Mind& Cosmos

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There are two approaches to ontology. One is bottom-up and is usually referred to as materialism, the other is top-down and known as idealism. In idealism we take as our basic point of departure our thoughts, meaning primarily our consciousness and our power to reason, which are very complex entities indeed, but with which we are very intimate, and are unable to view externally. In materialism on the other hand we start with very simply things. Things. Atoms so to speak, which are so simple, as the Greeks pointed out, that they have no features, because if they had there would be even smaller, more basic things. From those basic units everything is worked up in a transparent way to the most complex entities we do encounter.

Most people are repelled by the idea of themselves being made out of atoms, of mere things. I certainly was as a child, my instinctive reaction was one of horror. It is one thing for things like tables and chairs to be made out of atoms, quite another thing for somebody like me. As one grew older one realizes that much of oneself is thing, but the last thing to go, is the core of one's being. One's mind, but even much of one's mind and thought processes are mechanical and so in the end one holds on for dear life for one's soul, one's consciousness, all that with which one as an idealist is intimately aware of.[1]

What lies behind this horror? A sense that something simple and superficial cannot give rise to something profound and complex? Whatever is to be found in the conclusions, needs to be found already in the assumptions. There are many corollaries to this principle. Man cannot create an intelligence superior to his own, and thus hardly surprisingly: Man can only have been created by a being superior to himself. Furthermore the theorems of an axiomatic system cannot go beyond in depth and information content what is not already encapsulated in the axioms. Needless to add, all of those contentions are highly controversial and contested, still the principle go deep in us, and even if we dismiss it as sentimental, it exerts a strong pull on us. Thus in particular I feel a great affinity for any individual that voices those concerns.

If we were told that there were two types of atoms, one for ordinary matter, and one for the souls, many of us would feel relief. It would seem as if there was some mystery preserved, as well as establishing an impenetrable barrier between thing and thought, the confusion of which inspires in us fear and nausea. For a long time this distinction was held. Life needed an material element of vitality, without it dead matter would remain dead and inert. Now the doctrine is dismissed as vitalism. The point of giving a name, is to be able to dismiss. What is not named cannot be rejected. Once named something becomes possible to speak of and to be manipulated and weighed. And what can be spoken off, can

[1] The amount of cognitive facilties you can dispense with and still have a well-defined 'I' is remarkable. That is why people can say, 'I am demented', although few demented people have that insight. But you cannot say or even think 'I am dead', there is no 'I' any longer.

also be criticized and ultimately spurned. This is why the old Jews were so careful not to give their God a name. A very profound insight by the way. Now this old idea of vitalism has been reintroduced in philosophical circles in the sense that each particle contains a fragment of consciousness, and it is those fragments that combine to a full-blown one. The doctrine may be consoling, but is nevertheless silly and *ad hoc*. The author gives it some attention, more perhaps than it deserves.

Mathematics is not a language, but there is a language for mathematics. It is known as Set-theory. Everything in mathematics can be expressed in terms of sets, even the arguments of mathematics, the deductive chains, may be so encoded. But set-theory is not mathematics, even if it can encode it. It (and by implication the whole deductive process) serves the same roles as pixels in a picture. To use pixels is a great and obvious way of encoding a picture, of transmitting it, of transforming it, but when a human mind encounter a description by pixels, nothing pops up. A picture is structured differently, the pixels are but a mesh, not unlike a co-ordinate system or a geographic grid, a picture comes alive in a different sense, and it needs a mind to do so, otherwise it is but dead inert information. The same thing with mathematics. The material objects of mathematics, sets, are just means of Platonic mathematics to manifest itself, to form the material wall on which to cast its shadows. And of course mathematical sets can be built up from literally nothing - the empty set to be exact, and what gives it structure and solidity, are the simple procedures of constructing sets.

