only acknowledged, but never get known, it cannot be even nearly known." (Translated by M. U.)

[11] "Therefore, the absolute infinite series of numbers seems to me in a certain sense an adequate symbol of the Absolute." (Translated by M. U.)

[12] John Barrow calls our attention to the vicinity of Cantor's conception of the Absolute with Anselm's conception of God when he says: "Thus Cantor seems to think of Absolute Infinity in the way that Archbishop Anselm thought of God in his famous 'ontological' proof of the existence of God, as being that above which no greater could be conceived" (Barrow, 2005: 89).

[13] Cantor wrote to Russell on September 19, 1911, *inter alia*, these harsh words: "… and I am *quite an adversary of Old Kant*, who, in my eyes has done much harm and mischief to philosophy, even to mankind; as you easily see by the most perverted development of metaphysics in Germany in all that followed him, as in Fichte, Schelling, Hegel, Herbart, Schopenhauer, Hartmann, Nietzsche, etc. etc. on to this very day. I never could understand that and why such reasonable and ennobled people as the Italians, the English and the French are, could follow that yonder *sophistical philistine*, who was *so bad a mathematician*." (I am indebted for this quotation to Jari Palomäki on the 14th Congress of Logic, Methodology and Philosophy of Science, in Nancy, France, 2011.) Here I can just add that mathematicians and philosophers often fail to find a common language and mutual understanding, even in cases when their thoughts deeply converge.

is, according to Kant, meaningless to ask about the "whole" of space and time, i.e., about whether this "whole" is finite or infinite. In Chapter 7 of the cosmological antithetic under the title "Critical Solution of the Cosmological Problem" Kant says:

> If one regards the two propositions, 'The world is infinite in magnitude,' 'The world is finite in magnitude,' as contradictory opposites, then one assumes that the world (the whole series of appearances) is a thing in itself. For the world remains, even though I may rule out the infinite or finite regress in the series of its appearances. But if I take away this presupposition, or rather this transcendental illusion, and deny that it is a thing in itself, then the contradictory conflict of the two assertions is transformed into a merely dialectical conflict, and because the world does not exist at all (independently of the regressive series of my representations), it exists neither as *an in itself infinite* whole nor as *an in itself finite* whole. It is only in the empirical regress of the series of appearances, and by itself it is not to be met with at all. Hence if it is always conditioned, then it is never wholly given, and the world is thus not an unconditioned whole, and thus does not exist as such a whole, either with infinite or with finite magnitude (Kant, *Critique of Pure Reason*, B 532-33, see Kant, 2007: 518).

If the concept of the *whole* or the category of "totality", which is one of the twelve pure concepts of understanding <*Verstand*> in Kant's transcendental analytic, transcends all possible experience – like in assertions concerning the *universe* "as a whole" – then it becomes a *dialectic idea* of pure reason <*Vernunft*>, which does not refer to any objectivity *per se* since an idea cannot constitute any "thing in itself", although it is necessary for understanding as a *regulative* idea (the classics would name its regulative function *télos*, a "goal"), that is as a limit or measure of a whole "series of appearances"; otherwise said, the conceptual, rational understanding of the world of phenomena (in this case of their quantity) needs the "regulative" epistemic "openness" of the whole series. But let us repeat: regarding the *idea of the whole*, we cannot say neither that the world is finite nor that it is infinite. And like by the classics, for Kant it also holds that *completeness* lies only in the *whole*, although it is slipping away from understanding into infinity: "Yet the idea of this completeness still lies in reason, irrespective of the possibility or impossibility of connecting empirical concepts to it adequately" (Kant, *ibid*., B 444, p. 465). Kant's thought that the world does *not* exist as a *thing* in itself, or differently put, that the "world as whole" is not an experienceable whole, nowadays still holds, *if* by world we mean "everything there is": the Universe or Cosmos in the maximal sense. That is, from the point of view of contemporary cosmology the Universe is not only "our universe" – which is yet, according to the standard "big-bang" cosmology, a "relative" whole, it is the largest "thing" *within* our possible experience – but it is the *multiverse* that has today become the transcendent and in principle unreachable *whole* in the Kantian sense. Contemporary scientific cosmology talks much about the multiverse(s), but a critical philosophical thought recognizes in the "whole" of the Multiverse once again the transcendent *Universe*.

To sum up: in this chapter I have tried to show, *first*, that contemporary theories of multiverses transcend not only available physical experience, but tend to slip also beyond all possible human experience, and that is why the Kantian critique of "cosmological ideas" is

still justified and relevant, although many specific elements of Kant's own critique have to be changed, "updated" (due to Non-Euclidean geometries, the theory of relativity, Hubble's discovery of universal red-shifts, etc.); and *secondly*, in respect of a possible (and as it seems also reasonable) use of the conceptual apparatus of mathematical set theory in the analysis of the theories of multiverses, an important epistemo-logical question, analogous with Russell's question to the "naïve" set theory, is raised and has to be answered, namely concerning the infinite *regressus* in these theories. The problem of paradoxes of the presumably "highest" Multiverse (i.e. the "multiverse of all multiverses") has to be solved, at least "in principle" – and in this respect it is worth to call into attention Cantor's belief in the transcendence of the Absolute, which transcends all its "symbolic" manifestations in transfinite numbers. Cantor himself was a Christian believer, a catholic, but his conception of the *ontological* transcendence of the infinite Absolute can be understood also in some different way, for example from the point of view of pantheism: as *epistemological* "transcendence-in-immanence". We may in our context, *per analogiam*, address with Cantor's "lesson" to Russell (and to other "logicists") those contemporary physicists and/or cosmologists who – sometimes too "naively" – advocate multiverses: *beyond* all multiverses, at least in our thoughts, there is still the Universe, the Absolute – which transcends all Tegmark's hierarchy. Without this transcendent "idea" (namely in the Kantian sense) of the ultimate *whole(ness)* no consistent thought about multiverses would be possible, since if we "multiply" our universe in such a way as to place it among a multitude of other universes, i.e., if we introduce the concept of multiverse(s), the question of the ultimate Unity nevertheless remains open – and my answer (following Kant, Cantor and other great minds) is that the "highest" Multiverse is indeed *the Universe*, which cannot be reached by scientific theories, since it reveals itself only *in the spirit*, which is a *living* "reflection" of the universal, immanent cosmic Mind. I will return to this main point (see below, Chapter 7).

4. "Intelligent Design" vs. cosmological Darwinism

In the first chapter of this part of the book I have stated that there are, generally speaking, three main ways to explain the fine-tuning of the universe: 1. the "Final Theory" or "Theory of Everything", 2. the "Anthropic Principle" with the multiverse(s), 3. the "Design Hypothesis", either in the theistic or in the pantheistic sense. As I have already said, my preferred option is some pantheistic, immanent Mind *in* Nature, classically conceived as "Logos *in* Cosmos", which we shall discuss in the following chapters, while the topic of the present chapter is the (in)famous opposition between theists and atheists in contemporary cosmological discussions, which is especially sharp between the adherents of the "Intelligent Design" on the one hand and Neo-Darwinists (also in cosmological matters) on the other.

It seems that the question of fine-tuning with all its related issues comes down to the dilemma: either *teleology* (which presumably implies theology) or the *Anthropic Principle* (which presupposes the multiverse). Is this dilemma really inevitable? – John Leslie pointed out that concerning the Anthropic Principle we are not confronted with an exclusive alternative theism–atheism, but with an "inclusive disjunction" (see the first chapter), and I

agree with him in this point. However, this inclusive disjunction is nevertheless conditioned by some sort of teleological premise, namely, the Anthropic Principle is compatible with theology only in the case *if* it is understood as a *teleological* statement – that is why it was welcomed by some "anthropic' minded theists. But, as we have stressed in the first chapter, the real point and aim of the original Carter's Anthropic Principle was to explain the fine-tuning of our universe *without* teleology. If we presuppose teleology of nature/cosmos, the Anthropic Principle becomes simply redundant. So, after all, the above stated dilemma, only with a rather different accent, remains sharp: either teleology with *theology* or the Anthropic Principle with *many universes*. My preferred option is outside this dilemma, a "third way", namely cosmic teleology (pantheism) without theology (theism) and also without unjustified speculation about multiverses, that is, regardless of God's *possible* existence as well as of the possibility of other universes – but let us say, for the sake of the present discussion, that we are confronted with the above dilemma, if we put it shortly, "*either* theology *or* multiverse", and try to answer which horn of these it would be more rational to hold to.

Probably for most people, not only for those who believe in God as the creator of the universe, except for some scientists and philosophers, it is harder to accept the existence of the multiverse as some kind of cosmic teleology (of course it does not mean that this "common sense" is right). To a certain extent I agree with Richard Swinburne, one of the leading proponents of theism in modern cosmological philosophy, who is very critical against the many-universes hypothesis:

> [B]ut to postulate infinitely many worlds in order to save a preferred interpretation of a formula, which is in no way simpler than the alternative explanation […] seems crazy. Many-worlds interpretation is like an enormous inverted pyramid of theory resting on a vertex of observation. [...] The postulation of the actual existence of an infinite number of worlds, between them exhausting all the logical possibilities […] is to postulate complexity and non-prearranged coincidence of infinite dimensions beyond rational belief. […] The existence of God is much more likely on the evidence of our life-producing world than the existence of 'many worlds' (Swinburne, 1998: 178).

Yes, perhaps he is right, but God's existence is more "evident" than the existence of the multiverse primarily for those who already *believe* in God as the Person who created the universe with his transcendent Mind and Will. It is difficult to weigh the evidence for both existences with the same scale. For those people who are convinced that atheism is true, and among scientists atheists are in a majority, the "God's Hypothesis" cannot be taken even into consideration for scientific issues, so atheists, confronted with the enigmatical fact of the cosmological "fine-tuning", do not hesitate very much to accept the multiverse if it is required for the "natural" explanation via the "observational selection effect", expressed by the Anthropic Principle. The other lure of this approach for atheists is its similarity with Darwin's "natural selection", which has explained so successfully the evolution of biological species. It is interesting to note that nowadays, when the Roman Catholic Church has practically accepted Darwinism in biology, there is still a strong opposition against applying "natural" explanations in cosmology among theologians and/or scientists who declare themselves as Christians. We have to say that the reasons for this distinction between biology

and cosmology are not only theological or religious, but also quite "neutral", scientific and epistemological, since, as we have already stated, the Darwinist method of explanation is *not* simply transferable to cosmology. This warning is nicely articulated by the renowned astronomer Martin Rees in the following passage:

> Two centuries ago William Paley introduced the famous analogy of the watch and the watchmaker – adducing the eye, the opposable thumb, and so on as evidence of a benign Creator. This line of thought fell from favour, even among most theologians, in post-Darwinian times. But the seemingly biophilic features of basic physics and chemistry cannot be as readily dismissed as the old claims for design in living things. Biological systems evolve in symbiosis with their environments, but the basic laws governing stars and atoms are given, and nothing biological can react back on them to modify them (Rees, 2003: 213).

The cosmological fine-tuning is a different and also a harder epistemological problem than Paley's presumed "design" in pre-Darwinian biology, which has been rightly rejected by Darwin and his followers. We have already mentioned in the first chapter that cosmologists do not have any data or "fossils" from other universes, so they cannot directly compare several putative evolutions of "parallel universes" in the same or similar manner as evolutionary biologists compare species, having not only real fossils at disposal for their investigations, but also many "parallel" living branches of life, "living fossils" included. The same difficulty of applying Darwinism to cosmology is reflected in the above passage of Martin Rees from another, for our context even more important point of view: biological species and such complicated organs as the human eye have evolved *in long periods of time in interaction with their environment*, which is a necessary condition for "natural selection", however, in the case of physical and/or cosmological fine-tuning there is no environment available if the *uni*verse is one and unique, and it seems that already in the first moments of cosmological time the basic physical parameters were simply given in their fine-tuned "biophilic" values. And for those scientists who accept only "natural" explications of phenomena (natural in fact means: within the prevailing scientific paradigm), there is only one and indeed logical step from here to the idea that the "environment" of our universe (i.e. of "our big-bang") is the *multiverse*. This idea was explicitly picked up by two most prominent contemporary Neo-Darwinists in cosmology, Leonard Susskind and Lee Smolin. However, there are considerable differences between their interpretations about what Darwinism means in cosmology, as we shall briefly explain in the following.

I have already presented some cosmological ideas of Leonard Susskind, particularly his concept of the "megaverse", which he explained in his book *The Cosmic Landscape* (2006). The subtitle "String theory and the illusion of intelligent design" shows not only that the basis of Susskind's Cosmic Landscape is string theory (he himself is one of its pioneers), but also announces a sharply polemical attitude towards the proponents of "Intelligent Design". In this respect, Susskind considers himself a follower of Pierre Simon de Laplace by quoting as motto to his book the famous Laplace's answer to Napoleon's question: "Where is God in your System of the World"? – *Je n'ai pas besoin de cette hypothèse* ("I do not need this hypothesis"). For Susskind, the Cosmic Landscape is a huge mathematical space of

possibilities for various physical "designs" of universes, since Calabi-Yau spaces, which serve for the construction of the Landscape, yield ~10^{500} possibilities (and so many "different physics" as well!), but for all these "designs" there is no "Designer", so that our chance to be in a rare "biofriendly universe" is due only to the "observation selection effect", following the Anthropic Principle.

However, between Laplace and Susskind there is an important difference concerning the methodological role of mathematics in physics. Laplace, like the majority of great physicists before and after him (including Newton, Einstein, Heisenberg *et al.*), endeavored to formulate mathematical models of nature which would have a structure as clear as possible, and also much theoretical elegance and uniqueness. Especially Einstein's expected "Final Theory" should be profoundly simple and absolute, expressing the "divine thoughts" – and this ideal is still, at least implicitly, the principal motive for the majority of contemporary theoretical physicists (for instance, for researchers of the "Standard Model" in particle physics). But Susskind abandoned this long striving to find the final and absolute physics. Instead he has found methodological inspiration in biology, and his Cosmic Landscape is more similar to some vast, impassable jungle than to the crystal structure of an ideal "Ultimate System". His vision of future developments in physics is shifted to more open, more "fluent" approaches of "softer sciences" (sure he has many critics in this point). Biology was indeed the "natural choice" for his purpose: it is not too far from physics, but is different in its basic methodology, and probably also more philosophically suitable for a convinced atheist like Susskind. In the first chapter of *The Cosmic Landscape* he provocatively states: "I'll venture an opinion: modern cosmology really began with Darwin and Wallace" (Susskind, 2006: 17), because "[o]nce the magic was removed from the origin of living creatures, the way lay open to a purely scientific explanation of creation" (*ibid*., 18). According to Susskind, cosmology has at last also reached the point, when it can eliminate/remove all "magic" (that is, religion, theology, metaphysics …?) from its theories, and "[t]he only god permitted to cosmologists would be Richard Dawkins's 'blind watchmaker'" (*ibid*.).

Susskind is one of the principal advocates of the Anthropic Cosmological Principle in its original form, especially of the importance of the "observational selection effect" for explaining the *apparent* "fine-tuning". But in spite of this methodological transition from the "natural selection" of biological species to the "anthropic selection" of universes, it is perfectly clear also to Susskind that there are some important scientific differences between biology and cosmology. Two necessary conditions of Darwinist evolution are: 1) small, but long-term genetic mutations, and 2) competition for resources and/or struggle for descendants – however, in Susskind's "megaversum" these two factors are absent, because "there is no competition for resources among pocket universes [following Linde's theory of "eternal inflation" which is adopted by Susskind]", since "resources are so unbounded that there is no need for competition" (Susskind, 2006: 345). This is just another view of the essential difference between Darwinist explanations in biology and "anthropic" explanations in cosmology: the former are *causal* (or "dynamic") explanations which answer *why* and *how* the evolution of complex structures (living beings and their organs) occurs, while the latter are only *epistemological* (actually statistical) explanations which give *reasons*, not causes, for

the "fine-tuning" of our universe. This is of course a serious deficiency of the latter from the scientific point of view, and Lee Smolin tried to overcome it. (An interesting dispute between Susskind and Smolin was published in the web journal *Edge*, 2004.) Let us now consider shortly Smolin's proposal.

