Continuity and Change in Science and Technology from 1800 – an Interdisciplinary Perspective

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The Interdisciplinary Center for Science and Technology Studies (ICST) of the University of Wuppertal brings together in close collaboration historians, sociologists and philosophers of science. Since 2013 the perspective has been widened to include the history of technology, as well as gender history.

Under the aegis of ICST, and in addition to already established joint research projects, colloquia and lecture series, the project aims to establish the nucleus of a joint interdisciplinary graduate training structure concerned with the history, sociology and philosophy of science and technology.

In their analyses of modern science and technology, historians, sociologists and philosophers have in the past generally focused either on continuity (with concepts such as progress, accumulation, normal science, incremental innovation) or on breaks in continuity (with concepts of revolution, paradigm change, incommensurability, radical innovation). The two perspectives have often been thought mutually incompatible, and the academic approach has in fact generally been confined to a single discipline. Two currently planned doctoral theses will take a new approach that seeks on the one hand to overcome the polarity between continuity and breaks in continuity, and on the other to bring into fruitful dialogue the different perspectives of history, sociology and philosophy with regard to the development of science and technology. This promises to make a valuable contribution to the current discussion of the interrelations between these fields and their potential synergies. The two doctoral projects in question will be conducted in close collaboration with the disciplines concerned: sociology, philosophy, history, and mathematics/science.

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For further information please contact the project leaders.

Description of research project

Analyses of the development of science and scholarship have long been informed by the idea of a continuous accumulation of knowledge taking place in every discipline. Indeed, the history of technology is still today marked by the concept of linear progress. In contrast, the failure of specific technologies, the use (and usefulness) of "old" technologies, the erosion and loss of technological knowledge, and the removal of existing technologies from society (exnovation) have scarcely been researched. Ever since Thomas S. Kuhn's influential work *The Structure of Scientific Revolutions* (1962), however, greater attention has been paid to the discontinuities and breaks in scientific development, and concepts like normal science, paradigm, crisis, and scientific revolution belong today to the core vocabulary of historians, sociologists and philosophers of science and technology alike. Kuhn's examples stem for the most part from physics and astronomy; especially relativity theory and quantum mechanics are interpreted as breaking with the paradigm of Newtonian

mechanics. But his ideas have spread, and in the wake of his pioneering study other disciplines such as mathematics and biology, as well as areas of the humanities and social sciences, have been scrutinized for paradigms and revolutions. Here, however, the search for models has proved rather more confusing and controversial.

Moreover, most analyses of the development of scientific knowledge have long been marked by the assumption that the production of new mathematical, scientific and technological knowledge is essentially a matter of formulating and improving the basic theories of the disciplines concerned. As a result, fundamental scientific theories have taken pride of place in the conventional historiography of science (dynamics of theory). More recent approaches, however, emphasize that the growth of new knowledge through experimentation, like the construction and use of new technical artifacts, can take on an institutionally autonomous existence, that empirical science is organized in experimental systems which constantly produce new and unexpected empirical facts and environments, and that the development of new research tools and instruments calls not only for scientific entrepreneurship but also for specifically focused scientific communities. The impact of institutional and pragmatic influences – e.g. typical national or local styles of thinking – on the development of mathematical theories has also been a matter of increasing interest in recent years. In this context the universal encroachment of data processing technologies into research also triggers far-reaching questions, for instance about concepts of evidence and proof.

Although the debate about the relation of continuity and discontinuity is by no means over, few attempts have yet been made to conceptualize the issues concerned. The research project presented here is based on the thesis that received descriptive methods, with their one-sided focus on either discontinuity or continuity, have frequently been the product of overly restricted premises. While these are in themselves able to generate plausible descriptions of phenomena, they are inherently incapable of doing justice to the complexity of scientific and technological developments. A comprehensive analysis of the dynamics of scientific knowing processes, of technological research and construction, and of innovation and exnovation will contextualize received polarities and integrate them into a multidimensional (or multi-faceted) picture. It will be seen that the old and the new are generally contiguous, develop in mutual dependence, and in the course of time adopt varying relationships to each other.

Historical change is not a universally applicable category. While the concept of discontinuity clearly implies a break with the past, continuity does not per se imply development: it can also indicate a condition of stasis – or, if contrasted with change, of resistance or inertia. Moreover, to contrast change with continuity is to widen the spectrum of dynamic development by including unchanging aspects of science and technology, whether these have been merely handed down or accepted as proven. In this sense the project can be thought of as a program not only for scrutinizing but also for rescuing the range of phenomena commonly associated with continuity and discontinuity.

One of the shortcomings in the analysis of change and continuity in science has hitherto been a lack of cooperation between the academic disciplines concerned with such matters. The present research project brings together historical, philosophical and sociological approaches and aims also to integrate the history of technology into this framework. While the philosophy of science can have

recourse not only to general developmental models but possibly also to normative statements, the sociology of science, and the history of science and technology are descriptive. The facts they present provide not only the material with which to test existing models of the development of science, but also the platform on which new models can be based.

The time-frame of the project is wide. It begins with the point at which science takes on the form of a process of change, with the revision of existing concepts and increasingly innovative production. This is the point at which continuity begins to fray and the cult of the new puts its stamp on an epoch, when in other words the “modern” scientific and technological age has arrived. The time-frame ends with the establishment of the “knowledge society”, typified by the penetration of science and technology into every sphere of life, and the concomitant surge in the pace of structural change.