The following programmatic statement seeks to articulate BiCoDa's claim that the partners in the Alliance are engaged in exemplary work on the ways in which "the technological condition" shapes research-practice today and in the past. From this point of view, all sciences are "technological sciences," including the humanities and social sciences.
This third (and probably not last) version of the discussion paper was posted in February 2010.

The BiCoDa Alliance for the History and Philosophy of the technological Sciences (HPtS)

The History and Philosophy of the technological Sciences (HPtS) is not a division of the History and Philosophy of Science (HPS). Instead, it is a novel and distinctive enterprise that complements HPS as a well-established field of study.

For most of the 19th and 20th centuries, philosophers looked at the history and philosophy of all the sciences and of technology through the glasses of pure basic research and especially of the theoretical sciences. The technological sciences and engineering were considered impure or applied. Moreover, with physics, evolutionary biology, or theoretical chemistry as the primary exemplars of science, the history of science became largely a history of theories and ideas, of methods, instruments and experiments – it dealt with just those aspects of science that had been singled out as important by philosophers of science. Accordingly, historians of science typically led a separate existence not only from social or environmental historians, but also from historians of technology. And while a philosophy of the engineering sciences was largely neglected, the philosophy of medicine created its own niche.

However, the history and philosophy of all the sciences looks rather different when one looks at it through the glasses of the supposedly impure sciences that wear their technological origins and purposes on their sleeve. This is what HPtS does. These "impure" sciences include the engineering sciences such as mechanical and chemical engineering but extend further to all scientific research guided by practical ends, to all research that ranks making higher than knowing, and to all research that considers the practical control of phenomena more important than their theoretical representation. Today, nanotechnologies, biotechnologies, information and communication technologies, biomedical research, genetic engineering and synthetic biology are paradigm examples of these sciences, but synthetic chemistry, pharmacy, and agriculture all belong under this heading. Indeed, even physics begins to look different when one looks at all the sciences from this angle. According to Francis Bacon as one of the 16th century founders of modern science, making is always the hallmark of knowing and even the theories of physicists can only be known if one can technically control phenomena and reproduce nature. Also according to Bacon, even (fundamental) physics has to prove in the end its utility for society. It is only a small step from here to include the social sciences, including Science and Technology Studies (STS), for their development of techniques of shaping science-technology-society interactions.

The recognition is not new that the engineering sciences, agriculture, synthetic chemistry, or nanotechnology are not merely "applied sciences" but have their own methods and involve distinct ways of approaching the world. What is new is the general shift of perspective that comes with HPtS as

it approaches all sciences, including physics, from a technological point of view, rather than privilege some ways of doing science and treat the others as impure or applied. With this comes a different role for historians: The history of making and remaking the world with the help of science and technology involves far more than a history of knowledge production. Alongside historians of science and technology, environmental historians play a prominent role since they study the transformative effects of science and technology. In other words, the "H" has a different place in HPtS than it usually does in HPS. This holds also for the philosophy of medicine which can now be integrated with the study of closely related technological sciences.

While its scope and ambitions are quite like those of HPS, HPtS highlights aspects of scientific research that have played little or no role in HPS. For example, when HPtS investigates problems of representation, this includes the role of visualizations and of the technical media for their production. Also, HPtS needs to develop a theory of non-propositional skill-knowledge. It considers the production of ignorance alongside that of knowledge, and is particularly interested in decision-making or risk evaluations in the absence of numerically defined probabilities. It studies how the technological sciences become public sciences as they enter the marketplace and become popularized in museums. It investigates how certain conceptions of "machine" or "environment" structure research and the development of technical systems. HPtS reflects on changing practices and changing concepts of "experiment" in the lab and the field and society at large. And of course, it is interested in simulation modelling and in claims that explanation consists in the specification of mechanisms or in the production of a local fit between theories and phenomena. By bringing these issues to the fore, HPtS complements, builds on, and expands HPS scholarship. It thereby makes an essential contribution to a comprehensive understanding of science and technology in modern society.

When a new field of research begins with the inversion of a familiar perspective and looks from the point of view of contemporary technological sciences at all the sciences and their history, this entails not just new questions but also poses new ***methodological challenges***. A canon of established approaches is not available as in HPS with its "rational reconstructions," laboratory ethnographies and other case-study methods, or its arguments for and against various brands of realism and constructivism.