And now we come to the crux of the matter. What is materialism really? Those atoms, which for cultural reasons initially was thought of as small featureless balls interacting mechanically, are in the paradigms of modern physics, assuming more and more abstract and intangible forms. Instead of particles firmly anchored in the spatio-temporal world, we now speak about fields and equations, and the original tangible quality of those that belongs to naive materialism seems to have been completely dissolved. Should this not provide at least some partial relief for the ardent anti-materialist? On the other hand it points more deeply to what materialism is about, its wonders, beauty but also its apparent emptiness and soullessness from which so many of us recoil. Materialism is more than congregation of mere atoms[2] it is a matter of structured congregations. Ontologically we can naively think of the universe as an aggregate of simple soulless particles. But that is not all there is. We can think of subsets of particles, those are somewhat more abstract entities, which cannot be identified with simple particles, it is something fundamentally new, and once we allow this type of entities to exist, why not proceed to the new level of considering sets of subsets, a process our mind cannot conceive of ever terminating, although it is unable to pursue it with any kind of persistence[3]. Thus in principle if the

[2] I use atoms in the sense of irreducible building blocks. The often quoted adage that the Ancient Greeks thought that the atom was indivisible, but we know better as it has been disproved my modern science, is of course too silly to justify any explanation.

[3] Mathematical structures can be thought of as sets of sets of sets... but in practice only a few levels come into play, similar with chains of quantifiers for mathematical statements which formally can be of arbitrary length in practice stop very soon. This might reflect a cognitive inability of the human mind to master more than a few layers of abstraction, just as we in principle can fold a paper indefinitely, but soon find the process impossible.

universe only contained one thing, it would in fact contain an infinitude of entities[4]. Do all those entities really exist, or are they only in the mind of an observer? The Platonic view is that they exist, independent of any observer, human or otherwise, as far as they have a presence in the observer, it is but, for reasons just alluded to, a most spectral and dreamlike one. The materialistic project is to explain the physical universe in terms roughly alluded to, namely not through material particles per se, but through intricate structures. The *a priori* existence of those structures is one thing - one may think of that as a huge configuration space in a Platonic realm, their potentiality another. But once realized they are bound by intrinsic constraints beyond the will of any observer or constructor. The materialist talks about emergent features, structures so complicated that they seem to take on a 'life of their own'. Features that have no counterpart in the constituents of which they are made. We are thus talking about something far more intangible and simple than featureless particles. Materialism contains much more than meets the eye. Thus an important aspect of materialism is its intelligibility, at least in principle, it presents to the mind ultimately a transparent understanding, with no room for miracles, special pleading. Materialism is the ultimate manifestation of reason. Therein lies a big irony, to which we will have occasion to return. Nagel does not really delve into what it means to understand, and I think he thereby misses a crucial component of his discussion

Descartes dualism is of course thought of as a philosophical cop-out, but of course from a practical point of view not only attractive but inescapable. It amounts in effect to getting the best of two worlds. Most people are dualists, whether they are aware of it or not, including philosophers in their daily lives, as opposed to when they argue against it in philosophical journals or at high tables[5]. And humanism as a whole is of course committed to this split[6]. Descartes made a clear distinction between the material world of things, in which he included animals, and the world of the mind. In the first world, so to speak, we were outside observers, while detached observation in the world of the mind would be not only impractical but intractable. The worlds were separate but somehow interconnected. To explore this connectivity lead to *ad hoc* measures that in retrospect look silly. This is always the danger when you treat metaphysical questions in a technical way. Similarly mathematical anti-Platonists such as Banacreff, have tried to ridicule mathematical Platonism by suggesting comical lines of communication between its putative realm and the standard physical. But Descartes by clearly delineating a realm of scientific inquiry, where reason could reign supreme, paved the way for the ensuing scientific revolution, which undoubtedly can be considered as the supreme human endeavor, whose ultimate fruits are by nature unpredictable and hence source for worry. The problem

[4] the mathematical universe, as noted above could even start with nothing!

