Alexander Bird, **James Ladyman, (eds.)**
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Paraphrasing Karl Marx's eleventh *Thesis on Feuerbach* we can state that we have to interpret the world in order to change it and science, in this respect, seems to be the perfect discipline able to do it. Science interprets and explains natural phenomena, but at the same time it allows us to develop technical instruments able to modify the world we live in. Nowadays science it is considered as the main discipline responsible for responding to the most important problems concerning eco-system, ethical issues and so on, but a lot of philosophers and intellectuals continue to mix up technology with pure science. Science is not a mere technological or practical discipline, because its driving force is human intellect that aims first of all at unconditional knowledge of natural phenomena. In this respect there is no difference between a scientist and a philosopher because both them are motivated by the pure will to knowledge. Obviously, the debate about the aims and methods of science is still *in fieri*, and it is very important to continue this debate in order to make clear what science is and what science can do (from a theoretical and practical point of view).

Recently, a very extensive volume has been published, *Arguing about Science*, edited by two outstanding scholars of science and philosophy of science: Alexander Bird (Professor of Philosophy and Faculty of Arts Research Director at Bristol University, UK) and James Ladyman (Professor of Philosophy at Bristol University, UK). This volume focuses its attention on the nature and methods of science but at the same time it takes into account also the relationship between science and some contemporary issues like race, feminism, biology, science policy, medicine and so on.

The volume is divided into nine parts and the first one, obviously, is devoted to the main question concerning science, that is to say: what is science?

This first part is an anthology containing writings of some classical philosophers of science like Karl R. Popper *(Science: conjectures and refutations*), Thomas Kuhn *(Objectivity, Value Judgement and Theory Choice),* Adolph Grünbaum *(Is Freudian Psychoanalytic Theory Pseudo-Scientific by Karl Popper's Criterion of Demarcation?)* and Stephen Jay Gould *(The Mismeasure of Man).* As it is well known, sir Karl R. Popper used to distinguish science from pseudo-science by taking into account the problem of demarcation. Science, according to Popper, must satisfy the requirement of falsifiability: some examples are taken by Popper from Marx' economic theory and Adler's individual psychology. Neither, according to Popper, are scientific theories because they never try to falsify their own assertions but instead they try to verify them; that way these theories are able to explain everything and they are never wrong. Instead, according to Popper, science often errs and scientific progress has been possible through to the discovery of new theories that dethroned the old ones (for instance, the heliocentric theory dethroned the geocentric one). In this respect, according to Popper, falsifiability is the main requirement of science and not verifiability; further, Popper analyzes the issue of scientific method taking into account the difference between induction and deduction. The first cannot be the correct scientific method because it starts with

pure observation, while according to Popper every observation is guided by a theory or by an hypothesis. In *Conjectures and Refutations* Popper states that the "belief that science proceeds from observation to theory is still widely and so firmly held that my denial of it is often met with incredulity. […] But in fact the belief that we can start with pure observations alone, without anything in the nature of a theory is absurd" (p. 25). The second reading, that is to say Grünbaum's *Is Freudian Psychoanalytic Theory Pseudo-Scientific by Karl Popper's Criterion of Demarcation?*, it is a sort of defense of Freudian theory, while Popper, instead, tried to attack it. According to Grünbaum inductivism provides good instruments that put into light some deficiencies of Freudian psychoanalysis better than Popperian falsificationism.

The third chapter is a Stephen Jay Gould's reading entitled *The Mismeasure of Man*, that analyzes issues like correlation, cause, factor analysis and so on.

The fourth one, Thomas Kuhn's *Objectivity, Value Judgment and Theory Choice*, is taken from Kuhn's famous major work entitled *The Structure of Scientific Revolutions*. As it is well known, according to Kuhn, science is not cumulative, but on the contrary there is an alternation between normal science and scientific revolutions (an example of normal science was geocentric theory while an example of scientific revolution was the rise of heliocentric theory).

The second part of this book is entitled *Science, Race and Gender* and it focuses on very important recent issues concerning racism, sexism and so on. The issue of race, in the field of science, concerns first of all the problem of its validity from a scientific point of view, because is not easy to assess whether "race" is a meaningful scientific category or not (some philosophers assert that the category of race can act as a good social and legal category, which is very useful in order to confront political and legal issues concerning racism, sexism and so on).

The first reading is entitled *Gender and Race: (What) are they? (What) do we want them to be?* and is written by Sally Haslanger. The author focuses her attention on the ethical, social and political aspects of issues concerning race and gender. She doesn't try to provide a unique set of categories for this problem but instead an epistemological framework "explicitly designed to allow different definitions responding to different concerns" (p. 96).

While Haslanger faces the issue of race and gender from a social, ethical and political point of view (and Lucius T. Outlaw does the same with his reading entitled *Toward a Critical Theory of "Race"*), Helena Cronin, with her reading entitled *The Battle of the Sexes Revisited*, analyzes this issue taking into account the biological and evolutionary point of view. Evelyn Fox Keller, with her reading entitled *Beyond the Gene but beneath the Skin*, takes into account the issue of genetics.

Robin O. Andreasen, with his *Race: Biological Reality or Social Construct?*, analyzes the issue of race taking into account the history of race debate that he summarizes into three incompatible propositions: BR: Races are biologically real, SC: Races are social constructs and I: Biological realism and social constructivism are incompatible views about race.

The other two readings at the end of the second part of this book, that is to say Joshua M. Glasgow's *On the New Biology of Race* and Clark Glymour's *What Went Wrong? Reflections on Science by Observation and the Bell Curve*, analyzes the issue of race from a biological point of view like Fox Keller's and Andreasen's readings.

