Building Bridges

Connecting Science,
Technology and Philosophy

ESSAYS PRESENTED TO HANS RADDER

Edited by

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VU-filosoof
zoekt
werkkamer
(met boekenkasten)

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Introduction

Henk de Regt and Chunglin Kwa

Philosophical reflection on science and technology can be practiced in many different ways. Usually, philosophers have their own favorite approach, stick to it, and ignore the alternatives. Hans Radder is an exception: his work in the philosophy of science and technology is wide-ranging, not only in the scope of questions and topics that he addresses but also in the variety of approaches he employs to analyze science, technology, their interaction, and their impact on society. It is this broad interest and open-minded attitude that makes him an ideal 'mediator' between seemingly irreconcilable views and approaches. For example, Hans bridges the divide between continental and analytical philosophy, as was already clear from his dissertation, in which he discussed the work of Jürgen Habermas in an effortless combination with analyses of the ideas of analytic philosophers such as Hilary Putnam and Saul Kripke. Moreover, while being a philosopher by nature and by education, he takes a serious interest in the empirical study of science. Both history and sociology of science have his continuing attention, and his philosophical views on science and technology have always been well-informed by the study of actual scientific practice, both past and present. Here again he aspires to mediate between different cultures in 'science studies': he has reflected on the thorny question of how a stable and fruitful relation between philosophical and empirical study of science and technology can be arrived at. No one reading Hans or interacting with him will fail to notice the precision in which he does so.

This volume contains essays by colleagues and friends of Hans, presented to him on the occasion of his retirement as Professor of Philosophy of Science and Technology in the Faculty of Philosophy of VU University Amsterdam. In this introduction, we will present a brief sketch of Hans' career and work, and give an overview of the essays in this volume.

Hans' first degrees were in theoretical physics at VU University, leading to the M.Sc. degree in 1978. Subsequently, he studied philosophy at the University of Amsterdam, graduating *cum laude* in 1978. He started his doctoral work at VU University, under the supervision of Peter Kirschenmann. The resultant dissertation was entitled *De Materiële Realisering van Wetenschap* (The Material Realization of Science),

for which he received the Ph.D. degree *cum laude* in 1984. The topic is revealed by the subtitle of the dissertation: 'A philosophical view on the experimental natural sciences developed in discussion with Habermas'; in Dutch, following the alternative spelling used by progressive intellectuals of the day: *Een filosofiese visie op de experimentele natuurwetenschappen, ontwikkeld in diskussie met Habermas*. The thesis featured several themes that would remain prominent in Hans' philosophical work of the decades to come, such as scientific realism and experimentation. Regarding the latter topic, in particular, his work turned out to be pioneering. Philosophical attention for experimentation had been scarce if not non-existent until the early 1980s. With a few like-minded scholars, among whom Ian Hacking and Peter Galison, Hans contributed much to challenging the 'theory dominance' in philosophy of science. His original, in-depth analyses of the nature of scientific experimentation can be found in various articles and books (Radder 1984; 1996; 2012). Moreover, he stimulated research and debate on this topic by organizing a high-profile workshop, which resulted in the seminal volume *The Philosophy of Scientific Experimentation* (Radder 2003).

After receiving his doctoral degree, Hans remained at the Faculty of Philosophy of VU University. In 1985, he became *universitair docent* (assistant professor), and was promoted to *universitair hoofddocent* (associate professor) in 1996. In 2002, he was appointed *hoogleraar* (full professor) of philosophy of science and technology, occupying a chair endowed by the *Stichting Het Vrije Universiteitsfonds*. At this time, his attention had been drawn to a recent development in academia that he called the 'commodification of academic research'. In his 2003 inaugural lecture *Wetenschap als Koopwaar?* (Science as Commodity?), he critically discussed the trend towards an 'entrepreneurial university', in which making financial profit is seen as one of the main objectives of science. Hans shows that philosophical analysis can shed important light on this idea, focusing on the conceptual problems that surround the idea of patenting scientific results. In the next decade, he further developed his views on these issues, arguing for an institutionalized normative structure of science based on a deflationary interpretation of Robert Merton's well-known codes of scientific conduct (see Radder 2010).

