RESEARCH REPORT 2006—2007

MAX-PLANCK-GESELLSCHAFT

MAX-PLANCK-INSTITUT FÜR WISSENSCHAFTSGESCHICHTE

Max Planck Institute for the History of Science

Cover:
Preparation for "Sonatas and Interludes" (1939) by John Cage (1912–1990), performed by Markus Hinterhäuser in the series "Physiologie des Klaviers" (see p. 129–130) on December 14, 2006 at the Curt-Sachs-Saal, Museum for Musical Instruments, SIMPK, Berlin
Image: Michael Behr, Berlin

Back cover:
Sgrilli's planimetry of the Pratolino Garden (1742) superimposed on a GoogleEarth satellite photo. A tool used to locate the original positions of the hydraulic devices in the Medici Garden.
Project: The History of Science in a Garden, Matteo Valleriani, Jochen Büttner (see p. 39–40).
<http://pratolino.mpiwg-berlin.mpg.de>
Image: DigitalGlobe

Most of the portrait photographs were done by Skúli Sigurdsson, Berlin/Reykjavík

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Max Planck Institute for the History of Science

Introduction

The Max Planck Institute for the History of Science (MPIWG) was founded in 1994 to promote "the development of a theoretically oriented history of science which studies scientific thinking and knowledge acquisition in their historical development and their interaction with the cultural, technical, and social contexts of science." The MPIWG has since pursued this program in breadth and depth, embracing the natural sciences and the humanities and spanning topics from the origins of counting systems in Mesopotamia to today's postgenomics. The research of the Institute cuts across conventional disciplinary lines in order to explore the dynamics of scientific change as well as the history of basic epistemological categories such as experiment and objectivity. The MPIWG here follows the general mission of Max Planck Institutes to take up new and innovative research areas of an interdisciplinary character that are either not yet represented adequately at universities in Germany or that require special equipment and funding.

The Institute comprises three Departments, each administered by a Director, and three (as of 2008) Independent Research Groups, each led for five years by an outstanding junior scholar. Department I, directed by Jürgen Renn, focuses on structural changes in systems of knowledge; Department II, directed by Lorraine Daston, investigates the history of the ideals and practices of rationality; and Department III, directed by Hans-Jörg Rheinberger, studies experimental systems and spaces of knowledge. Research Group I, led by Dagmar Schäfer, traces the history of innovation in China. The other two Research Groups will be taking up their work toward the end of 2008. This Research Report describes in detail the work of the different research units over the past two years.

Each of the Departments and Research Groups sets its research agenda and develops and cultivates its own working style. Each of the following reports briefly describes in its opening paragraphs how the work of the research unit is organized. The diversity of the formats of the reports that follow reflects the diversities of the Departments and Research Groups themselves. There are nonetheless important overlaps between the groups' research interests, as will become evident from the reports.

Department I and Research Group I, for example, share an interest in the history of science and technology in China; Departments II and III have common interests in the history of scientific observation and the ways in which observations are registered; all three Departments have joined forces to set up a Research Network on the History of Scientific Objects (funded by the Innovation Fund of the President of the Max Planck Society) that also links the MPIWG to major international centers in the history and philosophy of science and technology, both universities and museums.

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All research units take the historicity of scientific knowledge as a fundamental premise and seek new ways of characterizing and understanding it. This common commitment to historical epistemology in its various forms is a red thread that runs through all of the reports. Historical epistemology also means, in our understanding, that scientific and other forms of knowledge acquisition and transmission must often be studied together, as historical and cultural context dictate. In July 2008, a workshop on the question of "What (Good) is Historical Epistemology" (organizers Uljana Feest and Thomas Sturm) will bring together scholars from all Departments with leading international scholars in the history and philosophy of science to reflect on the past, present, and future of this research program.

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The Institute sustains collaborative research projects with other Max Planck Institutes such as the Bibliotheca Hertziana in Rome (Department I, "The Epistemic History of Architecture"), the Max Planck Institute for European Legal History in Frankfurt am Main (Department II, "Natural Law and Laws of Nature") and the Kunsthistorisches Institut in Florence (Department III, "Knowledge in the Making"). Moreover, the local cooperation between the Free University, the Humboldt University and the Technical University of Berlin and the entire MPIWG has been intensified over the past two years, resulting in a formal cooperation agreement between the Max Planck Society, the Free University and the Humboldt University; a comparable cooperation agreement with the Technical University is in preparation. All these agreements will entail the creation of new positions in history of science on the part of the Berlin universities and the cooptation of each of the leaders of our Junior Research Groups as faculty members. The ultimate goal of these cooperations is the creation of an International Center for the History of Knowledge in Berlin with the MPIWG and the three universities at its core, with affiliations with other Berlin-based research institutions such as the Center for Human and Health Sciences of the Charité Hospital, the Prussian Cultural Heritage Foundation, and the Natural History Museum. The new center aims at establishing an intellectual and organizational framework for researching and teaching past knowledge cultures in new ways. Located in Berlin next to the Institute's building, it will create a unique basis for future collaborative research projects in order to attract students and scholars from many different countries and disciplines.

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The MPIWG aims to innovate first and foremost in research, but it has also pioneered new forms of publication and the exploitation of new source materials. The MPIWG has created a new genre of publication, "working group volumes," which are the result of years of collaborative research by teams of scholars, in contrast to the more famil-

iar conference proceedings or edited volumes. To mention only a few examples: *The Genesis of General Relativity* (Dept. I); *Things that Talk: Object Lessons from the History of Art and Science* (Dept. II); *Heredity Produced. At the Crossroads of Biology, Politics, and Culture, 1500–1870* (Dept. III). In the past years, our cooperation with museums has intensified, including several exhibitions, both small and large. In the context of the Research Network on the History of Scientific Objects, for example, a "Wandering Seminar" of pre- and postdocs visited major European collections of scientific objects and then drew on their experience to mount an exhibition at the MPIWG devoted to the problem of presenting scientific objects as "publications" in the history of science. All research units of the Institute draw upon not only published texts and written archival materials but also on images and material objects as carriers of knowledge- ranging from mechanical drawings (Dept. I) to natural history collections (Dept. II) to children's drawings (Dept. III). Finally, all research units are developing electronic research environments for historical work on science and knowledge on the basis of tools developed by the Information Technology Group. They include the collaborative database European Cultural Heritage Online (Dept. I), the Islamic Scientific Manuscripts Initiative (Dept. II), the Virtual Laboratory of Physiology (Dept. III), and the tracing of knowledge dissemination by geographic information systems (IRG Schäfer), to mention only some prominent examples.

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In the spring of 2006, the Institute moved to its new building at Boltzmannstraße 22 in Berlin-Dahlem. We are grateful to the Max Planck Society for giving the MPIWG this comfortable and well-designed home in the immediate vicinity of the Free University and the Archives of the Max Planck Society. In particular, we thank our Advisory Board for its support, and we hope that the work presented in this report will reward the reading.

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Structure and Organization of the Institute

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Departments and Research Groups

Department I: Structural Changes in Systems of Knowledge

Jürgen Renn

DIRECTOR *Prof. Dr. Jürgen Renn*

RESEARCH SCHOLARS *Dr. Peter Beurton* (associated), *Dr. Katja Bödeker, Jochen Büttner*, *Costanza Caraffa* (October 2006 to February 2007), *Giuseppe Castagnetti*, *Dr. Jacob Lebovitch Dahl* (since April 2007), *PD Dr. Peter Damerow* (associated), *Brian Fuchs*, *Prof. Dr. Dieter Hoffmann*, *Dr. Malcolm Hyman*, *Dr. Horst Kant*, *Dietmar Kurapkat* (until September 2007), *Prof. Dr. Wolfgang Lefèvre* (associated), *Dr. Christoph Lehner*, *Dr. Ernst-Wilhelm Osthues*, *Dr. Albert Presas i Puig* (until March 2007), *Simone Rieger*, *Matthias Schemmel*, *Dr. Volkmar Schüller*, *Matteo Valleriani*, *Milena Wazeck*

Department II: Ideals and Practices of Rationality

Lorraine Daston

DIRECTOR *Prof. Dr. Lorraine Daston*

RESEARCH SCHOLARS *Dr. Charlotte Bigg* (since July 2007), *Dr. Anke te Heesen* (until September 2006), *Dr. Bernhard Kleeberg* (until December 2006), *Dr. Andreas Mayer* (since November 2007), *Dr. Tania Munz* (since August 2007), *Dr. Christine von Oertzen*, *Dr. Thomas Sturm* (since October 2007), *PD Dr. Fernando Vidal*, *Dr. Annette Vogt*, *Dr. Kelley E. Wilder*

Department III: Experimental Systems and Spaces of Knowledge

Hans-Jörg Rheinberger

DIRECTOR Prof. Dr. Hans-Jörg Rheinberger

RESEARCH SCHOLARS *Dr. Dr. h. c. Hans Erich Bödeker* (since December 2006), *Dr. Christina Brandt* (since February 2006: Research Group Leader), *PD Dr. Sven Dierig* (until March 2006), *Dr. Uljana Feest* (until September 2006), *Dr. Bernd Gausemeier* (since June 2007), *PD Dr. Christoph Hoffmann*, *Prof. Dr. Ursula Klein*, *Dr. Julia Kursell*, *Dr. Carsten Reinhardt* (March 2006 to March 2007), *Dr. Henning Schmidgen*, *Dr. Barbara Wittmann* (since September 2006)

Independent Research Group I (2006–2009)
Concepts and Modalities: Practical Knowledge Transmission

DIRECTOR *PD Dr. Dagmar Schäfer*

RESEARCH SCHOLAR *Dr. Martina Siebert*

Dagmar Schäfer

Independent Research Group II (1999–2007)
Experimental History of Science

DIRECTOR *PD Dr. H. Otto Sibum*

Since September 2007: Hans Rausing Professor, Uppsala University, Sweden

RESEARCH SCHOLAR *Dr. Charlotte Bigg* (until June 2007), *Annik Pietsch*

H. Otto Sibum

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Robert Casties

Hannah Lotte Lund

Claudia Paaß

Jochen Schneider

Urs Schoepflin

Dirk Wintergrün

Hansjakob Ziemer

Standing (left to right):
Yin Xiaodong, Albert Presas i Puig, Peter Damerow, Jacob Dahl, Milena Wazeck, Christopf Lehner, Lindy Divarci, Christian Joas, Anna Holterhoff, Donald Salisbury, Ursula Müller, Matteo Valleriani, José Pacheco, Julia Damerow, Jochen Büttner, Shadiye Leather-Barrow, Thomas Gertzen, Carmen Hammer, Elio Nenci, Jürgen Renn, Wilhelm Osthues

sitting:
Circe Dynnikov, Arianna Borrelli, Marta Jordi, Daniela Monaldi, Oscar João Abdounur, Stefan Trzeciok, Chen Yue, Simone Rieger, Volkmar Schüller

Department I

Structural Changes in Systems of Knowledge

Director: *Jürgen Renn*

Research Focus

The work of the research group headed by Jürgen Renn is mainly dedicated to understanding the historical processes of structural changes in systems of knowledge. This goal comprises the reconstruction of central cognitive structures of scientific thinking, the study of the dependence of these structures on their experiential basis and on their cultural conditions, and the study of the interaction between individual thinking and institutionalized systems of knowledge. This theoretical program of a historical epistemology is the common core of the different investigations and research projects pursued and planned by the research group.

Methodology

Department I understands its research program of a historical epistemology as contributing to an evolutionary history of knowledge. The emphasis is on macro-studies to enable the identification of large-scale structures of knowledge development in social, technological, and cultural contexts. Approaches, methods, and objects of inquiry are taken from a large array of disciplines, ranging from the history and philosophy of science, technology and art, via the cognitive sciences and linguistics, to archeology, Middle Eastern studies, classics, Sinology, Indology, sociology, to physics, mathematics, chemistry, and other natural sciences. The creation of innovative IT instruments is essential for managing the concrete historical evidence for the research of Department I, provided by sources that are written in various languages and come from a broad range of historical periods, cultures, and fields. The work of the Department continues to take inspiration from challenges of the present and future development of science, tackling such issues as the role of the new information technologies, globalization, and the position of science in society. It thereby opens up opportunities for younger scholars of the Department in finding positions in a broad variety of fields, including science organization and dissemination, in addition to academic positions inside and outside the history of science.

As the research projects of Department I integrate knowledge from a wide range of disciplines, cultures, and historical periods, they are realized in co-operative networks extending well beyond the boundaries of the Institute. The Institute typically

represents, however, a central node of such networks, bringing together scholars to form teams characterized by intense co-operation over longer periods of time. The challenges of cross-cultural comparisons, diachronic studies of historical developments, and the close integration of computer-assisted source analysis and scholarly interpretations are addressed with the help of a combination of core teams, who bear the main responsibility for a project, and an array of informal working groups which are often independently funded, characteristically shaped by the interests of younger scholars and connected by weaker or stronger links to the activities of the core team. Exploring and validating theoretical conclusions with reference to the vast collection of primary sources, but also building upon the existing scholarly literature would be inconceivable without the support and substantial active participation of the Institute's library, and the information management facilities that were built up with the support of the IT-group.

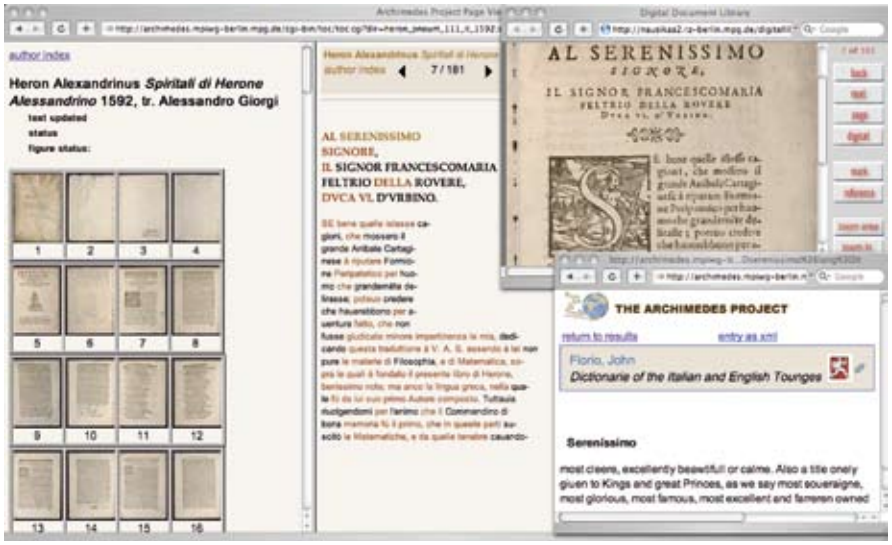
Main Achievements

In the past, research in Department I has led to the formulation of an overarching theoretical framework, offering cohesion to the wide spectrum of individual research activities realized under its auspices. Among past achievements was the filling of this framework with studies on the emergence of writing and mathematical thinking in ancient civilizations, investigations of the role of practical knowledge for the emergence of early modern science, a comprehensive analysis of the relativity revolution at the beginning of the 20th century, groundwork for a long-term history of the development of architectural knowledge, as well as studies of knowledge development in an intercultural perspective, pursued in close collaboration with the new independent research group dealing with Chinese knowledge culture. *The Cuneiform Digital Library Initiative (CDLI),* a pioneering endeavor launched in 2000 by the Institute together with the University of California at Los Angeles, with support from the US National Science Foundation (NSF), has not only introduced advanced techniques of electronic information management into scholarly work, but has also created an international network of research institutions, universities, and museums with the aim to virtually rejoin and analyze cuneiform archives now scattered in numerous museum collections <http://cdli.ucla.edu>.

→ Concepts and Modalities, p. 161

CDLI website prepared for The Iraq Museum

In a similar way, the *Archimedes Project,* originally funded by a major grant received from the NSF and the Deutsche Forschungsgemeinschaft, has enabled the historical reconstruction of mechanical knowledge to be addressed in a much more systematic way than was previously possible <http://archimedes.mpiwg-berlin.mpg.de>.



A page of the 1592 Italian translation of Heron of Alexandria's *Pneumatica* from Alessandro Giorgi in the Archimedes Project's display environment. One can see the thumbnail navigation and the text (left), which is linked to a dictionary (bottom right), as well as an image of the original (top right). The text and the images are downloadable as xml-files for local use.

An initiative entitled *European Cultural Heritage Online (ECHO)* was established in 2002 in collaboration with sixteen European partners, including two other Max Planck Institutes (Max Planck Institute for Psycholinguistics in Nijmegen and the Bibliotheca Hertziana in Rome). The initiative has created an open-access infrastructure bringing cultural heritage online with more than 70 collections comprising over 206,000 documents, 266,000 high-resolution images of historical and cultural source documents and artifacts, more than 240 film sequences of scientific source material, and more than 57,500 full-text page transcriptions in several languages. The ECHO

Example of a historical source (Benedetti, *Diversarum specvlationum mathematicarum, et physicarum liber*, 1585) with extensive coeval annotations by Guidobaldo Del Monte in the chapter on mechanics, representing the scholarly network and communication of the time (original book and digitization: MPIWG Library)

infrastructure serves as the basic model for all research projects of the Department that deal with the digitization of cultural heritage <http://www.echo-project.eu>. These achievements form the basis for the present work of the Department as do various projects that are supported by external funding and that have been continued in the period under consideration.

Projects

Present research focuses on four central projects and on a cluster of activities directed at new forms of creating access to the empirical basis as well as to research results of the history of science. Each of the projects involves its own forum of discussion (project colloquium), while overarching issues are being discussed at team meetings involving the scholars responsible for the individual projects.

1 Mental models in the history of knowledge: the relation of practical experience and conceptual structures in the emergence of science

The first project seeks to understand the emergence of fundamental concepts of empirical science arising from the reflection of practical experiences, prior to the period in which experiments became the dominating experiential basis of science. The empirical focus of the project is twofold: On the one hand, the rich source materials left by the early cultures of Mesopotamia and Iran provide a unique occasion for studying the earliest forms of knowledge formation. Remains of technical devices and technologies and the long tradition of technical and scientific treatise on mechanics show, on the other hand, how different forms of knowledge interacted in bringing about coherent bodies of mechanical knowledge.

In the context of this project, primarily focusing on the development of mechanical knowledge, the acquisition, analysis, and commentary of a substantial number of relevant primary sources has been accomplished and major studies have been completed. The investigation has now been largely concluded and will result in a four-volume book series. Parallel to the publication, the relevant source material is being made openly available as an open-access resource within the framework of the ECHO initiative.

Left: The Ancient Peking Observatory. Unnumbered woodcut from the *Xinzhi yixiang tu* of F. Verbiest (Beijing, 1674)

Right: A group of researchers from the MPIWG and its Partner Group at the Chinese Academy of Science studying the instruments at the Ancient Peking Observatory

The joint work with the Partner Group at the Institute for the History of Natural Sciences of the Chinese Academy of Sciences in Beijing, which yielded contributions to the reconstruction of the long-range development of mechanical thinking in China and to the understanding of the interaction between western scientific knowledge and that of the Chinese tradition, has now been brought to a close. These studies will be continued with smaller scale individual studies within the context of this project.

2 Reorganizing knowledge in developed science: integration and disintegration of knowledge systems

The second project studies the reorganization of knowledge in developed science. In this context, earlier studies on the relativity revolution have been completed and published. They are currently also being linked to key primary sources of an online publication that will be openly available in the framework of the ECHO initiative. A joint venture with the Fritz-Haber-Institute of the Max Planck Society (MPG), supported by the Strategic Innovation Fund of the President of the Society, to investigate the history of quantum mechanics was launched in 2006. Its aim is to continue the reconstruction of the conceptual revolution of modern physics in order to trace the roots of quantum mechanics in the developments of classical science.

3 The epistemic history of architecture: the long-term history of the knowledge that has made the great architectural achievements of mankind possible

The third project deals with an epistemic history of architecture and analyzes the knowledge implicit in actions that emerged long before the advent of science, and that was repeatedly subjected to transformations that explain the fascinating interplay of utility, rationality, and art that is the hallmark of architecture. The work is in its final stage, with a major publication to be edited in 2008. In order to extend the research in this field, a joint proposal has been submitted to the Project Cluster of Excellence TOPOI (see below) to investigate the diffusion of practical knowledge in antiquity, focusing on tracing the techniques of stonemasonry in the ancient Mediterranean cultures. Its acceptance will provide a unique opportunity to continue the research undertaken in this project in a multidisciplinary environment.

4 The globalization of knowledge and its consequences: the transfer and transformation processes of knowledge across different cultures

The fourth project focuses on the conditions, pathways, and consequences of globalization processes of knowledge, relating them to present processes of globalization, in particular those involving the development of the Internet and the global organization of science. The following thematic foci are addressed:

- Focus 1 The spread of culture in the ancient Mediterranean and neighboring regions
- Focus 2 Knowledge transfer within Eurasia
- Focus 3 The place of local knowledge in the global community
- Focus 4 Modeling the diffusion of knowledge.

The project is conceived as a multi-disciplinary and multi-national research network in which research groups from various countries participate. Scholarly cooperation within this research network have been negotiated with numerous research groups from a range of disciplines, groups located and/or doing research in all five continents.

5 History of science in action: alternative forms of dissemination

Further areas of work belong to what may be called "history of science in action." Alternative forms of dissemination have been adopted to investigate the potential of the history of science as a mediator between science and society by exploring new forms of combining scholarly communication with public outreach. This includes the development of advanced tools for an historical epistemology: New electronic media have been used and developed—in close co-operation with the library and the IT-group of the Institute—to explore innovative ways of creating access to the empirical basis and the research results of the history of science.

The large 2005 exhibition "Albert Einstein: Chief Engineer of the Universe" conceived and organized by the Department has not only contributed to the public visibility of the history of science as a field of active research but has also created a platform for several institutes of the Max Planck Society to place their research results and technological developments into a historical context. In 2007 the exhibition won the 2007 International Museum Communication Award (Bronze). While the considerable impact of the exhibition has never been questioned, it did engender, however, discussions about the legitimacy of Max Planck Institutes adopting exhibitions as a medium for the dissemination of their scholarly work. In reaction to such ambivalence, exhibition activities of the Department were continued on a smaller scale, renouncing opportunities such as an already planned joint exhibition with the Gemäldegalerie in Berlin or the proposal by the Max Planck Society to realize a major exhibition on the occasion of the 150th anniversary of Max Planck's birthday. Work on virtual exhibitions and smaller-scale exhibitions, however, has been continued. The Department thus organized a small-scale exhibition in cooperation with the Comenius Garten, the Museum für Naturkunde and the Monash University in Melbourne to present the results of the joint venture *Wunderforschung* with contributions also from Department II.

Events

The period of the report was not only characterized by the termination of old projects and the inception of new ones but also by developments concerning its research team. Jacob Dahl, who is the Institute's responsible scientist for the Cuneiform Digital Library Initiative (CDLI) project, is leaving the Department to take up a professorship at Oxford University. Claudia Bührig, former coordinator of Project III, left the Institute to take up a position in the Orient-Department of the German Archeological Institute (DAI) in Berlin, Dietmar Kurapkat joined the department of Architectural History in the Technical University Berlin, and Ulrike Fauerbach became member of the DAI in Cairo. In 2006 Matthias Schemmel received the prize for junior scientists from the Georg-Agricola-Gesellschaft for his thesis *The English Galileo: Thomas Harriot's Work on Motion as an Example of Preclassical Mechanics.* In 2007 this work was also awarded

the Georg-Uschmann-Preis für Wissenschaftsgeschichte from the German Academy of Sciences Leopoldina. The coordinator of the ECHO project, Simone Rieger, left the Department to take up a position with the MPG. She is now—together with Susanne Kiewitz, an exhibition expert recently hired by the MPG—part of a team of mediators between research and public outreach in the Berlin area which is hosted by Department I.

Collaborative Ventures

Once again, it has been possible to substantially expand the ongoing investigations of the Department with collaborative ventures supported by third-party resources. At the same time, the Department was able to contribute to the successful establishment of major research initiatives such as the excellence cluster TOPOI or joint research ventures in Mongolia and Spain.

The work of the research program "Jesuits on Statics, Dynamics, Mathematics and Astronomy between Galileo and Newton" is now underway. Partly funded by the German Israeli Foundation for Scientific Research Development (G.I.F.) and undertaken with the Cohn Institute for History and Philosophy of Science and Ideas at Tel Aviv University, it examines an important aspect of the development of mechanical knowledge: the dissemination and transmission of scientific knowledge in the early modern period through the highly developed communicative network of Jesuit colleges and universities.

Since January 2005, the Department has participated in a venture of the Sonderforschungsbereich (SFB, Collaborative Research Center) of the Humboldt University in Berlin, which concentrates on the transformation processes by which European cultures, arts, and sciences were formed in a continuation of the cultures of antiquity. The scholars of the Department taking part in this venture focus in particular on the conceptual structural changes in ancient knowledge as a result of its transmission. Within the framework of this cooperative venture, a special initiative has been launched with the Garden of Pratolino in Florence to investigate the transmission and transformation of the technical knowledge of antiquity. Its aim is to enable a comparison of the conflict between technical and theoretical knowledge during the Renaissance and during antiquity.

