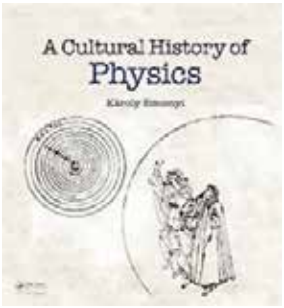

K. Simonyi
A Cultural History of Physics
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This is a massive book! One which, by its size and weight, could deserve Sakharov's sarcastic characterization of big volumes (perhaps referring to the Bible or Das Kapital) of being useful if only to "serve as door stops". However, I hasten to add that Simonyi's œuvre will serve beyond that prosaic purpose and emulate admiration for its enormous scope and readability. In any case, to handle this book, the reader will need a reading lectern.

The book offers a total history of a discipline, a "World Book" claims the author in the foreword (that is, for English-reading scientists in this translation from Hungarian). Although apologizing for being a "dilettante" in historical and philosophical matters, Simonyi nevertheless ambitiously aims at, and in my view largely succeeds in, fostering the public understanding of a science in its broad historical context. This is a very honorable goal today when the hard sciences have at best lost much of their aura and at worst are under attack from several cultural quarters. To the question "is it still possible to bridge the widening gap between the famous C.P. Snow's two cultures, the humanities and the natural sciences", yes answers Simonyi, this could be achieved if only physics and other natural sciences were taught, from elementary school to university, along with their proper historical context. This is precisely the overall aim of the book.

In the introductory pages, Simonyi analyses the epistemology of the scientific enquiry, initiated during the Renaissance and fundamentally developed in the 17th century, the grand inductive-deductive machinery (fig. 0.13, p. 11) starting from empirical observation of reality, inventing theories, constructing models to finally go back to confront reality again. He discusses the historical-evolutionary dynamism of the process, its limits, uncertainties and dangers. He sees in physics "the most marvelous creation of human imagination, capable of filling an active life with meaning". As another physicist, this reviewer could hardly dispute such enthusiastic outburst but I wish to point out that mathematicians, chemists, biologists, and other natural scientists can legitimately utter similar laudations for their own disciplines.

When Simonyi envisages a "new role" for physics in the future, namely by promoting its pure aesthetic aspect beyond its educational and utilitarian virtues, just the same vision can be expressed for other disciplines as well. As an example, the author takes the great scientific and utilitarian import of Einstein's general relativity, pointing out the intrinsic beauty of the differential field equations (and their immense practicality for, *e.g.,* the GPS, not known in the original version of the book). But an equally powerful example is the DNA double helix in biochemistry, now a universal icon of at once geometrical beauty, pure logic and biological-medical practicality. In fact, it is the whole of natural sciences, math included, which, although supposedly empty of ethical values, by its aesthetic, logical and practical aspects, can provide a "spiritual" content sufficient to assuage the scientist's thirst for giving a meaning to his or her life.

It is of course not possible in the present, necessarily brief review to go into any detail of the enormous amount of novel concepts accumulated by multitudinous contributors in the development of physics through the ages in the cultural contexts of each period. Only the shortest possible sketch of the content of the book will be given here.

Chapter 1 gives a broad survey of the "classical heritage" of mathematics and "proto-physics", mainly mathematics and the Greek heritage, with a useful section attempting to summarize the "major achievements" including instrumentations and technologies. The chapter ends with "The Twilight of Hellenism" *i.e.* the beginning of the backward movement through which the admirable philosophical teachings such as those of the Stoics or the Epicureans, were overruled by rigid religious dogmas, sectarianism, irrationalism, fanaticism. All "isms" which were to flourish for over two thousand years, and are still persisting today simultaneously, and indeed in spite of, the enormously successful developments of modern sciences.

Chapter 2 covers over a thousand years of scientific near stagnation in the "Middle Age" of the Western World during which, fortunately, much of the classical heritage would be preserved, notably by the Arabs and Hindus who also contributed (or reinvented) novelties in mathematics such as algebra, zero, place-value numeration, negative numbers, etc.… Simonyi reviews the "technological revolution" of the so-called "Dark Ages" which, contrary to the Hellenistic era, valued artisan work (*e.g.* in the building of cathedrals) at a very high level. The author emphasizes the importance, for the preservation of knowledge, of the development of monastic orders (such as the proverbial Benedictines) which combined intellectual, contemplative and active life. For the preservation and advancement of learning, the Middle Age should also be credited with the creation of the Universities, an entirely new system of paramount importance which had no real equivalent in Antiquity.

In Chapter 3, Simonyi covers the fantastic development of physics (and some of the mathematics) in the 17th Century. A table on p. 241 gives a time line going from 1550 (Tyco Brahe) to 1700 (the Bernoullis) showing the overlap of the many great figures (Galileo, Kepler, Newton, Huygens, Descartes, Leibnitz, and many others). This extraordinary century more than any other, apart from the 20th century as far as physics is concerned, deserves the name saeculum mirabile. This is also the all-important period where the methodology of empirical sciences with its constant testing of ideas and submission to reproducible experiments and repeatable observations, was consolidated as the exclusive, operational approach to the acquisition of reliable knowledge about the natural world. The chapter ends (table 3.4) with an amusing labyrinth of gossip-like opinions expressed by the great innovators about each other's contributions and personalities.

Chapter 4, "the Completion of Classical Physics", is devoted to the accumulation

and consolidation of acquired knowledge based on the great foundations covered in the previous chapter. From the philosophical perspective the whole period reinforced the illusionary Laplacian idealism, stated at the head of chapter 4 that science, as perfected by the end of the 19th century, provided a theory of everything (TOE) with which, in principle, absolutely nothing could be left unexplained.

The conception of a TOE (the phrase is of recent invention), was to be relegated to nostalgia and even to derision by the discoveries of the 20th century physics covered in chapter 5, going up to the Standard Model of Particle physics, modern cosmology and even string theory. Unfortunately, there is very little in this chapter on the wonderful discoveries in condensed matter physics which has made possible the explosion of communications and the attendant spread of all cultural values, good or bad. Nor does this last chapter, the longest on account of the several revolutions that occurred in physics, contain hardly any reference to the dramatic cultural context of the century. This is strange given the title of the book and given that physics and science in general have, for the first time in world history, drastically changed *e.g.* the available means for the conduct of war and thus of politics. In reverse, political ideology, *e.g.* the racial laws of the Third Reich, has contributed to a massive translocation of physics and culture in general, from one continent to another.

The book ends with an interesting overview piece by Edward Witten on the recent evolution of Physics and on its speculative future in particle physics, cosmology and astronomy, including the likely discovery of life-bearing planets, possibly the potentially biggest revolution yet to come in the cultural history of over two millennia.

In the middle of the book the reader is treated with a sumptuous set of color plates attempting to give an overview of developments in physics interacting with the cultures of the successive periods.

Finally this book is not one to be read all at once, from cover to cover but is organized so that its richly illustrated chapters and sections can be enjoyed independently, absorbed and savored slowly, by little doses of the magnificent history of our discipline.

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