Lee Smolin's cosmological and philosophical book *The Life of the Cosmos* (1997) is still, after a decade and a half and while many things have changed in cosmology, up-to-date and interesting, especially from the methodological and epistemological point of view, in spite of some very speculative and disputable hypotheses which appear in his *chef-d'oeuvre*. First we have to note that the title of the book is meant quite literally: Smolin's point is the life *of* the Cosmos, not just the life *in* the cosmos, i.e., the Cosmos *itself* (we could not say himself, since it is also herself) is looked upon as *alive*, that is in a more radical sense than in some well-known philosophies of vitalism in the 20th century (for instance, in Bergson's philosophy of *élan vital*). Smolin regards the Cosmos as the largest living being, of course very different from human beings and other biological species and even from its astronomic parts (stars, galaxies etc.), but still with some analogous features with respect to us, for example, the Cosmos has also seeds which generate "descendants", new "baby universes" *within* it – otherwise said, the Cosmos is Smolin's variant of the multiverse, and our universe (with "our big-bang") sprouted some 14 billion years ago as one of its "buds", which has been separated from its big parent from the moment of birth on. It sounds almost crazy, but Smolin is perfectly conscious that his cosmological model seems very bizarre. His principal aim is the following: in a time of conceptual crisis of cosmology and physics as well (his more recent book is titled *The Trouble with Physics*, 2008), which he sees also in the "anthropic reasoning" and in huge abstract "megaverses" in Susskind's style (Smolin's Cosmos is a relatively modest multiverse of Level I according to Tegmark), he tries to present quite *new ideas* in order to open ways for some future breakthrough, without receding into the old "theology". A very brave attempt indeed, but unfortunately with scanty perspectives, at least in such a form.

What has Smolin's proposal in common with Darwinism? Very much indeed, almost everything, *mutatis mutandis*, of course. His cosmological theory applies Darwinist "natural selection" – in contrast with Susskind – to cosmology directly, at face value (also see Smolin, 2007). He is not satisfied with the statistically conceived "observational selection effect", since "[t]o argue this way is not to reason, it is simply to give up looking for a rational explanation. Had this kind of reasoning been applied to biology, the principle of natural selection would never have been found" (Smolin, 1997: 45). Science has to find (1) "a *physical mechanism* which converts the improbable to the probable, i.e. that raises the probability that a universe such as ours was chosen from infinitesimal to order unity", and (2) "that mechanism must be falsifiable" (Smolin, 2007: 339). Briefly said, Smolin wants to explain the "fine-tuning" *causally* (he says "dynamically"), also by the "self-organization" of nature, not just statistically. In his story, the Darwinian role of biological species (and/or individual living beings) is played by *universes*, "buds" of the great cosmic "Tree of Life", universes which "compete" in their "natural environment", i.e. in the multiverse, become parents themselves, and so on. As a part of a concrete physical mechanism for the generation of "baby universes" the role of cosmic "seeds" is proposed to be played by *black holes*,

which are supposed to be physical entrances into new universes (this statement is unfortunately beyond all actual physical knowledge). Universes which have more black holes – like presumably our universe – are more fitted to survive than those with few black holes, just analogous to the "survival of the fittest" in the biological natural selection. And what is the connection between black holes and us, observers? We must not forget what this story is meant for (*inter alia*): for explaining the "fine-tuning" of our universe for the generation of us, conscious observers. So the "middle term" of the connection between black holes and observers are the supernova stars, because they form black holes (at least some of them), and on the other hand their explosions scatter into space all heavier elements which constitute our bodies. This connection sounds quite logical, however, the most vulnerable point of Smolin's theory is just the "black hole hypothesis" (Susskind objects that our universe is alive just because it has only *few* black holes), and to make things worse, Smolin himself has proposed some ways to test his theory empirically, because as a good scientist he believes that every sensible scientific theory has to be at least falsifiable (in Popper's sense), but facts, at least for the moment, do not speak in his favor. Nevertheless, from the philosophical point of view this theory remains interesting, because it is in some sense a *reductio ad absurdum* of the proposed transfer of the Darwinist theory of evolution from biology into cosmology. Smolin, with his radical position and his high scientific standards, which unfortunately his own theory does not fulfill, willy-nilly "clears" the ground for more plausible options. And we may ask, before going on to the "other party", to the defenders of the "Intelligent Design", whether Smolin's Darwinian Cosmos is the last (not historically) effort to explain the "Goldilock's Enigma" – as Paul Davies has named the "mystery" of our fine-tuned universe – without any kind of teleology?

From the philosophical point of view, we can, of course, consider as relevant and rational also the theistic "Design Hypothesis" for the explanation of the fine-tuning of the universe. In some respects (Ockham's razor) it is probably even more rational than the "Multiverse Hypothesis", as Richard Swinburne pointed out in the passage quoted above. However, for a no-theist like me it is difficult to ignore the strong impression that *for theists the answer is given before its question is put*. Their arguments, as much rational as they might be, cannot really persuade anybody who does not already believe in God the creator of the universe.[14] – A good example for this point is Swinburne's "Bayesian argument" for the existence of the "Intelligent Design" (and, consequently, God the creator) in his book *The Existence of God* (1979); the chapter from this book which is relevant for our context is reprinted in the already quoted collection of essays *Modern Cosmology & Philosophy* (ed. John Leslie). Swinburne presents the "Design Argument" in the following Bayesian form (see Swinburne, 1998: 161):

$$\Pr(H/O{\cdot}K) > \Pr(H/K) \text{ iff } \Pr(O/H{\cdot}K) > \Pr(O/K).$$

[14] In general, I am quite skeptical concerning the possibility that anyone could "find faith" in a rational way, for example, by being persuaded with Anselm's "ontological argument" for God's existence or with Pascal's rational "wager". I am more inclined to think that the famous Augustine's dictum *Crede, ut intelligas* ("You have to believe, in order to understand") is justified – at least for those who do believe.

The signs in this formula mean, i.e., have to be interpreted as: Pr = probability of … given (/) …, sign '·' means product, sign '>' bigger than, *H* = hypothesis of God's Design, *O* = observation (evidence) of "fine-tuning", *K* = background knowledge (that is, laws of physics which govern our universe, but do not necessarily yield intelligent life, an "observer") – so that this Bayesian proposition means: "*O* confirms *H* in the sense of 'raises the probability of *H*' above what it would be on mere background knowledge *K*." If we consider *K* as a "constant", we may simplify the formula by dropping the "background":

$$\Pr(H/O) > \Pr(H) \text{ iff } \Pr(O/H) > \Pr(O).$$

And the latter formula follows directly from Bayes' Theorem:

$$\Pr(H/O) = \{\Pr(O/H) \cdot \Pr(H)\} \div \Pr(O).$$

Pr(*H*) and Pr(*H*/*O*) are prior and posterior probability of *H* (given *O*), respectively; Pr(*O*) is probability of *O*, given the laws of nature (background knowledge); Pr(*O*/*H*) is the likelihood of *H*, given *O*; sign '·' means product, sign '÷' division. Right, but the main problem with this argument is how to determine the value of the "prior probability" of the hypothesis in question. This critical point was very well and in a "sober-minded" way expressed by Elliott Sober: in the case of the cosmological "Design Argument" Bayes' theorem has to be used as a form of the *likelihood* principle, which does not confirm the high *objective* probability of *H* ("Design Hypothesis"), but only raises the degree of *subjective* prior beliefs. Sober thinks that the best (the most correct) version of the design argument is formulated as the following likelihood principle:

> Observation *O* supports hypothesis H_1 more than it supports hypothesis H_2
> iff $\Pr(O/H_1) > \Pr(O/H_2)$. (Sober, 2003: 29).

The likelihood of *H* is defined as the degree to which *H* predicts the data, i.e. observation (evidence) *O*. To say that *H* has a high likelihood, given *O*, is to comment on the value of Pr(*O*/*H*), not of Pr(*H*/*O*). (It is perfectly possible for *H* to have a high likelihood and a low posterior probability.) The likelihood and probability of *H* are related by Bayes' Theorem. If we consider Pr(*O*), i.e., if there is given only background knowledge (as a constant), we can deduce from Bayes' Theorem:

$$\Pr(H_1/O) > \Pr(H_2/O) \text{ iff } \Pr(O/H_1) \cdot \Pr(H_1) > \Pr(O/H_2) \cdot \Pr(H_2).$$

Sober comments: "Which hypothesis has the higher posterior probability depends on how their likelihoods are related, but also on how their prior probabilities are related. This explains why the likelihood version of the design argument does not show that Design is more probable than Chance" (Sober 2003: 30). The main problem with Bayesian arguments for the Design is obvious: "I see no way to understand the idea that the two hypotheses have *objective* prior probabilities. […] However, those who have prior degrees of belief in H_1 and H_2 may use the likelihood version of the design argument to update their subjective probabilities" (*ibid.*). And Sober concludes: "In summary, likelihood arguments have rather modest pretensions" (*ibid.*, 31). I quite agree with him on this point.

William A. Dembski, a mathematician, theologian, and famous (for atheists infamous) American "creationist", the most fervent advocate of the "Intelligent Design" and opponent

of Darwinism in biology as well as in cosmology, is like Swinburne, albeit less self-critically, convinced that the Design and consequently God's existence can be in have to be demonstrated quite rationally, in a logical, even mathematical way. In our context we limit this discussion of Dembski's ideas mainly to cosmological issues, although he thinks that biology and cosmology are closely related in God's Design – similarly as do think his opponents, among which the most famous (for believers infamous) is Richard Dawkins, but of course in the opposite sense, without the Design – in spite of the important epistemological differences between biological and cosmological domains which we have already pointed out. Anyway, we have to admit that Dembski's criticism of the atheistic "Multiverse Hypothesis" is intelligent. He calls this hypothesis an "inflationary fallacy" and says: "It is illegitimate to take an event [i.e., fine-tuning], decide for whatever reason that it must be due to chance, and then propose numerous probabilistic resources because otherwise chance would be implausible. I call this the *inflationary fallacy*" (Dembski, 2003: 256). Then Dembski states four main contemporary "inflatons": 1. Alan Guth's inflationary cosmology, 2. Hugh Everett's interpretation of quantum mechanics, 3. Lee Smolin's cosmological natural selection of self-reproducing black holes, 4. the possible worlds of David Lewis's extreme modal realist metaphysics (see *ibid*., 257–260). Dembski, in his principal book *Intelligent Design* (1999), connects the argumentation for the "Intelligent Design" with the theory of information: on the basis of Shannon's criterion of informational capacity and Kolmogorov's definition of algorithmic complexity Dembski formulates his "complexity-specification criterion", which is supposed to be an objective, quite formal test for identifying some intelligent design, "a rigorous criterion for distinguishing intelligently caused objects from unintelligently caused ones" (Dembski, 1999: 127). In this respect, Dembski refers to some scientific disciplines which already use similar criterions, for instance cryptography, then the project SETI ("Search for Extraterrestrial Intelligence") etc. Following Dembski, it is not enough for a signal to be just regular in order to be intelligent, it must not be a consequence of some natural law, for example of the rotation of pulsars, which send only apparently meaningful patterns of radio waves, and it is also not enough if the patterns have a high informational complexity in Kolmogorov's sense, but they have to be "specific", as they would be for instance if we got from the outer space a signal in which we recognized a well-ordered series of more than thousand initial prime numbers – in such a case the origin of this signal would be very likely an intelligent entity. This approach is in itself scientifically correct and promising, however, troubles arise when we apply this criterion of intelligence to the whole universe, i.e., when it becomes an argument for God, its creator. More precisely, specificity in Dembski's sense could be best recognized just in living beings, for it is hard to decide if some lifeless, even very large molecule is informationally "specific" or not, while the specificity of a living cell, let alone of some living being which contains millions of cells, is quite obvious – however, for the organization of living beings a good alternative explanation exists: the Darwinist evolution. And also from the cosmological point of view, Dembski's "specificity" does not help a lot since it cannot differentiate between the fine-tuning of the universe (for us, observers) and many other possibilities which are, from the informational aspect, very specific as well. While concerning Dembski's conviction that "[t]he Christian doctrine of creation is consonant with the Big Bang and can justifiably be

regarded a better explanation of the Big Bang than its naturalistic competitors" (*ibid*., 205), this point has no relevant connection with his "complexity-specification criterion".[15] The main target of Dembski's mathematical-informational theology is still Darwinist biology, as is evident from his introduction to *Intelligent Design*:

> Although design remains an important issue in cosmology, the focus of the intelligent design movement is on biology. That's where the action is. It was Darwin's expulsion of design from biology that made possible the triumph of naturalism in Western culture. So, too, it will be intelligent design's reinstatement of design within biology that will be the undoing of naturalism in Western culture (Dembski, 1999: 14).

From this and similar passages it is obvious that Dembski's "science" is actually an ideology with specific (i.e. Christian) aims – and it would remain ideological also in the case if science indeed turned to some new paradigm, that is, transcended the "naturalism" of the Galilean Paradigm which has been its general way of thinking for the last four centuries. Dembski considers naturalism, which he defines as "the view that nature is fundamental and self-sufficient" (*ibid*., 17), as his ideological enemy, against whom he tries to raise almost an ideological "crusade", and he wants to set up a "movement" against this evil which has prevailed in the Western culture etc. This is neither science nor philosophy, not even a fair theology, but just a prejudiced ideology.

In the ideological sense, Dembski is actually more fervent than his older fellow Michael Behe, a biologist and biochemist, who wrote the much debated book *Darwin's Black Box: The Biochemical Challenge to Evolution* (1996). Dembski, from his side, of course explicitly supports Behe's searching of "irreducible complexity", which is his main argument for the existence of some intelligent design in biology. Behe defines as irreducibly complex "a single system which is composed of several well-matched, interacting parts that contribute to the basic function, and where the removal of any one of the parts causes the system to effectively cease functioning" (Behe, 1996: 39, quoted from Behe, 2003: 279). The anti-Darwinian point is that, following Darwinist natural selection, evolutionary mutations have always arisen from some previous functional state which they modify – however, Behe thinks that this is not possible in cases of irreducible complexity, because such systems simply do not have "previous states", since they are either functional or not, *tertium non datur*. Of course the question remains open whether such completely irreducible systems exist at all. Among Behe's principal proofs we do not find Paley's eye any more, but he rather refers to *flagellum*, which is "quite literally an outboard motor that some bacteria use to swim" (*ibid*., 280), and his point is that: "Either the flagellum doesn't work, or it doesn't even get constructed in the cell. Like a mousetrap, the flagellum is irreducibly complex" (*ibid*.). Well, we can doubt, of course, if a mousetrap is indeed irreducibly complex since it is put together from several parts which could be functional themselves, although for some other purposes. Anyway, let us leave the question of *flagellum* to biologists (they are mostly very skeptical

[15] It is interesting to note that George Lemaître, one of the fathers of the Big-Bang hypothesis (he spoke about the universal "primordial atom" in the 1920s), who was a priest as well as a physicist, expressed much more skeptical views concerning the possibility that we can reach with physical equations a realm "beyond physics" (see Steinhardt & Turok, 2007: 175).

concerning Behe's theory), while for a philosopher like me who endeavors to reflect relations among science, philosophy of nature and also theology Behe's methodological point is more relevant when he says that his principal motive is not to develop some "natural theology" as Paley tried in his days, but to argue only for "a minimalistic argument for design itself" (*ibid*., 277), while not to define the identity of the designer himself:

> Thus, while I argue for design, the question of the identity of the designer is left open. Possible candidates for the role of designer include: the God of Christianity; an angel – fallen or not; Plato's demiurge; some mystical new-age force; space aliens from Alpha Centauri; time travelers; or some utterly unknown intelligent being. Of course, some of these possibilities may seem more plausible than others based on information from fields other than science. Nonetheless, as regards the identity of the designer, modern Intelligent Design theory happily echoes Isaac Newton's phrase, *hypotheses non fingo* (Behe, 2003: 277).

Does it indeed? We can say that this passage is quite open-minded, although the "God of Christianity" is put in the first place among "possible candidates" for the designer, as it is also to be expected from the side of a good Christian, and although it is not clear what is meant by "information from fields other than science". Which fields? Does religion give "information"? Moreover, if the question of the identity of the designer is really open, we may ask why should we not consider among the candidates also some *immanent* design(er), the Neo-Platonic Logos *in* Cosmos, or Spinoza's *Deus sive natura*? (Actually, we shall try to consider this kind of option in our next chapters.) And last but not least, from Behe's amusing enumeration of possible designers we cannot infer that his project is really so minimalistic from the philosophical and/or theological point of view as he wants to believe. John Leslie wisely remarked: "It is bizarre to suppose that the Design Argument could be an aid to Christianity, only if it itself said things about Christ" (Leslie 1989: 164). But in the latter case, it would be part of theology or revelation, not a (meta)scientific or philosophical statement. Leslie adds: "Equally bizarre is the widespread opinion that it [Design Argument] could be an aid only to someone already believing in Christ" (*ibid*.). Yes, because *if* this argument *were* right, it would be important not only for Christians, but also for other theists and finally for atheists as well.