A unifying theme running through Hans' work is the idea that science is not an isolated phenomenon that can be studied *in abstracto*. Its relation to society is very important and should not be ignored by philosophers, as for example the issue of commodification shows. This is one of the main reasons that Hans has always had a keen interest in the philosophy of technology. He rejects the naïve view of technology as merely applied science, which not only misconceives the nature of technology and science but also leads to distorted assessments of the role of science and technology in society. Science and technology are often seen as either the cause

of today's societal problems or as the solution to these problems. The matter is more complicated, as Hans' philosophical analysis of the normative and political significance of science and technology reveals (see e.g. Radder 1996). His interest in these matters has also led him to enter the debate about the so-called epochal break thesis, which states that in recent times science has been fundamentally transformed due to its entanglement with technology and society (see Radder 2011). Furthermore, Hans' view that science cannot be abstracted from its concrete material context is reflected in his analysis of the notion of observation. Empiricist philosophers of science, while deeming the concept of observation central to science, typically take it for granted. They fail to see that observation is a complex process that requires material realization and conceptual interpretation, as Hans has argued at length (Radder 2006).

Hans has been an active member of the Dutch philosophy community throughout his career. He was one of the founding editors of the Dutch philosophy journal *Krisis* and served as editor from 1980 to 1987. The new journal did much to shake up the Dutch philosophical landscape, engaging itself with a number of interdisciplinary developments going on in fields such as cultural studies and science studies. The journal, which still exists, later on added as subtitle 'journal for empirical philosophy', which expresses the societal relevance of philosophy, in a critical vein. For a number of years Hans was a board member of the Netherlands Graduate Research School of Science, Technology and Modern Culture (WTMC). In 2003, he initiated the Dutch-Flemish Network for Philosophy of Science and Technology (NFWT). Finally, Hans has regularly participated in public debates about issues concerning science, technology and society, and he often expressed his critical views in interviews and opinion articles in magazines and newspapers. He addressed the problematic aspects of the commercialization of science, drawing attention to the detrimental effects of patenting practices, and discussed issues surrounding scientific publication practice, in particular the idea of 'open access' publication. Most recently, he initiated a debate about university management. The hierarchical, top-down way in which universities are currently run, with emphasis on measurable productivity and efficiency, is in his view completely misguided, as it undermines the quality of academic research and teaching. In 2013, Hans was one of the founders of the *Platform Hervorming Nederlandse Universiteiten* (HNU), which aims at to countering these developments, working with a similar Dutch initiative called Science in Transition.

This volume contains nineteen essays, written by colleagues, friends and students of Hans. In this section we will briefly summarize the content of these essays (the four essays written in Dutch will be given a somewhat more extended treatment). The essays cover a large part of the topics with which Hans has been occupied during his

career, with an emphasis on his more recent work. Although sharp boundaries cannot be drawn, we have categorized the essays in four classes (which admittedly has some similarity with Jorge Luis Borges' famous classification of animals):

- – Essays by his former Ph.D. students
- – Essays on commodification and patenting
- – Essays on experimentation and technology
- – Essays on general philosophy

Essays by his former Ph.D. students

Henk de Regt discusses Hans Radder's views on the aim and methods of philosophy. In his work, Radder has always insisted on a self-reflexive attitude: philosophers should critically assess the aims their own practice and the validity of their methods. An important issue for the philosophy of science and technology is how philosophy relates to empirical 'science studies' such as history and sociology of science. While Radder believes that philosophy should be informed by the actual practices of science and technology, he maintains that philosophical analyses can and should do more than merely follow the activities of scientists and engineers. In this respect, he criticizes the purely descriptive approaches of social constructivists and naturalistic or radically historicist philosophers. In order to save philosophy from critics who want to eliminate it in favour of purely empirical science studies, Radder characterizes philosophy as an enterprise that has three specific characteristics: it is theoretical, normative and reflexive. De Regt subsequently outlines his own view of the nature of philosophy, which he developed in his Ph.D. dissertation (written under the supervision of Radder and Peter Kirschenmann). As this work investigates the heuristic role of philosophical views in the development of science on the basis of historical case studies, it required an explicit account of the methods and aims of philosophy, and a workable demarcation between philosophy and science. De Regt argues that philosophical theories of science may function as tools to construct narrative explanations of historical episodes, thereby serving a function that Radder would classify as theoretical. Moreover, he develops a taxonomy of philosophical ideas that partly overlaps with Radder's characterization of philosophy as theoretical, normative and reflexive.