The Department's cooperation with the Moritz Schlick Research Institute at the University of Rostock is part of a wider scientific collaboration between the MPWIG and the University of Rostock which began in September 2006 with the founding of the Centre for Logic, History and Philosophy of Science at the University. Its aim is to initiate, coordinate, and organize research activities with the MPWIG on the interaction between science and philosophy in the 20th century, a theme that is particularly relevant to the ongoing investigations in the history of quantum theory.

The Department's activities in developing an innovative digital infrastructure to support its research have recently been strengthened by obtaining additional resources for personnel in the framework of the Max Planck Digital Library (MPDL), a central body for scientific information management.

Department I took part in the joint application of the Free University, the Humboldt University and other non-universitary institutions for the Project Cluster of

Excellence TOPOI—The Formation and Transformation of Space and Knowledge in Ancient Civilizations. The Cluster of Excellence has meanwhile been granted and, as a first joint venture of the Institute and the participating universities, an independent research group on the historical epistemology of space has been established and will start operating in April 2008. The group aims at a long-term history of fundamental structures of spatial knowledge, focusing in particular on the relation of experience and theoretical reflection in the historical development of spatial knowledge.

Several institutes of the MPG, among them the MPIWG, are developing a close cooperation with the Mongolian Academy of Sciences. Among the specific interests of the Department is the knowledge transfer along the silk road and the historical role of the Mongolian empire in fostering cultural, technological, and scientific exchanges between East and West. Against the background of existing contacts and research cooperation between Mongolian institutions and the MPI for Comparative Public Law and International Law (MPIL), as well as on the basis of a number of mutual visits, several joint research activities have been launched within the framework of the project on the globalization of knowledge and its consequences. They are being supported by the establishment of a competence center for the digitization and online presentation of Mongolian cultural heritage, following a proposal developed at the MPIWG and recently approved by the Mongolian Academy of Sciences.

→ Knowledge Management, p. 204

Jews and Muslims are shown playing games together in a garden setting.
Alfonso X *El Sabio, Libro de ajedrez, dados y tablas* (Book of Chess, Backgammon, and Dice), finished in 1283 in Seville. Biblioteca de El Escorial, Madrid T.I. 6, fol. 71v.

A new research venture together with the Spanish Consejo Superior de Investigationes Científicas (CSIC) has been launched by the Social Sciences and Humanities Section of the MPG, following an initial proposal by the Kunsthistorisches Institut in Florence and the MPIWG. The research initiative was prepared during joint workshops held in the period of the report. Its aim is to address a formative period of the European world with its cultural and religious heterogeneity from a multidisciplinary perspective. The encounters and exchanges between Jewish, Christian and Islamic communities and elites constitute an historical laboratory of great significance for understanding interaction and transformation processes of cultures in the millennium between the decline of the Roman empire and the beginning of the early modern period. Aspects of these processes have been studied by single disciplines in an isolated manner. The challenge of the proposed research initiative, involving the establishment of a joint team of scholars located in Madrid, is to overcome such division and focus instead on overarching questions which create an intense dialogue and collaboration between the disciplines involved, among them the history of art, religion, language, and science.

Project 1

Mental Models in the History of Knowledge: The Relation of Practical Experience and Conceptual Structures in the Emergence of Science

General Goals of the Project

The goal of the project is to study the causes and long-term developments of scientific knowledge and to analyze the role of practical experience for the emergence and development of fundamental scientific concepts, such as those of number, force, and motion. In order to achieve a broad historical basis for dealing with these theoretical problems and to cover at least some of the major developmental steps in the history of science, extensive research has been pursued in two different areas: the emergence of writing and calculation as symbolic systems as well as the genesis of mechanics as an empirical science. The project seeks to understand the emergence of fundamental concepts of both formal and empirical knowledge systems as a result of reflecting practical experiences, prior to the period in which experiments became the dominating experiential basis of science.

In both cases, one finds that thinking can be reconstructed in terms of a variety of mental models that partly fulfilled functions in specific contexts of application which are later covered by abstract concepts such as those of number or force. A mental model based on manipulating object-specific symbolic notations, for instance, served in Mesopotamian civilizations for accounting purposes—without presupposing an abstract number concept. Similarly, dynamical explanations in preclassical mechanics did not make use of an abstract concept of force but of a qualitative mental model, in which a projectile continues its motion because it has received an "internal motor' (called 'impetus') from the original cause of motion. The reconstruction of such mental models makes it possible to concisely describe structures of thinking related to practical experience and hence to understand the role of this experience for the emergence of fundamental theoretical concepts such as number or force.

Social conditions and material culture leave their mark on the large-scale structures of scientific development. Writing and quantitative thinking entered the historical scene for the first time as the investigation of operations with systems of symbols, in those early ancient civilizations that used such systems of symbols as a significant aspect of social or economic control mechanisms. Such systems of symbols played an important role in the complex systems of administration and social rituals of the Babylonian, Egyptian, Chinese and Mesoamerican empires, which therefore produced a class of specialists who occupied themselves with the rules of these systems even beyond the context of their direct application.

The project is focused, however, on mechanics as a part of science that has extraordinary significance for the development of science in general. In particular, and more so than other disciplines, mechanics has a continuous tradition from its origins in antiquity to the elimination of fundamental categories of mechanics by modern physics. The focus of the project has been mainly the period from antiquity to the emergence of classical mechanics in early modern times. But key issues have been followed up into the 20th century by the research activities of Project II.

The peculiar longevity of mechanics has given rise to speculations that the experiential basis of such scientific knowledge must be of a special kind, distinct from that of other sciences, which emerged much later. It has been claimed, for instance, that knowledge in mechanics or in mathematics is rooted in an essentially universal everyday experience, or even based on a priori structures of thinking. However, these and other speculations involve a very restrictive notion of experience. They exclude the by no means universal experience that human beings acquire in a historically specific material environment when dealing, for example, with the technology of their times. Therefore, the project is focused in particular on the historical reconstruction of such collective, practical experiences and their influences on the structure and content of scientific knowledge.

Administrative Experience and Conceptual Structures in Babylonian "Science"

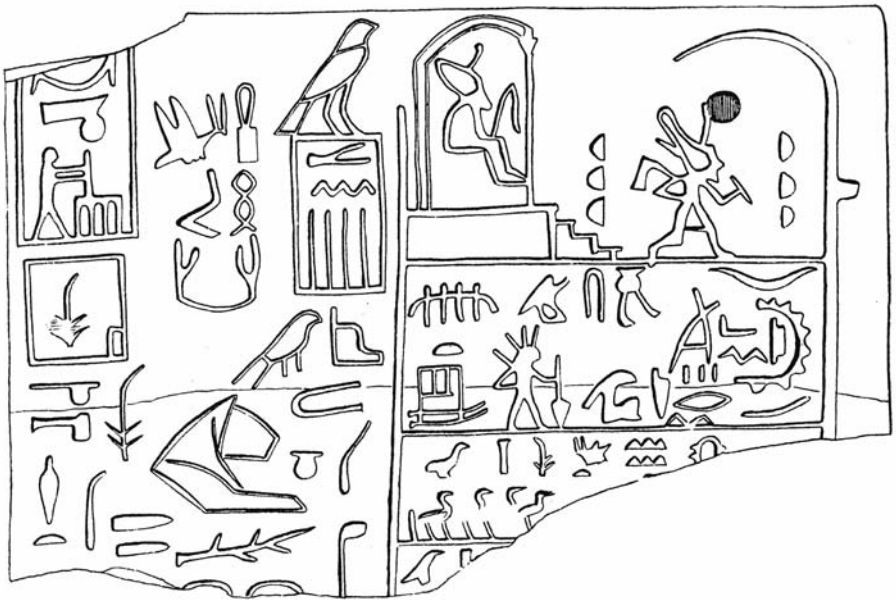
The rich textual and material record left by the early cultures of Mesopotamia and Iran provides an unparalleled opportunity for studying early forms of knowledge formation and transfer. In particular the invention and early spread of writing, being studied within the framework of the CDLI project is a case in point (Peter Damerow on early Mesopotamian writing; Jacob Dahl on early Iranian writing). In both instances, early Mesopotamia and Iran, the process of decipherment has proven to be much more than a linguistic puzzle, rather early writing is best understood as a sophisticated administrative tool which provides us with information about the local and specialized economies of the early urbanized societies of the Ancient Near East. The progress in the decipherment of early Mesopotamian and Iranian writing also exemplifies the advantages of the parallel development of an electronic infrastructure supporting this research.

Clay-cone in the collections of the New York Public Library documenting the sale of a house in the southern Mesopotamian city Nippur during the Ur III period, ca. 2050 B.C. (NYPLC 372)

The ancient Mesopotamian administrative record enables us to reconstruct in great detail the social structures of these ancient societies, among other things. Using the more than 25 000 extant documents from the ancient city of Umma (the modern Tell Djokha in southeastern Iraq), dating to ca. 2100–2000 B C, a revised version of a dissertation has been published on the structures of succession within the ruling family of that city (Jacob Dahl). The empirical basis for such a work—tens of thousands of unique, seemingly unrelated texts—become meaningful only after being made accessible in a coherent format that allows extensive data-mining and enables the reconstruction of the original ancient archives. The CDLI provides a framework for this kind of study, the results of which can at times be surprising. For example it could be shown that succession in southern Iraq during the last century of the 3rd millennium B.C. was not patrilineal, although inclusion in the line of succession was based on paternal affiliation, but rather can best be described as a system of seniority, whereby all male members of a family held rights to inclusion in the line of succession.

Equally surprising results were reached in the study of the earliest writing systems of the region, where it could be shown for example that what may be the world's earliest syllabary (found in the proto-Elamite texts from Iran) was apparently not based on the rebus principle. Instead, new signs for indicating owners were rather invented seemingly *ad hoc.*

Early writing and arithmetics has been a research focus of Department I over a number of years, and it has been conclusively demonstrated that writing and arithmetics had a common origin in early Mesopotamian administrative tools, highlighting the importance of early Babylonian practical knowledge for the understanding of modern sciences. Whereas the origin of writing in Mesopotamia and Iran is relatively well understood in terms of initial use and early development, the same is not true for the other seemingly independent inventions of writing, in Egypt, China, and Mesoamerica. Within the framework of the project on the globalization of knowledge and its consequences, the topic of the diverse backgrounds of the inventions of writing is being further explored.



An ancient Egyptian commodity label (ca. 3000 B.C.)

Although early Mesopotamian writing had a unique origin (in earlier administrative tools and processes), and although all early documents from Mesopotamia had either a purely administrative content or contained lists, presumably for learning purposes, early writing in the ancient Near East materialized in a multitude of manifestation from the earliest periods on. The earliest developed documents from Egypt, for example, may have been inspired by Mesopotamian ones, although sign-forms were certainly based on the well-known earlier "tags" from pre-dynastic Abydos which represents a unique Egyptian development. Building on the results and working within the framework of the CDLI project, now contributing to the globalization project, the research has been extended to the spread of writing in the Mediterranean and surrounding regions.

Historical Epistemology of Mechanical Knowledge

What does the term mechanical knowledge designate? Mechanical knowledge concerns material bodies in time and space, their motions, and the forces that cause or resist such motions. Mechanical knowledge allows us to predict how bodies change their position with time if only we know their current state and the forces acting upon them.

Mechanical knowledge of this kind played a special role in the process of development from natural philosophy to modern science. Natural philosophy from its very beginnings in the works of Aristotle constructed conceptual systems to represent pictures of the world as a whole, referred to in the following as world views. In contrast to such global intentions, the origins of mechanical knowledge have to be sought in the much more down-to-earth activities of realizing specific aims of practical life.

Over a long historical period, the development of mechanical knowledge and its transmission from one generation to the next remained an inherent dimension of such activities, unrelated to any cognitive endeavors aimed at constructing a mechanical world view. It was only after the first attempts in classical antiquity to include mechanical knowledge in the conceptual systems of natural philosophy that its assimilation to them and the corresponding accommodation of such systems to mechanical concepts could lead to conflicts between mechanical knowledge and knowledge about nature as a whole. It was only after the growing body of mechanical knowledge became a vital resource of early modern societies that mechanical knowledge within its own conceptual systematization started to compete with natural philosophy by constructing its own world views. This finally resulted in early modern times in what has been called the "mechanization of the world picture."

The main goal of the research project has been to explain the development and diffusion of mechanical knowledge throughout history in terms of historical-epistemological concepts. The project aims at a unified and systematic account of all kinds of mechanical knowledge which are commonly studied independently in the framework of research agendas informed by particular disciplinary perspectives such as those of anthropology, philosophy of nature, developmental psychology, ethnology, sociology, history of technology, history of education, history of science, etc. These disciplines may indeed contribute a breadth of empirical detail to the project, but none of them

alone would be able to integrate them into a coherent picture. Therefore, a systematic account has so far not been given of the conditions under which mechanical knowledge developed from its anthropological origins into foundations of a mechanical world view and after that was transformed into a framework for the interpretation of material interactions within the space-time geometry and quantum mechanics of modern physics.

In the course of the project, which goes back to the inception of the Institute, numerous contributions to such an overarching picture have been made, ranging from cross-cultural studies of intuitive and practical physics, comparative studies of the origin of mechanics in European and Chinese antiquity, investigations of the role of pictorial representations for the practical knowledge of Renaissance engineers, assessments of different modes in dealing with the Scientific Revolution, the development of interpretative models for reconstructing the transition from preclassical to classical mechanics, to explorations into the genesis of the analytical tradition of mechanics and studies of the decline of the mechanical world view in the context of Project II. In addition to these investigations of the historical transformations of mechanical knowledge, a large body of primary sources have been integrated into the digital infrastructure of the project, analyzed and commented upon.

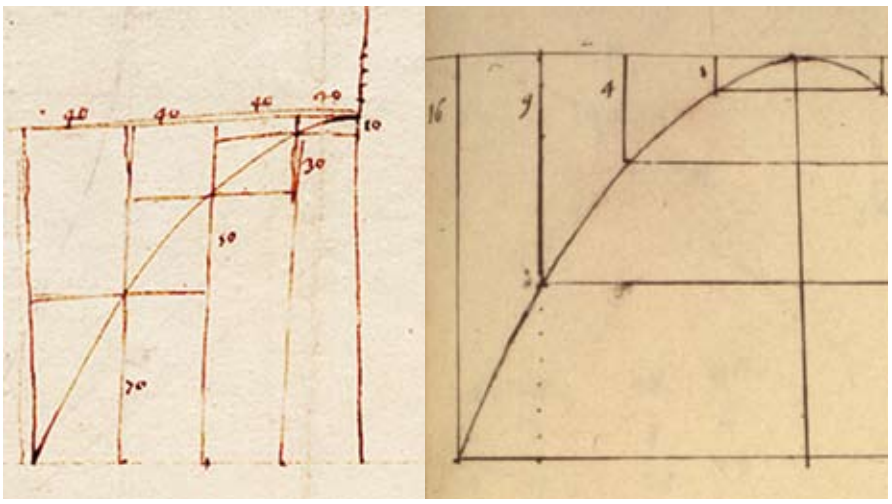
In the period of the report, a preliminary synthesis of these endeavors has been elaborated and is being prepared for publication in the form of a four-volume series under the heading *The Historical Epistemology of Mechanics,* conceived in analogy to the four-volume series on *The Genesis of General Relativity* concluding the Department's reconstruction of the relativity revolution. While the emphasis will be on the period of the Scientific Revolution, given the thrust of the investigations pursued so far, the analysis takes into account the long-term development of mechanical knowledge without which neither the emergence nor the consequences of this period can be adequately understood. Just as the reconstruction of the relativity revolution took Einstein's work as the point of reference for a thorough contextualization of his achievements, the reconstruction of the transformation of mechanical knowledge will similarly refer to Galileo's work as a point of departure for outlining a historical epistemology of mechanics.

The development of an adequate theoretical framework has been a critical aspect of the research program and provides a common basis for the investigations constituting *The Historical Epistemology of Mechanics.* The longevity of mechanics makes it particularly clear that large domains of human knowledge accumulated by experience are not simply lost when theories are revised, even if this knowledge does not explicitly appear in such theories. Formal logic is hence of little help when it comes to a description of the multi-layered architecture of scientific knowledge, allowing to account both for the continuous and the discontinuous aspects of the transmission of mechanical knowledge. In order to explain structural transformations of systems of knowledge, it is furthermore necessary to take into account the collective character and the historical specificity of the knowledge being transmitted and transformed, as well as to employ sophisticated models for reconstructing processes of knowledge development. Concepts such as that of *mental model,* of *shared knowledge,* of *challenging object,* and of *knowledge reorganization* have turned out to be pivotal for such an explanation.

We conceive of mental models as knowledge representation structures based on default logic which allow inferences to be drawn from prior experiences about complex objects and processes even when only incomplete information on them is available. Mental models relevant to the history of mechanics either belong to generally shared knowledge or to the shared knowledge of specific groups. Accordingly, they can be related either to intuitive, to practical, or to theoretical knowledge. They are, in any case, characterized by a remarkable longevity—even across historical breaks—as becomes clear when considering examples such as the mental models of an atom, of a balance, of the center of gravity, or of positional weight. Their persistence in shaping the shared knowledge documented by the historical sources becomes particularly apparent in the consistency of the terminology used, a consistency that offers one important element for an empirical control for the reconstruction of such mental models and their historical development.

We conceive of challenging objects as historically specific material objects, processes or practices entering the range of application of a system of knowledge without the system being capable of providing a canonical explanation for them. Examples run from mechanical devices challenging Aristotelian dynamics, via artillery challenging early modern theories of motion, to black body radiation challenging classical radiation theory. In reaction to such challenges, knowledge systems are typically further elaborated, occasionally to the extent of giving rise to internal tensions and even inconsistencies. Such explorations of their limits may then become starting points for their reorganization in which often previously marginal insights take on a central role in an emerging new system of knowledge. Such processes of reorganization may be exemplified by the emergence of theoretical mechanics from Aristotelian natural philosophy in ancient Greece, the transformation of preclassical into classical mechanics, or the emergence of quantum theory from classical physics at the turn of the last century.

The investigations constituting *The Historical Epistemology of Mechanics* build on this theoretical framework, three of them centering on the role of shared knowledge, of challenging objects, and of knowledge reorganization, respectively. A fourth study elaborates on this theoretical framework and provides a comprehensive survey of the long-term development of mechanical knowledge.



The parabolic trajectory resulting from horizontal projection in the research notes of Galileo (left) MS 72 , folio 117r, and of Harriot (right) British Library Add MS 6789, folio 67r

The first study *The English Galileo: Thomas Harriot's Work on Motion as an Example of Preclassical Mechanics* investigates the shared knowledge of preclassical mechanics by relating the work of Thomas Harriot on motion, documented by a wealth of manuscripts, to that of Galileo and other contemporaries (Matthias Schemmel). Harriot and Galileo indeed exploited the same shared knowledge resources in order to approach the same challenging objects. While the paths Harriot traces through the shared knowledge are different from Galileo's, the work of the two scientists displays striking similarities as regards their achievements as well as the problems they were unable to solve. The study of Harriot's parallel work thus allows the exploration of the structure of the shared knowledge of early modern mechanics, to perceive possible alternative histories, and to distinguish between individual peculiarities and shared structures of early modern mechanical reasoning.

A scientist undertaking an experiment.
Carlo de Bernardis, oil painting, 1695, Milan

The second study *Galileo Engineer: The Origins of the New Physics in Practical Knowledge* looks more closely at the role of challenging objects in early modern mechanics (Matteo Valleriani). In this period, the increased significance and advancement of technology confronted the traditional body of mechanical knowledge with challenging objects such as the trajectory of projectiles, the stability of constructions, the oscillation of a swinging body, or the curve of a hanging chain. As becomes clear from the outstanding example of Galileo's *Two New Sciences*, but also from the numerous letters Galileo exchanged with his contemporaries, these objects enriched the traditional knowledge but also induced fundamental revisions of its structure, which led eventually to classical mechanics. The study investigates the conditions for this change and sheds new light on hitherto neglected contexts of early modern science.

The third study *Galileo's Challenges: The Genesis of a New Theory of Motion* explores the reorganization of knowledge taking place in the course of Galileo's research process extending over a period of more than thirty years, pursued within a network of exchanges with his contemporaries, and documented by a vast collection of research notes (Jochen Büttner). It has revealed the challenging objects that motivated and shaped Galileo's thinking and closely followed the knowledge reorganization engendered by these challenges. It has thus turned out, for example, that the problem of reducing the properties of pendulum motion to the laws governing naturally accelerated motion on inclined planes was the mainspring for the formation of Galileo's comprehensive theory of naturally accelerated motion. It could furthermore be shown how explorative experimentation substantiated the conceptual structures of the emerging theory.

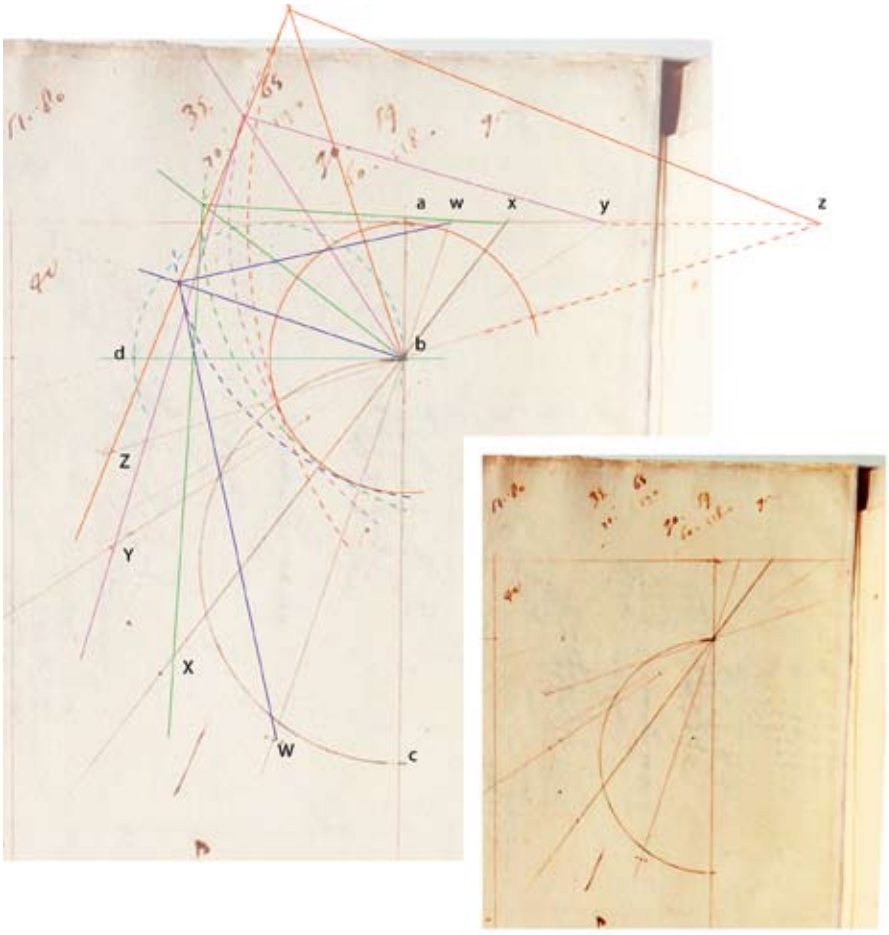


Diagram on folio 155 recto of Galileo's notes on motion (Ms. Gal. 72). A crucial part of the construction, not revealed by the original diagram (lower-right), has been reconstructed (upper-left).
Each color represents the construction necessary to find one of the five points d, Z, Y, X and W (marked but not lettered in the diagram). According to this interpretation Galileo constructed these points such that, after initial fall through the vertical ab, they are reached in the same time

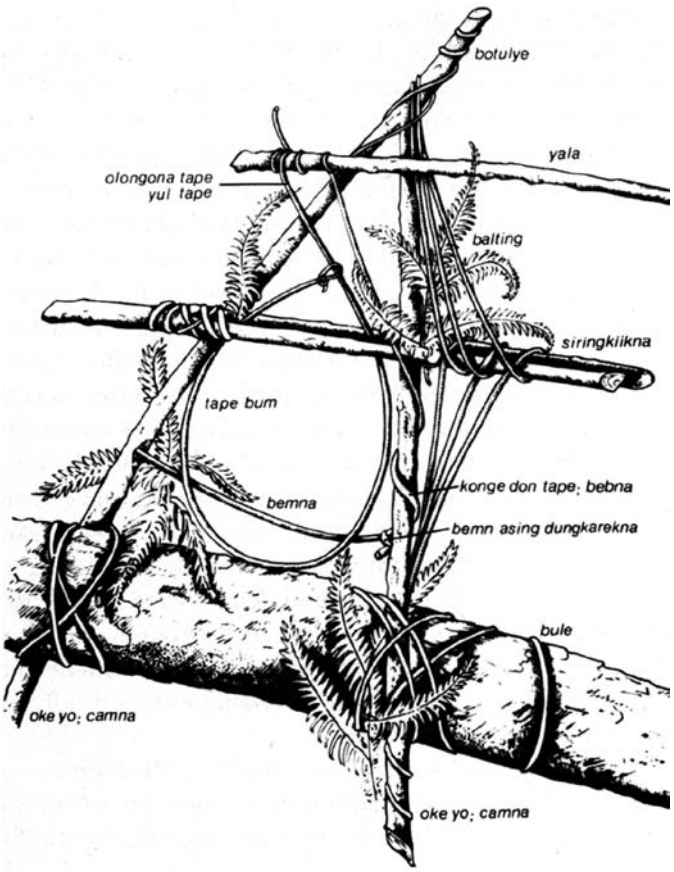
The fourth study *The Evolution of Mechanics: A Study in the Long-term Development of Knowledge* articulates more extensively the theoretical foundations of a historical epistemology of mechanics, provides an outline of the long-term development of mechanical knowledge, and offers an outlook on further research activities within the epistemological framework adopted by Project I. The theoretical foundations of the study draw on research results from various disciplines. They comprise, in particular, a conceptual structure that relates the social settings and material conditions of the development and transmission of mechanical knowledge to its cognitive structures and functions. This conceptual structure allows the methodological problems to be solved that arise from an integration of research results from different disciplinary approaches. The theoretical framework adopted makes it also possible to analyze and make explicit the relations between diverse forms of mechanical knowledge that have hitherto been mostly treated in isolation from each other. Among these different forms is the intuitive knowledge gained through basic material activities, the professional knowledge of practitioners, and the theoretical knowledge resulting from the reflection of various forms of knowledge in the context of scientific theories. On this basis it is thus possible to reconstruct the long-term history of mechanics. Major steps that are treated are:

- the origins of mechanical knowledge in elementary mechanical technologies of indigenous cultures on a stone-age level;
- the development of sophisticated machines in early civilizations;

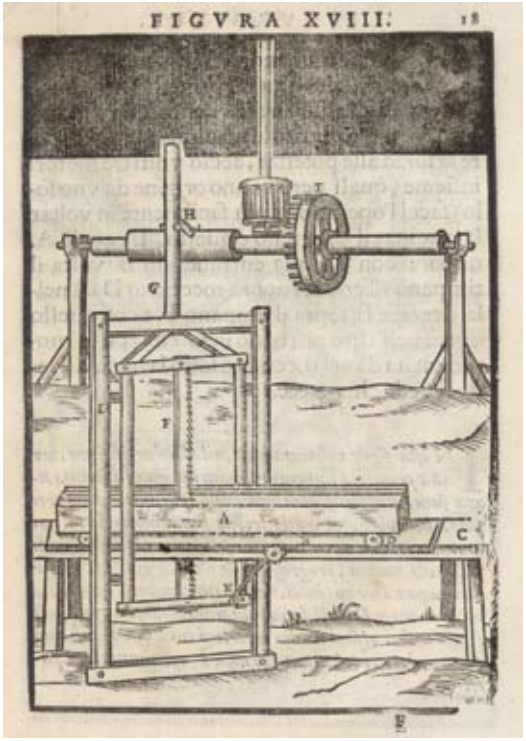
- the theoretical reflection of such technologies in ancient and medieval treatises;
- the origins of preclassical mechanics in Renaissance technologies;
- the development of mechanics into a mechanical world view;
- the failure of classical mechanics in the 19th century to deal adequately with new technologies as well as with the emerging borderline problems of classical physics; and finally
- the redefinition of the fundamental concepts of mechanics in modern relativity theory and quantum mechanics.

