

Somewhere over the Rainbow: Editorial introduction*

D. Aerts, J. Broekaert and E. Mathijs

Center Leo Apostel
Brussels Free University
Brussels, Belgium

The colours of the volumes of the *Einstein meets Magritte* series correspond to the colours of the rainbow. They are diverse but closely connected and present no hierarchy. Yet they are not randomly placed alongside each other. The same goes for the contributions in this volume: *Science, nature, human action and society: an interdisciplinary reflection*, which is the white book of the *Einstein meets Magritte* series. par The white book contains the papers of the invited speakers at the *Einstein meets Magritte* conference, held in May and June 1995 at the Free University of Brussels. The resulting articles were initially meant to express the theme of the conference: an interdisciplinary reflection on science, nature, human action and society. All of the articles in this volume do elaborate on this theme, but somewhere along the road the volume grew out to become more than an expression of a conference theme. The articles have one thing in common: they all address some of the most fundamental questions of science in the world of today. They carry the experience, research and conclusions of 13 renowned scientists and writers. The articles not only deal with the sciences and with contemporary life, they *are* science. As such, this volume presents a state-of-the-art of science today, in all its diversity.

All the contributions approach the fundamental questions from different angles. With different approaches come different observations, and hence no general and decisive conclusions are presented in this volume.

In the first contribution, John Ziman tries to unravel what basic science is and stands for. He compares Einstein's 'basic research' with contem-

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porary conceptions of science. What do people mean when they say that basic science should be fostered? For Ziman, the conventional responses to this important question are confused and contradictory. Historical accounts are out of date. Philosophical criteria are too reductionist. Sociologists deconstruct basic research entirely. Psychological interpretations are too self-indulgent. Populists deplore its elitism. Economic theory discounts it heavily. Industry merely wants to exploit it. Academia celebrates its pure irrelevance — and yet policy-makers imagine it can be planned. Perhaps Magritte tells us that the nature of basic scientific research is a suitable theme for basic metascientific research.

In the second contribution of this volume, Bas Van Fraassen considers the image of the world, in relation to the scientific image. For him, there are striking differences between the scientific theoretical description of the world and the way it appears to us. The consequent task of relating science to ‘the world we live in’ has been a problem throughout the history of science. But has this problem been made impossible to resolve by how it is formulated? Van Fraassen elaborates on several possible answers to this question. Some say that beside the successive world-pictures of science there is the world-picture that preceded all these and continues to exist side-by-side, (a stance?) elucidated by more humanistic philosophers. Wilfrid Sellars codified this conviction in his dichotomy of ‘scientific image’ and ‘manifest image’. Others say that all world-pictures are transient, evolve, conflict with and replace each other, undergo violent revolutions as well as periods of normal development, and may be incommensurable, allowing of no meaningful dialogue. All such formulations may themselves be tendentious metaphysics (metaphysical expressions?), full of false contrasts. Insistence on a radical separation between science and what we have apart from science, on the impossibility of accommodating science without surrender, may be a way of either idolising or demonising science rather than understanding it.

Barbara Herrnstein-Smith directs her attention towards the philosophy of science and science studies. Her article examines the bemusing but instructive logical, rhetorical and cognitive dynamics of contemporary theoretical controversy. It focuses on the recurrent non-engagements and mutually frustrating impasse between, on the one hand, those who - like philosopher of science Philip Kitcher in his recent *The Advancement of Science* — defend or attempt to rehabilitate traditional ideas of knowledge, truth, proof, objectivity, reason and reality and, on the other hand, theorists in fields such as the history and sociology of science whose research and analyses have issued in more or less radical critiques of those ideas and also more or less radical rethinkings of the operations of science itself.

Robert M. Pirsig approaches science from a distinct angle. He proposes a rational integration of science and value that does not do violence to either. For Pirsig, in the past, rejection of ‘values’ by scientific method has helped prevent corruption into religious dogma, social propaganda and other forms of wishful thinking, but it has also prevented scientific explanation of huge areas of human experience: art, morals and human purpose. This inexplicability undermines the universality and validity of scientific thought. Pirsig argues that values can exist as a part of scientific data, but outside of any subject or object. This argument opens the door to a ‘Metaphysics of Value’ that provides a fundamentally different but not unscientific way of understanding the world.

In his contribution, Ilya Prigogine deals with one of the basic characteristics of Western science since Galileo and Newton: the formulation of the laws of nature which are both deterministic and time-reversible. Today classical mechanics has been superseded by quantum theory and relativity. Still, the basic characteristics of Newton’s laws, namely determinism and time-reversibility have survived. In contrast, on all levels of experience, be it in cosmology, geology, biology or human societies, we observe evolutionary patterns. How then are there patterns rooted in the laws of physics? Prigogine shows that once we incorporate instabilities and chaos into their formulation, we can overcome this contradiction. The fundamental laws of nature then take on a new meaning. The role of creativity in this interpretation is given special consideration.