Richard Dawkins, a fervent "believer in atheism", ironically labels such kind of theories as Behe's or Dembski's – "theology of the gaps", i.e., of yet unexplained gaps in natural evolution. In the chapter "The worship of gaps" of his (in)famous book *The God Delusion* Dawkins says that "[g]aps, by default in the mind of the creationist, are filled by God" (Dawkins, 2006: 128). He and other advocates of the neo-Darwinist methodology in science (the "naturalists", as Dembski names them) are yet right in some of their points, at least they certainly make us philosophers have a deeper think about the thesis that the methodology of scientific knowledge should be unified as far as possible – that is, since the Darwinist method of thinking and explaining phenomena is so successful in biology, we may expect that it will be successful also in cosmology (for example, in Lee Smolin's manner), as well as in other sciences. This expectation, even in the form of an essential methodological maxim, has been articulated well by Paul Oppenheim and Hilary Putnam, who in the article

"Unity of Science as a Working Hypothesis" state that we usually understand the unity of scientific method as the statement "[t]hat all the empirical sciences employ the same standards of explanation, of significance, of evidence, etc." (Oppenheim & Putnam, 1958: 5). Right, but how far should these same standards extend? If we can transfer them from biology to cosmology, can we further apply them to psychology, sociology, economy … and maybe even to mathematics (for instance, in the sense of Stephen Wolfram's "cellular automata" in his "New Kind of Science", see Wolfram, 2002)? Things are of course not so simple, not only due to the traditional difference between natural and social sciences, or between empirical and formal ("a priori") sciences, but also because of different levels of "emergence" in the "great chain of being" from the Big-Bang to *homo sapiens*: on higher levels, new "emergent" laws obtain which are not bare consequences or instances ("by-laws") of presumably basic laws on lower levels. And finally, why should we not seek the unity of scientific knowledge and thereby the unity of science itself from "upside down", that is, *from mind to nature*? Such a new approach, inspired by classical "idealistic" philosophy, would not necessarily mean that nature, the universe, comes from or emanates from mind (or even from spirit) – although why should this option be excluded? – but that nature, in spite of its obvious priority in *time*, that is in the universal evolutionary process, could be understood from the *reality of mind*, maybe even more, that the *ontological* substance of nature is (in) mind?

5. New ways of solving the "Goldilocks Enigma"

The question why the universe is "fine tuned", just right for the emergence of complex structures which culminate in life and consciousness (i.e. in us, cosmic observers), was named by Paul Davies the "Goldilocks Enigma" after the well-known tale of the little girl Goldilocks who gets lost in the woods and comes to a hut where three bears live, father, mother and a little bear, and although they are not at home at the moment, the girl finds porridge on the table, as if it would have been prepared just for her, rightly warm, neither too hot nor too cold, so she begins to eat from the smallest of three plates … (Indeed, we all still have deeply in us the childish belief that the world was made just for us, in spite of all scientific evidence against it.) We try to understand this mysterious "fine-tuning", as Davies nicely writes in his book *The Goldilocks Enigma*:

> How has this come about? Somehow the universe has engineered, not just its own awareness, but its own *comprehension*. Mindless, blundering atoms have conspired to make, not just life, not just mind, but *understanding*. The evolving cosmos has spawned beings who are able not merely to watch the show, but to unravel the plot. What is it that enables something as small and delicate and adapted to terrestrial life as the human brain to engage with the totality of the cosmos and the silent mathematical tune to which it dances? (Davies, 2006: 5)

In the previous chapters we have discussed the dilemma between the theistic "Intelligent Design" and the atheistic Darwinian approaches in cosmology, and we have

shown that both horns of this dilemma meet serious objections from the scientific and also philosophical point of view. Is a third-way for the explanation of the "fine-tuning" possible (if we put aside the "Final Theory")? Personally, I believe – together with Paul Davies and other contemporary scientists and/or philosophers, whose ideas will be considered in the following – that a third way is possible (actually not only one, but several ways) if we are prepared to return to some kind of *teleology* of nature and/or cosmos. Davies states that it is unavoidable "for some element of teleology to creep back into cosmology" (*ibid*., 281), either in the form of the "participatory universe" (John A. Wheeler), in which consciousness has a very important, "co-formative" role, or by considering some kind of "cosmic mind", for instance, "that the universe has engineered its own self-awareness, through quantum backward-causation or some other physical mechanism yet to be discovered" (*ibid*., 283). Of course, here we have to be careful: the new teleology of nature will be *different* from the ancient Aristotelian teleology, which was overcome with so heavy efforts by Galileo and other founders of modern science, and different also from the traditional Christian theology of God's creation, since for the latter, as we have already remarked, "the answer is given before the question is put". The new teleology of nature has to found itself on the subtle "post-Galilean" idea that *télos* is *immanent* in nature as its own "formative principle", otherwise said, that *mind* is *in* nature as its own *télos*: "Logos *in* Cosmos".

When we use the classical term "Logos" in modern cosmological contexts, we mean in the first place the set or system of *laws of nature* (the Greek term "Cosmos" means not only the universal space, but also the universal order); furthermore, the word "Logos" connotes also the *sense of the universe* (again following the Greeks, i.e., independently of the Biblical eschatological sense). In this chapter we will discuss mainly the first of these two meanings of Logos, while in the last chapter we will try to give some ideas concerning the second meaning. – Davies puts in the first chapter of *The Goldilocks Enigma* the following very central question: "Where do the laws of nature come from?" (Davies 2006, 6). For some "hard scientist", this question may sound meaningless, just "philosophical" in the sense that it could be discussed, but never solved. This might be true from the scientific point of view, however, the founders of modern science have presupposed the answer: "Galileo, Newton and their contemporaries regarded the laws as thoughts in the mind of God, and their elegant mathematical form as a manifestation of God's rational plan for the universe" (*ibid*., 7). Einstein also shared this view of laws of nature, although not quite in the theistic sense (see Uršič, 2006), but, as Davies continues: "Few scientists today would describe the laws of nature using such quaint language. Yet the questions remain of what these laws are and why they have the form that they do. If they aren't the product of divine providence, how can they be explained?" (Davies, 2006: 7)

By introducing multiverses into physics and/or cosmology, the question of "nature" of the laws of nature has become even more indispensable and also differentiated: in Tegmark's hierarchy of multiverses the "effective laws of physics" (or "by-laws") vary on Level II, including various values of "natural constants", while on Level IV "other mathematical structures give different fundamental equations of physics" (Tegmark, 2007: 100). However, in order to avoid an infinite regress we have to postulate (at least in principle) some basic, "ultimate" physical and/or mathematical Laws of the Universe (or, if you prefer, for the

whole ensemble of multiverses). These "transcendent" Laws of nature – whatever they are, that we, followers of the "third way", conceive as "transcendence-in-immanence" – form the structure of the cosmic Logos. And concerning their own "language", we can also nowadays repeat the famous Galileo's remark that "the great book of nature can be read only by those who know the language in which it was written; and this language is mathematics" (see Davies, 2006: 9).[16]

However, great philosophical questions remain open: Are these basic mathematical Laws "a priori" in the Kantian sense, i.e., independent of all empirical experience? Are they just epistemologically "transcendental" or are they "transcendent" in the classical Platonic sense, i.e., do they really exist as ideal, eternal Forms? We are inclined to answer positively the latter question, and we can state that also many great mathematicians and/or logicians of modern times, among them Cantor, Frege, Gödel *et al*., as well as some well-known contemporary mathematical physicists, for example, Roger Penrose – are essentially Platonists. But questions like: *where* and *when* Platonic Forms exist, whether they are independent of the whole Universe or not, what kind of ideas they include (only mathematical or also ethical, esthetical etc.) – these questions have to remain open, especially if our domain of research is supposed to be scientific (even in the widest sense), for we simply do not have conclusive arguments and evidence to answer them definitely. I like to suggest to my students that philosophy, which is from its beginning on entitled to discuss the "ultimate questions", is more the *guardian* of such questions than their solver.

Nevertheless, I am sympathetic with the "Platonic Way" of conceiving the Laws of Nature, although here another philosophical question could be raised: Is the Platonic Way consistent with the *immanence* of Logos in Cosmos, especially when applied to modern science? I think that it is, as some kind of *evolutionary pantheism*, based on modern scientific investigations and discoveries. Metaphorically speaking, this means that "the book of nature" is written "by itself", but not just by chance, i.e., not following only statistical laws, as in Darwinist theoretical models, if they are applied to cosmology, but meaning that the book of nature is written "from within", following some mindful pattern, the "cosmic blueprint" (see Davies, 1995). The proposed evolutionary pantheism might be considered, from the philosophical point of view, as a modified classical pantheism, so that Spinoza's *Deus sive natura* develops in the *immanence* of nature. The origins of this conception are also in the dialectical philosophy of nature of Friedrich Schelling, i.e., in the "idealistic" idea that mind (or spirit) and nature are *identical* in the ultimate or highest sense. If we prefer more recent formulations, we can also express the idea of modern evolutionary pantheism with the concept of *emergence* (more about it in the next chapter), provided we do not presuppose that only mind emerges from matter, in the sense that only matter is considered to be basic and primordial as in traditional materialism, but if we assume instead that the development of mind–matter (or, more specific, of mind–body) is mutual, interactive, "dialectical": complex material structures emerge from implicit "cosmic blueprints", they become "explicit" from

[16] Concerning the "almost deistic status" of laws of nature, Paul Davies remarks: "Modern scientists are mostly not religious, yet they still accept that an intelligible script underlies the workings of nature, for to believe otherwise would undermine the very motivation for doing research, which is to uncover something meaningful about the world that we don't already know" (Davies, 2006: 5).

some underlying Platonic Forms, patterns of the cosmic mind *in* nature – and *vice versa*, in this long-term process the conscious mind finally emerges from natural evolution in human beings, observers of the universe.[17]

From the scientific point of view, the "cosmic blueprint" (or "mind in nature" or "Logos in Cosmos") would be only a nice speculative philosophical idea if it were not supported with scientific arguments, or at least offered some proposals for investigation, for example how it could work in practice, from cosmology to biology and other sciences. So, if we want to argue for the "third way", we have to specify more closely which are its most important scientific and also philosophical features. We shall briefly survey three of them: 1. holism, 2. complexity, 3. self-organization.

5.1. Holism and its implications

Holism is an idea as ancient as philosophy itself, and it was present through all history of human thought as one of the major philosophical maxims; we may even say that with holism philosophy "stands and falls", at least classical philosophy. The word itself is derived from Greek: *tò hólon* means "the whole", i.e. the universe, "all that is"; the ancient concept of the wholeness of everything that exists is best and shortest expressed by Heraclitus' phrase *hen pánta*, "one–all", in the famous fragment: "Listening not to me but to the Logos, it is wise to acknowledge that all things are one." (DK 22, B50, see Heraclitus, 1994: fragment 118). This phrase implies that "one is all" and, *vice versa*, that "all is one"; the latter can be understood also in the sense that the one, *the whole is present in all*, namely in every single being in the universe. This spiritual intuition was poetically expressed by William Blake in his *Auguries of Innocence*:

> *To find a World in a grain of sand*
> *And a Heaven in a wild flower,*
> *Hold Infinity in the palm of your hand*
> *And Eternity in an hour.*

From the philosophical point of view, we may add that the whole, conceived in this sense, is *more* than the sum of its parts, but it is present in all its parts, since they are always *more* than themselves, taken individually and separately. – On the other hand, in the development of modern science the idea of holism has been transformed into a related, yet not equal idea of unity and/or consistency (of a system, of a theoretical description of the world). The great success of modern science, particularly in physics, following the "Galilean Paradigm", is also due to one of its basic (albeit usually implicit) tenets, which is contrary to classical holism: it is *not* the case that the whole is more than the sum of its parts, and if we know by analysis all parts of some phenomenon, then *eo ipso* we know it as a whole. In the strongest version this tenet is known as reductionism, which is the opposite of holism in

[17] A similar idea was expressed already by Nicholas Cusanus (15th century) in an old metaphysical and/or theological form: the universe is *explicatio* of the primordial *implicatio* (or *complicatio*) of God's Mind (see Uršič, 1998).

recent discussions (see, for instance, the seminal book concerning this opposition: Hofstadter & Dennett, *Mind's I*, 1981).

In the 20th century, the idea that scientific holism might be yet the right way of thinking, re-entered into the "hardest" natural science, into physics. This revival of holism, which has, of course, also many adversaries, is due, generally speaking, to two main factors: 1) discoveries in quantum physics which show "complementarity", "non-locality", "entanglement" of quantum phenomena; 2) discovery of the "hologram" (Dennis Gabor, 1971), and later formulation of the "Holographic Principle" (Gerard't Hooft, 1993), which stimulated the research of the entropy of black holes (Stephen Hawking & Jacob Beckenstein, 2003 and later). The principal feature of Gabor's discovery of holography is the possibility of storing all information of some three-dimensional object on a two-dimensional surface, for example, on film; by retrieving this information from the 2D-surface we get back the image of the 3D-object; in this "reduction" of 3D to 2D and back it is not a bare coincidence that wave interference is used for this purpose, i.e., a process which requires the fourth dimension of space-time – *time* (so, in a sense, we might say, that the third special dimension is "substituted" by the temporal dimension). Hooft's "Holographic Principle" expresses the generalization of this possibility: for the complete physical description of some 3D-structure there is always some isomorphic theory available, whose objects are 2D-structures. Hawking & Beckenstein have applied this principle to black holes: the entropy of a black hole, which is by Shannon's definition the measure of its informational capacity, is equivalent to its surface, i.e. to the area of its "event horizon" (see Hawking, 2001 and Beckenstein, 2003). This relation between surface and volume can be philosophically interpreted in two different, indeed opposite ways: either as an argument that only surfaces are "real" (following, for instance, Gilles Deleuze), or the other way round, that is, that we see just surfaces, including 3D-space as a "surface", which store information about "higher dimensions" (Platonist view). But we will not enter into this discussion here since in our present context the main point concerning modern physical holography is the scientific recognition that some part of an object implicitly contains the whole of it, and if we generalize this possibility, we *might* say that *the whole of the universe is implicitly present in every part of it*. If this is true, then the "Goldilocks Enigma" is simply resolved, at least in principle: there is no enigma, since there is no "fine-tuning" *in advance*, provided the future is implicitly present in the past, and if both "distant times" are *present* just now, in the present time, as in T. S. Eliot's initial verses in *Four Quartets* (see Eliot, 1969: 171) –

> *Time present and time past*
> *are both perhaps present in time future*
> *and time future contained in time past.*
> *If all time is eternally present*
> *all time is unredeemable.*

– then, by this "ever-presence" of all times, the "subtle teleology" of the universe hidden "on the surface" becomes intelligible. Yet, this solution re-opens the philosophical question of determinism: Is the future determined already in the past, that is, "all-the-time"? I think that

at this point the crucial question is the following: For *whom* all is (presumably) determined – not for our human consciousness, I guess.