[5] There is no materialistic evidence for the statement that women should be potentially as mathematically gifted as men, although there is plenty of speculative materialistic arguments for that not to be the case. It is, however, politically incorrect to claim that it is not true. Regardless of one's opinion on the matter, it is clearly a stand based on idealism. I do not offer that necessarily as a put-down, being myself very partial to the idealistic point of view, I just find it a bit amusing and ironic.

[6] As emphasized by the historian and philosopher R.G.Collingwood, who makes a very clear distinction between Nature and Man, referring to the former as a spectacle we can view from the outside, and the reconstruction of human thought is really the main task of the historian.

arises when we try to apply the naturalistic method to the mind, and thus arrive at a self-reference, the observer, observing himself.

Self-reference has been a source of paradox since antiquity. The liars paradox should be familiar to everyone. It was adaptations of the former that via Russell brought down naive set-theory, and constructive versions, initiated by Cantor (the diagonal method) which both gave birth to the transfinite hierarchy of cardinals and the major break-throughs in logic in the 1930's (such as Gödel's incompleteness theorem, and Turing's negative solution to the 'Entscheidungs' problem, each intimately related to the other). It is not hard to come up with similar paradoxes, turning the naturalistic argument on itself, the so called diagonal procedure. Thus this is something every thinking person encounters by himself if he has not already read about it[7]. Nagel centers his book as an argument against the naturalist method on the existence of three things. Consciousness, our rational faculty, and our normative notion of right and wrong. The first is the most psychologically compelling, the second lends itself to the paradox of self-reference, while the third I find irrelevant to the discussion. So let us concentrate on the first and return to the other two later.

The ultimate materialistic picture is the deterministic vision of Laplace, in which an unlimited intelligence, knowing all the initial positions and velocities of all the particles in the universe at one moment, would be able to work out their positions in any time in the past as well as in the future. The picture is too abstract and the project too absurd to really bother anyone. Different it was with Darwin's theory of natural selection and the first serious and convincing argument for evolution[8]. It really struck to the core. Although Darwin was mostly interested to use his principle of Natural selection to prove the case of evolution as a historical fact, purified as a philosophical principle (and this is the way most of us encounter it as [9]) of how explaining how order can arise out of chaos, without the intervention of an intentional designer. Darwin was also more consistent than his friendly rival Wallace, in emphasizing that evolution was universal, even including the human mind, a step Wallace shrunk away from. Thus we can form an argument. Our mental faculties, including our ability to reason and find out what is true about the world, is like anything else, a result of evolution. Thus those faculties have survived and developed because they have been compatible with successful reproduction. So what is truth? It is everything that is compatible with survival. This is the pragmatic point of

[7] I am convinced that I thought of it myself, but I cannot of course rule out the possibility that I had read it, or at least been given fairly explicit hints. It is a human psychological fact that it you encounter something you thoroughly understand you have a tendency to internalize it completely and make it totally our own.

[8] Evolution stared every naturalist in the eye at the end of the 18th century and the beginning of the 19th. In fact it was even used routinely as a method of dating rock, even by those, such as Darwin's mentor Lyell, who did not believe in it. It had been argued before Darwin was born by Lamarck, who had even proposed a mechanism for it. But Lamarck was, as we say, ahead of his times, and his theory was dismissed and ridiculed by his contemporaries as un-scientific and mere speculation. This may have greatly contributed to Darwin's noted tardiness to go public, he wanted to amass more and more evidence and not be thought of as a mere charlatan.

