

Book Review
Anaximander

Carlo Rovelli
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The interest of Carlo Rovelli, a brilliant contemporary physicist known for his fundamental contributions to the so called loop quantum gravity, for *Anaximander*, is motivated purely by scientific considerations. His only true aim is to evaluate, from the preferred perspective of contemporary physics, the first great conceptual revolution that stands probably as the birthmark of the scientific thought. In other words, his interest is the birth of that research spirit that nowadays we call the scientific investigation of nature and of natural phenomena.

Anaximenes, Thales and Anaximander constitute a first group of thinkers that Aristotle himself called naturalistic philosophers, because of their attempt to provide an explanation of the natural world solely in terms of natural causes.

Thales was concerned about a very general theme: what is the fundamental origin of nature and all of its parts, what is that fundamental substance that all of the things are composed of? Thales's own idea comes from the empirical observation that wherever there is water there you find life. Thus he advanced the hypothesis that water is the fundamental element that constitutes somehow the origin of matter in all of its forms. This was just an hypothesis, but, as Rovelli points out, it was the first one about the constitution of reality that neither appealed to mythical explanations nor required divine interventions.

Anaximander, Thales's pupil, learned the very spirit of this first lesson. He founded however his teacher's answer unsatisfactory and thus he set on to provide a different and better one. Probably his argument was something like the following. If there is a fundamental substance out of which all other substances somehow derive their being, it cannot be any of those visible substances that are immediately available to sensible experience. That fundamental substance cannot have constant properties but it must be something indefinite in its own nature, always capable of assuming different

forms without thereby changing into a particular of those forms.

Moreover he takes a further step. The natural world, natural events and their intrinsic dynamics have to be regulated by Necessity that manifests itself in laws that govern the passage from one state of affair to another. These laws are exactly natural laws, in the sense that they regulate natural events according to a necessary temporal order. Every natural phenomenon is at the same time both cause and effect of other different natural phenomena and thus the natural world is causally closed.

We know that Anaximander wrote a treatise, *On Nature*, but all that is left from this work is an obscure fragment. What we know about him and his work comes from the testimony of later authors such as Aristotle and Theophrastus. Therefore a faithful reconstruction of Anaximander's work is not an easy task. However in recent times modern scholars have been reading again all of the existing materials and have been able to find new material as well. On the basis of these new developments Rovelli is able to sum up Anaximander's thought and highlight the revolutionary character of many of his thesis. The result is simply amazing for audacity and depth. Anaximander was the first one to hold that:

- 1) Meteorological phenomena have natural causes.
- 2) Earth is a body of finite dimension that is suspended in empty space and does not fall since there is no privileged direction of motion.
- 3) Sun, Moon and Stars revolve around the Earth dragged by invisible wheels.
- 4) Every animal, and men among them, comes from the sea and they have evolved from different forms of life.
- 5) All of the things in their multiplicity comes from a unique origin or principle, called *apeiron*, that can be translated as indefinite and limitless and
- 6) things change according to necessity, i.e., in accordance with universal laws.

Philosophical historiography has focused solely on the philological or metaphysical aspects of the word *Apeiron* and on its origin. There has been a long discussion on how to interpret this terms that can have so many different meanings. Rovelli, on this underestimation of Anaximander's contribution to the birth of the scientific thought, has a precise idea that boils down to the difficulty, for many intellectuals that have a historical or philosophical

formation, in evaluating the measure of those contributions that have an intimate scientific nature.

The most flagrant example of this underestimation, and the central core of Rovelli's marvelous book, is the genial intuition of the fact that the Earth is somehow suspended in the empty space. Rovelli points out an interesting analogy. The fact that the earth was round and not flat is already found in one of the most widely discussed of Plato's dialogue, namely the *Phaedo*. This suggestion is another staggering contribution to the scientific thought that is always forgotten. For those who read and study *Phaedo* do focus only on the question of the immortality of the soul. This is a clear example, according to Rovelli, of the distance that separates two kinds of cultures, scientific culture on one hand and humanistic culture on the other.

Scientific thought is certainly a historical product of human civilization. And because it is a historical product is destined to undergo the influence of historical events and to share their destiny. The development of science is not a linear, cumulative process that does not know any stops or involutions. Rovelli, on this very point, refers to the wonderful essay, *La Rivoluzione Dimenticata (The Forgotten Revolution)* by Lucio Russo (1996). This is to remind us that science and scientific spirit even more, are fragile conquests that are always in danger, always exposed to the attacks of numerous and unsuspected enemies. More often than not underestimation is a weapon in the hands of those enemies.

Then today a new reflection on the nature of scientific thought is necessary. We should examine again its definition, its fundamental characters, its peculiar methods, its scope and its aim. And, as it is usually the case, one of the privileged way to understand the essence of a cultural phenomenon, is to go back to its roots and origins and focus more carefully our attentions to those first stages of its development. This is exactly what Rovelli has done in this wonderful book.

The figure of Anaximander seems to sum up all of the most salient aspects of scientific enquiry, its guiding principles and methods. According to Rovelli, Anaximander was the first one to understand e put in practice what can be thought as the fundamental credo of every modern scientist, that is that we should study great Teachers, comprehend their lesson, and on the very basis of this lesson, reveal their mistakes, correct them and promote an always better and always perfectible understanding of the world.

The cultural basis of the birth of the science is the same one on which

democracy is built upon, that is the discovery of the effectiveness of criticism and of dialogue among peers. Anaximander that proposes an insightful criticism of his own teacher Thales puts forward again, on an intellectual level, so to say, what was standard practice at the social and political level. And that was the fact that the authority of any political power should not be accepted unconditionally, for authority's sake, but the proposal of the city magistrate, should stand critical scrutiny, in a shred awareness that there is always a better proposal.

Rovelli draws attention to this analogy explicitly. It is in a certain sense the discovery of the scientific method. Someone proposes an idea, a thesis. It is considered carefully, it is criticized, it is improved upon. Then other theses are advanced. They are compared. The extraordinary discovery is that this whole process sometimes converges.

Science and scientific research are public, in the widest sense possible. Everyone can participate and everyone can criticize and even refute everyone's thesis. There are no absolute truths, nor untouchable authorities. The only source of authority is not a given name but the strength of the argument that is being put forward. And a proposed thesis is more convincing if it stands more attempts to be refuted. But it always remains provisional, refutable. It is not difficult to see, even in this very rough sketch of the nature of scientific enterprise, the essential traits of democracy as a form of government. Uncertainty and doubt are the strength of any truly scientific enquiry. This may sound paradoxical, but only to those that do not know the history of scientific development.

This topic inevitably leads to the question that Rovelli deals with in the last part of his work: the relationship between science and religion, both from a theoretical and an ethical standpoint. Rovelli, with subtle sensibility, asks himself two difficult questions. The first one is why science seems to have lost much of its fascination and seems more distant from the concerns and problems of most of the people. The second one is what is the real nature of religious thought and what are the reasons of why such a thought is so deep-seated in human nature. Almost all of the second part is devoted to possible answers to these two questions.

Rovelli observes that in the last decades the activity of practicing scientists has become more difficult and almost esoteric for those who are not in the field. And furthermore it seems to have lost its essential and fundamental capacity of being a visionary discipline, an immense producer of images of the

world. And along with that it has lost its appeal as a creative activity and its fascination of being capable of true human emancipation.

And these observations are, unluckily, true. Rovelli's book then becomes even more important for it gives us back an image of science that is but the great image that another major physicist of our time, John Bell has left us. The Enterprise is to understand the world and we should never betray the Enterprise.