If we take holism seriously from the scientific point of view, it implies the possibility of two kinds of physical interactions which were considered very improbable or even impossible in classical "reductionist" physics: "downward causation" and/or "backward causation" (or "retro-causation"). First let us consider *downward causation*, which was named by psychologist Donald Campbell as the action of higher levels (of complexity and/or wholeness) on lower levels, for example, of psychological structures on biological and physical structures. From the phenomenological standpoint, the most obvious type of downward causation is executed by the actions of our (supposed) free will; this issue is much discussed in contemporary cognitive philosophy and science, but here, in this mainly cosmological context, I will put this difficult problem aside. The relevant question here is whether downward causation obtains in the physical domain itself. "It is essential that the lower level laws are not in themselves so restrictive as to fix everything," says Paul Davies in his book *The Cosmic Blueprint* (Davies, 1995: 143). On the other hand, restrictions are also fixed from higher to lower levels: "Karl Popper has pointed out that many of the devices of modern optics – lasers, diffraction gratings, holograms – are large-scale complex structures which constrain the motions of individual photons to conform with a coherent pattern of activity" (*ibid*., 149). Beside that, quantum measurement is a good candidate for the actuality of downward causation as well (see *ibid*., 174). However, in order to solve the "Goldilocks Enigma" on the cosmological, universal level, these specific and "local" cases of downward causation are not enough; for this purpose we should demonstrate that the cosmic "whole", i.e. universal *mind* or Logos or the ensemble of the Laws of Nature, affects lower levels of physical reality, that is, specific "by-laws", the choice of "natural constants" or "free parameters" etc. – and this is indeed very hard to prove without some "Final Theory" which would express the highest "divine thoughts", as Einstein dreamed. Nevertheless, some important steps in overcoming the reductionism of classical science have already been made, especially in quantum mechanics, where also some cases of the other "holistic" interaction, that is, of a possible *backward causation*, have been detected. The latter is a special case of downward causation, with an additional request that the causal relation is *reversible in time*, i.e., that "bringing about the past", as almost half a century ago Michael Dummett dubbed this queer type of causation (see Dummett, 1964), is actually possible. The reversibility of physical processes in time has not yet been observed in the "macroscopic" world, and even if it were indeed possible to influence past events, this would lead to logical paradoxes; however, in the quantum world, some indications of backward causation have been found, especially in Wheeler's "delayed-choice experiment, which involves a type of retro-causation" (Davies, 1995: 174).[18] – From all this it is evident that *time* has an essential role in

[18] Let us just note here that a hypothetical "universal inversion of time" (or, otherwise said, cosmic isotropy of time instead of its actual anisotropy), which is not excluded by the equations of Einstein's theory of relativity, neither by the laws of quantum mechanics – at the utmost by the Second Law of thermodynamics – does not necessarily involve backward causation: for example, Kurt Gödel showed in 1949 that the equations of General Relativity permit (even enable, in principle) "time travels" into the past, but for a time-traveler all causal chains go only forward, as usually, i.e., from his local past to his local future. In this sense we can say

the establishing of holism vs. reductionism. If the "Goldilocks Enigma" is solved, just in principle, by positing holism, then another, maybe even more mysterious enigma emerges: the *enigma of time*. The much disputed question of the "reality of time" is so large and deep that the discussion about it would require another essay, of at least the equal format as the present one. That is why I only mention here one of my small papers on this topic, which is otherwise one of my principal philosophical endeavors, an analysis of McTaggart's paradox under the title "A remark on the 'unreality of time'" (see Uršič, 2000).

But how is holism connected with mind? I think that between mind and the whole (the universe) a very close connection obtains, actually we can say that *mind is the whole*, meaning the mind in identity with nature, which has been posited above as the core of the "third way", of evolutionary pantheism. Mind is not divisible as matter is, at least not in the same way. We cannot say "a piece of mind" or "an atom of mind", this is nonsense. Whereas mental states are divisible into some more elementary units, mind itself is not since it is either present "as a whole" or it is not present at all. This does not mean that mind is some different "substance" next to mental states, neither in its relation to physical states or phenomena. The main point of pantheism is the view that nature (matter, body) and mind are two *different* aspects of the *same* reality (Spinoza called them two attributes of the same substance). – This point has been wisely expressed also by physicist David Bohm, and his thoughts remain wise independently of the issue whether his conception of "the implicate order" in the quantum world withstands or not physical critics. In the collection of essays *Quantum Implications*, which was published as a *Festschrift* in Bohm's honor by his followers, Bohm himself wrote about holism of/in nature, and here we are again reminded of the pre-Renaissance "holist" philosopher Nicholas Cusanus:

> Instead of supposing that extended matter and its movements are fundamental, while enfoldment and unfoldment are explained as a particular case of this, we are saying that the implicate order will have to contain within itself all possible features of the explicate order as potentialities, along with the principles determining which of these features shall become actual. The explicate order will in this way flow out of the implicate order through unfoldment, while in turn it "flows back" through further enfoldment. […] What I want to emphasize is only that the implicate order provided an image, a kind of metaphor, for intuitively understanding the implication of wholeness which is the most important new feature of the quantum theory (Bohm, 1987: 41).

Personally, as a philosopher, I cannot judge if this interpretation of quantum physics obtains or not, I can only say that Bohm's holistic approach in scientific thinking seems to me wise and promising. However, if he were still alive and if I met him somewhere, I would put him an apparently simple, but essentially very hard philosophical question: Why should we seek the reality of mind and consciousness somewhere "outside", in Bohm's case in the deep (sub)quantum "implicate order", when the mind is in spite of all doubt evidently "inside",

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that asymmetry is a property of processes *in* time, not of "time itself", which might be perfectly symmetric, provided time *an-sich* exists at all (see Horwich, 1987).

namely in our own consciousness, in the obvious *cogito ergo sum*? Maybe I can suggest the answer to this question with the presumption that we have to seek the cosmic mind in the smallest phenomena so that we could find it in the largest – and then we return from the smallest and the largest to our *Self*…?

5.2. Chaos and complexity

The modern concept of "chaos" differs quite substantially from the ancient *chaos*, which was, following Hesiod's *Theogony* (8th century B.C.), a primordial state of disorder, from which everything derived in the process of the shaping of *cosmos*, i.e. the well-ordered universe, of course with the help of gods. On the contrary, chaos in the modern sense is not just disorder without any structures, but is a common term for various "non-linear", aperiodic complex states, in which some hidden mathematical and/or physical order lies under the apparent surface disorder. The main three features of chaos are: 1. sensibility for initial conditions, 2. non-linear order, 3. fractal structures. The first was discovered by Henri Poincaré, the precursor of modern theories of chaos, when he tried to solve the "problem of three bodies" (1887), i.e., to answer the question whether the system of three bodies which are bound together by gravitation in otherwise empty space, is dynamically stable (the answer would pave the way to solve the larger problem whether our solar system is stable). Poincaré showed that this problem is unsolvable in principle since we could never know the initial conditions of such a system precisely enough in order to predict its future development with certainty, although it is governed by simple Newtonian deterministic laws. – Ian Stewart, in his well-known book *Does God Play Dice?* (this title is, of course, a paraphrase of the famous Einstein's dictum that "God does not play dice"), with the subtitle "The New Mathematics of Chaos", writes:

> We are beginning to discover that systems obeying immutable and precise laws do not always act in predictable and regular ways. Simple laws may not produce simple behavior. Deterministic laws can produce behavior that appears random. Order can breed his own kind of chaos. The question is not so much *whether* God plays dice, but *how* God plays dice (Stewart, 1997: xii).

In the short epilogue of his book, Stewart wittily concludes: "If God played dice … He'd win" (*ibid*., 383). But as quoted above, the author's point is mainly to show *how* order can create chaos and, *vice versa*, how order can emerge out of chaos. Here we have to note that unpredictability in Poincaré's "deterministic chaos" is not yet uncertainty in the sense of quantum mechanics, and that Einstein's remark was directed against the latter, not the former. However, Stewart considers in one of the last chapters of his book also "the possibility of changing the theoretical framework of quantum mechanics altogether, replacing quantum uncertainty by deterministic chaos, as Einstein would have liked" (*ibid*., 330). His proposal is mathematical, not physical: "It may not be necessary to tinker with quantum mechanics itself: it may be that all we need is a deeper kind of background mathematics that explains why the probabilistic point of view works, much as Einstein's concept of curved space explained

Newtonian gravitation" (*ibid*.). This is an interesting idea, but we have to leave the decision about its actual weight to mathematicians and physicists.

Let us resume our main consideration: the principal point of "deterministic chaos" is that deterministic laws do *not* necessarily imply predictability of phenomena, which are otherwise adequately explained by them. Later, the concept of "deterministic chaos" was developed especially by Edward Lorenz, who introduced the term "strange attractor" (1963) for explaining chaotic phenomena in meteorology (convection of gases and liquids) and elsewhere; the most popular example is the "butterfly effect", i.e., the theoretical possibility that a swing of a butterfly's wings somewhere in the Amazonian jungle causes, in the long, non-linear causal chain, a hurricane in the Gulf of Mexico. – In modern theories of chaos, the term "non-linear" does not have a direct connection with the geometrical line, but it denotes aperiodic complexity. In this sense, a "linear" system is the sum of its parts (such systems are all periodical oscillations, which can be analyzed into Fourier series, even if the number of elements in these series is infinite) whereas a "non-linear", aperiodic system is *not* just the sum of its parts, it is "more" than that. We can see here a close connection of chaos theories with holism. Paul Davies explains: "In a non-linear system the whole is much more then the sum of its parts, and it cannot be reduced or analysed in terms of simple subunits acting together. The resulting properties can often be unexpected, complicated and mathematically intractable" (Davies, 1995: 25). The development of a chaotic, "non-linear" system – as well as of some "linear system" – can be represented in a multi-dimensional "phase space" (or "state space") so that the principal difference between them is directly visible from their graphs: the trajectories of a linear system are periodical and they yield "sharply drawn" graphs in its phase space while the trajectories of a non-linear, chaotic system form "dispersed" graphs, however, they preserve some well-articulated form, determined by "strange attractors" – and just this is essential for the modern concept of "deterministic chaos": *chaos has its own forms*, it is not quite formless as it was conceived by the ancients. Forms of chaos can be very spectacular, and one of the most beautiful among them is the famous Mandelbrot's fractal.

Benoît Mandelbrot began a new epoch in chaos research with his book *The Fractal Geometry of Nature* (1977). His "fractals" – he coined the term from lat. *fractus*, broken – have applied the concept of self-similarity into depth in mathematical "chaotic" structures (fractals are self-similar on all levels of magnitude) and have introduced new "fractal" dimensions of objects, designated with any real numbers, not only with natural numbers as before, but opened also some new and important physical and/or philosophical questions: What is the relation between fractal geometry and nature? Could the universe be ordered as a giant fractal? etc. And also the following question is raised, which is especially relevant for our context: How come that such infinite complexity as reveals itself in Mandelbrot's fractals emerges from a simple algorithm, written by the short formula $z \rightarrow z^2 + c$, where z and c are just two "complex numbers" (i.e., numbers with two components: $z = x + iy$), and the arrow denotes the iterative application of the same formula?[19] Davies called the Mandelbrot set "the most complex thing known to man" (Davies, 1995: 62) – this is maybe an exaggeration,

[19] For a more detailed explanation see, for example: Penrose 1990: 120 ff., or: Stewart 1997: 222 ff.

unless the word "known" is meant at its face value, that is, known in its whole construction, to the tiniest details, and although the universe or just a flower, which are probably more complex than Mandebrot's fractal, are not known in this sense, however, Davies's main point is clear and similar to that we have said above: "The exceedingly simple mathematical prescription for generating the Mandelbrot set is evidently the source of an infinitely rich catalogue of forms" (*ibid*., 63), and *this* is very interesting and instructive also from the philosophical and even theological point of view. The atheist argumentation (also used by Richard Dawkins) that the supposed creator should be at least as complex as his creation simply does not hold. The "Creative Formula", i.e. the Natural Laws or the Cosmic Logos, could be some simple structure (however, probably not so simple as in Douglas Adams' famous science-fiction novel *Hitchhiker's Guide to the Galaxy*, where the Formula is "42"), but there is another necessary condition for this "Cosmic Blueprint": it should be "deductively" universal, like some complete axiomatic system (for a specific theory), or, more generally, like a universal Turing machine (concerning this issue, also see: Wolfram, 2002), so that it implicitly involves all its consequences, which require time for becoming explicit, but never in a finite period of time all of them manage to do so. But the most important point here is that the Formula cannot be just any well-formed formula, no, since it has to be quite special, "fine tuned", and its fine-tuning is again to be explained, so let us repeat the main possible ways of its explanation: 1) the Formula might be the result of bare chance, but this implies the existence of the multiverse before the Formula (infinite regress?); 2) it might be chosen by some omniscient Subject, but this implies theism (the answer before the question?); 3) if we follow a third way, the Formula which generates universal complexity is "holistically" identical with its own consequences, as by Cusanus *implicatio* and *explicatio* "coincide" in the Absolute. Of course, the simple Mandelbrot's formula $z \rightarrow z^2 + c$ is not the Formula of the Universe, however, it is a good *metaphor* for it. This formula is in some important sense unique, for there are many other similar formulas which do not generate complex structures, although some of them also do, as Roger Penrose states:

> Many other iterated complex mappings (e.g. $z \rightarrow z^3 + iz^2 + c$) will give extraordinary similar structures (provided that we choose an appropriate number to start with – perhaps not 0, but a number whose value is characterized by a clear mathematical rule for each appropriate choice of mapping). There is, indeed, a kind of universal or absolute character to these 'Mandelbrot' structures, with regard to iterated complex maps (Penrose, 1990: 123).

Fractals and other "non-linear" structures are specific cases of complexity, and generally speaking, we can say that theories of chaos have been incorporated into theories of complexity, although neither the former nor the latter are sharply delimited since there are several definitions of "chaotic" systems on the one hand and of complex systems on the other hand. Theories of complexity are related to concepts of holism, self-organization and emergence, and thus they are very relevant for our main topic, the searching of a "third way" in modern cosmology. – Warren Weaver (1948) defined the *complexity of a system as the degree of difficulty in predicting its properties, if the properties of its parts are given*. Weaver's complexity is conceived from the epistemological aspect of holism, but in this

approach it is not quite clear why such systems which *could* be reductively analyzed into all their elements, and are therefore not strictly holistic (like, for instance, the game of chess), are not considered as complex systems, although they are evidently complex from the intuitive standpoint. Weaver also distinguished "organized" from "unorganized" complexity, meaning that only the former is complexity in the proper sense, whereas the state of a system which has maximal unorganized complexity is random (as, for example, the moving of gas molecules in some container).

The concept of organized complexity is connected with system theory: the complexity of a system depends on the *number and variety* of its elements as well as relations among them. However, the estimation of this variety might be quite subjective and context-dependent. In order to make the definition of complexity more general and formally precise, three mathematicians (Ray Solomonoff, 1960; Andrej N. Kolmogorov, 1965; Gregory Chaitin, 1965) independently defined complexity as the "algorithmic information content" – although this idea is usually attributed to Kolmogorov. The *Kolmogorov complexity* of a system (or of some other structure, most generally of some set of informational units: bits, digits, signs, words etc.) is determined as *the length of the shortest algorithm, which can completely describe this system* (or structure, or set). A set of information is maximally complex if the length of the algorithm, which describes it completely, is equal to the set itself, i.e., if no item in the set is redundant (or, put more simply, if no abbreviation is possible without loss of contents). This is probably the most general and exact mathematical definition of complexity, but from the epistemological point of view it has two serious deficiencies: 1) Kolmogorov's complexity criterion is not "sensible" to the amount of *regularities* in a system, on the contrary, every regularity is considered as a simplification, capable of algorithmic "abbreviation"; for example, a quite random series of digits is estimated as more complex in comparison with some periodical series, even if the algorithm of periodicity is extremely complicated; otherwise said, Kolmogorov complexity takes into account only the number and variety of individual *elements* of a system, but not also the number and variety of *relations* among them. 2) If Kolmogorov's criterion for complexity is applied to systems which develop in *time*, it is confronted with another serious deficiency: time-developing systems could be very complex, though they can be generated from simple algorithms. The best example for this point is again Mandelbrot's fractal set – following Kolmogorov, its complexity would be very low (since the algorithm for describing it is quite simple), but this is obviously *not* true, provided we leave a computer running long enough to draw at least the few initial levels of the very complicated fractal which is generated from the simple iterative formula $z \rightarrow z^2 + c$.

Murray Gell-Mann, the discoverer of quarks, in his popular book *The Quark and the Jaguar* (1994) introduced the concept of *effective complexity* – in order to overcome the epistemological deficiencies of Kolmogorov's "algorithmic information content" (AIC). In his own summary of the book, under the title "What is complexity?", Gell-Mann writes:

> A measure that corresponds much better to what is usually meant by complexity in ordinary conversation, as well as in scientific discourse, refers not to the length of the most concise description of an entity (which is roughly what AIC is), but to the length of a concise description of a set of the entity's regularities. Thus something almost

> entirely random, with practically no regularities, would have effective complexity near zero. So would something completely regular, such as a bit string consisting entirely of zeroes. Effective complexity can be high only a region intermediate between total order and complete disorder (Gell-Mann, 1995).

