

Conclusions

I was eighteen years old and the awareness was forming in me of how senseless it was to study the physical world without studying the brain, which is the machine with which one understands the world. Later deepening the physics I saw nothing else, after the discovery of the wave characteristics of matter, than a large amount of experimental results due to increasingly powerful machinery but no theoretical progress able to connect them organically. I only saw bits and pieces of theories, sometimes with sectoral predictive power, but these were soon overtaken by new experimental results. In particular, I regarded particle physics as a kind of children's herbarium and the probabilistic interpretation of quantum mechanics itself as a contrivance that added nothing to what was known. Mathematics began to irritate me because of its use in physics, which I compared to mere rhetoric, hiding nothing and constituting a large part of scientific publications. Possible, I said to myself, that when, before the twenties, the scholars of physics were very few physics progressed a lot, now with so many resources available the progress has stopped? I became more and more convinced that the explanation for this stagnation had to be sought within the limits of the human brain.

So I have begun to study neurophysiology, psychophysics, I learned to use the computer to prove my theories, oriented by the evolutionary vision of life and the thought of two giants: Democritus of Abdera and David Hume. I will explain some traits of their thinking that have connections with my work. I beg your pardon for any mistakes, I am not a professor of philosophy.

Democritus was born about 460 BC.C and died about 100 years later. We know little about him, even less than Leucippus, who perhaps was his teacher and who would have given many ideas to Ours. According to Democritus, matter is made up of atoms, that is, indivisible particles, different from each other in form and endowed with certain properties, including hardness. Their varied aggregation constitutes all the material variety of the universe. The atoms move in a straight line in the vacuum. They are not perceptible, they are reached only through reason. What we see is a kind of configuration. For Democritus, emptiness is not nothingness. In order for this awareness to be formed among the learned, it will be necessary to wait for Descartes and especially Evangelista Torricelli, about two thousand years later. This vision of the world was the basis of physics, from Galileo to the twenties of the twentieth century. It does not matter if atoms were studied in physics only in the twentieth century and shortly before, as a hypothesis in chemistry: the model of the world of physicists was that, the bodies behaved like the atoms of Democritus, more precisely as aggregates to them. However, the atom of Democritus has nothing to do with that hypothesized by twentieth-century physics, not even with the more archaic one, which resembles a solar system: the atom of Democritus must be thought of as a hard pebble. It goes without saying that it is the small element of mathematical analysis, so Democritus, as well as the father of physics, is also a forerunner of this discipline: he went against the ideas that would later triumph in Euclid's geometry, points without dimensions, planes without thickness... In any case, little is known about Democritus. His writings have been lost or burned by Plato's followers, by Christians, ... by severe men, aware of their superiority, of the role they have in the world, of the triumphal fate that they will have after death, etc ... I agree with Erwin Schrödinger who said bitterly : "We must not trust a humanity that loses the works of Democritus and keeps those of Plato". I smile thinking that if such a great, one of the greatest geniuses who has trampled this Earth, has had this consideration, he who knows what will be the success of my modest reflections.

David Hume was born in Scotland in 1711, over two thousand years after Democritus. He did not believe that in the world outside our skull there were people, streams, mountains... He argued that the world outside our brain is unknowable. In fact, a person is led to think that there is a flower, with its petals and its colours, confusing the visual perception, that is the shape of the flower with reality. If man did not have sight but only smell he would be induced to think of the flower as his perfume and of the world not as a whole of smells and not of forms. The flower is nor the shape of the flower neither its perfume, who knows what it is. Our ideas come from perceptions and Hume defines several ways to associate ideas: the cause-effect relationship is the most important one and

this association is the result of a habit. We hear some cats meow and we associate the cat with the meow: there is no reason why the cat doesn't bark or chirp. In the same way, we repeatedly see the Sun rise in the east and there we wait for it to rise, we generate the cause and effect relationship in our mind. Physical law? No, habit from which the physical law is derived, hoping it will last. Tomorrow either the sun could rise in the west or the cat could start barking.

The conception of Democritus and that of Hume are very different: at the basis of Democritus' thought there are atoms and voids that collide and swirl in a predictable way and each state of the universe is a consequence of the previous one, for Hume the physical reality is unknowable and predictions are cast out of habit. The development of the universe according to Democritus is deterministic. Hume does not ask himself this problem because he excludes that reality can be fully known, consequently all its development is doubtful and insecure. I adhere to this second world view, although I think that a scientific theory has increasing value the more it manages to provide accurate results in its predictions. Hume said: cats may bark tomorrow, but I still act like they keep meowing. The mechanistic model of the universe has a very powerful predictive power and this meant that, as many people confuse the shape of the flower with the flower, many physicists confused the mechanistic model of the world of Democritus with the world.