Kai Eigner develops a theme from his Ph.D. dissertation, which was written under the supervision of Hans Radder and Henk de Regt. Eigner applies Radder's analysis of theoretical concepts to a concrete episode in the history of psychology: the discussion about the status of so-called intervening variables and hypothetical con-

structs in neo-behaviorist psychology. Originally, neo-behaviorists wanted to employ a radically operationalist methodology, on which such theoretical terms are defined exhaustively in terms of their observational consequences. It appeared, however, that theoretical terms unavoidably have 'surplus meaning' that transcends their operational definition. In the 1950s, psychologists were engaged in a heated debate about the nature of this surplus meaning and the question of whether it was advantageous or undesirable. An example is the notion of 'reinforcement', which was introduced by Clark Hull in an operationalist fashion but articulated and extended such that its surplus meaning was clearly visible. While orthodox neo-behaviorists insisted on the dubious epistemological status of the surplus meaning of theoretical terms, such resistance gradually disappeared as a result of the undeniable heuristic power of the surplus meaning. Eigner relates this historical episode to Radder's idea that abstract concepts possess 'non-local meaning', which he has developed in his book *The World Observed / The World Conceived* (2006). It is this non-local meaning that, according to Radder, allows for the extensibility of abstract concepts to new domains. Both in his analysis of scientific experimentation, which revolves around the notion of replicability, and in his defense of referential realism, which assumes that theoretical terms may refer to real entities, Radder emphasizes the importance of nonlocal meaning for the development of science. Eigner illustrates the viability of Radder's analysis, which sheds light on this episode in the history of neo-behaviorist psychology.

Sabina Leonelli, who also wrote a dissertation under the supervision of Radder and De Regt, discusses the social, epistemic and political role of organizations created by biologists to regulate the development of standards for the online dissemination of data. She focuses on two types of organizations: ontology consortia, which recently emerged as informal regulatory bodies in bioinformatics, and steering committees for model organism communities, which are crucial contributors to the governance of biological research. Drawing on ideas from social and political theory, Leonelli argues that viewing these organizations as social movements is a fruitful strategy to make sense of their development into regulatory bodies enjoying legitimacy in the scientific community. Moreover, in line with the approach that characterizes the philosophical work of Radder, she argues that understanding these social and institutional dynamics is relevant to the philosophical analysis of scientific knowledge today, and particularly of the processes of inquiry involved in biological research.

Arthur Petersen holds two Ph.D.'s, one in atmospheric science and the other in philosophy, the latter supervised by Radder and Kirschenmann. Petersen tackles the epistemological status of Earth system science and addresses how uncertainty and ignorance with regard to the future development of the atmosphere play out in the

relationship between science, governments and citizens. The designation of climate science as 'science of the post-normal age', coined by Silvio Funtowicz and Jerry Ravetz now two decades ago, is still relevant. Petersen argues that the situation of post-normalcy necessitates a new role for scientific advice, which he calls reflexive scientific advice. The reflexive advisor involves specialists along with non-specialists, and sees to it that a broad array of values and world-views are brought to bear on the policy process. Petersen then goes on to place this scientific advisor in the larger framework of the formation of the public realm through the formation of publics, the perspective through which the pragmatist philosopher John Dewey analyzed the democratic process. Scientific advisors, Petersen says, should try to make connections between different spheres of public policy making, and thereby (hopefully) contribute to a public engaged with the climate issue.