Using extensive reinterpretations of the historical sources documenting this long-term development, the final publication will demonstrate that changing mental models of the material reality account for the dynamics of this process (Peter Damerow, Jürgen Renn).

In addition to these studies by members of the Department, a number of further investigations have been pursued by guest scholars in coherence with the main goals of the project. It was investigated, for instance, how Guidobaldo del Monte's writings on mechanics relate to the Aristotelian category of the subalternate sciences, to which it is often assimilated (Maarten van Dyck). Also the role of conservation principles in 17th-century physics was explored, focusing on the question of how the ideal of conservation allows for the introduction of new fruitful concepts, in the work of Stevin,



The spring snare 'wena', a mechanical device of an indigenous culture of New Guinea for capturing small animals.
Left: If an animal touches the 'bemna' the small pin 'bemn asing dungkarekna' releases the string 'bebna' which holds the tensioned beam 'yala' and the noose 'tape bum' captures the animal.
Above: A photo of a spring snare camouflaged with fronds above a jungle trail



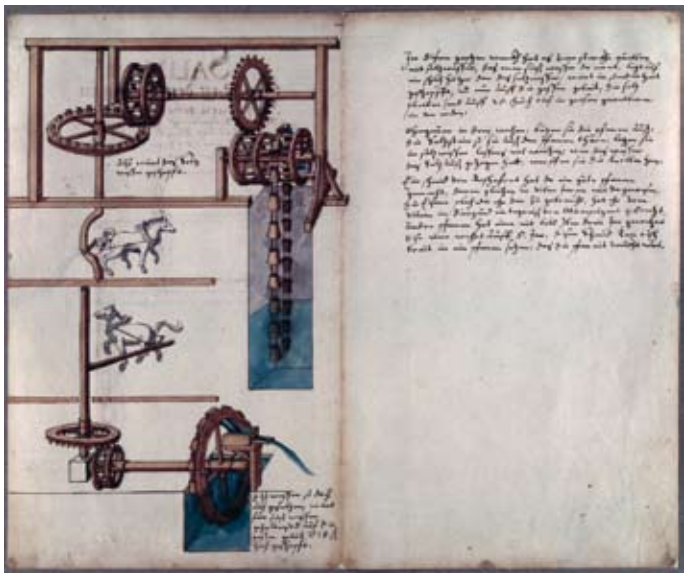
Saw mill, Giovanni Branca,
Le machine,1629

Galileo and Leibniz. The reception of Aristotle's mechanics in the Renaissance was studied, focusing on questions of the authenticity of the work and on philosophical reasons for its importance in the 16th and 17th centuries (Peter McLaughlin). Furthermore the relation of science and technology as presented in the first so-called externalist interpretations of the Scientific Revolution by Henryk Grossmann and Boris Hessen was examined along with the first internalist criticisms.

The Professional Knowledge of Practitioners

Mechanical knowledge evidently predates any systematic theoretical treatment of mechanics. The most basic knowledge presupposed by mechanics is based on experiences acquired almost universally in any culture by human activities. The outcome is an intuitive mechanical knowledge embedded in a qualitative physics, which is built up in ontogenesis and guides human activities related to our physical environment. A second kind of mechanical knowledge, which predates any systematic theoretical treatment of mechanics, is the knowledge achieved by the use of mechanical tools. In contrast to intuitive mechanical knowledge, this type of knowledge is closely linked to the production and use of tools by professionalized groups of people and it consequently develops in history. The professional knowledge of practitioners is historically transmitted by immediate participation in practices such as the processes of labor and production in which such tools are applied and by the oral explanation that accompanies their application.

Chain of buckets,
Heinrich Schickhardt, 1610.
Courtesy of Hauptstaatsarchiv Stuttgart



Research on professional knowledge related to mechanics has been mainly dedicated to the study of the tradition of engineering knowledge in the early modern period. To facilitate the study of con-

temporary engineering drawings and to enable systematic comparisons of the wealth of information contained in these drawings, an analytical database has been developed that allows a standardized description of the images and enables systematized comparisons, as is customary for texts or quantitative data (Wolfgang Lefèvre, Marcus Popplow). As part of the digital research library developed within the framework of Project I, the *Archimedes Project,* the '**d**atabase **m**achine **d**rawings' (DMD) has in the period under consideration been extensively expanded to include rare manuscripts from the 15th and 16th centuries. For example, a large set of unique drawings by engineer-architect Heinrich Schickhardt (1558–1634) is now accessible online thanks to a fruitful cooperation with the Hauptstadtsarchiv and the Württembergische Landesbibliothek in Stuttgart. The database now comprises around 1850 engineering drawings ranging from the late Middle Ages until 1650. Each drawing is presented in a frame of categories comprising bibliographical information and secondary literature, the technological details of the machines depicted, and the drawing's pictorial language and social context. In most cases, the original texts accompanying these drawings are accessible as well. All the categories can be analyzed by means of different searches: The large variety of contemporary types of machines, or the more than one hundred different machine elements they were composed of can be searched as well as graphic techniques such as sections or ground plans, or the mention of measures and materials in the accompanying texts. Statistics show that the databank is used by European and international research and teaching facilities and has close to 1000 visitors per month. Around 1500 machine drawings by Leonardo da Vinci are currently in preparation for inclusion in the databank. This has been made possible by the transference of exclusive rights held by Giunti publishers to the library of the MPIWG. Future plans include the extension of the databank to include drawings from the period 1650–1750 as well as new collaborations with other research database projects. DMD is openly accessible at <http://dmd.mpiwg-berlin.mpg.de>.

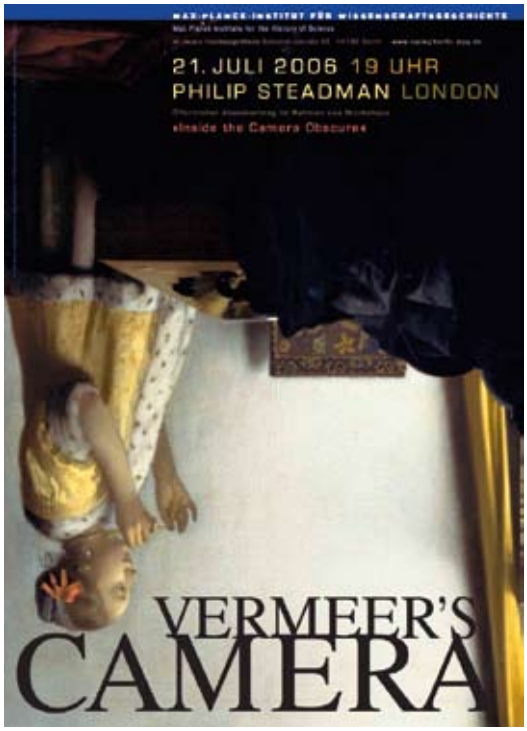
Further investigations have been dedicated to the professional knowledge employed in shipbuilding, extending earlier research on knowledge organization in the Venetian Arsenal (Matteo Valleriani) and also on the relation between ship design and developments in fluid mechanics (Horst Nowacki). A book on civil and naval architecture is being published (Wolfgang Lefèvre, Horst Nowacki).

Matthew Baker's illustration of the naval architect at work. From Mattew Baker's *Fragments of English Shipwrightry* of 1586, unpublished manuscript. Courtesy of the Pepysian Library, Magdelene College, Cambridge

The Parallel Cases of Optics and Music

The development of mechanics as the result of an interaction of practical knowledge with other forms of knowledge ranging from antiquity to the early modern period finds its parallels in the evolution of optics and music theory as fields of scientific knowledge similarly dependent on the accumulated experiences of practitioners. In this context the role of the 17th-century camera obscura as an optical instrument was further investigated in a workshop that explored its significance for both science (theory of vision as well as optics) and art (Wolfgang Lefèvre, Carsten Wirth). The results of this workshop are documented in the Institute's preprint series. In the framework of the workshop, an experimental historical camera obscura was designed and constructed for the MPIWG that allows all known types of cameras employed in the 17th century to be configured. The apparatus serves as a research tool for historians of art and science. A future prospect is to employ this tool in experimental research, particularly for the investigation of the optical performance of mirrors, lenses and further optical glass devices employed for scientific and artistic purposes during that century.

Poster of the workshop "Inside the Camera Obscura"

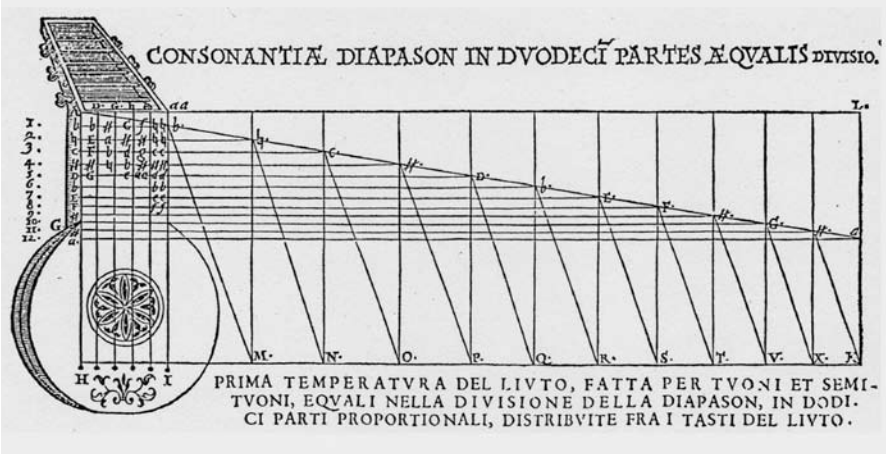


Work on a translation of Isaac Newton's *Opticks* into German has continued (Volkmar Schüller). Meanwhile the compilation of a critical text of the *Opticks*, which forms the basis for the new translation, has been completed. This critical text takes into account Newton's English manuscript, the three English editions of *Opticks* as well as Samuel Clarke's Latin translation carried out under Newton's supervision.

Practical needs both in mathematics and music, such as the need in the late Middle Ages to divide the tone in contrast to the predominant Platonical-Pythagorical tradition that proscribed it, caused ratio in the context of music to become gradually interpreted as a continuous magnitude, whereas previously it was a comparison between two integer numbers. This change would eventually lead to an arithmetization of the theory of proportions in music theory. In the context of practical needs both in mathematics

Experimental Historical Camera Obscura. A research tool for historians of art and science who investigate the 17th-century camera obscura. Designed and constructed for the MPIWG by Carsten Wirth and Henrik Haak

and music, the skepticism against Pythagorical arithmetical dogmatism in theoretical music at the end of the 16th century stimulated interest in the physical foundations of pitch in music. The role of musical practice in the arithmetization of the theory of proportions in music theory is being investigated from this perspective. Such developments are representative of a change in the interpretation of music theory in the Renaissance, a change from a mathematical-speculative conception to a physical-empirical one. In this context it is also being investigated to what extent epistemological concepts such as that of the Scientific Revolution according to Thomas Kuhn or that of epistemological break according to Gaston Bachelard are transferable to this change in the interpretation of music in the early modern times. It is also considered how such changes in the concept of ratios are applicable to mathematical education contexts (Oscar Abdounur).



A proposal of division of the octave in 12 parts with equal and proportional semitones by Gioseffo Zarlino, *Sopplimenti Musicali*, Venetia, 1588, vol 3, book 4, chapter XXX, p. 209

Cooperative Ventures

Conferences and Workshops

Several conferences and workshops have taken place in the framework of Project I, partly under the auspices of major cooperations that have been initiated or continued in the period of the report. They have provided occasions for presenting results by scholars of the Department to a wider scientific audience in a form that conveys their coherence in an overarching research endeavor. One such occasion was offered by the *Galilean Lectures,* a prominent lecture series held in 2007 for the first time outside of Italy at the MPIWG and organized in collaboration with the Istituto e Museo di Storia della Scienza in Florence and under the patronage of the Italian Embassy in Berlin. The event focused on the relations between Galileo's scientific work and the technology of his time.

Another such occasion was offered by a session at the HSS 2007 Annual Meeting dedicated to Aristotle's *Mechanical Questions,* bringing together members of the Project's network from Humboldt University, Harvard University and the University of Heidelberg.

In 2006 a large workshop under the title *The Machine as Model and Metaphor* was organized by Department I and funded by the European Science Foundation (ESF) in the framework of the Research Networking Program *From Natural Philosophy to Science,* co-initiated by the department in 2002. It brought together historians of science, of technology, and of philosophy to take a closer look at what in the early modern period was considered to be a machine, i.e. machines used in building, vehicles, clocks, automata, pumps, wind and water mills. It is planned to publish the results in an edited volume.

Independent Tradition and Knowledge Transfer: the Case of China

In 2006 joint work with the Institute's Partner Group at the Institute for the History of Natural Sciences of the Chinese Academy of Sciences on the exchange of practical and scientific knowledge between China and Europe in the early modern period was brought to a close (Chen Yue, Peter Damerow, Jürgen Renn, Matthias Schemmel, Tian Miao, Xiao Yunhong, Yin Xiaodong, Zhang Baichun, Zou Dahai). A major Chinese publication, an edition and commentary of the *Yuanxi Qiqi Tushuo Luzui* is ready for publication. In the English language, a preprint is available which comprises several studies of the Jesuit intervention in Chinese mechanical knowledge (Jürgen Renn, Zhang Baichun).

Annotating texts and images with scientific commentaries. MPIWG and the Chinese Academy of Science in ECHO

The *Yuanxi Qiqi Tushuo Luzui* is the first monograph on western mechanics ever to be compiled in Chinese. In order to introduce western mechanics to China, the authors of the *Qiqi Tushuo*, Wang Zheng (1571–1644) and Johann Terrenz Schreck (1576–1630), worked together on a Chinese presentation of western mechanical knowledge, thereby merging the traditions of the two cultures. The *Qiqi Tushuo* has been made available on the Internet as a high-quality facsimile with introductory notes and as a transcription linked to a dictionary, together with further texts pertinent to the history of mechanics in China. This digital library on Chinese texts on mechanics is part of

the ECHO infrastructure <http://echo.mpiwg-berlin.mpg.de/content/chineseknowledge> and is being further extended. Work on a commented English translation of the *Qiqi Tushuo* is being continued.

→ Knowledge Management, p. 204

The Jesuits Matteo Ricci, Adam Schall von Bell, and Ferdinand Verbiest. In Johann Baptista du Halde, *Ausführliche Beschreibung des Chinesischen Reiches und der grossen Tartarey*, Rostock 1749

The transmission of European scientific knowledge in the early modern period has been further investigated within the framework of the globalization of knowledge project. Patterns of reception and rejection of knowledge are being explored as well as the ways in which knowledge is transformed during the process of its transmission. It has turned out that the knowledge transfer between Europe and China is best understood if the historical events are interpreted in terms of an interaction between two comprehensive systems of knowledge; the early modern European and the late-Ming/early-Qing Chinese, including their respective social and cultural embeddings (Matthias Schemmel).

Jesuits on Statics, Dynamics, Mathematics, and Astronomy Between Galileo and Newton

The research venture *Jesuits on Statics, Dynamics, Mathematics and Astronomy between Galileo and Newton* was launched in 2006 together with the Cohn Institute for History and Philosophy of Science and Ideas at Tel Aviv University and is partially funded by a grant from the German-Israeli Foundation for Scientific Research and Development (G.I.F.). It aims at an important aspect of the development of mechanical knowledge in the early modern period: the dissemination and transmission of scientific knowledge through the highly developed communicative network of Jesuit colleges and universities (Jochen Büttner, Peter Damerow, Rivka Feldhay, Jürgen Renn, Matteo Valleriani). The three-year period envisaged for the initial research phase was recently extended until 2010. Most of the goals of the first part of the venture have been achieved during the first two-year period. Preliminary results were presented at the annual meeting of the German and Israeli group in Berlin (2007). Major problematic areas have been defined that were crucial for the transition from the ancient and medieval understanding of mechanics as a science of weights towards the "classical" understanding of mechanics as a "general theory of motion." These concern the interplay between a mathematical study of weights in equilibrium and the philosophical study of motion, attempts to build bridges between dynamics and

statics, and the role of quantitative experiments. Several papers dealing with these areas have been published or are in press. A preprint of collected contributions focusing on the themes, methods and constraints of Jesuit mechanics is in preparation.

By the close reading of a selected list of 17th-century texts written by Jesuit mathematicians and philosophers concerned with problems of weight, equilibrium, resistance, machines, free fall and projectile motion, the discourse on mechanics between 1630 and 1685 is being reconstructed from the particular Jesuit perspective. During the winter and fall of 2007, a weekly seminar took place to discuss and read a series of texts in which mechanical knowledge is applied to understand and explain a possible motion of the earth in non-Copernican terms, to demonstrate its existence and measure it, or simply to clarify its implications and then reject it. The texts include Paulus Guldin's *Dissertatio de motu terrae* (1635); Paulo Casati's *De terra machinis mota* (1655) and Honoré Fabri's *Dialogi physici in quibus de motu terre disputantur* (1665).

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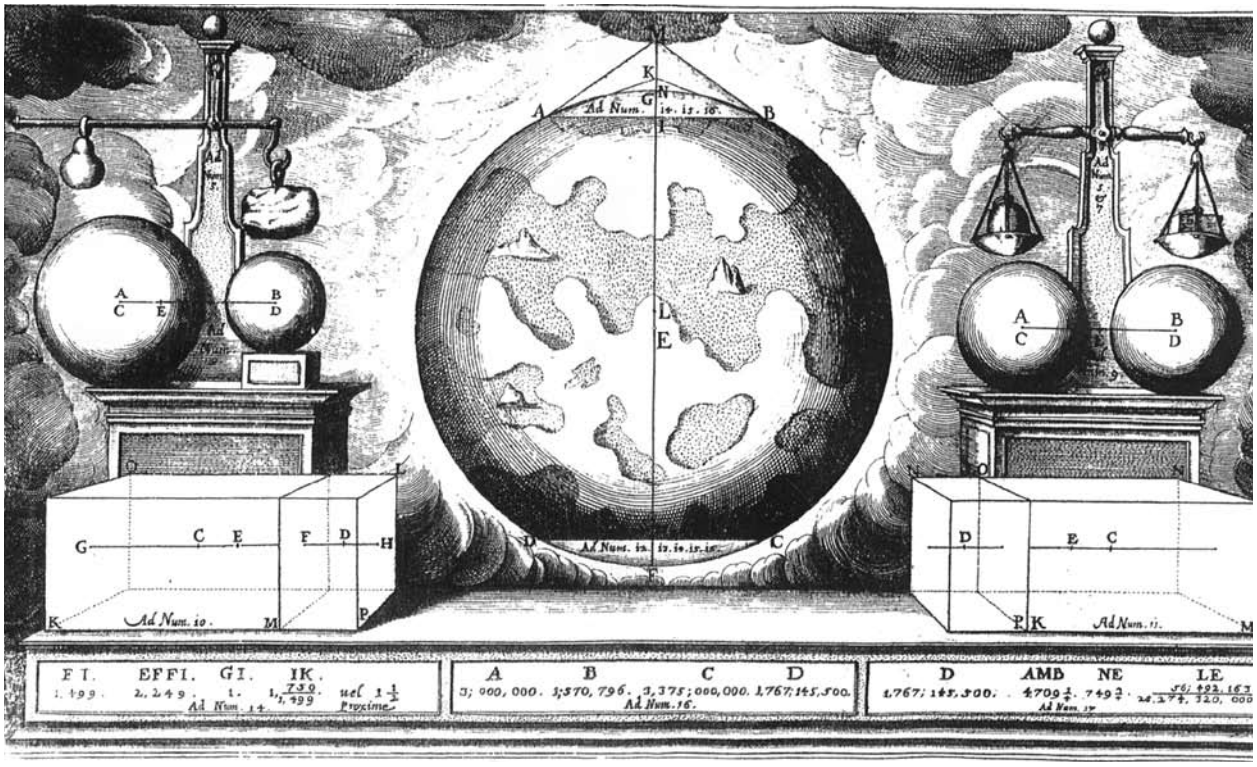
Jesuits discussing motions of the earth without adopting a Copernican worldview. In Pauli Guldini Sancto, *Gallensis et Societate Jesu De centro gravitates*, Liber Primus, Viennae 1635

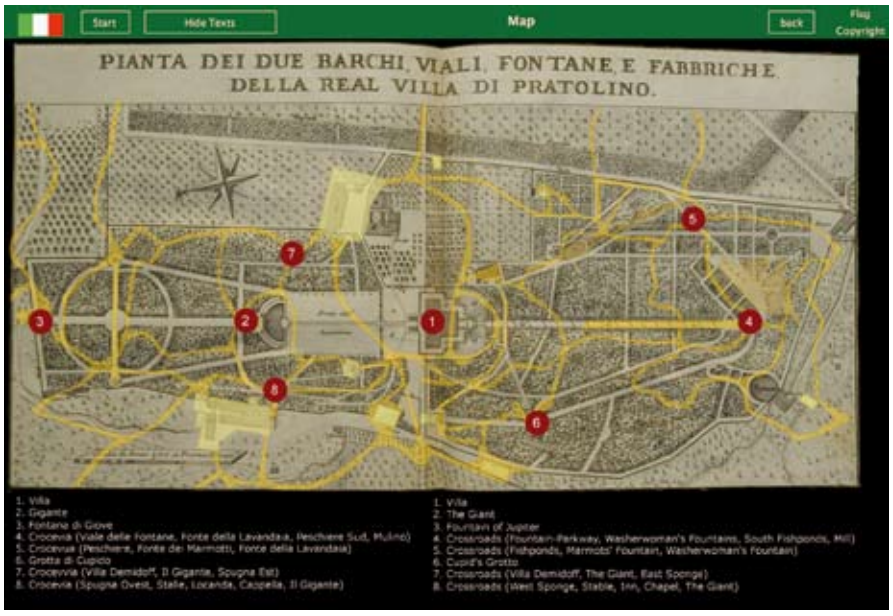


Aristotelian Mechanics, Conceptual Change, and Knowledge Transfer

Since January 2005, the department has participated in the *Sonderforschungsbereich* (SFB, Collaborative Research Center) *Transformations of Antiquity* at the Humboldt University in Berlin. The work of the Department in the framework of the SFB has focused on the sub-project "Weight, Energy and Force: Conceptual Structural Changes in Ancient Knowledge as a Result of its Transmission" (Peter Damerow, Malcolm Hyman, Jürgen Renn, Matteo Valleriani). Work on this sub-project has resulted in contributions to the first volume of a book series documenting the results of the Collaborative Research Center. These range from an account of the theoretical potential of the concept of mental model for understanding the transformation of technical knowledge, via an analysis of the understanding of Hero's pneumatics by Renaissance engineers, to an exploration of semantic networks as a tool for investigating conceptual change and knowledge transfer in the history of science.