It is interesting to note that Gell-Mann, by using the phrase "the length of a concise description of a set of the entity's regularities", does not say that this description is the *most* concise (as he can say in the case of AIC, which considers only the algorithmic length of description), because the most concise description of the set of *regularities* simply cannot be defined in a strict formal way: "There can exist no procedure for finding the set of all regularities of an entity. But classes of regularities can be identified …" (*ibid.*). Although this does not mean that we relinquish the idea of AIC, since "[t]he effective complexity of the regularities can then be defined as the AIC of the description of the set of entities and their probabilities" (*ibid.*), however, by such a concept of the "effective complexity", that question which was already formally solved with Kolmogorov complexity, is raised again, as Gell-Mann himself states: "Since it is impossible to find all regularities of an entity, the question arises as to who or what determines the class of regularities to be identified" (*ibid.*) – and we may add: it is usually so with definitions of complex concepts (and complexity is surely one of them) that higher semantic adequacy is paid by lower formal exactness. Nevertheless, this gambit is reasonable, especially if we step down from mathematical theories to physical reality. This point we can also see from the following example: *if* we some day still find a "Final Theory", that is such which could be "written on a T-shirt", then, following just Kolmogorov complexity, the complexity of the universe should be *small*, but this is evidently not the case, at least in our cosmic epoch. But maybe it was small just at the "beginning"? This is of course possible, however, it reopens the question where complexity has come from. As many other physicists, Gell-Mann attributes the "primordial" complexity to quantum uncertainty: "Thus quantum mechanics introduces a great deal of indeterminacy, going far beyond the rather trivial indeterminacy associated with Heisenberg's uncertainty principle" (*ibid.*). In order to define this implicit complexity, which becomes explicit in the passage of (cosmological) time, Gell-Mann proposes another, additional definition of complexity, named *potential complexity*: "Therefore it is important to define a new quantity, 'potential complexity,' as a function of future time, relative to a fixed time, say the present. The new quantity is the effective complexity of the entity at each future time, averaged over the various coarse-grained histories of the universe between the present and that time, weighted according to their probabilities" (*ibid.*). In his concept of potential complexity Gell-Mann gives consideration to the *development from simple to complex structures*. At the end of his interesting essay he remarks that it is far from necessary that our epoch of (self)developing, more and more complex structures will last forever.

We may paraphrase Gell-Mann's effective complexity also by saying that the complexity of a system can be expressed by the degree of probability of its "state vector", and this would imply that complex systems were less probable in some selected "phase space", however, neither in this way can we avoid the difficult task to make precise the particular state vector in question from the *physical* point of view. – Furthermore, we can say that the relations among several levels of complexity, or among several complex scientific

systems (mathematical, physical, chemical, biological, sociological etc.), are themselves complex. Nowadays, the conviction is prevailing among physicists that all chemical complexity is, *in ultima analysi*, reducible to physical complexity, for example, that we could in principle explain with the laws of particle physics every process of crystallization, without paying regard to some "higher level" laws of chemistry. But this is, of course, not the end of the story, since the next question is: How do things stand on higher levels of complexity, especially concerning *biological* complexity? This issue is discussed most fervently, *pro et contra*. On the one hand, the majority of contemporary scientists, among them certainly also physicists, accept the Darwinist theory of evolution with its basic tenet that all the complexity of living organisms (and/or of their organs, the eyes, for example) is due to the "mechanism" of natural selection, i.e., that biological complexity in all its rich and diverse forms has been generated in interaction with the natural environment, where those species and individuals who are better fit have prevailed genetically (by the way, it might be disputed whether we, specimens of *homo sapiens*, are better fit for our natural environment than some bacteria or insect, but it is not a relevant part of the present discussion); on the other hand, there are scientists – we will meet some of them in the next chapter – who think that there is an intermediate zone in the formation of living organisms which is due *both* to evolutionary selection *and* to some "deeper" (and in cosmological time also older) laws, namely to the "underlying" physical (and ultimately mathematical?) laws of nature. It is not necessary that these two sources of form and complexity are mutually exclusive, on the contrary, in principle they have to be compatible and even complementary, "parallel" in their forming of biological complexity *and order*. The idea of some "deeper" or even "parallel" morphogenesis is not very popular among contemporary biologists, the prevailing view is that all forms of life could be explained just by "reduction", i.e., only with the Darwinian natural selection, supported by and supplemented with important achievements of modern genetics and molecular biology – the most extreme among contemporary reductionists in biology is Richard Dawkins. However, as we have already said in some other contexts, the strategy "either–or" (either reductionism or holism) is probably not the best, neither on the biological nor on the physical (or cosmological) level. The next essential issue in our searching for a "third-way" is the *self-organization* of nature in its wholeness, and in its identity with mind. So let us consider shortly some ideas about how natural systems may have organized *them-selves*, following also some *holistic* laws, which eventually "underlie" the actually known "by-laws" of modern science, and thereby we might show that the enigma of being is deeper than it seems to modern reductionists. After all, from the philosophical point of view, the great question remains open: Where do the Laws of Nature come from – such that are just "fine-tuned" for life?

5.3. Self-organization

In the background of the dispute about the relation between biological and physical (including chemical) complexity there is thus not only the physical and/or biological, but also the metaphysical, philosophical question whether some kind of self-organization of living organisms is possible *without* the mechanism of evolutionary natural selection. Are there in

"matter itself" any "tendencies", "dispositions" toward the development into complex structures/systems, also into living and conscious ones? In the domain of "non-living nature" processes of self-formation obviously exist, otherwise it would be inconceivable how structures like galaxies, stars, planets etc. were formed in the macro-cosmos, and atoms, elements and molecules in the micro-cosmos, that is without any physical "natural selection", since the latter starts to operate only in the biosphere. We can consider the relation between the development of the cosmos and biosphere from two different perspectives, which in the extreme turn into opposites: on one hand we can, like Lee Smolin with his hypothesis of "cosmological natural selection", infer from the obvious evolutionary (Darwinist) self-organization of the biosphere that an analogical explanation holds for the development of the "cosmosphere", while on the other hand we can conjecture that "behind" known biological evolutionary processes there are some more basic and yet unknown (or not enough known) physical and/or mathematical laws which "underlie" the whole universe like some transcendent-and-immanent Platonic Forms, and that from these basic Laws also the laws of the biosphere derive, at least partially, including laws which determine the morphogenesis of living organisms.

In the searching of the cosmological "third way" it is one of the central questions whether new scientific discoveries about complexity and self-organization of nature can solve the "Goldilocks Enigma" or at least help to find its solution. I think that the "pantheistic" approach in science could be promising in the long-term, although for now it is still weak in the strictly scientific sense. One of the main strategies of this approach is to connect biological evolution with cosmology, though not simply by extending Darwinism onto cosmology (as Smolin has done), but to connect the biosphere and the "cosmosphere", biology and physics (including chemistry), with the concept of self-organization of nature as a "whole". Paul Davies has written in *The Goldilocks Enigma* the following interesting lines:

> Another possible evolutionary mechanism is self-organization. Many non-living systems evolve complex patterns and organizational structure from featureless beginnings. They do this entirely spontaneously, without variation or selection in the Darwinian sense. For example, snowflakes form distinctive elaborate hexagonal patterns. Nobody suggests that there are genes for a snowflake, but nobody suggests that they are made by an intelligent designer either. They spontaneously self-organize and self-assemble, in accordance with definite mathematical rules and physical laws. Non-Darwinian evolution by self-organization is found in physics, chemistry, astronomy, earth sciences and even in networks such as the World Wide Web. It would be surprising if it didn't happen here and there in biology too, but I may be wrong. Even if I am right, that doesn't mean that Darwinism is disproved, just that it may be only a partial account of the evolutionary mechanism. But the missing bit is not some cosmic magician, it is a natural process complying with some yet to be elucidated principle of organization deriving from physical laws (Davies, 2006: 223–224).

I have quoted this somewhat lengthy fragment because it is typical for Paul Davies in his searching of the "third way". On one hand he does not accept the "Intelligent Design

Hypothesis" in its notorious theological variant, and he particularly rejects it in biology as the suggested "scientific" alternative to Darwinism, saying that "intelligent design in biology is magic, not science" (*ibid*., 222); but on the other hand he rejects also the cosmological inflation of multiverses, particularly if "anthropic reasoning" is taken as a barely statistical approach and if it is combined with the application of Darwinist methodology to cosmology. Davies remarks that "clearly, Darwinism is not an appropriate framework for explaining the appearance of design in cosmology" (*ibid*., 225). For him, the solution of the "Goldilocks Enigma" is given in the development of the primordial "cosmic blueprint", which can also be understood as a *meaning* of the universe, although not in the theistic eschatological sense, but rather in the pantheistic sense, as Davies has pointed out in the concluding lines of his earlier, already mentioned book *The Cosmic Blueprint*:

> The very fact that the universe is creative, and that the laws have permitted complex structures to emerge and develop to the point of consciousness – in other words, that the universe has organized its own self-awareness – is for me powerful evidence that there is 'something going on' behind it all. The impression of design is overwhelming. Science may explain all the processes whereby the universe evolves its own destiny, but that still leaves room for there to be a meaning behind existence (Davies, 1995: 203).

But let us return from these philosophical heights to some important and beautiful details concerning the self-organization of nature. Morphologically we can distinguish, at least in most cases, between the complexity of living beings and of the non-living world. Crystals are a classic and evident example of physical order: in their structure geometrical patterns occur regularly, they are some kind of "platonic bodies" in nature. Physical order is usually much more hidden, complex, non-periodic, "nonlinear", "chaotic", for example in air turbulences or in the rotation of galaxies, but despite this we are able to distinguish from the phenomenological point of view between physical *order* and biological *organization*. Usually we do not attribute self-organization to "non-living" nature, but only to living beings, and that is why we call them *organisms* – but what is the actual dividing line between non-living and living nature? Is there any clear at all? Paul Davies says:

> The mystery of life, then, lies not so much in the nature of the forces that act on the individual molecules that make up an organism, but in how the whole assemblage operates collectively in a coherent and cooperative fashion. Biology will never be reconciled with physics until it is recognized that each new level in the hierarchical organization of matter brings into existence new qualities that are simply irrelevant at the atomistic level (Davies, 1995: 101).

As we have already said, Davies advocates "downward causation", and when he considers morphogenesis as "the mystery of pattern formation", he concludes that for science the "real challenge is to demonstrate how *localized* interactions can exercise *global* control" (*ibid*., 104), for example, how some embryonic cells "know" that they have to become blood cells, other to become kidney cells etc. (*ibid*., 103). Davies thinks that it is impossible to explain all development of organisms with the already known evolutionary mechanisms alone. He speculates that "[a] possible escape is to suppose that somehow the global plan is

stored in the fields themselves, and that the DNA acts as a *receiver* rather than a source of genetic information" (*ibid*., 106). – Stuart A. Kauffman, a well-known theoretical biologist, has developed a similar view, and he has given more argumentation for his conjectures from the biological point of view. When he discusses the unsolved problem of the differentiation of embryonic cells, he stresses that it is not possible to solve it only by means of evolutionary biology, and that "[i]t is, at a minimum, a concrete example of the *possibility* of emergence, non-reducibility, and, as we shall see, the powerful idea that order in biology does not come from natural selection alone but from a poorly understood marriage of self-organization and selection" (Kauffman, 2008: 101). Of course, this does not mean that Kauffman rejects Darwinism, but only that he tries to enhance it with a kind of downward causation or at least with some holistic "formatives", with the self-organization of a whole by influencing its parts. We will return to Stuart A. Kauffman later.

Philip Ball in his beautiful book titled *The Self-Made Tapestry, Pattern Formation in Nature* presents several interesting examples of beings whose complex structure is formed in the "intermediate zone" between physics and biology. He starts with the example of a meteorite from Mars, which with its "fossil" structures supposedly represents a proof for the existence of life on our neighboring planet, at least in some distant past. Ball states that these structures, as far as their origin is concerned, cannot be distinguished from very similar formations that are created by non-living chemical processes. The close relationship of the living and non-living is evident also in the shapes of some viruses, which resemble complex crystals very much, while on the other hand there are some human artifacts, for example rice fields that look very much like natural geological formations when seen from far. "Complex form may not require an organic origin, but similarly geometric form does not exclude it" (Ball, 2004: 4).[20] Ball says that nature itself weaves its "tapestry". A beautiful example of visible physical structures in the biosphere are also radiolaria, sea unicellulars with fantastic variously symmetrical skeletons, which attracted the German zoologist Ernst Haeckel so much that he collected many drawings of them in his great atlas *Art Forms of Nature* (*Kunstformen der Natur*, 1899–1904 (also see Ball, 2004: 40)). On the other end of the intermediate zone there are "mineral dendrites", fractal crystals which could be easily mistaken for living beings, mosses or lichens (*ibid*., 111). In the biosphere, there are many structures, for example the branching of neurons or blood vessels in lungs, or in the vein system of leaves, that are "so tantalizingly similar in many respects to those observed in the inorganic world that for many researchers it is hard to resist drawing some analogy, or even

[20] Erwin Schrödinger in his famous lecture titled *What is Life?* and subtitled "The Physical Aspect of the Living Cell", which he held at Trinity College in Dublin during his exile in 1943 and which was subsequently published in a booklet with the same title, put forward the hypothesis – a decade before the discovery of DNA (James Watson & Francis Crick, 1953) – that genes or maybe chromosomes are "aperiodic crystals", while the physical crystals are periodic. "Organic chemistry, indeed, in investigating more and more complicated molecules, has come very much nearer to that 'aperiodic crystal' which, in my opinion, is the material carrier of life" (Schrödinger, 1992: 5). In this thematically rich lecture Schrödinger deals with several themes and opens many interesting questions, the importance of which was then yet to show during the following decades, for example, he discusses the "negative entropy" of living beings (*ibid*., 70), and in the epilogue titled "On Determinism and Free Will" he reflects on mental causality (as contemporary cognitive science would call this topic). But most of all, Schrödinger stresses the *unity* of consciousness.

suggesting that there must be fundamental similarities between the growth mechanisms" (*ibid*., 130). Nearly a century ago, D'Arcy Wentworth Thompson wrote about the physical foundations of biological morphogenesis in his influential book *On Growth and Form* (1917), and despite the fact that most contemporary biologists are skeptical about Thompson's "physicalism" – because today the possibility of the reduction of biology to physics or even mathematics is discussed almost exclusively on the molecular level (in researches of the structure of genome etc.) – Ball thinks that "there is nevertheless a sense in which geometric imperatives have directed the outcome of nature's processes" (*ibid*., 49). For example, the importance of the "golden section angle" ~137,5° (or of Fibonacci's numbers) for *phyllotaxis*, that is, for the arrangement of leaves around a stalk, has been known for long; of course, such an arrangement has also evolutionary (functional) importance, but such patterns have "a mathematical structure in which we can surely see the fingerprint of some *physical* mechanism at work" (*ibid*., 105). This is even more explicitly stressed by the biologist Brian Goodwin, a critic of neo-Darwinist reductionism, who says that "there are some fundamental aspects of an organism's form that persist *in spite of* natural selection, not because of it" (see Ball, 2004: 9). Another researcher of chaos, complexity and self-organization, Steven Strogatz shows in his book with a peculiar title *Sync*, subtitled "Emergent Science of Spontaneous Order", that mathematical patterns – periodic or "chaotic" – are widespread also in the *temporal* order of nature (*sync* is an abbreviation for synchronization, for patterns in time), for example in the waving lighting of a swarm of fireflies, or in the harmonious flight of a flock of birds, or in the working of the human heart; various kinds of "synchronized chaos" are important also in technology, for example in the spontaneous synchronization of the phase in electrical networks, or in the market economy (we know too well that the latter, unfortunately, sometimes collapses, like an electrical system or the cardiac rhythm), and also in many other cases. – Philip Ball, in the last chapter of *The Self-Made Tapestry*, when summarizing the "principles of weaving", i.e. of pattern formation in nature, nicely writes about the beauty of self-creation, especially concerning details, emerging from the self-organization of nature:

> To my mind, the astonishing thing about, let's say, butterfly wing patterns, is not just that we can implicate a few basic processes that lie at the heart of them all (reaction–diffusion mechanisms? morphogenetic fields?) but that small changes in the details, in the specific initial or boundary conditions, produce such fantastic variety (Ball, 2004: 252).