Still talking about cats: there are no two identical cats in the world, just think of the various breeds. However, a two-year-old child seeing a cat and a goat recognizes the cat and expects the first one to meow. Hume would say: the child associates ideas by similarity. Excellent observation but must be investigated. The recognition of shapes but also of sounds, which a small child can manage is one of the most difficult and unsolved problems in the theory of artificial intelligence, goes by the name of pattern recognition and has been the study of my life. However, it is not necessary to solve this problem to understand the relationship between the world and the brain, rather it is necessary to reflect on the evolution of the species. Let's consider a primordial, uniform and nutritious broth in which a protozoan grows and multiplies. Although life and intelligence are poorly defined terms, I don't see intelligence in this protozoan behavior, I only see life. If after some time a poisonous molecule appears in the broth, most of the protozoa will die because they will absorb the molecule. Only some of them, lucky, due to a genetic mutation will be able to keep out the molecule and survive. It can be said that the latter recognize the molecule, because they keep it out of the nucleus, realize the prediction, concretize the relationship between cause and effect and it can be said that they have the membrane endowed with intelligence. The membrane is the beginning of what will be the chemosensory system, it is reached with further massacres and mutations, certainly not through the chemical analysis of the broth and the work of genetic engineering to form this apparatus. The genesis of the cerebral apparatus, of its ability to predict, of what an imprecise phrase is called intelligent behaviour, must be sought only in luck. It is not possible to design the senses and the brain if one does not even know what they have to interact with. Molecules are not the only link between the world and the brain: I think of photons, vibrations, physical contacts. I will limit myself to consider the first, which concern the sense of sight. Initially the visual apparatus consisted of photosensitive cells scattered on the body of the primitive being, then they are concentrated in areas, etc ... It is an apparatus that operates a kinematic recognition, as it warns of the effects of bodies in relative motion with respect to the living. This allows you to avoid shocks, understanding if a predator is moving closer ... The chemosensory apparatus, which recognizes the molecules, instead realizes a substantially static recognition. In humans and higher animals there are two visual apparatuses: a more archaic one in the midbrain and a more modern one in the visual cortex. The mesencephalic vision has less and less weight as you climb the evolutionary ladder. Both the cells responsible for mesencephalic vision and those of the visual cortex are in correspondence with those of the retina and respond, not only to the excitation of retinal cells, but also to the direction of movements. In the visual cortex they are the complex cells, discovered by Hubel and Wiesel, whose studies were a comforting confirmation of my intuitions. Both in the midbrain and in the visual cortex appear excited areas, interpretable as empty and large areas not excited, immobile, interpretable as opaque bodies. In excited areas, small unexcited areas appear, interpretable as small bodies, aggregations of atoms, which tend to move in one direction. It is the model of Democritus.

Ever in the visual system there are cells called phasics that respond to the passage of a body from quiet to motion. All this makes sense in the prediction of the effects of the movement: it is important to know that a stone is set in motion but it is important to know its direction, possibly to avoid it. The first principle of dynamics states: a body in stillness remains at rest and a body in motion perseveres in its state of rectilinear and uniform motion if there are no forces altering these states. Phasic cells detect the transition from quiet to motion, complex cortical cells and directional cells of the midbrain detect the change of direction. The first principle of dynamics is the reflection of the functioning of the visual system, which is predictive in itself, which can be improved if you throw mathematics over it, but a billiard player can be a champion without having studied rational mechanics. The first principle of dynamics is unproven, Einstein became obsessed with it and thought he had found the inertial system, the place where this first principle applies, in the elevator in free fall. In fact it is not very true in it the gravitational field is not uniform, in it a moving body does not proceed in a straight line, moreover he identifies gravitational field and field of forces due to acceleration: it is not exactly so, the latter field is instead uniform. I can talk about this in detail elsewhere, here explicit that, in front of the first principle, I put myself in another perspective: I think it is the reflection of an approximate predictive model, valid in the environment in which we have evolved, related to our needs and limited by the connection between the world and the brain due to photons. I find it foolish to attribute ontological nature to this model and try to prove its existence in the world. As non I believe that outside our heads there are flowers, streams, mountains as we see them I do not think there are even motions: they are indices of who knows what transformations in the world. Since many of them appear as rectilinear, it can be said that they are the most usual. So far I have spoken of the chemosensory system as the responsible for static recognition and the visual one as the person responsible for kinematic recognition.