Within the project novel techniques in the area of computational philology have been developed. These techniques are intended to provide new sorts of data for research into the long-term development and transformation of ancient scientific and technical knowledge. Moreover, they constitute a contribution to open research questions in the history of science regarding the relation between terms and concepts belonging to different scientific theories. The techniques allow for computer-assisted analysis of the semantic relations between technical terms in a text and draw upon the linguistic concept of semantic fields and work in cognitive science and computer science on semantic networks and semantic memories.

The sub-project has also produced analyses of the structure and terminology of six works selected from the 16th- and 17th-century Aristotelian translations and commentaries (by Bernardino Baldi, Giuseppe Biancani, Giovanni di Guevara, Henri de Monantheuil, Niccolò Tomeo, and Alessandro Piccolomini) that document a critical phase in the transformation of Aristotelian mechanics. These data comprise a functional description of each section of the text (in terms of categories such as premise, problem, theorem, definition, literary reference) and a core list of about six hundred technical terms



Project "Pratolino: The History of Science in a Garden" (first page of the online presentation)

→ Knowledge Management, p. 204

(together with concordance information for the six texts) chosen on the basis of their theoretical importance. The primary texts have been published in digital form as part of the open access publication initiative of the MPIWG, and the content and terminological data constitute a set of structured XML annotations on these electronic texts. These data will be crucial in further research on transformations of ancient mechanics.

The reception and transformation of the technical knowledge of antiquity is being investigated also with regard to early modern translations and commentaries on Heron's *Pneumatics*, which are being related to early modern knowledge on the design and functioning of pneumatic machines. A basis for this investigation is provided by the rich source material of a partially unexploited estate: the Garden of Pratolino near Florence, which documents the construction and decoration of an outstanding achievement of early modern technology <http://pratolino.mpiwg-berlin.mpg.de>. This initiative is undertaken jointly with the Ente Provincia of Florence, which owns the garden, the Riccardiana and Moreniana libraries, the State Archive of Florence, the Biblioteca Nazionale Centrale of Florence, as well as with the Kunsthistorisches Institut of Florence.

TOPOI — The Formation and Transformation of Space and Knowledge in Ancient Civilizations

The Department participated in the original proposal for the Project Cluster of Excellence *TOPOI — The Formation and Transformation of Space and Knowledge in Ancient Civilizations* with two project proposals: one for an independent junior research group and one for a cross-sectional group aimed at linking research efforts from different areas of the cluster. The TOPOI Cluster has meanwhile been granted. In the internal reviewing process of the Cluster, the independent research group has been approved and is on the way to being realized. The project of the group, *Historical Epistemology of Space: Experience and Theoretical Reflection in the Historical Development of Spatial Knowledge,* aims at a long-term history of basic structures of spatial thinking, ranging from prehistory to the most recent and ongoing scientific revolutions. It focuses on the question of how the emergence and the development of spatial concepts is shaped by experience and how, in turn, these concepts influence the acquirement of further experiential knowledge. Experience in the sense of the project is to be understood in a broad sense, ranging from the interaction of biological organisms with their environment to the systematic production of knowledge by means of the complex experimental systems of modern science. The experiential spaces that one may thus distinguish have traditionally been investigated by different disciplines—developmental psychology, anthropology, ethnology and psycho-linguistics, archeology, and the history of science and technology—and shall in the framework of the project be set in relation to each other with respect to their research potentials and results concerning the historical development of spatial knowledge (Matthias Schemmel).

The Department's second proposal will be decided upon once the cross-sectional groups have been chosen. It is designed to investigate the diffusion of practical knowledge in antiquity. The focus will be on tracing the techniques in stonemasonry, which formed the basis of the great architectural achievements of the Mediterranean cultures. Practical knowledge of this kind can be taken as an example for the very

effective circulation of knowledge in antiquity since it is much less connected to the individual characteristics of societies; their traditions, language and social organization. Since its transfer is not restricted to a specific form, knowledge can be gained from personal contact 'on the job' as well as from objects such as drawings and texts; it can even be studied and adopted without any specific documentation when existing buildings are analyzed. Details of the techniques used also help to distinguish

The oldest surviving manuscript of Euclid's *Elements*, 9th century AD. The *Elements* document an early theoretical reflection on the figures that can be drawn with compass and ruler and became a paradigm of deductive reasoning with far-reaching consequences for the later development of the concept of space

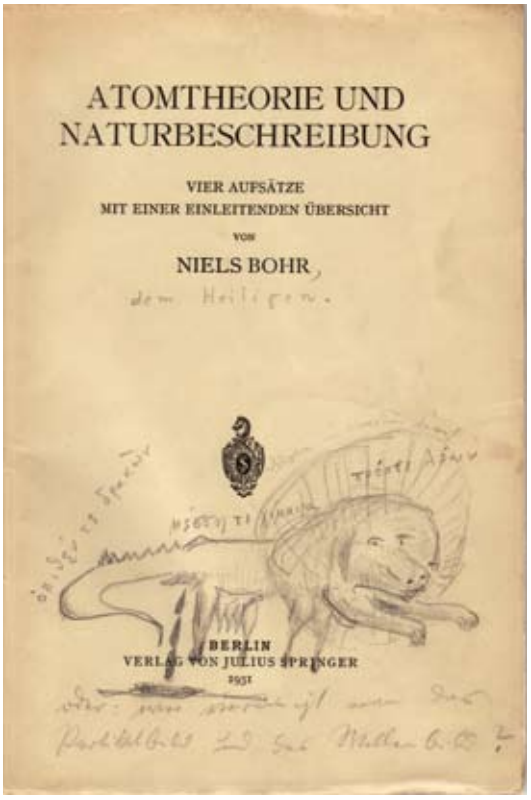
between the actual adoption of knowledge from 'stimulus diffusion'. The project shall profit from the vast expertise in archaeology and architecture present in the TOPOI cluster, from the results of the Department's project *Epistemic History of Architecture,* as well as from ongoing research in the context of the project on the globalization of knowledge and its consequences (Wilhelm Osthues).

Project 2

Reorganizing Knowledge in Developed Science: Integration and Disintegration of Knowledge Systems

General Goals of the Project

The goal of the project is the study of the emergence and dissolution of core groups of concepts that structure the vast knowledge embodied in the mechanical worldview as a result of processes of knowledge integration and disintegration. In the context of the project, the emergence of such a core group of foundational concepts is conceived as a restructuring of the cognitive organization of previously acquired knowledge. Core concepts of the mechanical world view such as space, time, force, motion, and matter achieved their privileged position in the organization of knowledge only after a long process of knowledge integration in a material, social, and cognitive sense. Such concepts proved to be extremely stable in the face of an enormous growth of knowledge in the course of the further development of science. Nevertheless, physics, like many other scientific disciplines, has witnessed in the past century fundamental changes of precisely such core groups of foundational concepts. These fundamental changes were preceded by more or less extended periods of knowledge disintegration, in which the established cognitive organization of knowledge became problematic. Processes of integration and disintegration of knowledge are studied in close connection within the project since it has turned out that the essential mechanisms at work in periods of destabilization were of the same nature as those in the original processes of the emergence of core concepts of a discipline.



Erwin Schrödinger's personal copy of Niels Bohr's *Atomtheorie und Naturbeschreibung* on which he drew a wave-particle chimera

The project is focusing on the history of the central mental models which shaped scientific thinking in the periods ranging from classical mechanics to the revolutions of modern physics. These challenged fundamental categories of mechanical thinking. The project also traces the far-reaching restructuring introduced by the analytical tradition and disciplinary organization of scientific knowledge. The results already achieved for the

emergence of the new concepts of space and time in the context of the two relativity theories are being complemented by similar research on the emergence of new notions of matter and causality established in the context of quantum theory.

The History and Foundations of Quantum Physics

The quantum revolution emerges from a series of crises of the classical mechanical world view from the late 19th century to the 1920s. These crises were caused in part by conflicts between theoretical expectations and experimental results, but also importantly by the difficulty of integrating relatively newly established physical theories such as electrodynamics and thermodynamics into the mechanical world view. Similar to the case of relativity theory, conflicts between theories necessitated a reorganization and re-evaluation of the most fundamental concepts of these theories.

Central to this process of re-evaluation was not only a large amount of undoubted empirical knowledge accumulated over a long period of time but also the persistence of certain theoretical structures and methods. Theoretical physicists were therefore confronted with critical decisions about which concepts and theoretical structures could be maintained in the emerging theory and could thus serve as a guide for the development of the theory. As in the case of relativity, it turned out that it was often high-level and abstract structures that survived, although frequently with a new physical interpretation.

Differently from the case of relativity, a consensus about the physical reinterpretation of the abstract structures was not easily attained. Famous dissenters, such as Einstein and Schrödinger, while accepting the new theoretical structure, disagreed about its meaning and its connection to the traditional mechanical world view. Later on, the establishment of quantum field theory, including the unification with the theory of relativity, has turned out to be at odds with the traditional demands on an interpreted physical theory. These disagreements have persisted up to this day, even though quantum mechanics is a highly successful predictive theory by all counts.

Most importantly for the historian, this lack of closure of the theoretical structure has also affected the historiography of quantum theory, which can be divided into three periods:

- A first generation of historical works was written mainly by physicists who had participated in the quantum revolution themselves or witnessed it closely. Not surprisingly, these accounts have a rather whiggish character: they present the history as the triumph of good scientific practice and especially of good epistemology.
- A second generation of historical work refrained from the high-level disputes of the previous generation altogether and concentrated on the collection and presentation of large amounts of historical material. Examples are especially the Archives for the History of Quantum Physics and the monumental monograph by Mehra and Rechenberg.
- Only in a third generation of more recent publications one finds a more critical distance from the founders of quantum mechanics and their account of the course and meaning of the events. Also, the scope of the

inquiry was widened, paying more attention to experimental practices and social and cultural influences.

Aiming to present a fourth generation of historical writing, the research project on the history and foundations of quantum physics began work in October of 2006 (Christoph Lehner). It is a joint initiative with the Theory Department of the Fritz Haber Institute and has been funded for five years by the Strategic Innovation Fund of the President of the MPG. The project attempts to arrive at a deeper understanding of the genesis and the development of quantum physics, using the tools of historical epistemology that have been developed in Department I over the last years. The project thus focuses on the long-term history of the process of theory change, stressing the continuity of methods and structures. The experience in writing the history of relativity has demonstrated the strength of this method: It leads to results that have been outside the view of approaches limiting themselves to an account of historical developments narrower in a temporal and contextual sense.

A page from a notebook by Erwin Schrödinger shows him struggling for a physical interpretation of the wave function: Here he tries to understand it as a (matter or charge) density

On the other hand, the project builds on the results of the previous generations of quantum history: In the tradition of the first generation, it turns to working physicists to reach a detailed understanding of the sources. It also takes advantage of the wealth of source material amassed by the second generation, but retains a position of reflective distance introduced by the third generation. Attention is being paid to the role of experimental practices and instruments in the creation of new phenomena, and to the institutional, social, and cultural dimensions of the development of quantum physics.

Since the development of quantum physics was the achievement of a large group of researchers without a single center, the project faces distinct challenges, such as the huge amount of material and the absence of a single historical thread to lead the research. Therefore, the project was conceived from the beginning as closely cooperating with a larger network of researchers who are working on the history of quantum physics.

The research done within the project has so far covered the following topics:

Research activities on the development of wave mechanics (Christian Joas, Christoph Lehner, Jürgen Renn) are dedicated to the historical roots of wave mechanics and in particular to an extensive study of the research notebooks of Erwin Schrödinger. One aim is to reconstruct the origin of wave mechanics in discussions about the nature of light quanta and about the problems of quantum statistics. A detailed account of Schrödinger's formulation of wave mechanics, using the notebooks extensively for the first time, is in preparation.

Research on the life and work of Max Planck concentrates on his institutional, social and personal environment (Dieter Hoffmann). In preparation for his 150th birthday in 2008, a number of publications are being completed. They include a comprehensive scientific biography of Planck, a study of his role as an editor of the *Annalen der Physik*, the transcription of the correspondence between Planck and his co-editor at the *Annalen*, Wilhelm Wien, as well as an extensive annotated collection of Planck's *Annalen* papers.

Another activity is concerned with an in-depth reconstruction of the statistical derivation of Planck's radiation law and its connection with Boltzmann's combinatorics and follows the usage of statistical concepts in quantum physics from there to the eve of wave mechanics (Massimiliano Badino). Particular attention is paid to the conceptual interactions between statistical mechanics, quantum theory and thermodynamics, to the development of an adequate statistical formalism for quantum theory, and to the emergence of indistinguishability. A paper on Planck's derivation has been submitted for publication, and a paper in a volume on Boltzmann is forthcoming.

Das Rätsel des Lichts

Von E. Schrödinger

Wir Menschen gehören zu den „Augentieren". Fast alle Kenntnis der Umgebung, alle Lebensfreude, Natur- und Kunstgenuß (ausgenommen nur den musikalischen) vermittelt das Auge. Wir kennen kaum ein grauenvolleres Schicksal als Blindheit. In das Licht, in den lachenden Zeus, in die strahlende Sonne versetzen wir von alters her alle Götter und Genien des Guten und Schönen, die Geister des Bösen in Nacht und Finsternis.

Die naturwissenschaftliche Betrachtungsweise führt, da sie auf objektive Erkenntnis, nicht auf die subjektiven Bedingungen und Bedürfnisse des Menschen abzielt, sehr häufig zu einer Umwertung aller Werte. Unsere königliche Sonne wird zum einfachen Staatsbürger, zum Stern unter Sternen, die alle gleich wichtig und interessant sind. Die ehelbafte Kröte und die schillernde Libelle, der Pestbazillus und das menschliche Spermatozoon sind als Objekte der Forschung von gleichem Rang. Der ganze ausgesprochene Prunk des Lichtes jedoch setzt sich auf in die Naturwissenschaft hinein fort, er wird durch sie wenn möglich noch erhöht.

Wir sogenannten Gelehrten sollen uns der Aufgabe nicht entziehen, in beliebig weite Kreise hinaus zu „popularisieren", d. h. in großen, an das Gesamtinteresse der Menschheit anknüpfenden Zügen zu sagen, „um was es uns geht" und was wir glauben, „herausgebracht" zu haben. Aber es ist heillos schwer. Vielleicht liegt es daran, daß wir in Wirklichkeit so schrecklich wenig herausgebracht haben. Das glaubt uns aber der Leser nicht, denn erstens sieht er die märchenhaften Fortschritte der Technik, zweitens liest er viele populäre Darstellungen zweifelhafter Qualität, die in dem Gedanken schwelgen, „wie wir's denn zuletzt so herrlich weit gebracht". — „O ja, bis an die Sterne weit" — so weit, daß sich im gegenwärtigen Augenblick kein Teufel mehr auskennt! — Und da soll man nun sich an den Schreibtisch setzen und (um wieder auf den Faust zu kommen) „mit saurem Schweiß sagen, was man nicht weiß". — Mit diesen Zeilen antworte uns der Gelehrte, als wir ihn ursprünglich aufforderten, in einer populären Studie die Plancksche Quantentheorie darzustellen. Der Hinweis auf die großen Schwierigkeiten einer sachgerechten Popularisation hochwissenschaftlicher Gedanken erscheint uns grundsätzlich wichtig.

Zwar zu einer ganz kleinen „Umwertung" muß auch der Physiker, wenn er über das Licht sprechen will, sich die Erlaubnis erbitten. Es fiele ihm schwer, der Begriff „Licht" gerade nur auf den verhältnismäßig schmalen Wellenbereich zu beschränken, auf welchen das Tier- und Menschenauge bei seiner (phylogenetischen) Entstehung sich abgestimmt hat; denn das Auge hat sich diesen Wellenlängenbereich lediglich aus dem Grunde ausgesucht, weil unsere Sonne vermöge ihrer Oberflächentemperatur von 5700 Grad Celsius gerade diese Wellen vorzugsweise „sendet". Und das ist

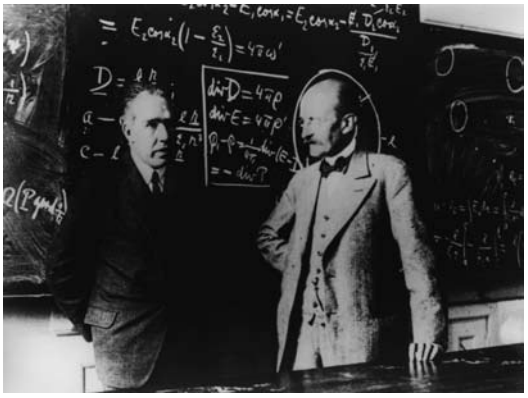
Geh. Rat Prof. Planck im Gespräch mit Prof. E. Schrödinger, seinem Nachfolger auf dem Lehrstuhl für theoretische Physik an der Universität Berlin bei der Leibniz-Sitzung der Preußischen Akademie der Wissenschaften am 4. Juli 1929, bei der Schrödinger, ihr jüngstes Mitglied, seine Einführungsrede hielt

Max Planck with Erwin Schrödinger in *Die Koralle*, 5, (1929), pp. 294–298

An investigation into the early history of Bose-Einstein condensation has looked at the initial response to Einstein's 1925 prediction of condensation occurring in the ideal gas (Daniela Monaldi). Through this episode, the historical evolution of the innovative concepts introduced by quantum statistics has been examined as well as their interplay with the general development of statistical mechanics, for example, the concepts of indistinguishable particles and of cooperative phenomena.

A further research activity investigates the role of molecules in the development of quantum mechanics, with special attention to the contribution of Michael Polanyi and Eugene Wigner (Arianna Borrelli). In 1926, Wigner was the first to introduce group-theoretical methods in quantum mechanics when he was working in X-ray crystallography at the Kaiser-Wilhelm-Institut für Faserstoffchemie in Berlin-Dahlem. The first stage of this investigation is a study of Wigner's early work and its historical context, in particular of the different notions of symmetry—both formal definitions and operational implementations — in mathematics, classical and quantum physics and crystallography.

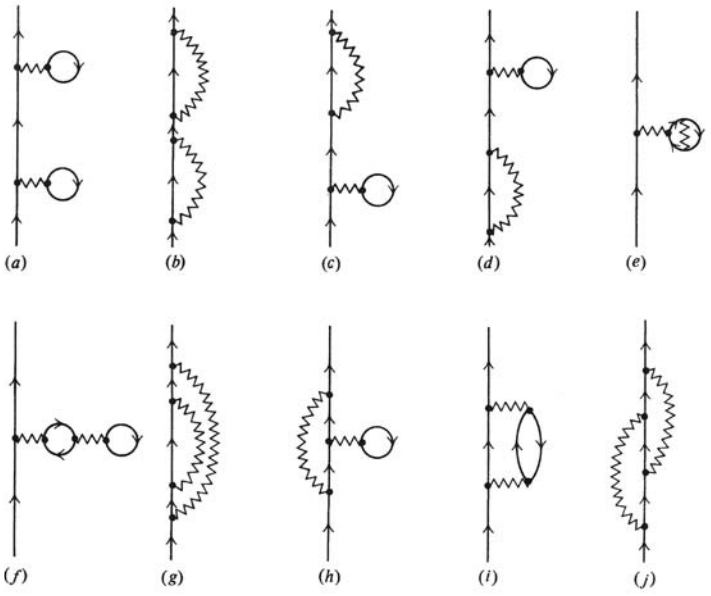
Research on the history of radioactivity and early nuclear physics is devoted to the investigation of the relationships between persons and institutions in Germany, and their international connections; it also treats the correlations between experiment and theory in this subject (Horst Kant). The investigation concentrates on the groups at the Kaiser Wilhelm-Institutes of Chemistry (at Berlin) and Physics (both at Heidel-



Niels Bohr and Max Planck, 1930.
Foto: AIP Emilio Segrè. Visual Archives, Margarethe Bohr Collections

berg and Berlin). Recently, the main focus has been on Walther Bothe and his Heidelberg group during the 1930s and 1940s. A first detailed paper is forthcoming in 2008. The contribution of Bothe to the idea of wave-particle dualism during the mid-1920s is studied with the help of his laboratory notebooks (Horst Kant, Dieter Fick).

An investigation into the advent of quantum field theoretic methods in solid state physics in the 1950s (Christian Joas) is examining the large-scale transfer of mathematical tools and computational methods from particle and nuclear physics to the then newly-evolving field of condensed matter physics, which has since become one of the largest subdomains of physical research. A paper on the use of Feynman Diagrams in theoretical solid state physics is in preparation. Two visiting scholars spent extended periods of time in the project working on the history of Feynman Diagrams in particle physics (Adrian Wüthrich) and on the history of nuclear power (Maja Fjaestad).
To support the individual projects, a coordinated effort has been made to collect, digitize, and make available a wide array of sources for the history of quantum physics (Carmen Hammer). Part of this project is the digitization by the MPIWG library of the complete *Archives for the History of Quantum Physics,* an extensive collection of sources compiled and microfilmed at the American Philosophical Society. This work is well under way and the digitized material is accessible to cooperating researchers on the project's website. This activity is now being complemented by the creation of a Digital Schrödinger Archive based on the collections in the possession of his daughter, Ruth Braunizer.



All second order Feynmann diagrams for the Green function in coordinate space

Since the inception of the project, a reading group has been meeting biweekly, joining physicists and historians from various local institutions in the study and discussion of important historical documents. To maintain contact with the project partners and to facilitate discussions, a mailing list has been established. To create an international network of researchers working in the history of quantum physics, a series of conferences has been established. The first such meeting took place at the Institute in July 2007. The talks and discussions were recorded and are available on the project's website <http://quantum-history.mpiwg-berlin.mpg.de>. A preprint volume of the proceedings is in preparation. A two-day symposium was held jointly with the Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy in honor of Max Born's 125th birthday in December 2007.

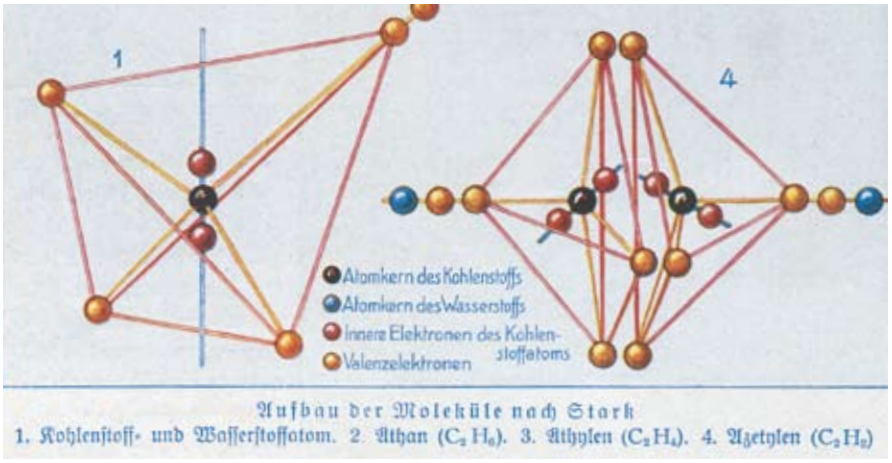
Left: Jürgen Renn and Christoph Lehner studying the Schrödinger material owned by his daughter Ruth Braunizer

Right: Poster of the first conference (HQ1) on the History of Quantum Physics

The Emergence of Modern Physics in the Public Sphere

The collective character of the formulation of quantum physics also met a great variety of discussions, interpretations and reactions from other scientists, amateurs and more or less educated audiences of the press. For this reason two research endeavors are investigating the controversial public reaction to quantum theory and modern physics in general. As part of a wider research project based at the Deutsches Museum on science communication and the changing relation between science and public in the 20th century, the first project focuses on the role of the public in shaping the concepts, notions and models in quantum physics. Two particular examples were the establishing of drawings and models of the Bohr atom, the reluctance of the physicists towards them, the negotiation process in popular science journals and the problem to adjust this model after quantum mechanics gave rise to major revisions (Arne Schirrmacher). Particularly influential for the reception of modern physics in the Weimar period were people from the border region of science, i. e. academic scientists outside the mainstream and non-academic, self-proclaimed researchers who publicly opposed the theory of relativity as well as the new quantum physics. The second endeavor, a recently accomplished dissertation, focused on this opposition phenomenon particularly in the 1920s. On the basis of a broad range of source material a

hitherto unknown international network of academic and non-academic opponents, in particular to the theory of relativity, was constructed and explained as a reaction to a marginalization process that accompanied the success of modern theoretical physics in science and the public sphere (Milena Wazeck).