[9] I recall that when I first became aware of the principle I was struck by the fat that beautiful principles also were to be found outside mathematics

view of truth, enthusiastically pursued by William James[10]. But is the proposal of the theory itself (i.e. that of Natural Selection) compatible with survival? What guarantees do we have that our sense of truth, biologically evolved, should coincide with Truth, i.e. what the world is 'really' like? The argument is similar to an argument against determinism. If the world would be deterministic, so would our theories about the universe. Why should they be necessarily true, determinism could in particular determine that we were convinced of an indeterministic universe[11]? In mathematics a single contradiction makes the whole edifice to collapse. In this sense mathematics is rigid and unforgiving. Reality is more flexible, or at least our theories of it[12]. Now theories on the level of evolution are not precise enough to lead to contradictions, this is after all the nature of flexibility. There is a popular view approaching genetic determinism, which is very simplistic and asserts that any trait has a genetic basis (in the most extreme form a single one) and that every trait has appeared because it has had a selective advantage. As a consequence there has arisen a field of so called evolutionary psychology, doing in earnest what Kipling did tongue in cheek. The truth is that the genetic material plays its pivotal role during embryology when the genotype manifests itself as a phenotype. This process depends on more than the genetic information and is affected by all kinds of environmental noise. Thus there is a rather tenuous connection between genes and traits, especially when it comes to mental ones. (The neurological development of the brain may, like the immune system follows its own mini-evolution). Furthermore there are many traits, and most of them depend on the presence of several genes which are transmitted independently, thus if not exactly invalidating the selective process, does so in a far more indirect and slower way[13]. Finally any invention has unintended consequences, this holds in particular for evolution. This ties up with the issue of Platonism we brought up initially. Certain configurations of material actually are realized, it will behave in inevitable but unexpected ways. Thus much of what appears in evolution are in the nature of so called spandrels[14] features that have no prior adaptive explanation. But one thing the argument shows is that there is no real convincing argument that reliable rational reasoning should evolve. To use a mathematical metaphor, a logical system cannot assert the truth about itself. Our rationality seems to transcend

[10] Such a view of truth, is logically inconsistent and leads to silliness, as Russell pointed out. When James tried to defend himself, he only mired himself more deeply into the quagmire he had voluntarily placed himself in.

[11] This argument at least I thought of as a youth independently of any reading, just as the notion of solipsism. It stands to reason that such insights are made all the time by sufficiently inquisitive adolescents.

[12] Quantum theory is as known riddled with internal inconsistencies, that does not prevent it from being a powerful predicative method. As the Russian mathematician Yuri Manin has pointed out. In the 20th century mathematics and physics diverged. Mathematics (at least its formal and logical aspects) became introverted and obsessed with the nature of thought, physics became obsessed with reality. Of the two roller-coaster rides the second was the most exciting.

[13] There is no limit to the number of mathematical models one can concoct, and in evolutionary theory it is very hard to definitely exclude specific scenarios, hence the existence of many so called paradoxes, which become spurious on closer inspection.

[14] Introduced by Gould and Lewontine in the 70's.

its biological provenance[15]. Our rationality is in fact something we must take on faith, any attempt to rationally argue for it, is bound to be circular (an example of which we have just seen). Without any faith in our rationality, as Nagel rightly points out, the whole program of rational inquiry, in which all our scientific efforts are based on, will founder. Maybe it is simply too much to ask for to have a rational explanation of how evolution evolved our rational minds. Ultimately the philosophical conviction is based on idealism (which in that sense ironically provides the basis for materialism.)