Makoto Katsumori wrote a Ph.D. dissertation on Niels Bohr's conception of complementarity, under the supervision of Radder. In his contribution to the present volume, Katsumori shifts the focus from Bohr to Werner Heisenberg, analyzing the way in which Bohr's student reinterpreted the notion of complementarity. While one may consider Heisenberg's reinterpretation a misreading of Bohr's original intentions, it turns out that it allows for a novel way of understanding the structure of reality. Katsumori analyses Heisenberg's 1942 manuscript "The Order of Reality", in which he distinguishes six areas of reality, ranging from physics via chemistry and organic life to "symbol and form" and "creative powers". On Katsumori's analysis of Heisenberg's view, these different areas of reality do not exhibit a straightforwardly linear ordering. Rather, there are complex relations of complementarity between them, which involve the double character of language as being, in Radder's terms, "both in and about the world".

Essays on commodification and patenting

Pieter Pekelharing's contribution addresses the subject of intellectual property. Works of art and inventions by scientists enjoy judicial protection through a system of laws such as copyright law and patent law. Pekelharing asks: what should be the balance between the safeguarding of private interests and the public interest in sharing? He thereby takes up a concern of Radder's, that the current patent system constrains rather than facilitates technological innovation. Pekelharing notes that the amount of patent applications is steeply on the rise, that the current trend in law making across the world is toward improving the judicial possibilities with regard to patent protection, and that in the large majority of court cases the winners are

the patent holders. Needless to say that most of these are big corporations. Patent applicants, keen on protecting a new finding, find themselves in need to reserve relatively large sums of money to defend themselves against potential charges by these big corporations, that new applications are ever so many infringements on the patents held by them. Pekelharing's take on this subject is that it is now becoming apparent that a historical mistake has been made by modeling intellectual 'property' on property right in general. In the latter case, it is the scarcity of goods which is at stake. Scarce goods are cared for more efficiently when they are not up for grabs, in which case they might be destroyed. Intellectual property, on the other hand, fares better when it is shared. At the very least, its value is not diminished by sharing. Pekelharing rests his case for a restricted (and more stringently temporal) protection of intellectual property on this observation.

Loet Leydesdorff's take on these matters is entirely different on several accounts. Leydesdorff does not address the issue of intellectual property rights directly, but focuses on a higher level of aggregation: the links between industry, the university, and the state. Leydesdorff calls for an empirical, hence non-normative, investigation of this configuration, which through his own work in partnership with Henry Etzkowitz is known as the "Triple Helix". In the article for this volume, Leydesdorff argues that we should see this configuration as a dance. While the metaphor of the dance invites the thought that one of the partners is 'leading', his reference to the well-known drawing by Matisse apparently suggests that this is not so. Leydesdorff illustrates his case for an empirical investigation of university-industry-state relations by a number of comparisons. Focusing on the state, he observes that in Hungary the state has ceased to play an integrative role on the national level, while for the Netherlands it can be argued that the state still does. Focusing on the relationship between universities and industry, Leydesdorff points out that we should carefully identify the nature of 'industry'. In the Amsterdam case, there is a large cultural industry, and Leydesdorff argues that the university department of the humanities, including philosophy, is important for the industry-university configuration.

James Robert Brown discusses problems that are typical of research in the medical sciences, especially in pharmaceutical science. He focuses on two ways in which current medical research differs from other types of scientific investigation: first, the enormous impact of commercialization, and second, the dominance of the method of randomized clinical trials (RCTs). Reviewing a number of examples, Brown highlights how medical research systematically favors approaches that promise financial profit, while it neglects equally viable alternative treatments. Undesirable influence of commercial parties also threatens the alleged objectivity of RCTs, which are extremely

expensive and almost never repeated. To avoid the risk of biased results, Brown argues that all RCTs should be carried out by a publicly funded, neutral agency. In addition, intellectual property rights should be eliminated from medical research. Brown concludes that the existing problems might be overcome, if institutional structures are realized that allow for rational medical research and associated public health policies.