"Aufbau der Moleküle nach Stark"
from a plate in the popular science journal *Kosmos*, vol. 26, 1929

The Role of the Deutsche Physikalische Gesellschaft in the Third Reich

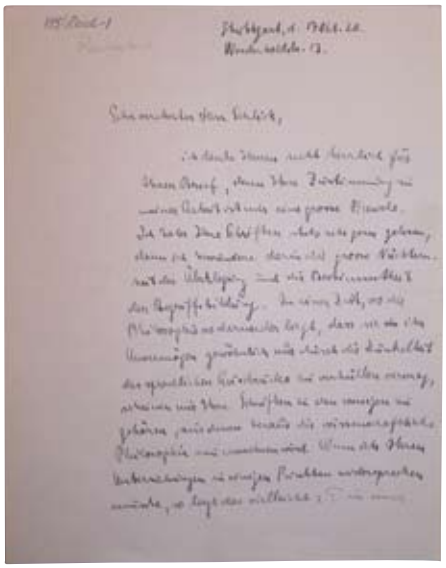
Following up on earlier research in the Department on the role of physics and its representatives in the Third Reich and the German Democratic Republic, an investigation into the conduct of physicists, the scientific institutions, and science policy during these two German dictatorships was carried out. While these studies are not central to the quantum project, they are particularly relevant as some of physicists studied—Peter Debye, Pascual Jordan, Carl Ramsauer—were among the pioneers of modern quantum theory. The role played by the Deutsche Physikalische Gesellschaft in the Third Reich was at the focus of a five-year project which has culminated in the publication of a comprehensive volume (Dieter Hoffmann, Mark Walker): An English translation is planned. Among the biographical studies carried out, that on Peter Debye merits special attention as it became part of an international discussion, which has been carried out in particular at Debye's work places (Utrecht, Maastricht, Aachen, and Cornell) and has played a key role in the initiation of a new research project at the Netherlands Institute for War Documentation to investigate Debye's role in Nazi Germany.

Peter Debye (1884–1966), Berlin 1939

Cooperative Venture

Modern Physics and Scientific Philosophy

The Department has established a close cooperation with the Moritz Schlick Research Institute at the University of Rostock, jointly forming a Centre for Logic, History and Philosophy of Science. Ongoing activities include the publication of selected parts of the literary estate of Moritz Schlick through the ECHO platform, and research on the relations between modern physics and scientific philosophy in the early 20th century, focusing on two central figures of scientific philosophy: Moritz Schlick and Hans Reichenbach. As their published papers, manuscripts and extensive correspondence indicate, both of them were very much involved in the philosophical debate about the scientific revolutions in modern physics. Reichenbach and Schlick not only gave an account of the changes of the fundamental concepts of space, time, causality and probability from a philosophical point of view, as early as the 1910s/1920s, and thereby anticipated some of the philosophical consequences of the development of quantum mechanics. Their discussion also led to an epoch-making change in scientific philosophy itself which was echoed by many physicists and scientific philosophers at the turn from the 1920s to the 1930s.



Left: First page of a letter from Reichenbach to Schlick (source information: Hans Reichenbach to Moritz Schlick, October 17, 1920; Literary Estate of Moritz Schlick, Haarlem, 115/Reich-1/2/3).

Right: Moritz Schlick at the University of Rostock in spring, 1914 (copyright: George Moritz H. Van de Velde-Schlick, Vienna Circle Foundation, Amsterdam)

Project 3

Epistemic History of Architecture: The Long-term History of the Knowledge That Has Made the Great Architectural Achievements of Mankind Possible

General Goals

The project *Epistemic History of Architecture* is a joint research endeavor with the Bibliotheca Hertziana in Rome (Max Planck Institute for the History of Art) and funded with a special grant from the Max Planck Society <http://www.biblhertz.it/deutsch/forschung/wissensgeschichte.htm>. The project is dedicated to establishing an epistemic history of architecture, a new approach which focuses on knowledge as a crucial factor for the development of architecture, in addition to the material, financial and personal resources investigated by the traditional academic disciplines. It thus comprises all dimensions of knowledge underlying the building trade, including knowledge of materials and construction techniques as well as logistics, organization and administration. The goal is to outline a long-term history of this epistemic basis, its structure, key innovations, its spreading and its interchange with other shared knowledge.

To achieve this goal, a wide range of periods and geographical regions have been selected: the very beginnings of permanent constructions in the Neolithic era, the Mediterranean high cultures (Mesopotamia, Egypt), classical antiquity (Greece and Rome), medieval cathedral buildings in northern Europe and the Italian Renaissance architecture. Since in all these periods construction is dominantly pre-scientific, i. e. it comprises only practitioners' knowledge, the project has had to extract the knowledge from a large set of sources which were not intended for communicating this knowledge. These include tools, drawings and administrative documents as well as the constructions themselves which are seen as representing knowledge 'in action.' The analysis of this intrinsic knowledge also provides insights into more general aspects of the development of practitioners' knowledge as compared to scientific, i. e. textual-based knowledge.

Oral transmission of practitioners' knowledge: construction, without centering, of a Nubian barrel vault using sun-dried bricks, Elephantine, Egypt, 2001 (photo by D. Kurapkat)

Developments

The project is now in its final stage, and a major publication of its results is in preparation. The publication will follow the revised and enlarged design of the project: The originally planned case studies will be embedded in a concept that is based on extensive review articles for each of the periods mentioned above (the so-called *basics*), flanked by in-depth investigations of relevant issues within these periods (the so-called *specials*). This two-fold concept has turned out to be necessary in order to cope with the vast amount of information that needs to be processed to produce a basis for the intended outline of the overall development of building knowledge, which will be presented in the last part of the publication.

A volume dedicated to early modern Italian architecture has already been published (Hermann Schlimme, ed.).

The enlarging of the concept required major changes, also in the personnel of the team. A range of external members had to be co-opted, because for each period covered an experienced specialist was needed. The team now consists of researchers in architecture, art history, history of science, Egyptology, Assyriology and classical archaeology from universities in Heidelberg, Cologne, Vienna, Zurich, Rome and Berlin as well as members of the German Archaeological Institute (DAI).

Besides a series of internal workshops and lectures held at the MPIWG, the project also supported the development of a digital archive for sources related to the erection of the Cupola for the Duomo in Florence at the Opera di Santa Maria del Fiore in Florence <http://www.duomo.mpiwg-berlin.mpg.de/home/_eng.html> (Margaret Haines).

The project has presented its new approach to the community of related academic disciplines at various scientific conferences and panel discussions. Three of the team members have been elected to the committee of the III. International Congress on Construction History 2009 in Cottbus (Antonio Becchi, Hermann Schlimme, Wihelm Osthues).

In the following, a preliminary synthesis of the results of the project is outlined with regard to the role of planning knowledge, the transmission of knowledge, and the relation between architectural and scientific knowledge.

Planning Knowledge

Since the early modern times planning in architecture has been conceived as sketching and designing; the need for architects to visualize their ideas and to present these to the contractor. This is a very old concept: From the times of Vitruvius, the architect was required to present a ground plan, as well as elevation and perspective drawings. But seen from a broader perspective, the status of design in architecture should be assessed quite differently. Although plans and elevations were known already in the second millennium B.C., the specifications of larger projects were mostly given by texts and not drawings. The basic reason for this is that visualization in many cultures did not present a problem since the vast majority of projects adhered to given building types, which could easily be imagined by contractors and builders alike. If pre-

Groundplan of a house depicted on a clay tablet found in Djokha (Umma), from the Neo-Sumerian period (ca. 2100–2000 BC)

liminary planning was required, it had to clarify the amounts of materials and labor needed. For the documentation of these data, texts were quite adequate. The domain in which architectural drawings (and models) were essential is found elsewhere, in the planning of structural and ornamental details. Although the forms of such details were also often highly standardized, the architect could hardly have communicated interpretations of these types to craftsmen by any other means than drawings and models.

Imitatio naturae between mechanics and architecture.
Left: John Shute, *The First and Chief Grounds of Architecture*, Marshe, London 1563.
Right: Alfred Bartholomew, *Specifications for Practical Architecture,* Weale, London 1841

Transmission of Knowledge

Whereas the transmission of scientific knowledge is strongly based on written texts, the transmission of the practical knowledge involved in the building trade was based on a variety of media. Some of them were clearly not intended for the communication of knowledge, but nonetheless used effectively for this purpose. The most prominent examples are the buildings themselves.

This variety of media has helped considerably to preserve architectural knowledge, especially where a vivid transmission—via a continuing practical tradition—was not possible or desired. Relying solely on Vitruvius' text, Renaissance architecture would have been inconceivable. This holds not only for this most prominent case, to a lesser degree it was already the case in antiquity. In Egypt, for instance, funeral buildings were 'studied' to understand the mechanisms of closure. Certain forms of ceramic roof tiles seem to have survived the so-called dark ages between late Minoan and archaic Greece by the conservation of specimen. Similarly, the reuse from the mid-13th century onwards of the Roman crane driven by a treadmill has probably been inspired by relief carvings.

On the other hand, forms of intentional knowledge transfer apart from the participation in work practice were developed at a very early stage, but not firmly established until relatively late: Institutional training in building knowledge was already included in the curriculum of the 'scribes' of Pharaonic Egypt, but nowhere else before the founding of the Renaissance academies. Writings on technical and formal aspects of construction were published by Greek architects already in the late 6th century B.C. (now lost, but mentioned in Vitruvius), the oldest of which range among the earliest non-literary texts of European history, whereas the masters of the famous early Medieval period were typically illiterate.

Architectural and Scientific Knowledge

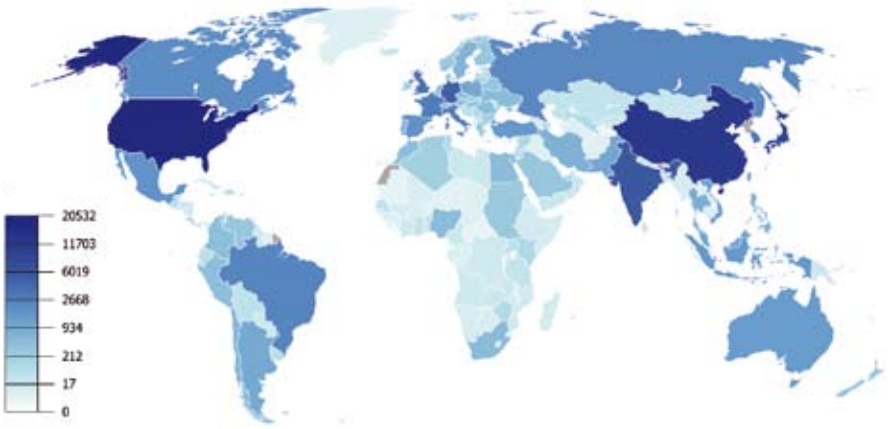
In the course of history, mathematics and especially geometry have had a varying relation to architecture. Elementary geometrical skills such as those needed for land surveying, have belonged to architects' competencies since antiquity. But the fundamental progress of geometry between the 4th and 2nd centuries B.C.. has left virtually no trace in architecture. Architecture hardly ever figures as an application—unlike surveying and astronomy—in the ancient or medieval manuals of geometry. Apart from the handling of fractions, even the architects of ambitious projects have apparently made no use of advanced mathematics. This loose relation between architectural and scientific knowledge only begins to change in the early modern period. The introduction of scientific results into architecture has been a goal for ambitious architects already in Hellenistic times, a tendency strongly promoted by Vitruvius. Its practical value has, however, remained rather limited. Instead the building trade provided, vice versa, early scientists with a significant experiential basis for their theoretical endeavors, in particular in the field of mechanics.

Project 4

The Globalization of Knowledge and its Consequences: The Transfer and Transformation Processes of Knowledge Across Different Cultures

General Goals

The aim of this newly launched project is to focus on a hitherto neglected dimension of globalization processes, the globalization of knowledge. The globalization of knowledge is being analyzed by integrating diverse studies of the conditions, pathways, and consequences of historical processes of the production, the transmission and the transformation of knowledge, relating them to present processes of globalization. The project aims at developing a new framework: comparative history of knowledge on a large scale, in which present processes, in particular processes of globalization, are conceived as the outcome of historical developments and their interactions. Science in the 21st century represents, in fact, globalized knowledge and benefits not only from the creation and exploitation of new social and technological structures that allow for the free flow of knowledge and expertise globally, but also from a historical awareness of the ways in which techniques and technology have in the past spread throughout the world. The present lack of this awareness hinges on a structural deficit of research in this field due to disciplinary boundaries. The project aims to overcome these boundaries not only by establishing an innovative research program but also by innovative forms of cooperation bridging cultural and social history and theoretically guided comparative approaches.



Internet users by country, in tens of thousands, as of 2006. Although more than one billion people worldwide can share knowledge through the Internet, there remains a huge "digital divide" between countries such as China and Somalia. Source: Wikimedia Commons

The project is pursued by the cooperation of a core research group of approximately 35 scholars covering a wide array of disciplinary fields, countries, and scientific institutions. The group will integrate results of currently 43 independently organized and funded individual research endeavors, hosted at research institutions, universities, museums, archives, and libraries.

The interest of these research endeavors in participating in the collaboration is rooted in questions that have emerged from their own research but can hardly be addressed within the scope of their current activities nor within the available conceptual frameworks. Their collaboration in the project is thus intrinsically motivated by the need of contextualizing—in terms of knowledge integration and differentiation processes—some of their most significant findings concerning the origin of knowledge, its transmission, and its transformation in cultural exchange processes. It is the primary aim of the project to develop an empirically validated conceptual framework for integrating specific findings concerning the origin, transmission, and transformation of knowledge.

The social processes constituting globalization in modern times are such processes of intercultural transmission that involve the spread or exchange of material goods, of social, political, and cultural institutions, as well as of belief systems, and result in the strengthening of worldwide interdependence. While some of these processes of intercultural transmission are as old as human history, their systemic interaction has yielded a number of outstanding historical phases that may be considered as antecedents of modern globalization and led up to their ever growing interdependence in modern times.

The project will address and historically validate some basic claims about the relation between the set of social processes constituting globalization, on the one hand, and knowledge development and diffusion, on the other hand. In terms of a short characterization, these basic claims are:

- The globalization of knowledge does not merely represent one more social process underlying globalization as precondition or consequence but rather constitutes a relatively autonomous developmental process that mediates between all the other processes involved, shaping their collective outcome.
- The globalization of knowledge is based on two complementary processes, the transformations of extrinsic contexts into conditions for the intrinsic developent of knowledge systems and the transformation of the intrinsic evolution of knowledge systems into extrinsic factors of knowledge globalization.
- The crucial role of knowledge in globalization processes is closely related to its function as a self-referential medium involving an interaction between internal cognitive and external material representations of knowledge.

Methodology

The foci of the project are chosen such that these claims can be validated with reference to outstanding historical phases in which knowledge production, transmission and transformation was critical for advancing processes of intercultural transmission:

- The spread of culture in the Mediterranean and neighboring regions will be investigated as the paradigm of a self-referential process of the globalization of knowledge constituted by the conversion of the knowledge outcome into a knowledge precondition of the stability of the levels of development attained.
- The outcomes of cultural exchange processes within Eurasia will be studied as a paradigmatic case for knowledge being a critical element in the adoption of transmitted technologies in spite of borders set by language barriers and incompatible belief systems.
- The place of local knowledge in the global community will be examined as a paradigm of obstacles and opportunities resulting from clashes between context-dependent local knowledge and the impact of the early modern and modern international science network.
- Different models of the diffusion of knowledge will be revisited in order to determine their ranges of applicability, their capability to conceptualize the interaction of the diffusion of knowledge with other diffusion processes, and the consequences of the change of media for knowledge representation, including the introduction of modern information technologies which potentially provide universal access to information as well as to the primary sources from which this information was originally derived.

The concentration on modern globalization of knowledge as well as on such historical settings in which knowledge production, transmission and transformation was critical for advancing processes of intercultural transmission has led to the choice of research foci corresponding to these four paradigmatic cases and the cooperation with a number of specific research groups. Intercultural transmission processes of this kind can only be addressed in a non-speculative way if the empirical results of historical and other research are interpreted and integrated within an adequate common theoretical framework.

The participation of the research groups representing various disciplinary approaches to historical processes of knowledge production, transmission and transformation is crucial for the initiative in order to avoid the pitfalls of speculative theory construction. The collaboration of the various participating projects towards the common overarching aim shall be realized employing an innovative knowledge platform to be implemented on the Internet, as well as by the regular exchange of scholars realized in the context of working sessions of the core project group and in the context of workshops together with the participating projects. These workshops will be dedicated to topics connecting the detailed research of the individual projects with claims emerging from the overarching research initiative and, at the same time, serving as evidence for the validity of the proposed concepts.

Developments

A kick-off meeting of the project dealing with the globalization of knowledge was held in November 2007 in the form of a Dahlem Conference funded by the DFG and the Freie Universität Berlin. It has yielded a first survey of the field, integrated research questions of collaborating projects, and delineated possible outcomes of the overall project. A preparatory workshop for this conference was also funded by the Freie Universität Berlin, following a positive decision of the Advisory Board of the Dahlem Conferences to accept the research initiative within its framework. This Board further declared willingness to consider organizing also the concluding conference after the end of the project. The results of this first meeting are being prepared for publication.

History of Science in Action: Alternative Forms of Dissemination

General Goals

Based on the insights that scientific knowledge evolves as part of a comprehensive system of knowledge and that external and cognitive representations of knowledge are closely intertwined in this evolution, the Department explores alternative forms of dissemination in order to probe the potential of research-driven technology development for opening up new horizons for the humanities and their place in society, and in order to investigate the potential of the history of science as a mediator between science and society.

Recent developments in electronic data processing have fundamentally changed the potential of research in the history of science as well as in other disciplines. The electronic storage of historical sources improves their accessibility and makes new and powerful methods of retrieving information possible. Scanning and optical character recognition techniques are being used to build electronic archives of historical sources, and databases and software tools are being developed to assist research and editorial activities. These activities aim at the creation of working environments that allow the integration of historical details into coherent models of historical developments. They are based on both the availability of a wide range of sources accessible to the scientific community as a whole, within the framework of open digital research libraries, and on scholarly cooperations extending well beyond a single institution. These cooperations, characterized by a novel unity of research and dissemination, are by their very nature international and interdisciplinary. They draw on the potential of the World Wide Web to cut across the traditional distinctions of research institutions, universities, and libraries, and also to open up scientific knowledge to the public at large.

An emerging trend is "cyberscholarship"—qualitatively different ways of working with digital data and sources, which, in their increasing proliferation, allow for the application of novel technologies and tools. Younger scholars, in particular, are accustomed to new models of content dissemination on the Web, which are characterized by rapid and easy access, sharing, and "swarming" around content. Just as computational tools have revolutionized many branches of the natural sciences, it can be expected that they will transform humanistic research and its relation to society at large.
New approaches to a public dialogue about science and its historical roots have been developed which are distinguished by:

- the representation of diverse worlds of knowledge that are subject to historical changes, along with the corresponding intellectual horizons of science and society as they evolve with these changes;
- the representation of the multitude of premises for experiencing knowledge and science, taking into account the most diverse perspectives;
- the representation of the diversity of the civilisatory and cultural spaces in which knowledge has developed historically, has been created or appropriated, and the communication between these spaces.

By introducing a historically informed perspective into the public discussion, the activities of the Institute have contributed to an awareness of the openness and plasticity of science, thus helping to overcome a polarized discussion shifting between the extremes of blind belief in progress and irrational hostility to science. Both positions are evidently based on the erroneous assumption that scientific progress is an automatism and not a historical process that can be shaped by mankind. If, however, science is connected by its very roots and not only post factum to other domains of society, unravelling these roots opens up opportunities for a new public understanding of science, relating it back to the sphere of human interventions. On this background, a new culture of science may emerge in which a public reflection on science can have repercussions on its cognitive and institutional structures.

The Cuneiform Digital Library Initiative

The Cuneiform Digital Library Initiative, CDLI, (Jacob Dahl, Peter Damerow, Robert Englund) represents the ongoing efforts of an international group of Assyriologists, museum curators and historians of science to make openly available through the Internet images and content of cuneiform tablets dating from the beginning of writing, ca. 3350 B.C., until the end of the pre-Christian era. The number of these documents currently kept in public and private collections is estimated to exceed 500,000. In the period of this report, 45,000 tablets were catalogued in electronic form by the CDLI, bringing the total to over 220,000.
In its early phases of research, the project concentrated on the digital documentation of the least understood archives of ancient cuneiform, those of the final third of the 4th-, and of the entire 3rd millennium B.C. which contained texts in Sumerian,

in early Akkadian and possibly in other, still unidentified languages. Despite the 150 years since the decipherment of cuneiform, and the 100 years since Sumerian documents of the 3rd millennium B.C. from southern Babylonia were first published, basic research tools such as a reliable paleography charting the graphic development of archaic cuneiform, and a lexical and grammatical glossary of the approximately 120,000 excavated texts from this period of early state formation, remain a desideratum for specialists, not to mention scholars from other disciplines for whom these earliest sources on social development represent an extraordinary hidden treasure.

The CDLI data set consists of text and image, combining document transliterations, text glossaries and digitized originals and photo archives of early cuneiform. At present, the online catalog of the CDLI contains more than 220,000 catalog entries with information about tablets of the third millennium B.C., more than 22,000 digital images of these tablets, more than 51,000 hand copies, and more than 72,000 transliterations, all of which are openly accessible through the CDLI web site. This electronic documentation is of particular interest to scholars distant from collections, and to museum personnel intent on archiving and preserving fragile and often decaying cuneiform collections.

The partners of the project continued in 2006 and 2007 to capture the form and content of ancient Mesopotamian documents. Particular attention was paid to the following three collections: the cuneiform collection of the New York Public Library, of the Ashmolean Museum in Oxford, and in particular the traditionally inaccessible collection of the Aleppo Museum in Syria. In 2007 an agreement was reached with the French Institute for the Near East (IFPO), and the Syrian Ministry of Culture to create a Syrian digital library of cuneiform documents.

Concerning the infrastructure of the initiative, 2006 and 2007 are characterized by a substantial and enduring change and a reorganization of the data processing and the cooperation between the CDLI research groups in Los Angeles and Berlin (Robert Casties, Jacob Dahl, Peter Damerow, Malcolm Hyman, Dirk Wintergrün) and the electronic Sumerian Dictionary Project (ePSD) in Philadelphia (Steve Tinney).

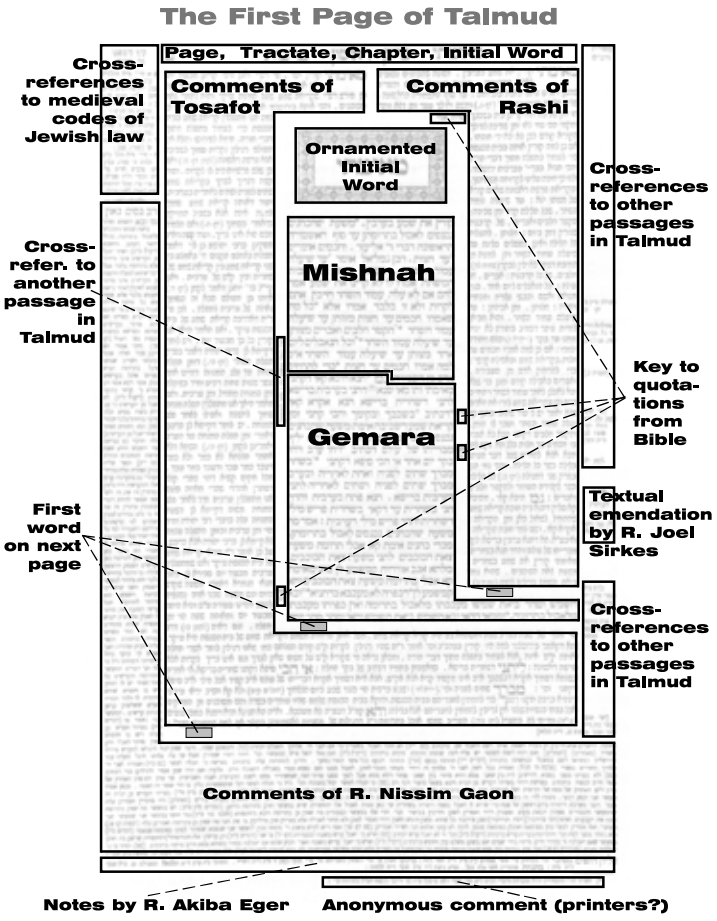
Until recently, the data were edited independently of the web presentation of the results. Data editing was done on local computers by the members of the project team. The final results were stored in databases with a front end for the web display. With the growing amount of data and participating scholars this system is increasingly confronted with technical difficulties. At a technical meeting of the Initiative in October 2005 it was therefore decided to fundamentally reorganize the data processing and distribution of the CDLI. A centralized storage system—hosted in Berlin and mirrored in Los Angeles—for versioned transliteration files has been designed and is now implemented. This can be accessed by all partners through a web front end and which at the same time forms the basis for the web display of the final transliterations. Also the catalogue data of the tablets are kept on a central server—hosted in Los Angeles—which automatically produces XML data used by the participating institutions of the initiative. The search facilities were completely reprogrammed and implemented in order to improve the response times. This new search engine is freely accessible since December 2007.