When it comes to consciousness, our puzzlement is of a different type, impossible to put in the same clean form as that of the case of rationality. To properly understand our inability, one needs to investigate more closely the notion of understanding. What does it really mean to understand how consciousness really occurred? I remember how the mechanism of the ear was explained in elementary school. One step after another, but there was of course no explanation of how all those vibrations could produce the sensation of hearing. It was just one step after another, never getting closer to the door. The explanation did not penetrate into the brain, but even if such would be available, it would not change the sense of steps getting nowhere. As Nagel puts it, even given the precise neural activity in the brain, how can you relate it to a personal quale? Looking at it, certainly is not the same thing as experiencing it. Consciousness is eminently subjective, unlike reason being eminently portable, in particular we can no have the qualia of another consciousness, and if so how can we expect to have an objective understanding, would that, if successful not imply that we could feel the other consciousness, and it is in the very nature of a subjective consciousness that you cannot. So once again what is meant by an explanation of consciousness, what is meant in this case by understanding. What is meant by understanding in science in general? Take two numbers say with a billion digit each and multiply them. In what sense do you understand the product. You understand products in principle, just as you understand the simple principles of natural selection, but in a specific instance. The result of a calculation is in many ways unpredictable, if not, you would not have to do the calculation. The power of the naturalistic method is that it allows 'calculations'. This is really a matter of extending our cognitative abilities. In what sense do we understand the results of the calculations? Mathematical proofs are supposed to give you an immediate understanding of something. They sometimes do in some simple cases (such as irrationality of the square root of two, the infinitude of prime numbers, the uncountability of the reals[16].) But most proofs are quite long and involved and do not automatically give this feel of immediate insight, often because they involve calculations,

[15] Dawkins, in perhaps the most succinct argument for genetic determination and certainly the one with the widest impact - The Selfish Gene, asserts 'We are built as gene machines and cultured as meme machines, but we have the power to turn against our creators. We alone, on earth, can rebel against the tyranny of the selfish replicators'. What is Dawkins saying? Is he repudiating his thesis that we are constructed out of the 'selfishness' of genes, because what would be the genetic basis for such a statement? This may be the first gleeful reading, or does he simply just state that inventions have unexpected consequences, and this is one, which so to speak happens to transcend the whole process, and in so doing making man special and unique in the natural world, just as the Victorians claimed.

[16] Those are usually presented in popular books of mathematics, simple as they are I am afraid that only a minority of people are getting the point.

and long chains of deductive arguments are also in the nature of calculations. Convictions are engendered by other means, how well the results meshes with other results and clarify them. Ultimately understanding means the possibility of construction. Understanding of physics allows you to construct an air-plane[17]. Thus a true understanding of consciousness should in principle allow you to construct artificial consciousness. Then there would be the problem how to certify that there is indeed a real subjective consciousness and not just a simulation of it[18].

The final point of our values I find less relevant. As Nagel points out, there is no real logical problem with our moral values being evolved, after all human morality only makes sense in a human context and is thus not as fundamental as truth. Even if they go deeper than mere social conventions, they may reasonably be limited by our biology. That our passionate sense of justice cold be as strong as our beliefs in truth is another thing. Belief is the human response to a statement, it is independent of its objective truth. As William James remarks, we would like to believe everything, would we only be allowed. The human prospensity, nay thirst for belief, seems inexhaustible. So the feeling of belief, the sense of right and wrong, and sexual attraction, may vey well be the result of our specific evolution. Especially as to sexual attraction, we stand outside it, and can well understand its contingent nature. This does not mean that we reject it, we may only be thankful for the opportunity of pleasure it provides[19]. Still, of course, it is a bit disconcerting to admit that things you feel strongly about, such as justice, and constitutes a important make-up of your identity, would be the result of evolution. But certainly it is within your ability to accept (as opposed to the special quale of feeling righteous etc, but that is part of consciousness and feeling of having a spiritual sole.)

It is not clear in what ways Nagel wants to extend naturalism. He obviously as an avowed atheist would not embrace theism (although of course our faith in human reason, sometimes in extra-human intelligence, may be thought, at least in formal terms, as a belief in deity. Certainly it amounts to a belief in Platonism.) Where to find the middle ground? This is a tall order, and after having explored a few possible avenues, the author more or less admits defeat. His main purpose is after all to show inadequacies of the present naturalist approach. But how should it be rectified? By reform or a complete over-haul?

There is a hierarchy of natural sciences. The most basic is physics. It can be codified by a simple set of physical laws, mathematically articulated, which form the basis for

[17] Admittedly there is some controversy why an airplane is able to fly, of so even if understanding is incomplete or maybe even faulty in its details, does not prevent successful application

[18] It is wise to leave aside the problem connected with the existence of other minds, which is basically the problem of solipsism, and hence something to take on faith.