The spontaneous self-organization of nature most frequently occurs in "far-from-equilibrium open non-linear systems with a high degree of feedback" (Davies, 1995: 142). In this context, we can mention also the optimistic scientific vision of Ilya Prigogine, who discovered the importance of "dissipative structures", chemical and/or physical states in which some stability of patterns is preserved far from thermal equilibrium; the ordered complexity of these structures increases spontaneously, forming higher and higher forms of being. Beside by physical "basic" laws, nature is determined and ordered – supposedly with "downward causation" – also by higher "laws of complexity", which have to be taken into account on different levels of scientific cognition. Why should primary laws of nature apply

only to the lowest level of entities (to molecules, atoms, particles) and not to higher entities in the hierarchy of complexity? Paul Davies argues that there is "a propensity in nature for matter and energy to undergo spontaneous transitions into new states of higher organizational complexity" (*ibid*., 142).[21] The concept of "propensity" means unavoidably some kind of *télos* in nature, a return of teleology into post-modern science, however, it does not mean a reconstruction of the ancient Aristotelian teleology of nature, but a search for a new *holistic* science, since the concepts of the *whole* and of *télos* are closely related, as we have already said. Davies points out that the laws of the lower levels should not and cannot be so restrictive as to determine everything; he expresses the premonition that "[w]e seem to be on the verge of discovering not only wholly new laws of nature, but ways of thinking about nature that depart radically from traditional science" (*ibid*.). – On the other hand, these new trends do not necessarily involve a radical scientific revolution, a sharp change of paradigm in the sense of Thomas Kuhn, for there are many predispositions in present-day science that indicate and already enable essentially new ways of thinking. The unity of science is desirable, but it does not mean that various scientific methods should be reduced either to physical or to biological or some other methodology. Nevertheless, if there are some basic Laws of Nature, probably mathematical in their form, which "underlie" not only physical phenomena but also the biosphere, then the evident "fine tuning" of the universe is not just a cosmological problem, but concerns the whole of science. Therefore reductionism cannot give us the ultimate answers.

6. Emergence and emanation

Can something "natural" be caused by itself? – Kant would probably answer to this question negatively, because according to his conviction "spontaneity" belongs to consciousness alone, not to nature. Nevertheless, he would have to admit that the answer depends also on *what* is meant by the "natural thing" that would supposedly be the cause of itself. Classical metaphysics (and/or theology) held that the only *causa sui* was God; and also in the thought of Descartes, the founder of "modern subjectivism", this issue is not settled much differently, because the *cogito* is not what causes its own being, but only what *cognizes* it with certainty. During the 20th century, which was marked by many more or less radical philosophical "-isms", Cartesian belief in the existence of self-thinking consciousness (*res cogitans*) was undermined: it was the century of discovering existential moods, unconscious motives, density of discourse, autonomy of structures etc., and meanwhile most classical philosophical questions remained unanswered, actually, science has been taking over them more and more, up to the "highest" questions: Where does the universe come from? How did life start? What is mind? *et al*. These questions partly depend on the answer to a more general question: Can anything exist without being *caused* by something (or someone) else?

[21] The term propensity was introduced by Karl Popper in his book *A World of Propensities*, where he wrote that "there exist weighted possibilities which are *more than mere possibilities*, but tendencies or propensities to become real" (quoted from Cunningham, 2007: 259).

Quantum physics, based on Heisenberg's indeterminacy principle, answers to this question positively: "non-caused", i.e., causally non-determined quantum phenomena are possible, much more, they might be common and universal, occurring at every "collapse" of Schrödinger's wave-function, at least following the standard "Copenhagen interpretation". However, quantum indeterminacy has been actually demonstrated only for elementary cases (for instance, in several variants of the "double-slit experiment" etc.), which cannot give a conclusive answer to the broader question whether "self-causation" obtains also in complex systems, and if it is the case, how self-causation would happen in the most complex system of all, in the universe. The developing "quantum cosmology" (Stephen Hawking, Andrei Linde, Leonard Susskind and others) still consists mainly of just theoretical speculations. The old question where does the universe come from, could it be "self-caused" (*causa sui*) etc., is still more metaphysical and/or theological than scientific, as well as its two main sub-questions, what is the origin/cause of life and of consciousness.

In the late 20th century, a new theoretical concept was proposed for possible scientific answers to these grand questions – *emergence*. This term is closely connected with holistic approaches in sciences, sometimes it is meant just as the opposite to reductionism, which seeks natural causes only in the "lower levels" of complexity, for example, in particle physics or in molecular biology. Although emergence is not a new idea (the classics of emergentism from the first half of the past century were C. D. Broad, C. L. Morgan and Samuel Alexander, and in a broader sense also Henri Bergson and Teilhard de Chardin, see Clayton & Davies, 2006: 9-26), the modern emergentism is more scientific in its origins and orientation. It has been presented and developed by different scientists, for example by Paul Davies, Brian Goodwin, Stuart A. Kauffman, Ilya Prigogin, Lee Smolin, if we mention here again just a few whom we have already encountered, and on the other hand also by several "analytically" (in the broadest sense) orientated philosophers, for instance by Karl Popper, Jerry Fodor, Thomas Nagel, David Chalmers, if we name only four in the chronological order. However, in spite of the uncontested success and importance of the concept of emergence in modern science and/or philosophy, we get sometimes the impression that this concept principally "fills the gaps" of still unknown and maybe also scientifically unknowable answers. Maybe this estimation is too severe, and in general I also support the idea of emergence – especially if it is complemented with the opposite idea of "emanation", i.e. origination of the "lower" from the "higher" levels of beings, as I will explain later – nevertheless, concerning such new (or reactivated) theoretical concepts we should not invest too much hope in them, until they are justified by some really persuasive argument. So, a little bit skeptically, yet with sympathy, let us refer to Stuart A. Kauffman's statement that emergence is "a major part of the new scientific worldview", and quote his holistic definition:

> Emergence says that, while no laws of physics are violated, life in the biosphere, the evolution of the biosphere, the fullness of our human historicity, and our practical everyday worlds are also real, are not reducible to physics nor explicable from it, and are central to our lives (Kauffman, 2008: x).

In the following, Kauffman especially emphasizes *consciousness*:

> Then there is the brute fact that we humans (at least) are conscious. We have experiences. We do not understand consciousness yet. There is no doubt that it is real in humans and presumably among many animals. No one knows the basis of it. I will advance a scientifically improbable, but possible, and philosophically interesting hypothesis about consciousness that is, ultimately, testable. Whatever its source, consciousness is emergent and a real feature of the universe (*ibid*., 4).

Although in contemporary debates in cognitive science and/or philosophy the emergence of consciousness is mostly discussed, this concept actually stems from biology: "In fact, the entire idea of emergence was invented by biologists to explain why some aspects of living beings – the rodlike shape of some bacteria, for example, or the tendency of bunnies to run away from foxes – are stable and reproducible, while the microscopic laws of chemistry from which they descend are random and probabilistic" (Laughlin, 2005: 158). We can remark that this biological origin of emergence is quite strongly present in modern cognitive discussions about consciousness, usually as an implicit supposition. In this context we can also mention John H. Holland's book *Emergence, from Chaos to Order*; in the introduction he says: "The hallmark of emergence is this sense of much coming from little. This feature also makes emergence a mysterious, almost paradoxical, phenomenon smacking of 'get rich quick' schemes" (Holland, 1998: 2). However, at the end of the book, after having strolled through different cases of emergence in modern science, he wisely concludes: "Though most scientists believe life is an emergent phenomenon, the same cannot be said for *consciousness.* […] The nature of consciousness is still an open question. It is unclear whether any, or all, of consciousness can be reduced to the interactions of neurons" (*ibid*., 247). – Anyway, when we speak about emergence, we cannot avoid speaking about the origin and nature of consciousness, albeit the main topic of this part of the book is not the "problem of consciousness", but the relation of mind and nature from the cosmological point of view. Therefore, concerning the emergence of consciousness and the related question of mental causation, let us just shortly consider two interesting, but essentially different views of two well-known cognitive philosophers, Jaegwon Kim and David J. Chalmers, which are relevant for our main context.

Jaegwon Kim advocates a variant of physicalist reductionism. In the critical essay "The Non-Reductivist's Troubles with Mental Causation" he points out that the theoretical meaningfulness of emergentism is related to the assumption that *mental causation* represents the main type of downward causation, especially in "strong" emergentism. According to Kim's view, "weak" emergentism in cognitive philosophy comes down, willy-nilly, to the conception that the mental is a mere "epiphenomenon" of the physical, and thus this view is actually *not* about the emergence of consciousness from the physical domain. However, a strong emergentist (or a "non-reductive physicalist") encounters a lot of troubles with mental causation, Kim continues, because by giving up the causal closeness of the physical domain, Pandora's box is opened for all possible quasi-scientific explanations. "The non-reductive physicalist wants both: mentality is determined by, and dependent on, the physical, and yet minds are to have causal powers, novel causal powers that can be exercised, if my argument is correct, only by causally affecting physical-biological processes in novel ways" (Kim, 1995: 207). Kim puts a straightforward question: Why then not preserve the causal closeness

of the physical domain and consider the mental as an "epiphenomenon" of the physical (see *ibid*.)? And in another article, "Being realistic about emergence", in which Kim discusses mainly the relationship between emergence and supervenience, he adds: "The problem is that the irreducibility component of [emergence] only gives a *negative* characterization of emergence. It tells us what emergence is not, but is silent on what it is" (see Clayton & Davies, 2006: 201). Kim concludes this article with the thought that "we need a positive account of how minds are related to bodies. Saying that they are not reducible to bodies says little about their relationship" (*ibid*.). We can agree with this remark, but on the other hand the long discussion of this issue has been going from Descartes on. We may wonder whether time is ripe for science to solve this problem. I'm personally quite skeptical about it. But anyway, it is intuitively evident that there *must* be some connection between mind and body – and why, after all, couldn't we understand it scientifically some day?

David J. Chalmers, the author of the famous book *The Conscious Mind* (1996), where he expressed his main point that consciousness has to be "taken seriously", in one of his more recent articles, titled "Strong and weak emergence", says that in the case of strong emergence the truths concerning some high-level phenomenon "are not *deducible* even in principle from truths in the low-level domain" (Chalmers, 2006: 244), while in the case of weak emergence the claims about a phenomenon on a higher level are only "unexpected", but at least in principle derivable from those on the lower level. Chalmers thinks that "if we want to use emergence to draw conclusions about the structure of nature at the most fundamental level, it is not weak emergence but strong emergence that is relevant" (*ibid*., 245). And to the unavoidable question, *which* are the "strongly emergent" phenomena, he answers directly: "I think there is exactly one clear case of a strongly emergent phenomenon, and that is the phenomenon of consciousness" (*ibid*., 246); and if we put the next obvious question whether this means that consciousness is *the only* strongly emergent phenomenon, he would agree by adding: "In short, with the exception of consciousness, it appears that all other phenomena are weakly emergent or are derived from the strongly emergent phenomenon of consciousness" (*ibid*., 247). I agree in principle with this neo-Cartesian point, however, I have a further question or rather an objection: Why should we presuppose "by default" that the only relevant monism in the modern age is *materialistic* (or "naturalistic") monism, and then endeavor to overcome it like Chalmers with some new variant of Cartesian dualism, in order for consciousness to be "taken seriously"? Where is Spinoza in this picture, and Schelling, and – with his specific variant of dialectical monism – also Hegel? I think that just declaring that (self)consciousness as a Cartesian "singularity" of *cogito* is "the only strongly emergent phenomenon" is still *not enough* for taking consciousness (and, furthermore, mind) *indeed seriously*. Why shouldn't we consider Spinoza's pantheistic monism as a proper alternative to *both*, on the one side to materialistic monism, i.e., to the causal closeness and also exclusiveness of the physical domain, *and* on the other side to Cartesian dualism?

In the context of emergence, let me mention Harold J. Morowitz, another well-known (meta)biologist and theoretician of complexity, who in his book *The Emergence of Everything* lists 28 levels of emergence in the development of the universe, from the Big Bang to consciousness. In the chapter titled "Philosophy" he writes: "In any case, 12 billion years of emergences have resulted in self-aware humans who seem driven to look backward

and forward in asking who we are, where we come from, and whither we are going. In short, we ask 'What does it all mean?' Philosophy provides a context for raising these questions" (Morowitz, 2002: 172). Encouraged by this *hommage* to philosophy by a renown scientist, let me put forward an important philosophical question, which I have not encountered in any contemporary analytical-cognitive debate about the reality of mental causation (Chalmers, too, remains at a halfway point in this respect): If we, like Morowitz, climb up the ladder to ever higher emergences which affect the lower ones by their supposed "downward causation", why then not climb up to the very top, to the highest universal Mind ("Cosmic Logos"), and conjecture that the highest "Laws of Mind" ultimately determine the whole hierarchic pyramid of reality in the *downward* direction? Would this conjecture mean a slip from the justified criticism of physicalism and/or reductionism into a naïve idealistic holism? Not necessarily. Furthermore, I think that a "pantheistic" mind–nature unity is a better and also scientifically more promising option than materialistic monism on one hand, or idealistic monism on the other.

Therefore, after having considered several aspects of the concept of emergence, my main proposal in this chapter shall be the following: let us reintroduce, at least tentatively, into modern philosophy and particularly into philosophical cosmology the ancient concept of *emanation* – in Plotinus' philosophy it meant, generally speaking, the process of becoming of the world in all its multiplicity and variety from the transcendent as well as immanent One, and more specifically the developing of nature from mind (or spirit) – so let us return to the concept of emanation and "update" it so that emanation would mean the *complementary* process of emergence. In this paraphrase, emanation is not just another name for mental causation; let it be considered broadly as a process which is parallel, yet inverse to emergence. Both concepts try to express an important and universal *connection*, not only between physical and mental events, but also *between mind and nature* in general, so that emanation, in contrast with emergence, proceeds "upside down", from mind to nature: i.e., likewise mind is supposed to *emerge* from nature, let's pose that nature *emanates* from mind (or spirit). I would like to point out here that this updated concept of emanation is quite as clear (or unclear, for some people) as the broadly accepted concept of emergence, neither less nor more. It might be objected that a conceptual asymmetry and thereby an essential difference between emergence and emanation follows from the *priority* of nature in relation to mind; of course, from the evolutionary point of view, many billion years passed before the human mind was born. This objection is justified only from the *temporal* point of view, but temporal (evolutionary) and ontological orders do not necessarily coincide, and it is quite rational for a philosopher to ask: Why the "supreme" ontological reality shouldn't be present just *now*, or for a theologian, in some eschatological *future* rather than in the "primordial" past? Nevertheless, if this way of thinking seems too strange – and it *is* indeed strange for our "linear" conceptions of time and evolution – we can at least agree that temporal and ontological orders are not *a priori* equivalent. And after all, the "reality of time" is still a deep enigma, in philosophy as well as in science (*cf.* space-time as a four-dimensional "timescape" in relativity etc.). Next, if we continue the philosophical argumentation for introducing the concept of emanation *in symmetry* with emergence, it could also be pointed out that the temporal priority of nature in relation to mind obtains only for the *human* mind, which

obviously "emerges" out of nature, but it could be just the reverse for the *cosmic* mind ("logos in cosmos"), which is the main topic of discussion here. If some kind of cosmic mind exists, it could and even should be temporarily prior to the human mind. This "pantheistic" tenet that mind is not just a local "event", the specific feature of *homo sapiens*, but much more, even a cosmic principle, is the main pillar of the "third way" we are searching for. Let me stress again that emanation of nature from mind is not something more mysterious and less rational that emergence of mind from matter. I think that the conceptual pair emergence–emanation (or *vice versa*) might lead us to a new, non-dualistic, holistic understanding of the universe and ourselves as its observers. Modern cosmology has come, also by the "anthropic reasoning", to the very threshold of an evolutionary pantheistic holism. There is of course still a long way for science to research and possibly demonstrate this way scientifically, but we simply have to think of new alternatives when we are confronted with old impassable dilemmas. The discussion about pantheism will be continued in the next chapter, now let's return to the broadly accepted concept of emergence.

A good old religious answer to the question where has the human mind come from, is written, as we know from childhood, in the biblical *Genesis*: God breathed the living soul unto Adam, and thereby mind as the main capacity of soul was given to the first man. Of course, this is not a scientific answer, furthermore, it seems to be incompatible with modern theories of evolution, unless the biblical story is understood only as a metaphorical, symbolic narrative, very different from the modern scientific discourse. Most people today, including scientists, see religion and science as two strictly separated domains, and do not even try to unite them or to make them compatible again (except fervent "fundamentalists" who do it in an utterly wrong way). Anyway, this irreconcilable split between scientific knowledge and religious belief does not represent a solution of this important dilemma in the long term, and we may even say that there is something "schizophrenic" in such a sharp and persistent division. That is why some contemporary scientists who in their (meta)theories do not avoid philosophy and/or theology still want and try to reunite human knowledge and belief. This is also an aspect of my search of a "third way", and following it, I have found an interesting attempt in this direction, Stuart A. Kauffman's book *Reinventing the Sacred*.