Constantin Piron builds his argumentation around similar lines. He specifically considers what he calls the failed revolutions of quanta and relativity. Bohr suggested that the usual rules of mechanics be abandoned to explain the hydrogen atom spectrum. Louis de Broglie associated a wave with each particle, and Erwin Schrödinger provided a non-local equation for the de Broglie particle wave. The use of the term ‘aether’ was rendered obsolete by Einstein after the discovery that the velocity of light was the same in every direction and independent of the chosen reference frame. Nevertheless, recent literature is indicative of how the vast majority of physicists still cling to the idea of a non-existing void full of little particles in the spirit of Leibnitz or Descartes. This implies that quanta and relativity revolutions have yet to come.

Rom Harré provides a historical account of special relativity, and connects it with the redundancy of space-time. It is not always easy to see whether an important theory in physics is about the world or a way of expressing the rules for talking about the world. Therefore Harré concentrates on the important differences in interpreting relativity theory, particularly

with respect to the question of the real existence of Minkowski space. A look at the history of relativity, from Nicolas of Cusa to Galileo to Einstein shows that special relativity is best interpreted as a grammar for coordinating narratives told by different observers. This viewpoint has consequences for other problems in physics, such as the EPR experiment.

Diederik Aerts investigates in his contribution ‘the stuff the world is made of’ taking into account recent findings and insights of theoretical physics. Two fundamental theories have reshaped our view of reality: quantum mechanics and relativity theory. Aerts analyses in which way some of the paradoxes of quantum mechanics are due to short comings of the axiomatic structure of the theory and others point to real new and mysterious aspects of reality. He also points out the deep problem introduced by relativity theory as to the question ‘what is reality?’. Through his analysis he elaborates a view on reality, that he calls ‘the creation discovery view’, in which creation and discovery cooperate as two fundamental aspects of the process of reality.

Francisco Varela’s article deals with the relation between brain processes and living human experience. In his view, both can be seen as the really hard problems of consciousness. Varela’s article takes up some of the most important alternatives today in dealing with this problem. Its main proposal is that science needs to be complemented with a sustained, disciplined analysis of experience itself to move this major question beyond the sterile oppositions of dualism or reductionism.

William H. Calvin devotes attention to the role of creativity. For Calvin, creativity on the forefronts of both science and art consist of trying new combinations of old things in the hope of discovering a good fit — though doing a great deal of the groping off-line, thinking before acting. Such is at the heart of intelligence (to paraphrase Piaget, intelligence is what you use when you don’t know what to do, when there is no tried-and-true routine to fall back on). But mechanistically, random combinations of old things have always seemed improbable, as most random combinations are nonsense (and sometimes dangerous). We know, however, that the Darwinian process shapes up quality from random recombinations: new species in millennia and new antibodies during the days and weeks of an immune response. Calvin discusses the prospects for a mental Darwinism that operates on the milliseconds to minutes time scale, shaping up novel ideas and sentences never before spoken.

Adolf Grunbaum aims to chart a *via media* for the human sciences by concentrating on psychoanalysis. He argues that the so-called ‘hermeneutic’ reconstruction of psychoanalytic theory and therapy proposed by Karl

Jaspers, Paul Ricoeur and Jürgen Habermas fails to multiply as a viaduct and alleged prototype for the study of human nature. One key to the failure is the misconstrual of so-called ‘meaning connections’ between mental states in their bearing on casual connections between such states.

Zygmunt Bauman concentrates on immortality, and considers its evolution from modernity to postmodernity. In Bauman’s article, consciousness of mortality and the dream of the transcendence of death are the constant moving force of cultural creation. The postmodern era, however, has modified the cultural perception of time in a significant way. Strategies of collective and individual immortality have shifted from modern deconstruction of death to a postmodern deconstruction of immortality. Bio-technology engenders individualisation of collective immortality, whereas electronic technology brings about collectivisation of individual immortality. Bauman urges us to take the possible consequences of this process into consideration.

Finally, Brian Arthur considers the practice of economics and economy in general to announce the end of certainty in economics. For Arthur, standard economics reduces the problems that concern us in economy to well-defined mathematical ones that can be ‘solved’ by deductive logic. But often in actual fact, our economic actions depend on our beliefs about others’ future actions and beliefs, and these depend in turn on their beliefs about our actions and beliefs, so that deductive logic - the theorist’s standby - becomes self-referential and breaks down. In reality humans use little deductive logic in economy. Instead they form subjective beliefs about future economic conditions and ‘test’ these against conditions created in large part by other’s subjective beliefs and expectations; and these compete, co-evolve, form patterns, appear, and decay over time. In Arthur’s view, our economy is therefore a ‘Magritte Economy’: one that is inherently complex, subjective, ever-changing, and to an unavoidable degree ill-defined.

Albert Einstein and René Magritte meet each other where these articles meet. To know where that place lies is to read the articles, and to think. Think of an arena where Einsteinian basic science, fundamental and pure, meets Magrittean emotion and sensation; a place where logic not necessarily disappears but is superseded by surprise, amazement and a general sense of wonder.