The centralized data repositories are also used for linking the entries of the electronic Sumerian Dictionary to the sources provided by the CDLI. Ongoing work is now

focused on applying language technology developed by the ePSD to the transliterations of cuneiform tablets provided by the CDLI and to back linking these data to the Sumerian Dictionary.
Due to the close interaction between research needs and technical developments, CDLI has become prototypical for what we call content-driven technology development.

The Epistemic Web

Against the background of the development of innovative infrastructures for humanistic research in the Department, the idea of a "Web of Knowledge"—an Epistemic Web has emerged. With this model, the Web of today, which may be characterized (in a deflationary way) as a "dumping ground" for information, can evolve into a technology that facilitates the construction of new knowledge—knowledge that is needed to address the challenges of an increasingly global society. Such a Web will allow for the creation of dynamic representations of knowledge, integrate research and dissemination, accommodate recursive processes in knowledge formation, integrate both conceptual models and data, and build "intelligence" into scholars' working environments.

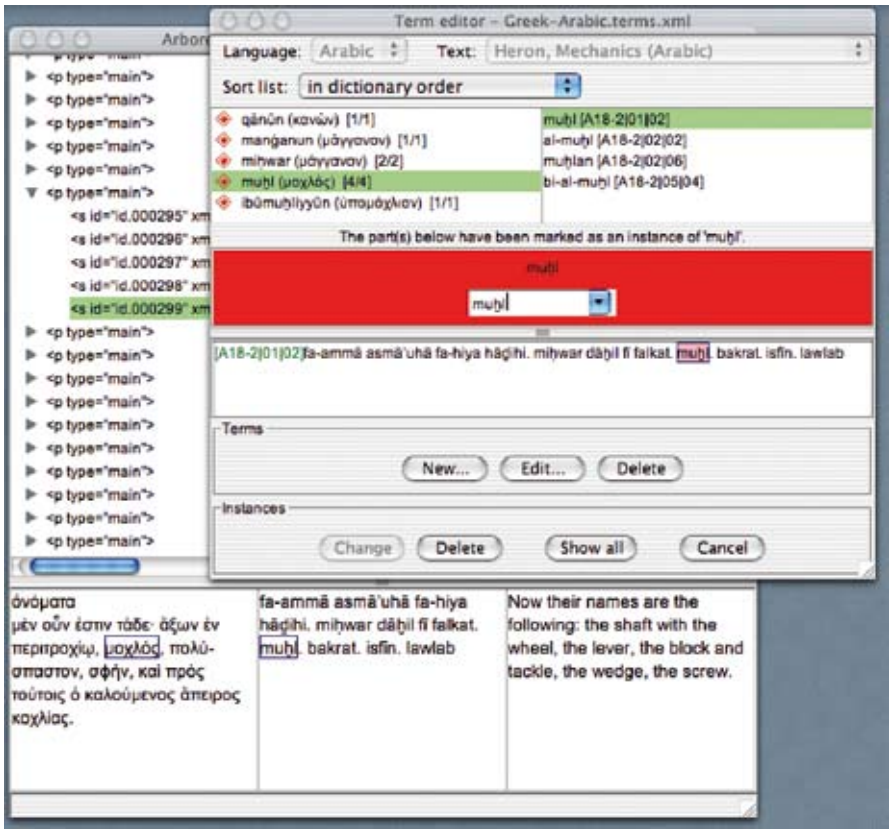


A page of the Talmud represents a complex epistemic model, incorporating commentary, super-commentary, annotation, and cross-reference that reflect fifteen centuries of scholarly dialogue

In the Epistemic Web, casual browsing will be replaced by the purposeful federation of documents. Users will (in accord with their interests and needs) choose which documents to view together; which documents they wish to select as entryways into the universe of knowledge; and which documents should serve as master documents, controlling the views of secondary documents. The views created by scholars can be easily shared and automatically published.

Work on realization of the key Epistemic Web concepts has recently begun, in the form of a two-year cooperative project with the MPDL, which has been established by the MPG to provide a unique structure to take up and further generalize tools and services that have been developed at individual Max Planck Institutes and to make them available for the benefit of the entire MPG. This relationship—research-driven development at the research front on the one hand and generalization by the expertise of a central body on the other—is a mechanism ensuring that the advanced services made available at the MPG have proven their specific relevance for research and can thus be expected to have an immediate impact on the work of the scholarly community. A project of the Department aimed at developing four complementary services within the MPDL framework has been approved. The services will constitute (1) a workflow for developing texts in an XML representation that represent historical (printed or manuscript) sources; (2) a content-based access mechanism for these texts to be built upon the MPDL infrastructure and to be publicly web-accessible; (3) software for Virtual Exhibitions; and (4) an Open GI (Geographic Information) network for the retrieval of scientifically relevant geo-information.

→ Knowledge Management, p. 204



The Arboreal software, developed at the Institute since 2004, is used for the studying the development of scientific terminology in multiple languages

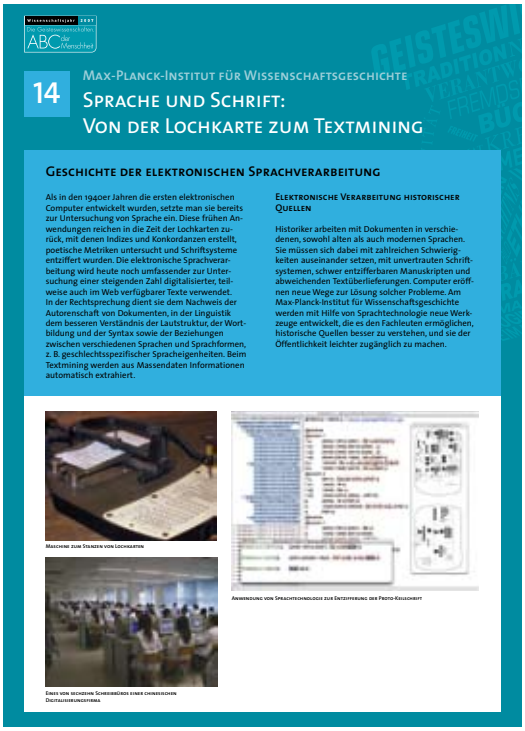
The Virtual Einstein Exhibition

The virtual Albert Einstein exhibition continues to offer, with more than 1,000 pages which have been continuously extended and updated, a living panorama of the history of science that is useful as a learning and teaching tool but also as a resource for the history of science, and that guarantees the long-term availability of the contents assembled for the exhibition <http://www.einsteinausstellung.de>. The structure of the virtual exhibition has been further developed to include a new search function which enables a systematic search of all the texts contained within the site (Julia Damerow).

A page from the virtual Einstein Exhibition in Pavia

The 50 media stations employed within the exhibition — the precursors to the virtual exhibition — encouraged children in particular to consult additional information resources about the exhibits, or to participate in quiz games in order to learn about the exhibits in a more playful manner. An evaluation of the exhibition's children's program was undertaken in the framework of a dissertation project to evaluate science communication in out-of-school environments (Silke Vorst). Significant differences were apparent in the children's understanding of the nature of science before and after the workshop program.

The Summer of Science

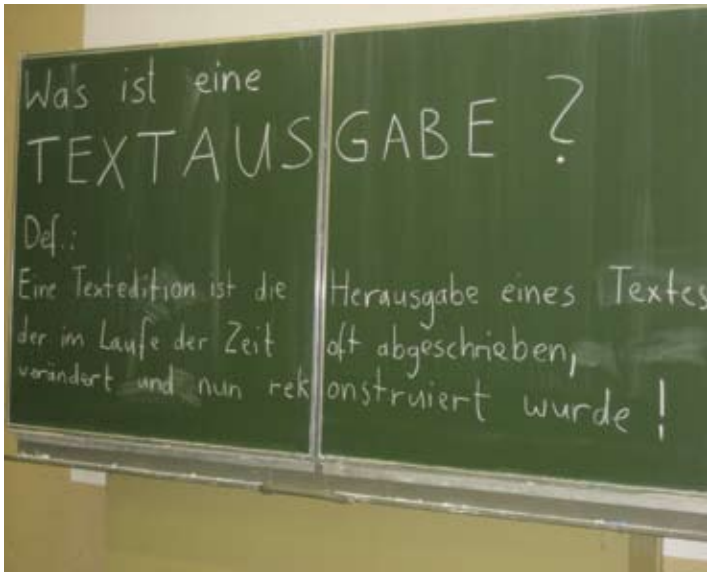


Poster from the "Summer of Science" 2007

In 2007 the Institute was invited, together with other Max Planck Institutes, to represent the Max Planck Society at the "Summer of Science" in Essen. This annual event is staged by "Wissenschaft im Dialog", an initiative supported by the Federal Ministry for Education and Research and the Stifterverband to promote a broader public interest in the developments in science and technology. Department I contributed to this large event with three presentations of research results; an overview of the invention of writing and the decipherment of early Mesopotamian writing systems (Peter Damerow), new developments in the decipherment of proto-Elamite obtained within the frame of the CDLI project (Jacob Dahl), and new language technologies developed at the Institute (Malcolm Hyman). The events were documented and turned into a virtual exhibition using software developed at the MPIWG (Julia Damerow). The results can be seen at <http://wissenssommer07.mpiwg-berlin.mpg.de>.

History of Science in Schools

In 2007, the Institute cooperated with a local secondary school, the Steglitzer Gymnasium, on the introduction of the history of science into school project work. The project days were concluded with a presentation night at the school where the results of the joint work were presented to parents, teachers, friends, and representatives of the MPIWG.



From a project to investigate the changes in text editions over historical periods.

Student taking part in an experiment to investigate Foucault's pendulum

Wunderforschung

The exhibition project *Wunderforschung* was initiated in 2007. Its main aim was to bring together the history of science, art and children's knowledge in an exhibition that is continuously changed by the interaction of the visitors. The exhibition resembles a historical curiosity cabinet displaying wonders of science and nature and is shown at Berlin's Natural History Museum <http://www.museum.hu-berlin.de/ausstellungen>. Its conception was based on research results of the Department e.g. on the intuitive knowledge of children (Katja Bödeker). The project was realized in cooperation with the Comenius Garten, the Museum für Naturkunde and the Monash University in Melbourne. Additional funding was provided by the Hauptstadt Kulturfond. Due to its success with the public, the exhibition was extended until 25 May 2008.

Children experimenting with light in a 'Wunderforschung Workshop'

Department II

Wet Specimens. Museum für Naturkunde Berlin, Claudia Terstappen, Photograph, face mounted 156 x 150 cm, 2007 (Courtesy of the artist)

Department II

Ideals and Practices of Rationality

Director: *Lorraine Daston*

Introduction: Towards a History of Rationality

Since it began work in 1995, Department II has explored the history of forms of rationality in the sciences through a series of projects, including *Biographies of Scientific Objects, Common Languages of Art and Science,* and *History of Scientific Observation.* Each project aimed to bring together a diverse group of scholars (junior and senior, from different specialties and national intellectual traditions) to explore a category of scientific thought and practice that was fundamental to the current understanding of rationality. Three premises informed these projects: *first,* that even the most central features of scientific rationality (such as "fact" or "objectivity" or "demonstration") have evolved historically; *second,* that their history is best pursued by simultaneously attending to both abstract ideas (e.g. philosophical discourses about evidence) and concrete practices (e.g. how scientific images are made and used); and *third,* that comparisons among historical periods, cultures, and disciplines are essential to such a history.

These premises, especially the last, have shaped the working methods as well as the topics investigated by Department II. Research projects bring together groups of scholars (approximately twenty-five at any given time), who contribute both by single-authored publications, which examine some specific aspects of the topic in depth, and by collective works, produced by groups that meet several times to plan, discuss, and prepare articles or chapters for a joint publication. Recent examples of the latter include *The Moral Authority of Nature* (Chicago: University of Chicago, 2004), *Things that Talk: Object Lessons from Art and Science* (New York: Zone Books, 2004), and *Believing Nature, Knowing God (Science in Context,* vol. 20, nr. 3, 2007; see *Knowledge and Belief,* below). Research projects are designed to cut across disciplines, time periods, and cultural traditions.

All scholars in residence in Department II meet regularly to present and discuss work-in-progress at the bimonthly departmental colloquium and irregularly in ad hoc reading groups and ongoing conversations about shared research interests. The colloquium follows a workshop format, with pre-circulated papers (in English, French, or German) and designated commentators. Approximately two-thirds of the papers are by members of the research group; the remaining third are by guests invited because

their work is particularly relevant to the themes of the department's current projects. Several conferences are organized every year in conjunction with departmental research projects, bringing in additional external participants.

During 2006–7, five research projects were conducted in Department II: *The History of Scientific Observation; Between the Natural and Human Sciences; Gender Studies of Science; Science in Circulation: The Exchange of Knowledge among Islam, Judaism, and Christianity, 9th–17th Centuries;* and *Knowledge and Belief.* A bibliography of publications listed by researcher's name may be found at the end of this volume.

Project

History of Scientific Observation

DURATION 2005–2010
MPIWG ORGANIZERS *Lorraine Daston, Andreas Mayer, Tania Munz, Kelley Wilder*
COOPERATION PARTNERS Freie Universität Berlin, Germany; Universiteit van Amsterdam, The Netherlands, (additional external funding of individual scholars noted below).

Observation is everywhere and nowhere in the history and philosophy of science. It is ubiquitous as an essential scientific practice in all the empirical sciences, both natural and human, and even arguably in mathematics in some of its exploratory phases. It is invisible because it has been generally conceived, especially since the mid-nineteenth century, to be so basic as to merit no particular historical or philosophical attention. This project aims to create the first history of scientific observation as an epistemic category, from the high middle ages to the late twentieth century, in both the human and natural sciences.

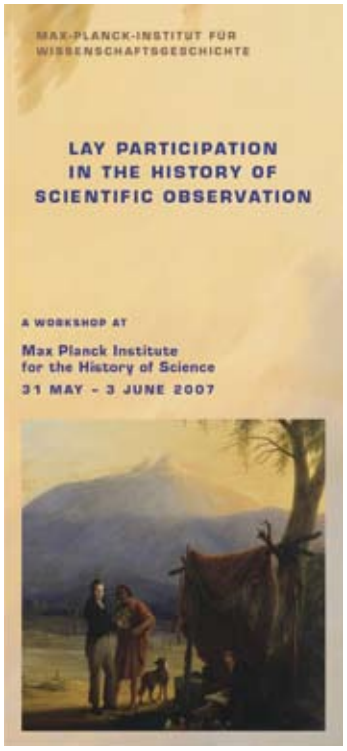
There is no science, natural or human, that does not make use of refined practices of observation to identify and investigate its objects of inquiry. Although almost all forms of scientific observation involve a long and arduous training of the senses, learning to look (or smell or hear) is only the beginning of an apprenticeship. Whether the observation in question is the psycho-physicist's detection of reaction times or the anatomist's mapping of the nervous system, novices are schooled in the use of instruments, the co-ordination of eye and hand, and the making of notes and often sketches. Nor does the observation stop there: it must be forged into a description and often a display. Numerical tables, maps, graphs, and stylized descriptions (as in the case of botany) are all part of the craft of performing, not just preserving an observation.

In addition to these tools and techniques, there are sites of observation: the astronomical observatory, the anatomy theater, the meteorological balloon, the field of naturalists and anthropologists, the laboratory of psychologists and chemists, the archives of the historian. The history of scientific observation is in many ways the inverse of that of the casual observation: an accumulation of paraphernalia (the collecting jar, the microscope, the chronometer, the notebook), of experiences (the expedition, the vigil, the dissection, the survey), of techniques (staining a microscope slide, pressing a herbarium specimen, deciphering an old script), and, above all, of habits of attention standardized by discipline—all these acquisitions, both of disciplines as they develop historically and of practitioners as they master their craft, render the scientific observation in the highest degree deliberate and specialized.

The history of scientific observation is in part that of instruments, buildings, and records and in part that of less tangible cognitive practices. Especially in its early stages, forms of scientific observation build upon skills and perceptual acuity acquired in other contexts, including the connoisseurship of natural materials possessed by artisans as well as the reading practices of the learned. Gradually, each scientific discipline acquires a tradition of observation, into which aspiring entomologists or astronomers or historians are initiated; indeed, the double meanings of "discipline" as field of study and molding of mind and body converge in this process.

Observation in the sciences has not only been practiced but theorized, and in strikingly different ways. Sixteenth- and seventeenth-century philosophers of observation, such as Bernard Palissy, Francis Bacon, and Robert Hooke emphasized the danger, difficulty, and tedium of the task; their eighteenth-century successors in contrast portrayed observation as an all-consuming obsession, pursued to the point of blindness. Starting in the nineteenth century, it became customary to oppose, as Auguste Comte and Claude Bernard did, "active" experiment with "passive" observation, a distinction that was nonetheless constantly blurred in scientific practice. In the twentieth century, philosophers of science such as Rudolf Carnap, Gaston Bachelard, and Thomas Kuhn debated the possibility of a "neutral observation language," as opposed to "theory-laden observation."

The *History of Scientific Observation* project seeks to bring to light varied and refined practices that will connect the history of science to the history of the senses and the self, as part of a larger history of the distinctive forms of scientific experience.



History of Scientific Observation

Conferences

Lay Participation in the History of Scientific Observation,
May 31–June 1, 2007
ORGANIZERS *Jeremy Vetter* (MPIWG/Dickinson College, U.S.A.), *Susanne B. Keller* (MPIWG/Altonaer Museum für Kunst und Kulturgeschichte, Hamburg, Germany)

One of the key issues in the history of scientific observation is how the producers of natural knowledge have incorporated the experiences, skills, and knowledge of lay people into their research. In various periods and domains, a crucial status or class boundary line of participation in science has been constructed as amateur vs. professional, mechanic vs. gentleman, or lay vs. expert. Questions addressed by the conference included: How have naturalists, natural philosophers, and scientists communicated, translated, and verified observational data from lay people? How have they translated experiential categories into scientific categories? What epistemological mechanisms have they devised to guarantee the validity of knowledge produced through lay observations? What criteria in different periods have shaped or created a distinction between experts and lay people? A publication is planned.

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- *Joachim Rees,* "The Draughtsman's Cont(r)act: Drawing Skills and the Economy of Exploration, 1768–1830"
- *Jan Altmann,* "Observing With Eyes and Hands: The Artists of the French Expedition to the Terres Australes (1800–1804)"
- *Victoria Cain,* "The Art of Authority: Exhibits, Exhibit-Makers, and the Contest for Status in American Natural History Museums, 1890–1940"
- *Brita Brenna,* "A Naturalist-Bishop and His Network of Priests: Mid-Eighteenth Century Natural History in Norway"
- *Brian Frehner,* "Wildcatters, Local Knowledge, and Bubblin' Crude"
- *Simon Werrett,* "Meteoric Heights: Art, Nature, and Audience Epistemology in Eighteenth-Century England"
- *Jenny Beckman,* "Schools, Clubs, Field Guides: Infrastructures of Biological Recording"
- *Oliver Hochadel,* "Watching Exotic Animals Next Door: The 19th Century Zoo as a Center of 'Lay Research' in Zoology and Ethology"
- *Jeremy Vetter,* "Lay Observers, Telegraph Lines, and Kansas Weather: The Field Network as a Mode of Knowledge Production, 1885–1915"
- *Emmanuel Didier,* "Why People on Relief Were Disqualified as Statistical Survey Interviewers: The 'Trial Census of Unemployment' of 1934 in the U.S."
- *Fa-ti Fan,* "The People's Science: Everyday Epistemology and Earthquake Prediction in Communist China"

Working Group on the History of Scientific Observation,
June 27–29, 2006; July 3–6, 2007; July 7–9, 2008;
November 5, 2008
ORGANIZERS *Lorraine Daston* (MPIWG), *Kelley Wilder* (MPIWG / University of Leicester, U.K.)

This group plans a collective publication treating the history of scientific observation from the high Middle Ages to the late twentieth century, with studies from the history of physics, psychology, biology, economics, natural history, astronomy, medicine, meteorology, and chemistry. A long introductory essay (co-authored by Gianna Pomata, Katharine Park, and Lorraine Daston) will trace the history of observation as an epistemic category from the thirteenth through the early nineteenth century. Four meetings are planned in all; the volume will be sent to press in 2009.

Working Group on the History of Scientific Observation

Members

- *Domenico Bertoloni-Meli** (University of Indiana at Bloomington, U.S.A.)
- *Charlotte Bigg** (MPIWG/CNRS, France)
- *Daniela Bleichmar* (University of Southern California, Los Angeles, U.S.A.)
- *Jimena Canales** (Harvard University, U.S.A.)
- *Lorraine Daston** (MPIWG)
- *Otniel Dror** (Hebrew University, Israel)
- *Michael Gordin** (Princeton University, U.S.A.)
- *Elizabeth Lunbeck* (Vanderbilt University, U.S.A.)
- *Harro Maas** (Universiteit van Amsterdam, The Netherlands)
- *Andrew Mendelsohn* (Imperial College London, U.K.)
- *Mary Morgan* (London School of Economics, U.K.)
- *Katharine Park** (Harvard University, U.S.A.)
- *Gianna Pomata* (Università di Bologna, Italy)
- *Theodore M. Porter** (University of California, Los Angeles, U.S.A.)
- *Anne Secord** (University of Cambridge, U.K.)
- *Mary Terrall** (University of California, Los Angeles, U.S.A.)
- *Kelley Wilder** (MPIWG)

(* member of Working Group also involved as resident scholar in the MPIWG research group on the History of Scientific Observation)

History of Scientific Observation

Planned Conferences

The Educated Eye: Photographic Evidence in Scientific Observation,
February 21–24, 2008
ORGANIZERS *Kelley Wilder* (MPIWG/University of Leicester, U.K.), *Gregg Mitman* (University of Wisconsin-Madison, U.S.A.)

Where do photography and film stand in the larger picture of scientific observation's history? And how exactly does their use in observation translate into evidence? What sort of relationship is there between observation and evidence in photography and film in the construction of scientific arguments or as part of the historian's craft? Presentations on topics ranging from the earliest photographs in 1839 to images from the Mars Rover mission in 2004 address these questions. The negotiation and renegotiation of documents made with photographic media stand at the center of discussion, bridging the methodological approaches of scholars from anthropology, history of science, and history of art and visual culture.

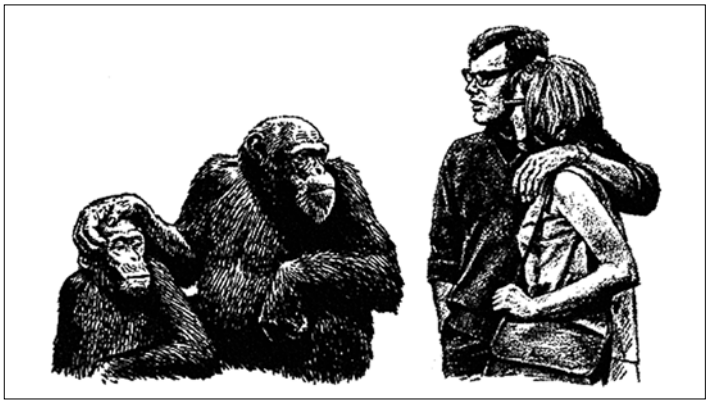
Animal Subjects under Observation,
July 11–13, 2008
ORGANIZER *Andreas Mayer* (MPIWG)

In many scientific disciplines, animals are cast less as passive objects of inquiry than as actual performers of truth, especially in psychology, ethology, equestrian science, or ornithology (to name just a few examples). The workshop will trace the emergence of the notion of the "animal subject" in the late 19th century and identify its models (machine, intelligent actor), discuss the problems of anthropomorphism and empathy through an analysis of the interaction of humans and animals in 19th and 20th century practices of scientific observation, propose historical examples and analytical tools for understanding the performative and active roles of animals in various areas of research, and reassess the notion of standardization of laboratory animals in the 20th century by analyzing the production of "technological animals."