The third part of this book is entitled *Scientific Reasoning* and it contains classic readings of classic authors like Peter Lipton (*Induction*), Hilary Putnam (*The "corroboration" of Theories*), John Stuart Mill (*A System of Logic*), William Whewell (*Of Certain Characteristics of Scientific Induction*), Peter Achinstein (*Waves and Scientific Method*) and Michael Strevens (*Notes on Bayesian Confirmation Theory*).

The fourth part of the book is devoted to the problem of explanation in science and it contains readings of Wesley Salmon (*Scientific Explanation*), Bas van Fraassen (*The Pragmatics of Explanation*) and Peter Lipton (*Explanation*). According to van Fraassen what matters, as far as the correctness of an explanation is concerned, is the explainer ,his interests and his context, according to Salmon the D-N model of explanation is not sufficient. As is well known, this is the D-N model or Hempel-Oppenheim model of explanation:

$$L_1, L_2, \ldots, L_r$$

$$C_1, C_2, \ldots, C_k$$

$$\_\_\_\_\_$$

$$E$$

In this scheme the premises $L_1, L_2, \ldots, L_r$ are general laws, while $C_1, C_2, \ldots, C_k$ are statements which describes the initial conditions of the general laws ($L_1, L_2, \ldots, L_r$ together with $C_1, C_2, \ldots, C_k$ is the *Explanans*). In this model *E*, the *explanandum*, is the statement that must be explained and it follows logically from the premises (that have to be true).

According to Salmon this model is not sufficient just because, for example, all the laws that occur in the D-N model are mere factual laws and as a consequence there is no place for ideal laws like Gay-Lussac's law of gas; also according to Peter Lipton the deductive-nomological model "is also too weak" (pp. 413-414).

Part five is entitled "Laws and Causation" and it contains writings of Fred I. Dretske (*Laws of Nature*), Bas van Fraassen (*What are Laws of Nature*), Marc Lange (*Natural Laws and the Problem of Provisos*) and Nancy Cartwright (*Causal Laws and Effective Strategies*); while in part four of the book the main issue is scientific explanation, this part is instead devoted to both laws and causes.

Part six of this book is very interesting and it is entitled *Science and Medicine*; this part contains writings of Ronald Munson (*Why Medicine cannot be a Science*), Kenneth F. Schaffner (*Hierarchy of Evidence*) and John Worrall (*What Evidence in Evidence-Based Medicine?*). Part seven is entitled *Probability in action: Forensic science* and it contains the following writings: William C. Thompson-Edward L. Schumann (*Interpretation of Statistical Evidence in Criminal Trials: the Prosecutor's Fallacy and the Defence of Attorney's Fallacy* and Neven Sesardić (*Sudden Infant Death or Murder? A Royal Confusion about Probabilities*).

Part eight, *Risk Uncertainty and Science Policy*, is devoted to the role of risk in the decision-making process and it contains the following writings: Neil A. Manson *Formulating the Precautionary Principle*), Per Sandin- Martin Peterson-Sven Ove Hansson-Christina Rudè and

André Juthe (*Five Charges against The Precautionary Principle*) and Sven Ove Hansson (*Risk and Ethics: Three Approaches*).

Part nine is devoted to a classical theme in the philosophy of science debate, that is to say *Scientific realism and Antirealism*. The first writing is Pierre Duhem's *The Aim and Structure of Physical Theory.* As it is well known, Duhem was an anti-realist because, according to him, science doesn't explain but instead it describes; in fact according to Duhem is impossible to explain natural phenomena through the use of abstract or non-observable entities. A similar point of view can be found in Henri Poincaré's *The Theories of Modern Physics*, because for Poincaré too scientific theories are mere conventions useful for organizing our experience (for instance, geometrical theorems). Another critique of scientific realism can be found in Larry Laudan's *A Confutation of Convergent Realism*, where Laudan criticizes the following form of realism that he sums up in the concept of *convergent realism*: "scientific theories are approximately true"; (...) "The observational and theoretical terms within the theories of a mature science genuinely refer", "Successive theories in any mature science will be such that they preserve the theoretical relations and the apparent referents of earlier theories", (...) "Acceptable new theories do and should explain why their predecessors were successful insofar as they were successful" (p. 704). According to Laudan, to these "semantic, methodological and epistemic theses is conjoined an important meta-philosophical claim about how realism is to be evaluated and assessed", and that is to say that these four theses "entail that ("mature") scientific theories should be successful; indeed, these constitute the best, if not the only, explanation for the success for science. The empirical success of science (...) accordingly provides striking empirical confirmation for realism" (p. 704).

The following essay, Bas Van Fraassen's *Arguments Concerning Scientific Realism*, is a radical form of anti-realism characterized by so-called "constructive empiricism". Ian Hacking's contribution, entitled *Experimentation and Scientific Realism*, focuses its attention on the important role that experiments play in scientific practice; according to Hacking, theories are very important but it is a great mistake to focus our attention only on theories disregarding the experiments performed by scientists. In fact, states Hacking, "no field in the philosophy of science is more systematically neglected than experiment" (p. 753).

The last essay of part nine and also the concluding essay of the entire volume, is John Worrall's *Structural Realism: The Best of Both Worlds?*, on so-called structural realism. Worrall asks whether we can we have the best coming from both realism and anti-realism? In this respect we must turn our gaze towards the mathematical structures employed by scientific theories, because when we try, for instance, to compare classical physics and quantum theory, we find enormous differences between the image of the world that they provide, but the passage from the mathematical equations of classical physics to the ones of quantum theory is "softer".

In conclusion, this very extensive volume provides a lot of interesting issues concerning science and its relationship with the main themes and problems of our contemporary world and it can be very useful not only for specialists but also for students and beginners because every section opens with a very clear introduction.

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