Henk van den Belt asks whether Radder's ideas about the commodification of science were anticipated by the Dutch philosopher R.C. Kwant. He traces the history of Kwant's views on labor, technology and science, which were developed in discussion with scientists and engineers at the *Philips Nat. Lab.* (Philips Physics Laboratory) in Eindhoven. In 1956, Kwant published a booklet titled *Het Arbeidsbestel* (The Labor Regime), in which he argued that modern labor processes are inextricably bound up with science and technology. A consequence was what he called "the capitalization of the intellect": science is made subservient to economic goals. In a 1960 lecture before the Philips staff, Kwant addressed "ethical questions around the practice of science and technology", endorsing a Merton-like ethos of science. He emphasized the openness of science (analogous to Merton's communalism), but, ignoring issues of patenting, failed to reconcile this with the interests of science practiced in a commercial setting. Therefore, Van den Belt concludes that Kwant did not anticipate the commodification thesis.

Steve Fuller presents us with no less than a different history of the twentieth century, in which he turns many received notions, such as about the nature of neo-liberalism, on their head. Drawing on work of, among others, Philip Mirowski, Fuller tells how and why contributions by the Left have been important to the development of neo-liberalism. Ultimately, Fuller would like us to reconsider the alleged danger of commodification and not roll the markets back but reach beyond them and make them serve the purpose for which they had been created: to allow non-coerced choice. The New Left, as Fuller calls an imagined program which is geared more to societal experimentation and is forward-looking, would not fight markets but transform them.

Essays on experimentation and technology

Astrid Schwarz enlists Francis Bacon as an ally to reach out to a broader concept of experimentation than has been prevalent during the modernist era, when experimentation was restricted to testing. In contrast, she sees a Bacon for whom finding things was as important as inventing things, and his experimentation served both ends. In

her essay, Schwarz builds on an interesting parallel in Bacon's work: his interest in experiments and his experimental mode of writing. An even more direct correspondence can be established between the aphorisms and Bacon's understanding of the famous metaphor of the mind as a mirror. Much unlike later empiricists, Bacon did not understand the mirror as faithfully reflecting the world in the mind. Instead, the mirror was uneven, leading to a fragmentary picturing of the world.

Andrew Feenberg develops a subtle argument about technoscience. Technoscience obviously exists. The boundaries between science and technology have become blurred and insofar as they can be shown to be analytically distinct still, the value hierarchy that once existed between science and technology has fallen apart. But even in the case of analyzing a single technoscientific effort, it will turn out that 'truth' and 'utility' claims are evaluated along different lines. Feenberg is concerned about the unfortunate influence of neo-liberal ideologies with regard to the (relative) autonomy of basic science, but he is optimistic about the possibilities of societal control of technology. In a concise history of post-World-War-II critical engagement with science and technology, he shows how technocratic paternalism was gradually shaken off. In the past, beginning with the Industrial Revolution, technology was a capitalistic juggernaut, but there are now many more ways of possible democratic engagement with technology than previously. Feenberg argues that we will be in need of new societal institutions to intervene in the development of technology, but he warns against destroying the existing ones which nurtured science and technology.

Alfred Nordmann's contribution takes us into a exploration of Ludwig Wittgenstein's *Tractatus*, which he uses to evaluate the so-called Chemical Revolution. As everyone knows, the story of Lavoisier's 'discovery' of oxygen is a famous paradigm case of Thomas Kuhn's account of revolutions in science. Implicitly, then, the reader is invited to a comparison between Kuhn and Wittgenstein. In Nordmann's account, the difference between Priestley and Lavoisier is not between two paradigms, but between an open world in the case of Priestley and a 'closed' world in the case of Lavoisier. This entails that Priestley and Lavoisier cannot be judged by the same rational standard. And if it is true, as Nordmann remarks in the beginning of his essay, that technoscientific chemistry is more like Priestley's that Lavoisier's, then the evaluation of technoscience will be along different lines than either 'truth' or 'utility'.

Peter Kroes, like Feenberg, continues to uphold the distinction between science and technology and is undeterred by their alleged merger in technoscience. In this respect, Kroes takes issue with Radder's argument that in experimental science, the material practice of experimenting is rather similar to technology. Kroes concedes

that Radder is right in claiming that scientists at CERN are engaged in the creation of the Higgs boson. Yet, Kroes argues, ultimately the creation of the Higgs boson serves an epistemic end, namely the testing of theories about the Higgs boson. According to Kroes, the claim that scientists are creating phenomena like the Higgs boson can be qualified even further: scientists can be said to create the boundary conditions under which the Higgs boson may enter the stage, meaning that the scientists create the stage rather than the actor.