[19] If the lust abates, we are not adverse to regenerate it, thus showing that the desire for pleasure goes deeper than its particular manifestation. It is in a nature of a poison, and erotic passion can be likened to intoxication. As such, much of its appeal is due to the fact that it is not willed but seems to be beyond our control. Love which is willed, is too easily construed as calculated and not genuine. Thus in such matters we gladly surrender our precious free will. That we voluntarily intoxicate ourselves is also due to social condonation. Few if any people would take pills that would make them erotically attracted to children or horses, however pleasant that lust might be. Thus the form of our erotic desire is not part of our core, it is more in the nature of a landscape in which we may find ourselves, by dint of natural selection, comfortable.

all material existence, including that of the mind, and thus is an encoding for all that exists. The simplicity of the physical laws is a subject of wonder, maybe more so to the philosopher of the 19th century than at present. A fact due perhaps to reinforced habit. Anything that cannot be explained by physical laws, or even contradict them, is said to be miraculous. In an enlightened world, there is no room, nor any need for miracles. Occasionally new phenomena have been discovered that cannot be explained by physics. This means that the laws have to be extended. Sometimes phenomena have appeared that contradict physical laws, then those have to be reworked. Electro-magnetism is not explicable in terms of the law of gravitation, hence it must be presented on its own. It is tempting to think of physics as being axiomatically based, as the standard presentation of mathematics. Newton certainly was of that opinion. His 'Principia' is written in the spirit of Euclid. Literal attempts to set up axiomatics for Quantum theory have not been particularly successful. The two great innovations of 20th century physics - General Relativity and Quantum Mechanics, are at loggerheads. The most important task of theoretical physics is to bring about a logical unification, and preferably a complete set of physical laws, setting down the rules once and for all. This would be the holy grail, a theory of everything. Inspired attempts to do so, is known as string theory. It has attracted a lot of activity and many young people. It is exclusively a mathematical exercise with no empirical grounding, its guiding light being mathematical beauty and economy, in other words appealing to human understanding. Mathematics is at least by those of a Platonist persuasion considered trans-human, but mathematical appreciation, understanding and sense of beauty, are of course components of the human mind. The driving philosophy behind such an enterprise is of course human intelligibility. This is a strong metaphysical belief. Of course any non-technical reflection inevitable leads you to metaphysics, As Collingwood quipped, those who reject metaphysics thereby take a meta-physical stand.

Now, as Feynman noted, knowing the rules, i.e. knowing the laws, does not mean that everything is done and finished. On the contrary, that is only the beginning. Only by knowing the laws of chess are you ready to start to play. And the intricacies of the game seem to stand in no relation to the simplicity of the rules[20]. It is hard to think of anything simpler than Newton's gravitational law, yet applied to more than two bodies it quickly becomes intractable for a mathematical analysis. Simple laws have complicated consequences. Now it is the time to digress. What kind of entities are physical laws? They obviously are not things, and due to their universality they cannot be pin-pointed in space and time? Some try to deprive them of real existence. Physical laws are just figments of the imagination. They have no real existence, they are just useful fictions, allowing us to describe, categorize and simulate reality to make predictions or present spurious explanations. The Catholic Church had no problem with an heliocentric theory, as long as it was understood as a mathematical model in order to facilitate calculations. Atoms (the very particles out of which matter is built) were for a long time thought of as theoretical metaphors not to be considered literally. The problem with this instrumentalist point of view, according to Popper, is that we cannot draw such a distinct line between theory

[20] This is incidentally even more true of the game of Go. Or to take the case of mathematics. The simple algorithm of Eratosthenes sieve selecting out the primes, leads to the deepest questions known to mathematicians

and reality, that our perceptual world carries no pride of place[21]. Yet, the laws are not canonical, just as the choice of axioms of a mathematical theory is a matter of convention and convenience. Certainly they can be formulated in many ways. A suggestive formulation is in the principle of least action. The movement of a particle is such that certain things are minimized. Could this not be seen, tongue in cheek, as a kind of teleological law?