Kauffman "rediscovers" God *in* nature, even more, God *as* nature. However, does this also mean the opposite, namely that nature itself is divine in the sense of Spinoza's famous "reciprocal" equivalence *Deus sive natura*? Let us have a little closer look at Kauffman's (post)modern "reinventing the sacred", at his reconnecting of science and religion. In the introduction of the book he says: "One view of God is that God is our chosen name for the ceaseless creativity in the natural universe, biosphere, and human culture" (Kauffman, 2008: xi). Are we confronted here with some kind of "natural religion" of David Hume, or with an anthropological conception of God in the sense of Ludwig Feuerbach? Both may be true to some extent, but Kauffman's philosophical credo goes further towards the sacred. For when he says that God is "the natural creativity in the universe" and that it "serve[s] as our most powerful symbol" (*ibid.*, xiii) – and this latter certainly holds, at least for monotheistic religions – Kauffman's intention is *not* the "de-sacring" of God by reducing him to the "natural world", rather the contrary, his main endeavor is the "sacring" of nature. When he speaks about his admiration of holy places like Notre Dame in Paris, the Sixtine Chapel in

Rome or Santuario de Chimayó in Mexico, he says: "That is why I feel we must use the God word, for my hope is to honorably steal its aura to authorize the sacredness of the creativity in nature" (*ibid*., 44–45). He is well aware of the various possible consequences of his belief: "If life is natural, as I firmly believe, then part of the immense call for a transcendent Creator God loses its force" (*ibid*.). From the theological point of view, it would be probably more acceptable to say otherwise, for instance like Harold Morowitz: "The nature of the creative event of science is so cosmic and so cataclysmic that we are forced to reexamine what we mean by the Creator. Small changes will not do. Here science is calling for a major paradigm shift in our conceptualization of God the Creator" (Morowitz, 2002: 42). But Kauffman, rather than modifying traditional theism, follows his "pantheistic" line, saying that "we will find ceaseless creativity in the universe, biosphere and human life […and that] creativity in nature is God enough" (Kauffman, 2008: 142). However, is such a belief indeed *good enough* for those who believe in Jehovah, Christ or Allah (or Krishna or some other "only" God)? Probably not, since it is hard to conceive nature as a god-person, and even if we try to do so, we just change the Father's gender by worshipping the cosmic Mother instead. Furthermore, if God is yet a person, how is it possible that there are more than one single divine Persons? Kauffman, himself Jewish by birth, muses upon the "God of the fathers":

> Is it, then, more amazing to think that an Abrahamic transcendent, omnipotent, omniscient God created everything around us, all that we participate in, in six days, or that it all arose with no transcendent Creator worthy of awe, gratitude, and respect, that is God enough for many of us. […] This view of God can be a shared religious and spiritual space for us all (Kauffman, 2008: 6).

On the other hand, Kauffman expresses deep respect for traditional religions, and he is fully conscious that his "naturalistic" conception of God could be understood by believers as disguised atheism, therefore he explains:

> How dare we use the word *God* to stand for the natural creativity of the universe? Yet I say yes, we can and should choose to do so, knowing full well that we make this choice. No other human symbol carries the power of the symbol, God. No other symbol carries millennia of awe and reverence. […] Our task is to engage the whole of our humanity and to be wise. It may be *wise* to use the word *God*, knowing the dangers, to choose this ancient symbol of reverence and anneal to it a new, natural meaning. Indeed, this potent symbol can help us orient in our lives (*ibid*., 284).

Concerning the "name" *God* which is the highest "symbol" in different religious languages – although it is only a poor designator for the supreme goal of all human aspirations – I agree with Kauffman: let this "name" stay, even for a pantheist, like in the famous Spinoza's dictum *Deus sive natura*. However, if Kauffman conceives God as the "name for the creativity in the universe" (*ibid*., 232), we may ask if he has really in mind the emphatic pantheistic identity of God and Nature? Does Kauffman accept and endorse Spinoza's pantheistic equivalence in both senses: God is nature *and* Nature is divine (or the Divinity itself)? This is not quite clear from the book *Reinventing the Sacred*, although in the concluding chapter Kauffman says that the God he talks about "is not far from that of Spinoza" (*ibid*., 287). Nevertheless, it seems to me that also Kauffman, like other

contemporary scientists, hardly accepts pantheism in its full philosophical and/or theological sense, and even more hardly the ancient idea of emanation of the universe from the One. – So let's remind ourselves in the next and last chapter of this part of the book what pantheism has been in the past in order to foresee what it might mean for the future of cosmology.

7. Pantheism as the "third way" of philosophical cosmology

When I speak about *mind* – I have used this term frequently in this part of the present book and it occurs also in its title – what do I actually mean by it? Obviously I do not mean mind only in the sense of the contemporary "philosophy of mind", which understands mind, generally speaking, as the unity of *mental* events or processes, either with the "seriously taken" Cartesian self-conscious *cogito* (Chalmers) or without this "theatre" (Dennett), or in some intermediary variant. In the cosmological context, I speak not only about individual human or computer mind(s), but also, even primarily about the *cosmic* Mind, although in most cases I have not used the capital letter to denote it in order to connote that the cosmic mind is in the deepest sense the *same* as the human mind – however, *nota bene*, the same *not* in the sense that the human mind, in the modern development of subjectivity, has taken the place which was supposedly abandoned by God, following the proclaimed "God's death" (Nietzsche *et al*.). In the proposed pantheistic cosmological philosophy I endeavor to re-turn to the epoch of thought *before* the great turn to subjectivity happened in the Western thought, considering from a post-modern standpoint the illusions and delusions of the modern age. This viewpoint leads us from Descartes' dualism to Spinoza's monism, since the latter, which is traditionally considered as a "step back" from the inauguration of *cogito*, comes not only historically after Descartes' turn, but also as a post-modern re-turn *after* the decline of subjectivity in our times. Furthermore, this way leads us deeper back to the "sources" of Western thought, especially to Platonism and to the pre-Socratic sages, and it would lead us, if more space-times for writing were available, also to the ancient Indian and Chinese wisdom. However, in this concluding chapter I cannot go so far and in such width, so let me just outline some ideas of mine about how and why classical pantheism could be renewed in the post-modern philosophical as well as scientific cosmology.

The next question is what is actually meant by the *cosmic* mind. In trying to answer this, I first remind the reader of some already used formulations: "Logos *in* Cosmos" (as a paraphrase of the pre-Socratic *hen pánta*, "one–all"), *complicatio explicans* (Cusanus), *Deus sive natura* (Spinoza), natural laws as "God's thoughts" (Einstein), "implicate order" (Bohm), "cosmic blueprint" (Davies) etc. – these phrases are mostly metaphors or descriptions, not strict philosophical definitions of the cosmic mind, but they tend to express the central feature of pantheistic doctrine, the unity and/or oneness of Mind and Nature. If we understand the identity of Logos and Cosmos in the conceptual frame of contemporary cosmology, it would correspond to the "updated" pantheistic idea that the Laws of the Universe are *the same* as the Universe itself, namely, that they are not "outside" the All, but *immanent* in the All, and also *vice versa*, that the Universe is "immanent" (or "implicit") in its own Laws, from which it "emanates" (or makes itself "explicit"). This idea sounds quite strange, especially if we recall

many possible values of "free parameters" (natural constants) which could occur in variable physical laws of the multiverses from Tegmark's Level II up (see above, Chapter 2), and besides it seems that the strict identity of Logos and Cosmos, or of Laws and Nature entails determinism (we will return to this point later) – however, if we further reflect upon it, we may call to mind of the following parallel: before Einstein's general theory of relativity with its basic claim that gravitation *is* the geometry of space-time, these two phenomena were considered as quite different, separated in physical theories and in "common sense": it *seemed* impossible that masses (or energies) could be in the co-relation of bijective mapping to geometrical spaces, since the latter seemed to be "free" of their "contents", but this is actually not the case, as Einstein has shown. Perhaps some similar or at least analogous "mapping" obtains between laws and their "objects", and in general, between Logos and Cosmos, Mind and Nature? (This is just a conjecture, a "query".)

In this context I would like to discuss shortly is the question whether pantheism is compatible with Platonism, i.e., whether the doctrine of the immanent "Logos *in* Cosmos" is compatible with the Platonic transcendent "World of Forms". I have already mentioned (in Chapter 5) that my answer to this question is positive: yes, they are compatible and they can even consistently support and complement each other, *provided* the transcendence of Platonic Forms is *not* understood as some other *physical* space and/or time, literally beyond the "vault of heaven" and/or in the "afterlife". In my opinion this interpretation of Platonism, which prevailed in the Christian theology of the Middle Ages, and which can be indeed entailed from some passages of Plato's dialogues (especially from *Phaedo*), is far from being necessary, on the contrary, the main point of genuine Platonism is that transcendent Forms (i.e. Platonic "ideas") are neither spatially nor temporally located, but exist eternally, "outside" space and time. From our sensuous experience, from the human spatial and temporal perspective they are "everywhere and nowhere", "always and never". Otherwise said, following authentic Platonism, the "World of Forms" is seen by the "mind's eye" only, and consequently it *could* be conceived, from the "pantheistic" standpoint, as paradoxical "transcendence-in-immanence", as transcendence of Logos in the immanence of the Cosmos. Instead of Logos we may also speak of the cosmic intellect or spirit, although these terms are of course not quite equivalent. George Santayana in his lovely essay *Platonism and the Spiritual Life* remarked that "those who think Platonism dualistic have simply not understood" (Santayana, 1957: 237), namely, Platonism is a philosophy of spirit and "why should [the spirit] quarrel with its earthly cradle?" (*ibid*., 250). I warmly join him in this view.

I have already used the term "evolutionary pantheism", which should be, if applied to modern cosmology, based on scientific investigations and discoveries. But we can put here a question of principle: Is pantheism compatible with evolution? I mean not only with the evolution of species in the Darwinist sense, but in general, with the very concept of evolution, that is, with the kind of development which brings something *new* into being, and does not just develop implicit contents by making them explicit (as, for instance, the whole classical geometry is deduced from Euclid's postulates). The philosophical answer to this question is not simple, it surely depends on what we understand as evolution and/or development, however, in principle my answer is: Yes, *pantheism and evolution are compatible*, and they

can even consistently support and complement each other, if I repeat the same phrase as above. Let me explain this point a little bit more. First I have to state that the modern concept of evolution (and particularly of emergence) is incompatible with determinism, which is an essential feature of the classical Spinoza's pantheism. The assertion of determinism in Spinoza's philosophy means primarily the statement that "God does not produce any effect by freedom of the will" (Spinoza, 1994: 106), since "God is the immanent, not the transitive, cause of all things" (*ibid*., 100), and "things have been produced by God with the highest perfection, since they have followed necessarily from a given most perfect nature" (*ibid*., 107). – In spite of Spinoza's conceptual distinction between *natura naturans* (God) and *natura naturata* (nature), the basic identity *Deus sive natura* deductively entails determinism, because – as he demonstrates in the same "proposition" (i.e.: I, 33) with an argument by *reductio ad absurdum* – if several different natures were possible (indeterminism), there would be also several Gods, but that is nonsense *per definitionem*. Spinoza, especially in parts IV and V of *Ethics*, argues also for determinism as the human determination, since the essence of a philosopher's *amor Dei intellectualis* is not in a contingent free will, but in accepting the things as they are, and *sub specie aeternitatis* everything is good and perfect, the evil is present just in our imperfect sight and in finite minds.

Determinism was thus a necessary consequence of Spinoza's strict ontological monism. Actually, the term "pantheism" – which etymologically refers to *hen kai théos* ("one and god"), the ancient dictum of Xenophanes, founder of the Eleatic school (6th century B.C.), combined with Heraclitus' *hen pánta* ("one–all") – was not introduced by Spinoza himself, but it was coined later by John Toland in his work *Pantheisticon* (1720) for denoting Spinoza's philosophy. In the late 18th century, when several leading German philosophers and men of letters were involved into the *Pantheismusstreit* ("dispute about pantheism"), either by following or by opposing Gotthold E. Lessing's favor of "spinozism", pantheism was still essentially connected with determinism, so it is understandable that the great *Naturphilosoph* Friedrich W. J. von Schelling, one of the protagonists of the romantic idea of man's freedom, explicitly distanced himself from "pantheism" already in his early works, although Spinoza's influence was essential for Schelling's *Identitätsphilosophie* while he was developing through several stages his majestic epopee of the identity of spirit and nature, and in the later works Schelling acknowledged his adherence to the "principle of pantheism". So we can say that Schelling's philosophy as a whole is the best and most elaborated dialectical system of *evolutionary* pantheism, although he did not use the term evolution, being also far from the Darwinist conception of "natural evolution", since Schelling's philosophy of nature and spirit is metaphysical and substantially *teleological*. One of the sentences, which expresses the very core and sense of his whole philosophy, is the famous sentence from the book *Naturphilosophie* (1799): "Nature should be a visible spirit <*Geist*>, spirit should be invisible nature" (see Schelling, 1985: I/2, 56, p. 294).

Among the great thinkers of 20th century, Alfred N. Whitehead has developed an evolutionary pantheistic philosophical system *sui generis* in his most important work *Process and Reality* (1929). The main tenet of Whitehead's "process philosophy" is the assumption that processes – not substances – are the fundamental ontological entities; this means that we have to conceive not only individual processes, i.e. physical, mental, historical etc.

phenomena, as ontologically irreducible realities, but also that the whole world, the universe, has to be seen primarily in its processional, "fluent", evolutionary reality. The classical dictum *pánta rhei* is not the most important point here, since Whitehead's processes are not in a simple opposition toward substances in the sense that they are unsubstantial, on the contrary, they *are* "substantial" themselves – in a similar way as Hegel's dialectical terms, although not closed in a definite and ultimate system which, after all, again slips into a "static" conception of substance. The pantheistic emphasis is strong in Whitehead's process philosophy, which is also cosmology as well as theology, and he articulated his main points in five lapidary sentences in the concluding chapter of the book, among which I have chosen for quoting the last, most relevant for our context: "It is as true to say that God creates the World, as that the World creates God" (Whitehead, 1978: 348).

In the same period of time when Whitehead developed his pantheistic "process philosophy", various elements of evolutionary pantheism can be found also by two distinguished French philosophies: Henri Bergson and Paul Teilhard de Chardin. The main concepts of Bergson's vitalism are *élan vital*, evolution and time; he was accused of pantheism, i.e. of a heresy, by the Cathotic neo-Thomists of his time, in spite of the fact that Bergson himself rejected pantheism by declaring that life achieves its supreme ascent in Christian mystical faith. A similar fortune befell Chardin, a Christian priest who tried in his cosmological philosophy to reconcile Darwin's theory of evolution with Christian theology. His interesting and philosophically still very relevant work was, from the standpoint of a Christian believer, the most sincere and far-reaching attempt to take Darwinism seriously. Alas, in his cosmology Chardin has abandoned the rational sense for reality by musing on the eschatological "Omega Point" which should be the final end of the evolution of "noosphere" (the sphere of the intellect, *noũs* in Greek).

Einstein's personal and informal philosophy was also close to pantheism, albeit as an admirer of Spinoza he did not appreciate very much its evolutionary variants. When Einstein spoke about the laws of nature as "God's thoughts", he did not take into account a clear distinction between theism and pantheism, since the main point in his public speeches and essays on science and religion was principally the critique of "anthropomorphism" in theistic religions and their respective theologies. In the famous essay *Religion and Science* (1930), Einstein wrote about three stages of religious development in the history of mankind: 1. religion of fear (from animism to polytheism), 2. social and moral religion ("God as Providence" in theistic religions, especially in Christianity), 3. the "cosmic religious feeling", *die kosmische Religiosität* (see Einstein, 1982: 36–37). The latter, which is in its basic traits an "updated" variant of Spinoza's pantheism, should be the religion of modern mankind. Let us see the following passage:

> The individual feels the futility of human desires and aims and the sublimity and marvelous order which reveal themselves both in nature and in the world of thought. Individual existence impresses him as a sort of prison and he wants to experience the universe as a single significant whole. […] The religious geniuses of all ages have been distinguished by this kind of religious feeling, which knows no dogma and no God conceived in man's image; so that there can be no church whose central teachings are based on it. Hence it is precisely among the heretics of every age that we find men

> who were filled with this highest kind of religious feeling and were in many cases regarded by their contemporaries as atheists, sometimes also as saints. Looked at in this light, men like Democritus, Francis of Assisi, and Spinoza are closely akin to one another (Einstein, 1982: 38).