However, in the visual cortex, always according to the classification of Hubel and Wiesel, there are also simple cells, a more recent result of evolution, which do not respond to movements but only to angles. I hold these cells responsible for static visual recognition, which is the competitor of chemosensory, but based on photons and not molecules. (Actually, a very rigid recognition is also the work of hypercomplex cells, but it is a path that evolution has abandoned). For human beings, the visual system is the main way to recognize objects, whereas animals, even the superior ones, that have the cerebral cortex similar to ours, trust the sense of smell more. I would underline recognition must be linked to the cause and effect relationship, and therefore in the case of the visual system two objects that appear similar must lead to the same effect. This ability of the visual system has been realized by the evolution, as happened for the chemosensory system, but it is not at all free of errors: It is true that a child recognizes two cats of different breed, but it is also true that two similar mushrooms can be one edible and one poisonous. The visual cortex of higher animals is extremely similar to human but, while higher animals improve the predictive power of visual perception by smell and taste, I think of a cat that first looks at food, then sniffs it and then tastes it, Man decomposes the object into many details, connects them in a geometric network and gives each particular a weight in the recognition of the object. For example, can be given a great weight at a small detail of the mushroom in question, thus allowing us to understand its edibility. Certainly powerful method that opens the door to the articulated language, proper to the human species alone, but the epistemological limits remain identical because every detail of the object is analysed by similarity, as the complete object: everything is always subject to evolution, environment and photons, as well as the primary needs of the living. Each of us would consider it stupid to study atomic and subatomic physics with the chemosensory system, that is, with molecules. A representation of that world in terms of smells, could not be exhaustive and predictive. That said, it is not clear why we want to study this world with physical laws that are habits inherent in the mechanistic model of Democritus that comes from photons, from the macrocosm. That the mechanistic model does not work in the microcosm there is awareness among physicists, however most believe that many laws of classical physics can be extended to the microcosm, even though with some modifications. There is a lack of awareness that knowledge of this environment is not possible without a new evolution, with massacres and massacres connected, that establishes a means

to connect the brain and the environment, as are molecules and photons in the macrocosm, which forms senses and brains capable of obtaining predictions for the specific purposes of the living being. In conclusion, they do not realize that knowledge of this world is substantially impossible to us. What I said for the extremely small applies to the extremely fast: small and fast are two indices that warn that we are changing environment.

That the brain is not able to understand the atomic and subatomic environment does not mean that we cannot understand the brain: it is an apparatus of the macrocosm, the currents, the molecular fluids that run in it are formed by millions of atoms, There is no quantum aspect to it. Its study is in the field of classical physics, the one that has always given excellent results and it will be possible to build an artificial one. Obviously it will have the same epistemological limitations as the human brain. It's been the study of my whole life.

I would like to say a few words on concepts that are fundamental in physics.

In my opinion, space is nothing more than an abstraction on the representation of the visual field. Field of view, that is, the excited zone in which non-excited stains run: vacuum and atoms. Does it make sense to ask whether this representation has physical reality? No, it is the same mistake that makes those who confuse the flower, external to our brain and unknowable, with its shape. Does it make sense to torment oneself over infinity? To think that space should be included in another space? No. It's a nonsensical extrapolation of the visual field, who knows what the outside world is like? It doesn't even make sense to think about a point without dimension: this is also an extrapolation that leads only to absurdity. Leucippus already warned that without the atomic hypothesis the paradox of Achilles and the turtle would make sense.

Time is a less immediate than concept of space, it is a construction that certainly comes from movement. Men have always measured the times with periodic motions: the war lasted 15 moons etc... Its use is useful in describing kinematic recognition, to understand, for example, whether one effect will precede another. However, the periodic motions are defined as those motions that, after always equal intervals of time, resume the initial characteristics. For example, a lunar period is the time between two full moons. Perhaps before giving this definition it would be useful to ask: how do I know if the time intervals are always the same if I do not know how to measure the time?

However, this is something that needs to be discuss elsewhere.

About the mass, the wondering what mass is like wondering what is a flower, we perceive, its shape, its scent, its softness,... Everything connects in Hume's idea of the object as a beam of perceptions. The object up to a certain point can be thought of as an aggregate of atoms in the sense that it gives it Democritus. They have hardness, extension, volume, inertia... Some of these characteristics are measurable and are used to operationally define mass. Of course, the Democritus model holds true in the macrocosm. On the mass it will never be possible to have clear ideas: it is a portion of the external world, that is unknowable.

About the visual sensation. The midbrain vision is called blind vision because people deprived of the visual cortex, therefore blind, placed in front of a lamp in a dark room can tell if it is lit and indicate where it is. However, they claim not to see the lamp. In the same way if on the path of these people they place boxes, they are able to avoid them, claiming not to see them. These people are clumsy in their movements and make many mistakes, but statistically it is unmistakable that they locate lights and objects, even without seeing them. If I built a machine that could juggle the world like a man, that recognized objects like a man, I wonder would have visual perception or would the machine have blind vision, like human mesencephalic vision? Elsewhere I have described the human visual system and I have shown how images are formed in the brain, how optical illusions are generated inside it, but I don't understand why people are conscious of perceiving things. It's a useless quality in the visual system. Moreover, only the motions and forms are perceive consciously and only at the level of cortical and not mesencephalic vision. In addition there isn't awareness of how you operate the brain to define similarity. What is consciousness is too big a question for me. However, consciousness is a useless hypothesis in the construction of a brain that simulates the behaviour of the human brain.