Physiologist Etienne-Jules Marey (left) and his assistant Georges Demeny (right, bare-headed) are watching a goatkid walking on the runway of the Station physiologique. May 5, 1887
(Courtesy Musée Marey, Beaune, France)

Animal Cultures—Human Natures:
Participant Observation in the History of the Natural and Social Sciences,
November 13–15, 2008
ORGANIZER *Erika Lorraine Milam* (MPIWG/ University of Maryland at College Park, U.S.A.)

If we take seriously the idea that animals have culture, from primates to dolphins, elephants, cats, dogs, and even experimental laboratory animals, how would that change the way we write the history of the social and life sciences? This conference will take a new look at the material and social interactions of ethologists, anthropologists, and sociologists with their animal subjects through the lens of "participant observation." The conference will highlight continuities between the natural and social sciences by exploring the traffic of scientific concepts between these disciplines: concepts such as culture, ritual, display, and language (communication), are equally resonant among scientists who study human and animal societies. The conference will also serve as a bridge between the kinds of historical narratives presented in publications for a scientific audience and the anecdotes told when relating research experiences in person or for the popular media or trade press.



The soothing effect of bodily contact. Irenäus Eibl-Eibesfeldt, *Love and Hate: The Natural History of Behavior Patterns,* translated by Geoffrey Strachan. New York: Aldine de Gruyter (Figure 33), 1970

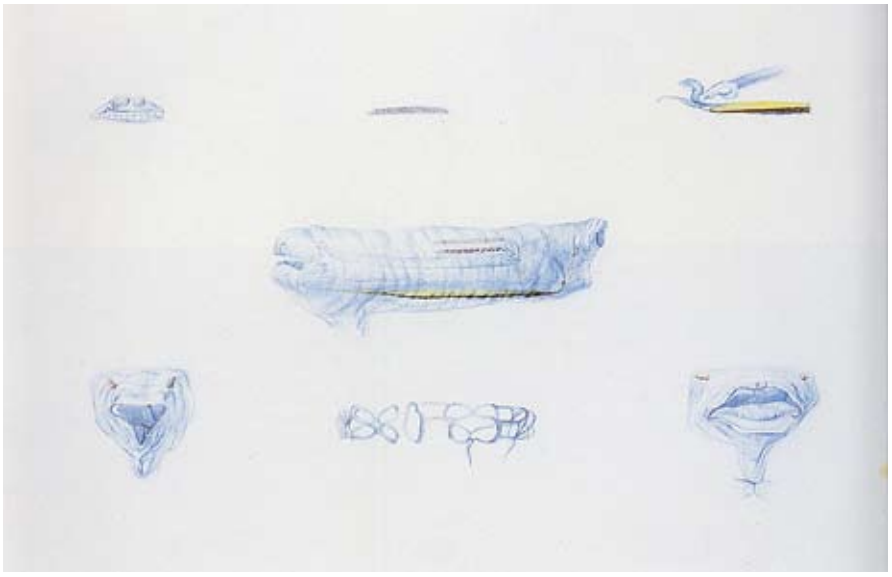
Evidence and Reason in the Long Renaissance, April 27–28, 2009
ORGANIZERS *Daniel Andersson* (MPIWG), *Richard Serjeantson* (Cambridge University, U.K.)

This workshop attempts to answer some fundamental questions in the intellectual history of early modern England. What is the best and most academically responsible way of gaining 'hermeneutic control' over the texts that we study? How porous are the schemata of dialectic and rhetoric with respect to the other disciplines, such as natural philosophy? To what extent does the informal assumption of the unity of knowledge affect the notion of disciplinary formation and the scholarly career? How widely diffused were the practices of the arts course outside of the academy? What is the relation of university learning to the alternative institutions of the period, such as academies? When does humanism lose its specificity? The workshop will focus on a series of case studies, each taking its starting point a given discipline of the arts course.

History of Scientific Observation
Individual Projects

Jan Altmann

Jan Altmann (Postdoctoral Fellow, Humboldt-Universität zu Berlin, Germany)
Drawing as Observing in the Enlightenment
Seeing involves focusing, noticing, ordering, attributing meaning, as well as overlooking and disregarding—all the more so when performing a visual scientific observation, with its highly standardized and specialized habits. When the observation is carried out and preserved in the form of drawing, the material drawing apparatus also literally enters the picture. In order to retrace the correlations between eye, mind, hand and body, the project examines the process by which the finished (or unfinished) image emerges from repeated strokes on textured paper, on the basis of a series of French case studies which are mainly situated in the field of natural history and which range



Salpe [Cyclosalpa pinnata (Forskål, 1775)]. Watercolor on vellum, 44 x 29 cm. Charles–Alexandre Lesueur, *Baudin in Australian Waters: The Artwork of the French Voyage of Discovery to the Southern Lands* (1800–1804), ed. by Jacqueline Bonnemains et al., Melbourne: Oxford University Press/Australian Academy of the Humanities (Cat.No. 75002), 1988

from the Académie royale des sciences in the late seventeenth century to Georges Cuvier's proto-paleontological studies in the early nineteenth. One main goal is to locate different 'styles' of observation, in both aesthetic and epistemological senses.

Daniel Andersson (Postdoctoral Fellow, Warburg Institute, London, U.K.)

Aristotelian Thought Between Concept and Observation

Starting from a thorough survey of the genres of university natural philosophy in early modern Europe, the main project involves looking at what J. L. Ackrill once termed the 'descriptive metaphysics' of Aristotle's *Physics* and seeing how it is transformed by various modes of analogical reasoning. One such mode, 'intuitive observation', shows how the influence of such things as 'heat' work their way into both the physical and the metaphysical presuppositions of mainstream natural philosophy.

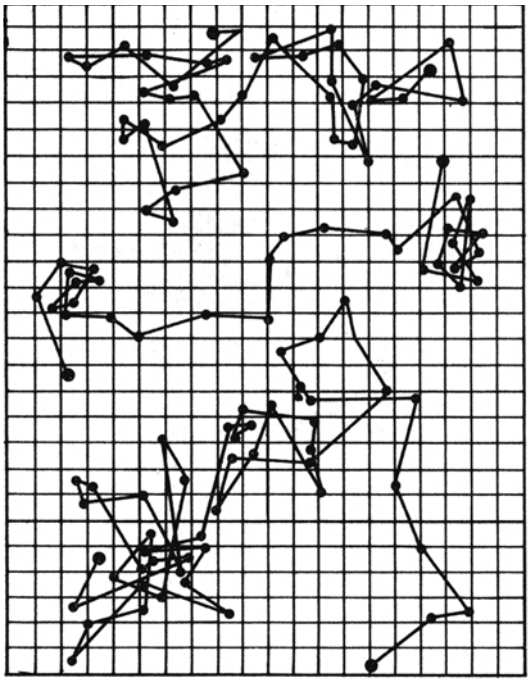
Daniel Andersson

Charlotte Bigg (Visiting Scholar, University of Cambridge, U.K., funded by Deutsche Forschungsgemeinschaft)

Brownian Motion and Observation of the Microworld circa 1900

In the years around 1900 scientific research was particularly concerned with sub-microscopic entities, including atoms, molecules, ions, bacteria and all sorts of minute organisms. In the physical sciences the opening up of new dimensions also stimulated the development of mathematical and theoretical tools to account for the workings of the microcosmos and to relate it to the macroscopic realm: new optical theories helped analyze the visual appearance of phenomena at the limit of optical resolution; statistical methods were introduced to treat the behavior of large numbers of particles and account for their effect on a macroscopic scale. The irruption of new microscales on scientific research agendas arguably contributed to a profound transformation in scientific practices and social organization in the early twentieth century, with for instance an increasing differentiation of physicists into theoreticians on the one hand and experimentalists on the other. These transformations are studied by focusing on Brownian motion research in early twentieth-century France, in particular the investigations carried out by the physical chemist Jean Perrin, the physicist Paul Langevin and the mathematician Emile Borel.

Charlotte Bigg



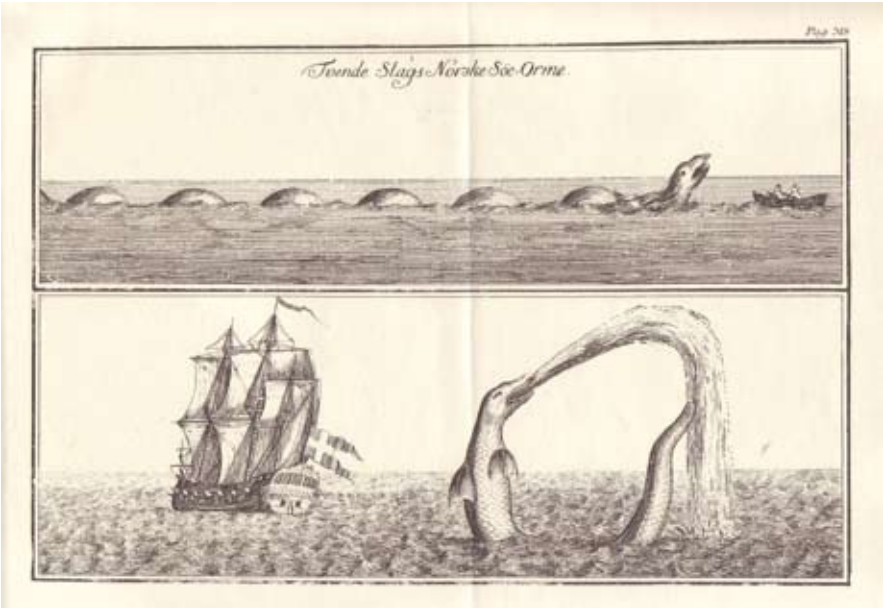
Displacement of invidual particles agitated by Brownian motion.
Jean Perrin, "Mouvement Brownien et Réalité Moléculaire", *Annales de Chimie et de Physique,* ser. 8, vol. 18, p. 81., 1909

Brita Brenna

Brita Brenna (Visiting Postdoctoral Fellow, Universitetet i Oslo, Norway, funded by the Centre for Technology, Innovation and Culture at the University of Oslo, Norway)

The Emergence and Practice of Natural History in Mid-Eighteenth-Century Norway

The *First Attempt at a Natural History of Norway* (1752–53) was translated from Danish into English and German soon after its publication and became a standard text for foreigners venturing into Norwegian nature. Mermaids, sea serpents, and diligent farmers colored the picture of Norwegian nature for years to come. But the work also prompted an array of topographical writings by vicars and local state officials, promoting an experience-based, rational approach to natural history. The project seeks to understand the physico-theological and scientific genealogy of Norwegian approaches to nature.



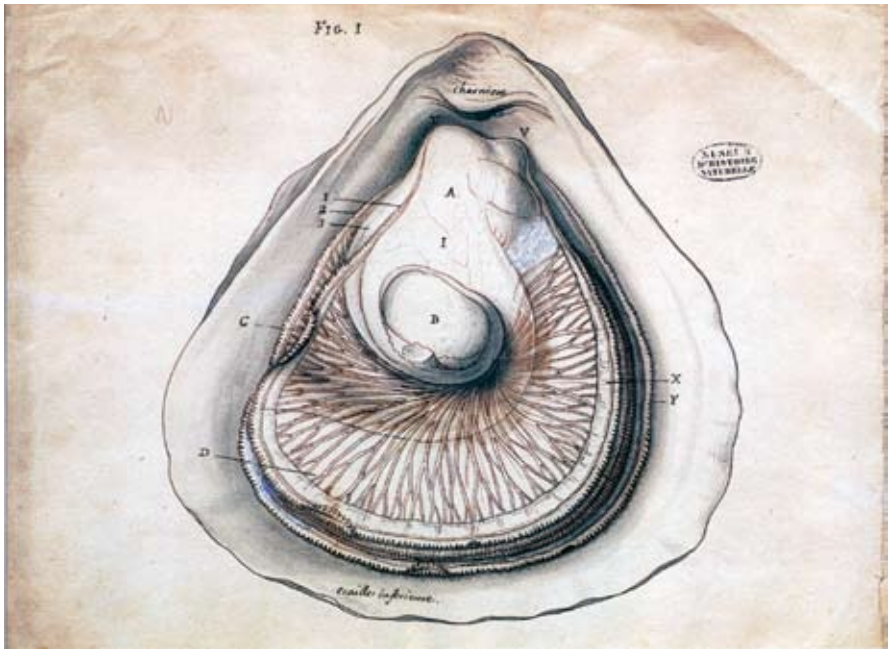
Erich Pontoppidan, *The First Attempt at a Natural History of Norway,* p. 318., 1752–53

Lorraine Daston

Lorraine Daston (Director)

The Cognitive Practices of Scientific Observation, circa 1550–1800

As an epistemic genre, "observation" took its place among a throng of other early modern innovations in the realm of disciplined experience, including the history, fact, case, and experiment. Far from being a lowly art, plied by unlettered artisans and peasants, or an inferior substitute for experiment, observation had by the late seventeenth century become an essential and ubiquitous scientific practice, an art in the service of science. During the Enlightenment, it enjoyed greater prestige than at any time before or since. The project attempts to reconstruct the cognitive practices of observation—attention, memory, judgment—and the material culture upon which they depended—the notebook, the magnifying glass, the pocket watch—on the basis of the published works and manuscripts of early modern European naturalists.



Joseph Pitton de Tournefort, *Observations sur les huitres,* fig. I, Bibliothèque centrale du Muséum national d'histoire naturelle. Paris, MS. 254.

Emmanuel Didier (Visiting Scholar, Centre National de la Recherche Scientifique—Centre de recherches Sociologiques sur le Droit et Institutions Pénales, Guyancourt, France, funded by the Centre National de la Recherche Scientifique, France)

Statistical Observation in New Deal America

The invention of statistical random sampling in the American administration during the New Deal had a little remarked but important effect on the politics of Franklin D. Roosevelt's administration. The new technique was enlisted in the fight against industrial unemployment, but some of its earliest applications were in agriculture. A very innovative and impressive random statistical survey, called the Master Sample of Agriculture, was invented at Iowa State University during the 1930's and 1940's in the Statistical Laboratory headed by George Snedecor. The project studies how a statistical technique and a policy option worked hand in hand, reinforcing each other.

Emmanuel Didier

Clerical staff of the Statistical Laboratory at Iowa State University drawing "sampling areas" into U.S. county maps. (Courtesy Iowa State University Library, Special Collection Department)

Erna Fiorentini

Erna Fiorentini (Visiting Scholar, Freie Universität Berlin, funded by SFB 626, "Aesthetic Experience and the Dissolution of Scientific Limits," Deutsche Forschungsgemeinschaft)

Protomodern Observers and the Camera Lucida 1806–1850

A new mode of seeing emerged and established itself in the first three decades of the nineteenth century, one that implied the conciliation of individual perception with the demands of images expected to convey 'objective' observational data. The new visual habit was concomitant with the appearance and spread of prismatic instruments for drawing, which combined subjective and objective aspects: "prismatic vision." In various fields of art and science, most notably landscape sketching, natural history and microscopy, the relationship between sensory, cognitive, and emotional experience and their translation into images became the object of practical as well as theoretical reflections. In addition to several conferences and publications, the project created the Open Digital Library *Drawing with Optical Instruments. Practices and Concepts of Visuality and Representation* <http://echo.mpiwg-berlin.mpg.de/content/optics>.

Den engelske konstnären (The Englisch Painter). Carl Jakob Lindström (1830), Photo: Bodil Karlsson/Nationalmuseum Stockholm, 1993

Michael Fotiadis

Michael Fotiadis (Visiting Scholar, University of Ioannina, Greece)

Practices of Classical Archaeology: The Emergence of the Aegean Concept in the 1890s

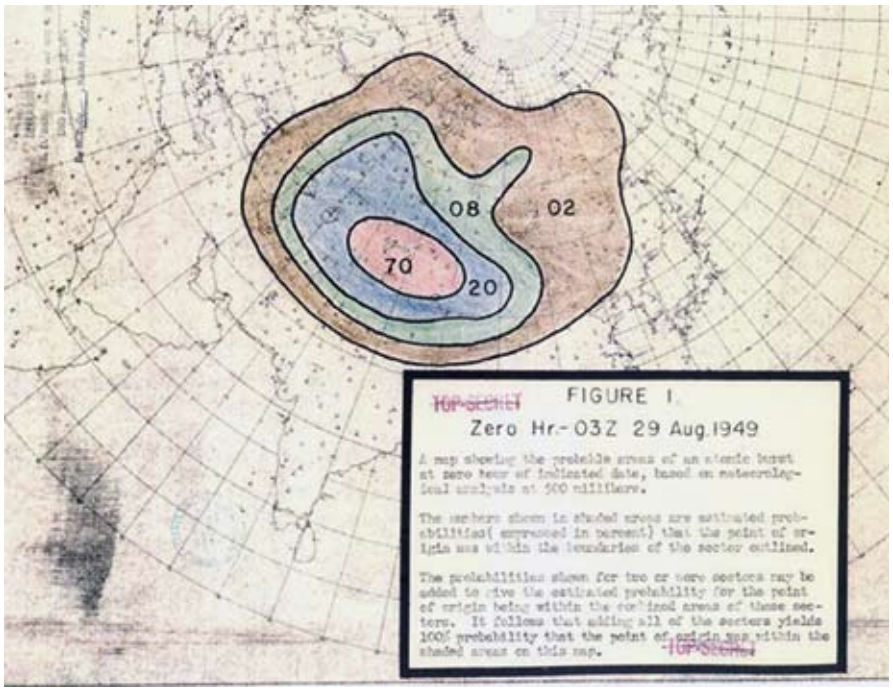
Schliemann is to this day thought of as "the father" of Aegean prehistory, but only because we have forgotten that Schliemann died without ever having suspected the existence of an "Aegean" civilization/culture. The concept grew out of 1890s creeds about the nature of nationality, race, and about "Europe" and "the Orient"—creeds that were shared across late-nineteenth-century human sciences and which came to inform the analysis of archaeological findings from the previous decades. The project documents the bearing of these habits of thought and niceties of practice—the discipline's "ethic"—on the observations that rendered "the Aegean" a distinct object of scientific research.

Michael Gordin (Visiting Scholar, Princeton University, U.S.A., funded by Princeton Bicentennial Preceptorship)

Michael Gordin

International History of the Atomic Monopoly, 1945–1949

The period of the American atomic monopoly—between the atomic bombing of Hiroshima and Nagasaki in early August 1945 and the Soviet detonation of their own atomic device in late August 1949—, far from being one of relative security for the Americans as the only people invulnerable from atomic attack, was beset by anxiety about how to maintain this monopoly, how to prevent others from breaking it, and how to know it when they did. The project deals with the practices of epistemology in the arena of atomic weapons—what one might call "nuclear observation." Both the Soviets and the Americans invested tremendous resources in "detecting" aspects of the other side's nuclear program, and the level of attention, the high stakes, and the extreme efforts by both sides to maintain secrecy highlight the epistemological problems that have been observed by historians of science in many other, less geopolitically fraught situations.



U.S. Weather Bureau Report on Alert Number 112 of the Atomic Detection System (Figure 3), 29 September 1949, President's Secretary's Files: Subject File 1940–1953, National Security Council – Atomic Files, Box 173, Folder: Atomic Bomb: Reports, Harry S. Truman Museum and Library, Independence, Missouri

Christelle Gramaglia

Christelle Gramaglia (Predoctoral Fellow, Ecole des Mines, Paris, France; as of 2007 Research Fellow of CEMAGREF, Montpellier, France)

Ecotoxicology and Expert / Lay Observations on Pollution: Contemporary Questions on Observation and Visual Evidence

Until the end of the 1980s, the observation and monitoring of pollution rested on conventional chemical methods that identify and assess concentrations of contaminants in the atmosphere, water, or sediments. As a young and controversial discipline, ecotoxicology developed new observation instruments that rely on "sentinel organisms," whose biological responses to environmental perturbation permit researchers to monitor the variations of toxicity in time and space in relation to their interaction and accumulation. The dissertation (completed 2006) concerns the interactions of these different modes of observation: What types of knowledge were produced, and when and how did lay practices and professional observational practices differentiated? Is there continuity between lay techniques for reading a river and the new scientific ones?

Portrait of Izaak Walton (author of *The Complete Angler,* 1653).
James Inskipp, Government Art Collection, London, U.K., 1831

Anna Grimshaw

Anna Grimshaw (Visiting Scholar, Emory University, Atlanta, U.S.A.)

Rethinking Observational Cinema

Observational cinema is one of the most ubiquitous terms in visual anthropology. More often than not, it seems synonymous with the genre of ethnographic film itself. Once hailed as a radical breakthrough in the established conventions of documentary and ethnographic filmmaking, observational cinema quickly fell out of favor. It was widely criticized as a form of scientism in which a detached camera served to objectify and dehumanize the human subjects of its gaze. Despite extensive critique, observational cinema has continued to be a crucial point of reference for those concerned with the documentation of social life. The project is concerned with building a new case for observational cinema. A primary objective is the identification of key features distinguishing this genre of ethnographic film. Does *observational* refer to a method of working, a conception of knowledge, or a particular ethnographic sensibility? Drawing on a handful of case studies, the project explores the different ways that particular filmmakers have interpreted the observational task.

Karl Hall (Visiting Scholar, Central European University Budapest, Hungary)
Fragmented Science: Fabricating Reliable Phenomena in Industrial Laboratories circa 1925

Karl Hall

The project uses the multidisciplinary context of industrial research in the 1920s to open up new avenues for approaching the problem of skills and tacit knowledge that the chemist and philosopher of science Michael Polanyi helped make central to a later generation of science studies—especially the contemporary awareness among chemists and engineers that received views of scientific method did not adequately account for the practical aspects of laboratory work, the more so the further one got from the physics of the atom. Polanyi's work as an industrial consultant at Siemens forced him to confront the problem of how to account for structural failure in physical terms. But the intractability of these breakdown phenomena point to a larger problem in what one might call the history of failure. Polanyi's idiosyncratic circumvention of the purported perils of analytic philosophy for science has its origins in a particular nexus of technoscientific investigations that happened to end in failure.

The atrium of the new Siemens Research Laboratory in Berlin-Charlottenburg. Photograph, early 1920s (Siemens Archives, Munich)

Alexandra Hui (Visiting Predoctoral Fellow, University of California, Los Angeles, U.S.A., funded by the German Academic Exchange Service)
Psychophysics and Music in Nineteenth-Century Germany

At the end of the nineteenth century, the worlds of natural science and music coalesced. The potent interaction of psychophysical studies of sound sensation with the music culture of late-nineteenth-century Germany contributed to new theories—both psychophysical and musical—as well as to a new awareness of the historical and cultural contingency of sensory perceptions. The psychophysicists' personal experience with music reinforced, even fueled, a shift to more relativistic, historicist conceptions of sensory perceptions. The dissertation, by addressing the rich relationship between natural science and music, supplements current histories of psychophysics by highlighting one of its critical cultural contexts.

Ludmila Hyman

Ludmila Hyman (Postdoctoral Fellow, Carnegie Mellon University Pittsburgh, U.S.A.)
Clinical Observation and the Making of Cultural-Historical Psychology
The cultural-historical program of the Soviet psychologists L. S. Vygostky, A. R. Luria, and A. N. Leontiev developed during the radical social upheavals in Russia that followed the socialist Revolution. These scientists developed new methods of psychological research, including observation of people in naturalistic contexts. This project addresses the following questions. (1) How did these psychologists' ideas develop in the socio-cultural context of the new Soviet society and in connection with their personal experience? (2) How did they use language to represent their concrete experiences, including observations? (3) How did they reason from observations to conclusions? The ultimate goal of the study is to test the theories of the Soviet psychologists against their practice.

Jeremiah James

Jeremiah James (Visiting Predoctoral Fellow, Harvard University, U.S.A.)
Observation and Structure Determination in Early X-Ray Crystallography
Central to the advance of X-ray crystallography both as a new field of inquiry and a network of research centers before World War II was the development of increasingly abstract and complex methods of using X-rays to observe the internal structure of crystals. These novel methods of observation often introduced and relied upon new modes of representing crystal structures and new understandings of how X-rays could expose the microstructure of crystals. Although many young disciplines face the challenges of standardizing and legitimating new observational and representational techniques, the case of X-ray crystallography is particularly interesting because X-ray crystallography became so rapidly and avowedly international and interdisciplinary.

Susanne B. Keller

Susanne B. Keller (Postdoctoral Fellow, Universität Hamburg, Germany; as of November 2006 Trainee at Altonaer Museum für Kunst und Kulturgeschichte, Hamburg, Germany)
Picturing the Inaccessible: Gazing Beneath the Earth's Surface (16th to 19th c.)
This project investigates the visualization of the hidden zones beneath the earth's surface and the interior of the earth in science and art. Pictures played a fundamental role in the production of knowledge of the earth's interior and the underground. Yet the translation of the fragmentary knowledge of the subterranean realms into images required the development of specific strategies of visualization. Starting with early mining illustrations, such as those by Agricola, the important role of images can be traced through eighteenth-century geological and stratigraphical treatises. By the beginning of the nineteenth century, geological sections had largely established themselves as part of the visual language of the earth sciences, as can be seen in the illustrations of books by Lyell, A. v. Humboldt, Cuvier, and others. A major focus of this project is the examination of the word-image relationship in those illustrated scientific treatises.