Now Nagel is certainly not out to present some new law of nature. It is very hard to imagine one that would change the picture so drastically. All the laws of nature are mathematical in nature and their consequences are worked out computationally. What he clearly has in mind is some other principle that goes beyond the postulates and involves some new way of thinking and drawing conclusions.

Now chemistry is about how atoms interact. Chemical laws empirically discovered can be 'explained' i.e. reduced to the fundamental physical laws. In this way chemistry, from the purely deductive point of view does not add anything to physics. But of course knowing the rules does not tells you how to play. What is chemistry really about? It is about constructing new chemical compounds, using known ones. The chemical property of a compound consists in how it reacts with other elements, how it produces new compounds. If we now considered the imaginary space of all possible compounds, a little bit like Borges library of Babel, then there would be no chemistry, because chemistry is the dynamics of creating new elements. Of course when a new element is actually realized (as when a new book is written, although its potential as a string of letters, were always there) it will have properties that are forced on it. But most of those will depend on what other compounds happens to be there already, just as the impact and importance of a book, depends on what other books there are. The chemical basis for biology depends on the existence of certain complicated and self-reproducing molecules along with a cloud of assistants doing all the necessary work. I am of course thinking of proteins and enzymes. The chemical properties of an enzyme depends very crucially on its spatial shape. The way a linear array of atoms twists can in principle be calculated by physical laws. It leads to a deterministic form. Thus we have here a case of unintended consequences. While the mathematics of basic physics is conceptually very simple and beautiful, this aspect disappears when we start contemplating complicated molecules. We cannot understand their shapes, this is something that has to be calculated. Thus the initial beauty of mathematics, as conceived by the human mind, is dissolved. Biology becomes so complicated that the notion of understanding is lost, each shape could be thought of a miracle given by God, although in principle deterministic and possible to simulate and predict on sufficiently powerful computers. Then of course this is just the beginning, The intricate interactions of those intricate molecules is far more elusive for the human mind. Is not biochemistry an adventure more intricate and subtle than anything we can think of? Why should it bother us that our souls are the result of the pinnacles of this process? But it does for most of us, maybe because of our ways we have been biologically evolved. Our natural attitude towards cosmological reflection may not be that of naturalistic science but some form of religion. You may dismiss that as a form of sentimentalism, but it is lodged deeply in us.

[21] A distinguished proponent of this attitude was the eminent French mathematician Poincaré, who pointed out that whether the universe was Euclidean or not, was not an empirical question, but one of discretion, depending on what we might define as a real line.

Now Nagel points out that no satisfactory explanation of the emergence of life has been given. What is life? When the Martian lander was sent to its target planet a philosophical question (famously addressed by Schrdinger) became of urgent practical importance. To look for life you need to be able to recognize it when you see it. On Earth it is easy, you can give a very precise definition of life, namely DNA. What is remarkable is that all 'life' on earth is based on DNA. In view of the fact that a huge variety of different life forms can cohabit our planet, why should there not be a similar case with different types of complicated self-replicating molecules? Or could it be that the real bottle-neck is the evolution of DNA? Evolution was initially thought of in teleological terms as an inexorable tendency to greater complexity and sophistication, but of course evolution can as well go the other way as exemplified by parasites. Yet this teleological bias is deeply imprinted. The advocates of extra-terrestrial life, argue that we must expect that the emergence of life is no accident, it is in the long run inevitable, and by implication the emergence of intelligence. Nagel is also of this view, a satisfactory explanation by science of the emergence of life and intelligence and consciousness, must show its likelihood, nay even its inevitability. Why is that? Could it no be the case that the emergence of life on this planet is not part of some universal law but a quirk, and we are indeed alone in a vast universe? The universe is large but the actual number of galaxies and stars is from a mathematical point of view minuscule, dwarfed by the combinatorial numbers that occur in the case of the Borgesian all-inclusive library. Do we really believe that any sufficiently big and complex entity, such as a vast computer, or a star, sooner or later by the Darwinian principle of selection, will refine itself spontaneously from chaos, to order?