Max Jammer in his book *Einstein and Religion* mentions Einstein's answer, when he was asked to define God: "I'am not an atheist, and I don't think I can call myself a pantheist" (see Jammer, 1999: 48). However, he was surely a pantheist in some broader sense. At another occasion, speaking of the superior Mind that reveals itself in the world, he maintained that "in common parlance this may be described as 'pantheistic' [belief] in Spinoza's [sense]" (*ibid*., 75). Jammer understands Einstein's "pantheistic" attitude in the following way: "Einstein agreed with Spinoza that he who knows Nature knows God, but not because Nature is God but because the pursuit of science in studying Nature leads to religion." (*ibid*., 148). In this sense we could understand also the famous Einstein's sentence, a paraphrase of Kant: "Science without religion is lame, religion without science is blind" (Einstein, 1982: 46; for more discussion about this topic, also see Uršič, 2006).

The answer to the question whether pantheism in compatible with evolution, which I have raised above and endorsed a positive answer by referring to some great, in the broad sense pantheistic thinkers who were evolutionists as well, depends essentially on the concept and understanding of time. Any discussion about the reality of evolution in the strict sense, i.e. of becoming or developing something really *new* in the world, presupposes the solution of the "enigma of time", as I have already suggested also in the context of the holistic solution of the "Goldilocks Enigma", i.e., by the searching of a "third-way" explication of the "fine-tuning" of our universe (see above, Chapter 1). If the future is implicitly present in the past, and if both "distant times" are *present* just now, in the present time, as in the quoted T. S. Eliot's verses, then the question of the reality of time and thereby of evolution is in principle re-solved too. Namely, if time is not ontologically real "in itself", if it is only "a moving image of eternity", as Plato defined it in *Timaeus* (37d) and Plotinus in *Enneads* (III.7), then evolution is also not real in the strict sense, and therefore there is no problem of its compatibility with the pantheistic One-and-All. Einstein's conception of time, interpreted as the fourth dimension of space-time, and forming the universal "space-time block", the timeless "timescape" – of course only from a theoretical standpoint, because every concrete physical observer is localized in his or her own reference frame – is from the philosophical point of view actually Platonic. Furthermore, the enigma of time is even deeper than that. The experience of time is essentially dependent on the choice and definition of the observer, on the subject for whom time is supposed to pass or "flow" from past to future, generally said, time and consciousness are closely related. As I have already said (in Chapter 5.1), the enigma of time, its putative unreality or "timelessness" opens so large a domain of discussion that it would require another book, at least of an equal format as this one, if we tried to develop the relation between time and consciousness. So let me suggest just two questions for further musing about the enigma of time: 1) Are all moments of time in some deeper and more fundamental sense "everpresent" (following Einstein and Platonism)? 2) Are there some moments of time which are "timeless" (following testimonies of "mystics" *et al*.)? – If the answer is positive for both questions, then pantheism and evolution are compatible in the

strict sense only for a finite, *temporal* observer in some moment of his or her time which is *not* timeless. But this paradox again opens other questions …

We have seen from this short overview of some important historical aspects of pantheism that its variants quite substantially differ one from another if pantheism is meant in a wider sense. Michael P. Levine in his extensive and comprehensive monograph *Pantheism, a Non-Theistic Concept of Deity* discusses also several other variants, and he considers what they have in common in order to formulate an inclusive, yet enough distinctive definition of pantheism. By referring to the definition of Alasdair MacIntyre in the *Encyclopedia of Philosophy* (ed. Paul Edwards, 1969 and reprints), Levine states that the common view of all pantheistic doctrines is that "everything that exists constitutes a 'unity' and this all-inclusive unity is in some sense divine" (Levine, 1994: 2). This formulation is rather a tentative description than the exact definition of pantheism, however, it adequately expresses three main characteristics of pantheism in the broadest sense:

1. monism (One is All and All is One, *hen pánta*)
2. immanentism (the One is immanent in Nature, in the Universe)
3. divinity (of the immanent One).

The first and the second component of pantheism are philosophical or rational, the third is "religious" or emotional, although pantheism is much more a philosophical belief than a religious faith. However, in pantheistic monism (1) not only the "natural" component (2) is essential, but also the "divine" component (3): *Deus sive natura* is meant as a both-sided implication, that is, as an equivalence, at least in the most strict pantheism of Spinoza. But on the other hand, as Levine rightly stresses, "pantheism never has been a simple identification of the world with God" (Levine, 1994: 27–28), namely, God is not equivalent with Nature in the sense of the "world", but "[s]omething about the world – namely the fact that it is taken to be an all-inclusive divine Unity – is the reason for calling the world 'God'" (*ibid*., 28). This remark is important also in order to reply to a quite common, though very superficial objection to pantheism that it worships the world and even individual natural beings or phenomena (that is actually a feature of animism, not of pantheism). Lavine says in another chapter of his book: "Pantheism maintains that in some ways, though not in others, the divine Unity and the universe are separate" (*ibid*., 194). The statement of this "identity-in-difference" reminds of Giordano Bruno's distinction between God as *totalmente infinito* ("completely infinite") and the Universe as *tutto infinito* ("all infinite"), which Bruno adopted from Nicholas Cusanus, or of Spinoza's distinction between *natura naturans* and *natura naturata*. These distinctions are also dependent on the viewpoint in considering pantheism, and Levine shows also some important implications of the difference between the ontological and the epistemological viewpoints: although there is for pantheism no ontologically real transcendence, there still is the epistemological "transcendence-in-immanence", i.e., "One is All and All is One" does *not* simply mean that "all is the same", so that any human endeavor to investigate and to know the multiplicity and variety of the world would be superfluous and futile. On the contrary, for a pantheist, it is most precious *to find a World in a grain of sand and a Heaven in a wild flower*, as it is wonderfully said in the already quoted Blake's verses. Therefore, the opinion that transcendence is utterly rejected by pantheists is wrong, since the

distinction and also "tension" between transcendence and immanence remains also in pantheism, but its meaning is different as in theism, as Levine well points out: "Unity is 'all-inclusive' but, with the possible exception of Spinoza, pantheists generally deny complete immanence. […] So the claim that pantheists deny 'God's' transcendence is altogether misleading on several counts unless taken to mean what it usually does mean when asserted by theists – which is that pantheists deny the transcendence of a theistic God" (Levine, 1994: 94-95). The preserved "tension" between transcendence and immanence in pantheism has of course also important ethical consequences: a pantheist is far from thinking that morally "all is the same", that "anything goes", on the contrary, pantheism intensified the sympathy and empathy toward other beings and the whole natural world.

If it is quite difficult to give an exact definition of what pantheism is, it is easier to say what it is not, at least concerning some quite common misinterpretations which were in history also deliberately sustained by theists, especially by the Christian inquisition. First I have to stress again, although this point should be already obvious after many centuries of the development of pantheism, that *pantheism is not atheism*, neither "naturalism" in the sense in which this term is generally used in modern science and/or philosophy. Some centuries ago, the great pantheist thinkers (let me recall just Bruno and Spinoza) were repeatedly and unjustly condemned of atheism, and this was obviously wrong, since pantheism is neither theism *nor* atheism, but the third "cosmic" way of philosophical and/or religious *belief*, as we have already pointed above, by discussing the component (3) in Levine's definition of pantheism. Nowadays, there are fortunately no more stakes and excommunications destined for pantheistic "heretics", however, some elements of stigmatization remain, not only from the side of theistic theologians, but also from the side of natural scientists. If I put aside here the skepticism towards reintroducing some new kind of teleology into natural sciences, especially into cosmology, since we have already extensively discussed this point above, I might shortly answer in the present context to a possible and indeed quite usual objection against introducing the concept of a "universal mind" (which implies also some variant of pantheism) into science, namely by trying to answer the question: What is actually *different* in explaining and understanding nature in the case we see it as "divine" in the pantheistic sense? Is it not just a matter of belief, which does not have any relevance in scientific investigations? Well, from the viewpoint of empirical science this objection is probably justified. For example, some concrete scientific analysis of the cosmic background microwave radiation (as the oldest known natural "fossil") will not be anyhow different if this phenomenon is philosophically and/or religiously considered as the "footprints of God's creation", or just as a "natural phenomenon", or – by a pantheist – as a manifestation of the cosmic Mind, Logos *in* Cosmos. However, this is not the "whole story", especially in the sciences of the "borders" of nature, like in cosmology or quantum-physics; the whole story requests *meaning*, and this is not possible without some wider and also deeper frame of thinking about nature. Beside that, when speaking about the difference between pantheism and atheism or "naturalism", I might add that the third component of pantheism, the "divinity of nature", which is absent in the mere "naturalistic" viewpoints, is important also in the ethical sense: for a pantheist, nature is not just an *object* of research, but a manifestation of a

"higher" divine order and meaning. And this is *very* important for contemporary science and all its consequences.

I have already mentioned that pantheism is essentially different from *animism*: the latter is a phase of religious history which was dominant *before* theism (even before polytheism) as a cluster of beliefs in spirits and demons of nature (spirits of trees, animals, ancestors etc.), while pantheism in some of its variants (maybe as Einstein's "cosmic religious feeling"?) might come or already comes *after* the dominance of theism in the historical development of our civilization. Another mistake is to identify pantheism with *panpsychism*. Panpsychism is the doctrine that all in the world, namely every single being, has a "soul" (*pan-psyché*), and/or that the whole world (or universe) has its great cosmic Soul. This belief certainly differs from animism and it is a much higher idea in the development of culture than the belief in "spirits of nature". The ancient panpsychism reached its philosophical apex in Plato's *Timaeus* where the cosmic Soul is considered to be the first creation of the demiurge, in Plotinus's *Enneades* the Soul was the third "hyposthasis" (after the One and the Intellect), and later in history this idea was present also in some "pantheistic" heresies of the Middle Ages and in the Renaissance, its traces can be found in Bruno's "cosmic religion" too, while more recently it was restored in the period of romanticism. However, we should not forget the *difference* between the *soul* (also the cosmic Soul) and the intellect or *spirit* (the cosmic Logos or Mind): pantheism is primarily the philosophical belief in the cosmic Mind ("One-in-All"), and only secondly, if at all, in the cosmic Soul, which is, for instance, absent in Spinoza's pantheism. It is indeed quite difficult to "take seriously" from the modern scientific view – and science is or should be very relevant also for contemporary philosophical, pantheist or another, discussions concerning nature and the universe – the idea that a cosmic Soul exists, let's say in the sense of the ancient Plato's cosmology. On the contrary, it is much easier and quite rational also from the modern scientific point to take seriously the idea that the cosmic Mind exists, the idea of "Logos *in* Cosmos".

When speaking about the difference between pantheism and panpsychism, we have to say a few words about Thomas Nagel's concept of panpsychism in the contemporary philosophy of mind. In his book *Mortal Questions* Nagel has put down the following definition: "By panpsychism I mean the view that the basic physical constituents of the universe have mental properties, whether or not they are parts of living organisms" (Nagel, 1979b: 181). Although Nagel is skeptical toward classical panpsychism (who is not?), nevertheless he accepts it in a modified, "updated" version, speaking about "basic physical constituents" of the universe and about "mental properties", which he uses as *definiens* in his definition. Nagel is an opponent of reductionism, as it is widely known from his famous paper "What is it like to be a bat?", and also in the above quoted book he says: "A physical explanation of behavioral or functional states does not explain the mental because it does not explain the subjective features what any conscious mental state is like for its possessor" (*ibid.*, 188). The "subjectivity" (or "intentionality") is for Nagel an irreducible property of mental states, even if it does not necessarily mean consciousness in the emphatic sense, even less self-consciousness, but also different lower, more primitive forms of "inner" experiences. Very well, but in this picture there is the danger of a "slippery slope": how far, actually how

low can or should we go in this "mentalization" of reality? What does actually mean the assumption "that the basic physical constituents of the universe have mental properties"? How could, for instance, an atom or a molecule or even a single living cell have "mental properties"? Nagel introduces here the additional assumption that "either the system has further constituents of which we are not aware, or the constitution of which we are aware have further properties that we have not yet discovered" (*ibid*., 182), however, this conjecture does not solve the main empirical trouble that in all the already known "basic constituents" no such feature has been found which could at least hypothetically support this assumption. From the genuine holistic point of view, there is a mistake already in the supposition that the "mental" (or "psychical") is present in some "constituents" of reality, even before they form whole(s), i.e. in living organisms. – Nagel's case clearly shows the difference between pantheism and panpsychism, even if the latter is "updated", and consequently also the difference in the conception of mind between the contemporary "philosophy of mind" on the one hand and the concept of mind (or Mind) in the cosmological sense, which I have outlined here. I cannot go further into the "philosophy of mind" (for instance, to comment debates between Chalmers and Dennett etc.), but as I have already said (in Chapter 5.1), in the cosmological sense *the mind is a whole*, namely whole in its pantheistic identity with nature. I think that the human mind is not divisible like matter, neither like mental states or processes. We cannot say "an atom of mind" or "a piece of mind" or "a part of mind", this is nonsense, unless we conceive mind as just a common term for the ensemble of mental processes. However, I think that mind is more than that. So I dare to suggest: Mind is either present "as a whole", or it is not present at all.

After having discussed several topics concerning the cosmic Mind (written with a capital or with a small letter), the last but not least philosophical and/or theological question might be raised here, namely, whether the cosmic mind could be *conscious* or even self-conscious from the pantheist point of view? The positive answer to this question would, of course, re-draw pantheism nearer to theism, so that another formulation of the same question would be the following: Are pantheism and theism yet in some sense compatible, after all? In the history of philosophy, which includes, at least implicitly, almost all ideas we can think about today, this option is known as "panentheism" (the term was coined from three Greek words: *pan-hen-théos*, "All-One-God"), which was lively debated some two hundred years ago when it was claimed that the universe is (like) "God's body" *per analogiam* with the relation between the human body and mind. Maybe the question of consciousness of the cosmic Mind or Logos should be left to theologians, nevertheless I would just like to remark here that, if *spirit* is conceived as "living mind" (in the sense of *Geist* by Schelling or Goethe), there is no *a priori* reason why the cosmic Mind should not be such a Spirit. However, the question which is from the theological point of view closely connected with the existence of the divine Spirit – namely the question of a divine Person who would have also His (or Her? probably not Its?) divine Will – is too remote and speculative to be answered even with minimally rational philosophical discourse. Concerning this point, I can just quote here Spinoza's remark from the *Ethics* that "the intellect and will which would constitute God's essence would have to differ entirely from our intellect and will, and could not agree with them in anything except the name. They would not agree with one another any more

than do the dog that is a heavenly constellation and the dog that is a barking animal" (Spinoza, 1994: 99). However, I still think, rather otherwise than *this* passage of Spinoza, that there *is* a significant distinction between postulating God's Mind and His Will: for a pantheist, God's Mind or, better said, the divine cosmic Mind could at least in principle be recognized from observing the "fine tuned" laws of the universe etc., whereas God's Will is quite unconceivable for our finite minds, particularly because there is so much evil in the world that it couldn't be in accord with some benevolent *and* omnipotent God's Will. Some theistic theologians argue against pantheism also because it presumably cannot solve the "problem of evil" – yes, probably it cannot indeed, however, we may ask: can the question of evil be solved by theism? Probably neither, it can only be expressed in biblical metaphors. Anyway, these questions indeed belong to theologians.

For the conclusion of this philosophical essay, I can state that the cosmic Mind is *conscious* – it is evidently conscious *in us, observers*, who have been born many billion years after the beginning (whatever it was), and who are able to wonder how the universe is magnificent and "fine tuned" just for us. And if we, after all, leave behind the discussed controversies concerning the "anthropic reasoning" in science, we cannot but agree with John D. Barrow and Frank J. Tipler, who have written in the first paragraph of their influential book *The Anthropic Cosmological Principle* this illuminating thought:

> The central problem of science and epistemology is deciding which postulates to take as fundamental. The perennial solution of the great idealistic philosophers has been to regard Mind as logically prior, and even materialistic philosophers consider the innate properties of matter to be such as to allow – or even require – the existence of intelligence to contemplate it; that is, these properties are necessary or sufficient for life. Thus the existence of Mind is taken as one of the basic postulates of a philosophical system. Physicists, on the other hand, are loath to admit any consideration of Mind into their theories. Even quantum mechanics, which supposedly brought the observer into physics, makes no use of intellectual properties; a photographic plate would serve equally well as an 'observer'. But, during the past fifteen years there has grown up amongst cosmologists an interest in a collection of ideas, known as the Anthropic Cosmological Principle, which offer a means of relating Mind and observership directly to the phenomena traditionally within the encompass of physical science (Barrow & Tipler, 1986: 1).

So, here we are, and our great Odyssey is going on …

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