László Ropolyi presents a historical and conceptual account of the relation between science and technology, defending the thesis that science equals technology plus philosophy. Starting from a very general conception of technology, on which it is a specific form of human agency that aims to realize control over a situation, Ropolyi argues for the primacy of technology over science and philosophy. Historically, both technology and philosophy preceded science, a fact that Ropolyi explains by pointing to the fact that science aims at universal, situation-independent knowledge, while technological praxis is always situation-bound. It is only with the help of philosophy, which "creates worlds out of situations", that science becomes possible. Philosophy transforms situation-bound validity into situation-independent truth. Ropolyi concludes that all science is technoscience, but all science is 'philoscience' as well.

Essays on general philosophy

Christian Krijnen continues a debate on realism in philosophy he held with Radder on previous occasions. At stake is the so-called ontological independence thesis. While this thesis is, generally speaking, not cast in doubt, the contemporary realism debate has shifted to the epistemological accessibility thesis. Krijnen argues that transcendental idealism endorses the latter (and thereby also the former). Drawing mainly on the neo-Kantians Heinrich Rickert and Hubert Bauch, Krijnen shows that the Kant-derived branch of idealism does not merely address the subjectivity of knowledge as knowing something, but also the objectivity of knowledge as knowledge of something. Form and content stand in an intrinsic relationship to each other, and this was true for both Rickert and Bauch, even if they derived this thesis differently.

Peter Kirschenmann, emeritus professor of philosophy at VU University Amsterdam, was Hans Radder's Ph.D. dissertation supervisor. In his contribution to this volume, he takes up his former task and critically discusses Radder's 2012 book *The Material Realization of Science*, which is a revised translation of his dissertation with a new postscript added. Kirschenmann focuses on the scientific realism debate, in which

Radder has defended a position that he terms 'referential realism'—a view that Kirschenmann characterizes as "a minimal form of realism". His essay contains detailed analyses of Radder's arguments, which are intended to "push Hans in the direction of a richer form of realism". Kirschenmann analyses propositions like "the normal carbon atom has six electrons", arguing that Radder's referential realism cannot adequately deal with their philosophical-ontological status.

Angela Roothaan addresses the question of how contemporary higher education can respond to the ongoing pressure to commodify academic knowledge. She first reviews the ideas of John Dewey, who analyzed the interdependent relation between society and education in the context of the early-twentieth-century situation. In line with his pragmatism, he regarded knowledge as inseparably connected with action, and believed that a democracy like the United States of America provided the best prospects for an education that fosters individual freedom and happiness. Roothaan observes that these naïve expectations were not fulfilled, and she subsequently discusses Ivan Illich's radical criticism of the schooling system in the 1970s. Illich advocated replacing the existing school system with "open, anarchistic learning webs that would answer the real needs of people." Finally, Roothaan discusses whether the internet offers opportunities for bringing about a revolution in the educational system of the kind envisaged by Illich.

Frits Schipper presents a general philosophical account of the nature of scientific research, which he subsequently applies to the field of management and organization Science. Like Radder, Schipper rejects the distinction between context of discovery and context of justification, arguing that there is a 'context of pursuit', which involves human activity and commitment. Applied to management and organization science, the decision to pursue a particular path of research necessarily requires answering questions about ethical issues and about what is valuable and interesting. Schipper subsequently compares two paradigms in management and organization science, the functionalist and the interpretative paradigm, concluding that intellectual and moral integrity are inseparable, and indeed essential to both approaches. He concludes by emphasizing the social character of science, endorsing Radder's claim that approaches to scientific integrity focusing purely on the individual are bound to fail. This holds even more for management and organization science, in which an entrepreneurial ethos should be combined with an ethics of research.

While the pieces included in this volume cover a wide variety of subjects, they share an outlook in which philosophy engages with the real world. Such commitment is characteristic of Hans' philosophy, and has been a source of inspiration to many.

Books by Hans Radder

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