To recapitulate and summarize what we have so far discussed. Is it possible to download a human mind into a computer and in such a way achieve immortality? This is considered the ultimate materialistic stand. What does it really mean? For one thing that structure is independent of material manifestation. There is no need to base consciousness on neurons, it can be based on electrical circuits. The informational content of a mind can be encoded in a long string of zeroes and ones[22]. In which way does that constitute a human mind? Frege asks sarcastically in his book on the foundations of arithmetic, what is a number. What is the number five? Is it Julius Ceasar? In this way Julius Ceasar would be encoded as a huge number? All numbers exist, so do than in fact all digital encodings of human minds. But how do we go from an encoding to an actual mind? Do we need a temporal calculation? The computer program that encodes the basic algorithm? But of course the entire calculation, which is seen as evolving in time, can dynamically be encoded in an even larger number. Once again, what is difference between this process and its encoding? All those strings do exist in some Platonic configuration space, just as all numbers exist. But if a number is large enough, why does it not come alive by its own? Is there a crucial difference between potentiality and actuality. This can only make sense if we really think that structure is not enough to exist, there has to be a particular material encoding. Thus in the sense endowing mere things with an mystical being. Matter is actually needed for something to be actual. There is where the buck ends, so to speak,

[22] This is of course clear for the purely factual information, but also for the dynamic process of a brain, which by this philosophy can be identified with some algorithm that can be perfectly encoded by a computer program, which by itself can easily be encoded.

because after all those encodings of information are in many ways *ad hoc*, but of course we can encode the encoding procedure together with the encoding, to get an even larger number. But of course this encoding needs also to be explained, and so on. Do we have an infinite regress, or does it end in a very tangible way?[23]

Behind this sentimental attachment to a transcendent reality is the fear that human reason and curiosity will have entered a Faustian deal. By the power of the reductive method, it will be able to manipulate reality, including itself into even more adept manipulators. And where will this spiral end? Will it lead to a galloping exponential growth in order, which soon leaves man behind as a primitive and outmoded intelligence? Tribal society has many advantages over a democratic one, as Popper scornfully points out, denouncing the former as fascist. It is static and thus paradisiacal, in modern parlance it provides sustainable living, and is in total harmony with the way we have as biological creatures evolved. As such probably more conducive to human happiness than the expanding and curiosity driven civilization of limitless growth of which science is the engine.

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[23] The text of a book is encoded ultimately by letters. It can be done in many different way. Ultimately the meaning of a text, in as far as it has a meaning, is not intrinsic to the text, but is to be fund in the human reader. (This is why the Library of Babel exists in its entirety only as a mathematical enumeration, in fact it can be seen as just a list of the first 10^{10^6} numbers or so, but not as a library of actualized meanings, only potential). In the same way we can think of the universe as a huge book, whose meaning only emerges externally through something we could not conceive as anything but 'God'. No doubt a very suggestive and seductive argument to many. But how to make the meaning intrinsic? All the information of the universe, could be encoded in a huge text (but of course quantum theory with its evasion of exact information for similar reason would give a way out, at least of this particular form of reasoning) or if you prefer a huge number. As we noted the spatial shapes of complicated molecules are determined of physical laws.The very shape determines the way it interacts, not by prediction but by the way it actually works out. Its properties are not encoded in it, because all the way an entity interacts with the environment can never be worked within itself. The universe is a giant calculation which cannot be simulated except by itself. Any part of it, no matter how small, cannot be isolated from the whole and perfectly simulated.