This is not to say that HPtS encounters its questions empty-handed. Indeed, it can draw on a variety of approaches. Where a patchwork of methods is available, this requires mutual learning on the side of HPtS researchers.
- As mentioned before, HPtS can builds on HPS especially where the latter has implicitly begun to look at science as a kind of engineering activity: For example, many recent theories of modelling regard science as the fitting together of theory and phenomena; some recent theories of explanation see the aim of science in the specification of mechanisms for observed processes; and certain theories of knowledge appeal to criteria of robustness or reliability. All of these claims and attendant debates contribute also to HPtS as evidenced especially in the work of Martin Carrier.
- However, HPtS can also draw on traditions that are entirely alien to HPS. For example, the most prominent philosopher who closely considered science as a technological enterprise was Martin Heidegger. Some observers have therefore argued that the rise of the HPtS perspective coincides with a renewed interest in Martin Heidegger, Edmund Husserl, or Hannah Arendt as philosophers of science.
- Another approach is suggested by theories and theorists of "technoscience," a term that was introduced by Gilbert Hottois, Bruno Latour and Donna Haraway and that has since been taken up by a wide variety of historians and philosophers (Don Ihde, Andrew Pickering, Paul Rabinow, Ursula Klein, Bernadette Bensaude-Vincent, Alfred Nordmann – with dedicated research groups in Århus, Bloomington, Darmstadt, Paris, Sao Paulo and elsewhere). According to Paul Forman, this shift from

"science and technology" to "technoscience" coincides roughly with that from modernism to postmodernism – which is not to say, however, that to study technoscience is to endorse the postmodernism that may be responsible for its rise to prominence.

- Recent interest in field vs. lab experimentation and society as a laboratory for collective experimentation draws attention to the interplay between policy and the production of evidence for use (Wolf Krohn, James Griesemer, Nancy Cartwright).
- There are beginnings of a philosophy of design which can serve as a common denominator of an epistemology of engineering and a philosophy of the technological sciences. Along with authors like Peter-Paul Verbeek, Ann Johnson explores the notion that the technological sciences pursue research in a design mode. Her historical work is complemented by Davis Baird's discussion of "thing knowledge."
- HPtS encourages further-reaching interdisciplinarity. Whereas HPS was seeking to involve historians, philosophers, sociologists, and perhaps anthropologists or ethnographers, HPtS brings in *Bildwissenschaft* (the science of pictures or images), economics, media theory, environmental history and philosophy, digital humanities, and geography.
- Several members of the BiCoDa Alliance are considering the code in which research software is written. The HPtS focus on ways in which technology shapes experimental and conceptual practice draws attention to diverse groups of invisible technicians and their unacknowledged research contributions.
- Finally, there are a fair number of conceptualizations of contemporary research culture that may have heuristic value but require historical critique and philosophical clarification. Prominent examples are "post-normal science," "mode-2 research," "post-academic science," "new natural history," and "entrepreneurial (triple-helical) science."

The BiCoDa alliance admits these various approaches and will provide an international forum where these differences can be appreciated and negotiated and where a canon of exemplary HPtS research can be generated.

In the meantime, there are nuts-and-bolts methodological issues associated with the focus on the technological condition especially of contemporary research. They concern the status of the source material. Traditional philosophers of science work with published scientific texts and archival manuscripts like laboratory notebooks. Traditional historians of science work with texts, images, and artifacts from the past. In HPtS research, however, many sources are current and even still under revision. They include casual testimony, e-mail exchanges, website-postings, grey literature reports, wikipedia entries, laboratory artefacts, snapshots at conferences, powerpoint presentations, or draft manuscripts. In order not only to cite these documents properly but also to make sources systematically available to other researchers, novel approaches and publication formats need to be developed and standards may have to be established at least implicitly through good practice. Here, traditional HPS researchers stand to gain from the archival experience of social and environmental historians as well as historians of medicine. This question of methods will be reflected throughout the work of the BiCoDa alliance.

The BiCoDa Alliance is a concerted effort by three universities (in *Bi*elefeld, *Co*lumbia, and *Da*rmstadt) that are recognized for their HPtS-research to create an international platform and forum for HPtS scholarship. There are, of course, numerous research activities all over the world that can be subsumed under the proposed heading of HPtS. However, there are as of yet no research centers, professional associations, journals, or societies dedicated to HPtS. The BiCoDa alliance makes a contribution toward filling this gap.