Ein Flöz, einen Gang ſchneidend A, C. Der Gang B.
Ein Flöz, mit einem Gang ſich vereinigend D, E. Der Gang F. Ein Flöz G.
Teilſtücke dieſes Flözes H, I. Der Gang, ein Flöz zerteilend K.

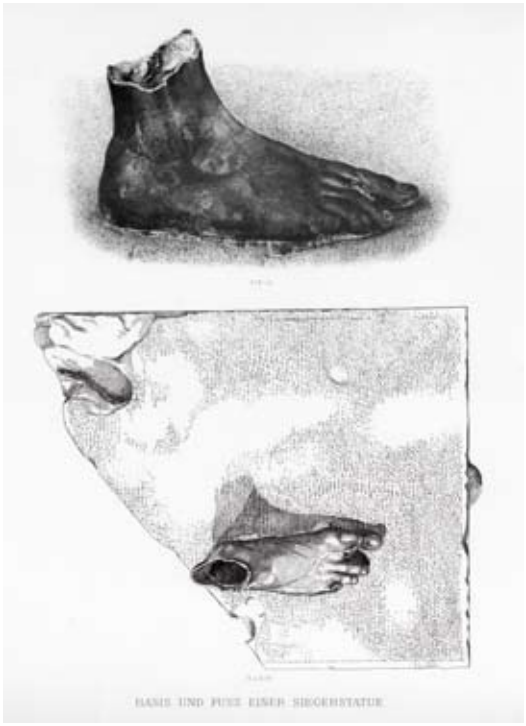
Georgius Agricola, *De re metallica libri XII.*, Basel 1556. German edition, Basel 1557: *Zwölf Bücher vom Berg- und Hüttenwesen.* Reprint edition, vol. 3, p. 53., 1928/2003

Stefanie Klamm (Predoctoral Fellow, Humboldt-Universität zu Berlin, Germany)

Strategies of Visualization and the Use of Images in 19th Century German Archaeology

Stefanie Klamm

As an object-based science, archaeology must retrieve objects of investigation not only in the place where they are actually situated but also make them available to a broader scientific discourse. Although the archaeologists stress that the *autopsia* of the object cannot be replaced by any visual reproduction whatsoever, it is nonetheless necessary to refer to reproductions for the purposes of comparative research, since the objects of archaeological inquiry are dispersed all over the world in different sites, museums and institutions. By the mid-nineteenth century different instruments of replication and reproduction were tested and improved; photographs, drawings, prints and plaster casts were used side-by-side. The project analyzes the plurality of media in the context of archaeological excavations, image archives and their classification systems, collections of plaster casts and the popular reception of archaeological images in the formation of archaeological knowledge.



Bronze foot on a stone basis in photography and drawing. Adolf Furtwängler, *Die Bronzen und die übrigen kleineren Funde von Olympia,* Berlin, Taf. 3., 1890

Fabian Krämer

Fabian Krämer (Predoctoral Fellow, Ludwig-Maximilians-Universität München, Germany)

Reference Structures in the Study of Nature in the Seventeenth and Eighteenth Centuries

The project examines intertextual relations in early modern naturalist publications on monsters and changing standards of learned credibility. Some of the cases mentioned in these works sound both familiar and likely to the modern ear. There is not much reason to doubt a report of the birth of conjoined twins in a Southern German village in a given year, for instance. But some sound far less familiar, and less credible: the birth of a horse with a human head and voice or a race of centaurs allegedly living somewhere in the East. Where did these authors' knowledge of monsters come from? Which sources did they privilege, book learning or empirical observation of individuals considered monstrous? And ultimately, what does this tell us about the reading and writing practices employed by the respective authors?

Reproduction of a centaur woodcut from a publication by the Swiss philologist, theologian and widely read prodigy book author Conrad Wolffhart (1518–1561), known as Lycosthenes. Ulisse Aldrovandi, *Monstrorum historia. Cum paralipomenis historiæ omnium animalium etc.* Bononiæ: Nicolai Tebaldini, p. 31, 1642

Daryn Lehoux

Daryn Lehoux (Visiting Scholar, University of Manchester, U.K.)

What Did the Romans Know?

The aim of the project is to flesh out a wide-field synchronic snapshot of a science, a knowledge-about-the-natural-world, very different from our own and then use it as a testing ground for a number of stubborn questions in the epistemology of the sciences. A basic contention is that much of what is said about ancient science (and especially of Roman science) suffers from a gross decontextualization that makes ancient science look fundamentally different from modern science in all the wrong ways. It is different—radically different—but that is not the same as saying it is *fundamentally* different. Over 2000 years, a lot of *what* we believe has changed, but not *why* we believe it. The project explores a conjunction of ideas around how we understand nature, with particular emphasis on law, knowledge, and observation.

Rhodri Lewis (Postdoctoral Fellow, Oxford University, U.K.; as of August 2007, Tutorial Fellow, St. Hugh's College, Oxford University, U.K.)

The Early Modern *ars memoriae*

Rhodri Lewis

The project studies the reception and development of the classical arts of memory (mnemotechnique), principally in northern Europe, in the years from about 1500–1700. At the beginning of this period, mnemotechnique was treated with some hostility by scholars, educators and natural philosophers who defined their activities with reference to humanism. But by the beginning of the seventeenth century, it had begun to be woven into the fabric of intellectual life once again. The collection of broadly observational practices arranged under Francis Bacon's heading of *experientia literata* are a convenient and useful index of this shift: mnemotechnique was approached as a set of tools through which one might accurately represent, and think about, the natural world. The goal is to shed some new light on the emergence of natural philosophical methodology—chiefly in terms of its journey from concerns that were principally logical, to concerns that were principally epistemological.

Harro Maas (Visiting Scholar, Universiteit van Amsterdam, The Netherlands)

A History of Observation in Economics

Harro Maas

How do economists observe the world? For contemporary economists, used to working with large data sets, gathered by statistical bureaus all over the world, or—nowadays—generated from experiments in the lab, this may seem a question with an obvious answer. For these extensive data sets or experimentally generated data are commonly considered to serve as input or testing grounds for their models and theories, and so they are the "observations" economists work with. From an historical point of view, however, the idea that the observations of political economists can be identified with statistical (quantified) data is far from obvious. Quantified (statistical) data are better considered as a particular *kind* of observation, one of several, from Adam Smith's "armchair observations" on the division of labour to John Maynard Keynes' practical experience with and introspective insights about the "animal spirits" driving speculators on the stock exchange. This project studies economists' observational practices from an historical point of view, tying practices to specific sites: observatory, laboratory, and the armchair.

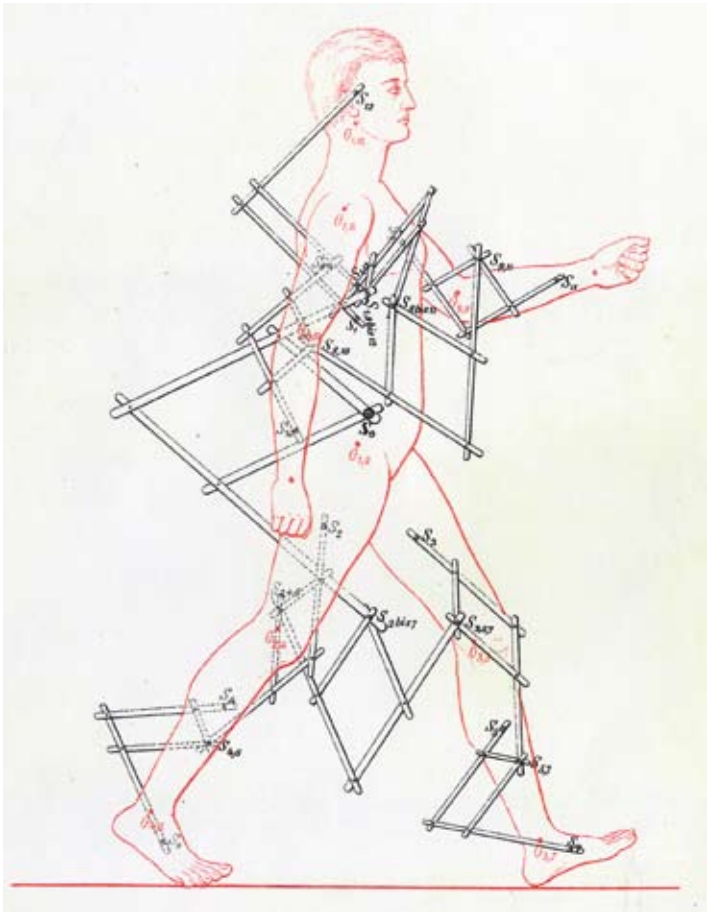
Cartoon of John Maynard Keynes as armchair economist. David Low, *The New Statesman* 28, October 1933

Andreas Mayer

Andreas Mayer (Visiting Scholar, University of Cambridge, U.K., funded by the Welcome Trust, U.K.; as of November 1, 2007, Research Scholar, MPIWG)

The Science of Walking: Towards a History of the Pedestrian Age

This book project (completed in 2007) examines the emergence of the scientific study of human walking in the first decades of the nineteenth century in western societies (particularly France, Germany and Britain). To gain insights into the laws of human walking in its normal and pathological forms with the aim of improvement or accurate representation became the concern of a variety of professional groups such as anatomists, physiologists, neurologists, ergonomists, orthopaedists, shoe-makers, artists, gymnastic teachers, and the military. The general question this project raised was the following: How and to what extent did scientific knowledge about the anatomy and physiology of the moving body shape walking practices in modern Western societies?



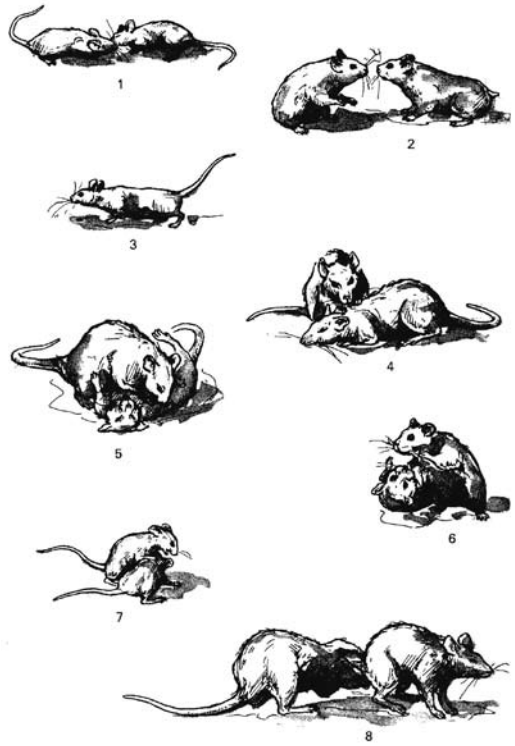
Concrete projection of the mechanism of walking illustrating the theory of Wilhelm Braune and Otto Fischer (*Der Gang des Menschen,* 1899)

Erika L. Milam

Erika L. Milam (Postdoctoral Fellow, University of Wisconsin at Madison, U.S.A.; as of January 1, 2009, Assistant Professor, University of Maryland at College Park, U.S.A.)

Animal Models of Behavior: Anthropomorphism, Zoomorphism & Cultures of Observation

There are two main techniques by which scientists establish equivalencies across the animal-human boundary. One is to anthropomorphize animal actions as simplified versions of human behavior. Another is to zoomorphize human behavior as "animalistic" or "instinctual" in basis. These two techniques contribute to the ways in which social and natural scientists have used "nature" to justify contemporary social structures (the naturalistic fallacy). The project analyzes scientists' uses of zoomorphism



in twentieth-century animal behavior research (spanning anthropology, ethology, psychology, and zoology), and the acclaim and/or critical eye with which their peers received this research, focusing on how and why social and natural scientists have turned to the study of non-human (often non-primate) behavior as a tool for understanding human social and cultural problems.

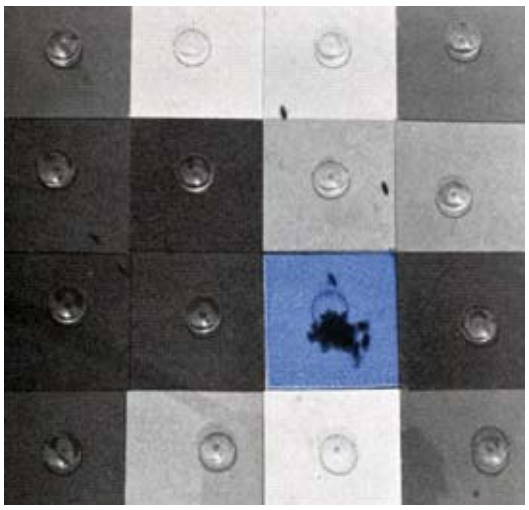
Allen W. Stokes, ed. *Animal Behavior in Laboratory and Field,* San Francisco: W. H. Freeman and Company, p. 167, 1968

Tania Munz (Research Scholar, MPIWG)

Of Birds and Bees: Konrad Lorenz, Karl von Frisch, and the Science of Animals

By the time they won the Nobel Prize in Physiology or Medicine (together with Niko Tinbergen of the Netherlands) in 1973, Karl von Frisch and Konrad Lorenz had emerged as two of the most significant voices on animals in German-speaking Europe—von Frisch attained acclaim for his discovery of the bee dance language, while Lorenz is remembered for his work on geese, imprinting, and as a controversial founder of ethology (the European approach to animal behavior that offered evolutionary explanations of complex instincts). Both scientists promoted a particular way, not just of doing science, but of observing and understanding animals—and both used film to investigate their animals and promote themselves and their science. The project examines how they understood, created, and transgressed the animal-human boundary in their science and how they sought to teach the public about animals in their numerous popular writings and films.

Tania Munz

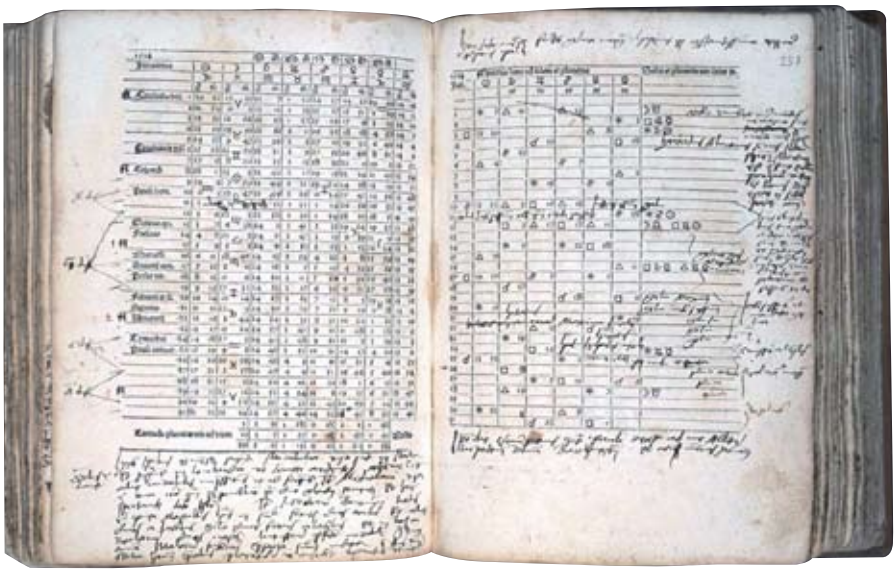


Trained honey bees cluster preferentially on the blue tile in an experiment designed to test their ability to see color.
Karl von Frisch, *Der Farbensinn und Formensinn der Biene,* Zoologische Jahrbücher, Abt. f. allgemeine Zoologie und Physiologie der Tiere, p. 1–182, table 1, figure 4, 1914

Katharine Park (Visiting Scholar, Harvard University, U.S.A.)

Scientific Observation in Medieval Europe

This topic has never been studied in a manner sensitive to actors' categories; the few scholars who have written on this topic have treated observation anachronistically, assuming that it was part of an undifferentiated, experience-based study of nature. In fact, there was a clear distinction between the sciences of experience (*experientia/experimentum*) and those of observation (*observatio*). The former—notably the Aristotelian sciences, as well as medicine, alchemy, and astronomy—invoked experience in the sense of trial or test: a punctual intervention intended to test the truth of a statement (e.g., that the cries of migrating birds are cries of pain, rather than attempts at communication), the accuracy of a planetary table, or the efficacity of a remedy or procedure. In contrast, the sciences of observation—astrology (the part of astronomy dealing with the terrestrial effects of changes in the heavens), agriculture, and navigation) were organized around the idea of watching and waiting, the patient noting and recording of longtime cyclical phenomena in order to determine patterns and correlations, e.g., among particular planetary configurations, weather conditions, political events, or optimum times to harvest or plant. Although medieval writers typically attributed observation to the ancient founders of the sciences in question (the Babylonians, the Egyptians, the pre-Hippocratics), there is evidence of medieval programs of observation related to monastic timekeeping and, beginning in the 13th century, weather science; individual observers attempted to lay the foundations for a science of weather prediction based on the positions of celestial bodies, by making daily records of the weather in the margins of manuscript and, eventually, printed ephemerides.



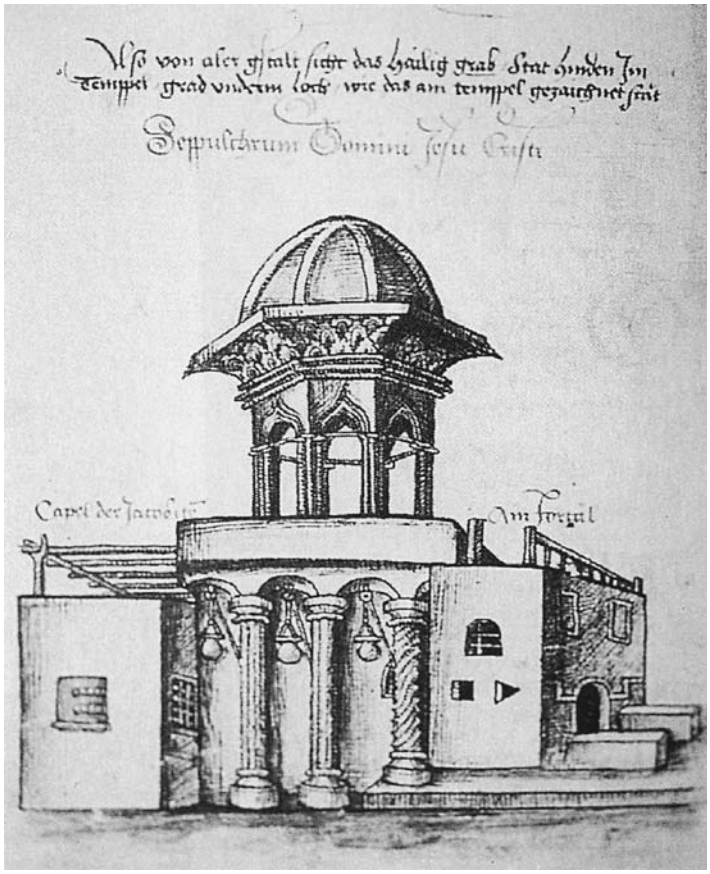
Annotations from 1514 by Martin Biem, professor at the university of Krakow, in his copy of Johann Stoeffler and Jacob Pflaum. Biem recorded his observations of the day's weather in the righthand margin of this and later almanachs over a period of more than 30 years. *Almanach nova sive Ephemerides* 1499–1531 (Ulm: Reger, 1499), fol. 250v–251r. (Krakow: Jagiellonian Library, Inc. BJ 2697)

Susanne Pickert

Susanne Pickert (Predoctoral Fellow, Humboldt-Universität zu Berlin, Germany, funded by the Gerda-Henkel-Stiftung; as of January 1, 2008, Scholar in Residence, Deutsches Museum, Munich, Germany)

Seeing and Believing. The Description of the Holy Sites of Jerusalem in Medieval Travel Accounts, 12th to 15th Centuries

The dissertation (completed in 2007) investigates the history of pre-modern observation in travelogues from the 12th to the 15th centuries. Deeply rooted in Christian mysticism, with a theoretical basis of the physiology of the mind and the practices of memory, the monastic phenomenon of the pilgrimage of the mind enabled medieval readers of travel accounts to recreate a little world within, which can be traversed and observed like the real world outside. The author of the travel account serves as an expert and teacher who preselects facts according to theological relevance and processes them for the reader. The critical philology of the Bible is at the core of these texts. Conversely, the terminology of Scripture and observed material reality are tested against each other in order to obtain reliable images for spiritual practice.



Drawing of the Holy Grave of Konrad von Grünemberg, 1847.
Arwed Arnulf, *Mittelalterliche Beschreibungen der Grabeskirche in Jerusalem,* Colloquia Academica, Stuttgart, pp. 1–43, ibid. p. 41., 1997

Sarah de Rijcke

Sarah de Rijcke (Visiting Predoctoral Fellow, Rijksuniversiteit Groningen, The Netherlands, funded by the Netherlands Organization for Scientific Research)

Regarding the Brain: Scientific Practices of Cerebral Representation

The dissertation analyzes four diverse practices of visualizing the brain, plus the instrumental role these images play as part of constituting neuroscience. One focus is Santiago Ramón y Cajal's (1854–1932) drawings and photographs of neurons. Cajal won the Nobel Prize for Physiology or Medicine in 1906, and is still renowned for his artistic skills in translating his microscopic observations into drawings. He was also a gifted photographer. In light of this experience, it is remarkable that he rarely resorted to photography in his neurohistological work—just at a time when there was a deep competition between photographs and drawings. Instantaneous photography only recorded what could be seen in one focal plane, while direct (expert) observation had the added value of averaging over more planes. This was partly an unconscious process, relating to a peculiarity of human perception. Cajal's sensual experience was inextricably tied to process of observation and depth perception when looking through the microscope and adjusting the micrometric screw.

Santiago Ramón y Cajal with microtome, self-portrait, albumen print, 1888. Reproduced from Santiago Ramón y Cajal. *Ciencia y art Ed.* Obra Social Caja Madrid, 1852–2003

Anne Secord

Anne Secord (Visiting Scholar, University of Cambridge, U.K.)

Taking "Nature's Path" in Eighteenth-Century Britain

The project examines how eighteenth-century imperatives to *follow* nature actually operated in practice. By considering processes not susceptible to quantification but that signaled a mastery of nature, the historian has to think more about eighteenth-century attitudes and ways of doing things rather than systematic bodies of knowledge or specific theoretical borrowings. A series of natural objects that can also be considered as artificial and, at times, even unnatural provides a window on to these attitudes. This approach promises ways to tap the voices of those rarely considered in connection with debates concerning natural knowledge, luxury, display and consumption, as early research on the cucumber, considered to be "unnaturally cultivated" in eighteenth-century Britain, has begun to reveal.

Frontispiece of Thomas Mawe [John Abercrombie], *Every Man His Own Gardener,* showing (on the left) a hotbed, whose heat was preserved by laying "straw, waste hay, or fern" round the sides of the bed. Forced cucumbers would be cultivated in hotbeds such as these. 2d ed., London, 1767

Hanna R. Shell (Visiting Predoctoral Fellow, Harvard University, U.S.A.)

Hide and Seek: Camouflage, Animal Skin and the Media of Reconnaissance

The dissertation (completed 2007) "Mending the Net: Camouflage, Serial Photography and the Suture of Self-Effacement and Reconnaissance (1914–1945)" argues that between the late-nineteenth century and World War Two, camouflage emerged out of nineteenth-century scientific practices as a potent response to film's practical and theoretical impacts on natural science, art and the military.

Hanna R. Shell

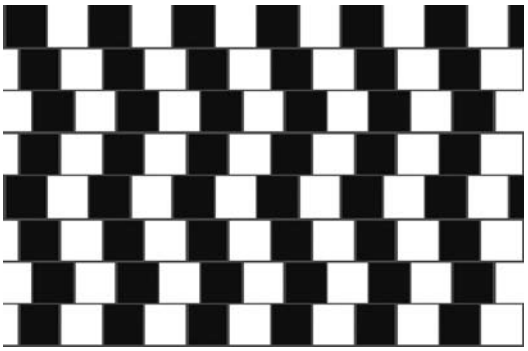
Mending the Net. Hanna Rose Shell, Mixed-Media Assemblage, 2006

Thomas Sturm

Thomas Sturm (Postdoctoral Fellow, Universität Marburg, Germany; as of September 2007, Research Scholar, MPIWG)

Perceptual Illusions in Psychological Research

Illusions of perception create familiar problems for the reliability of observation and empirical knowledge; hence scientists try to account for them. How do psychologists explain perceptual illusions? In important cases such as the moon illusion, theories and even data are still open and disputed. What is more, the number of competing explanations of the illusion has increased rather that decreased, despite the development and spread of new experimental techniques over the last century. Why? Major reasons for this are conceptual ones: researchers have never agreed what concepts are necessary and legitimate in descriptions of the illusion, and where to draw the line between judgment and perception. The project examines whether such difficulties are specific to research on such illusions, or symptomatic of larger problems within perception research.



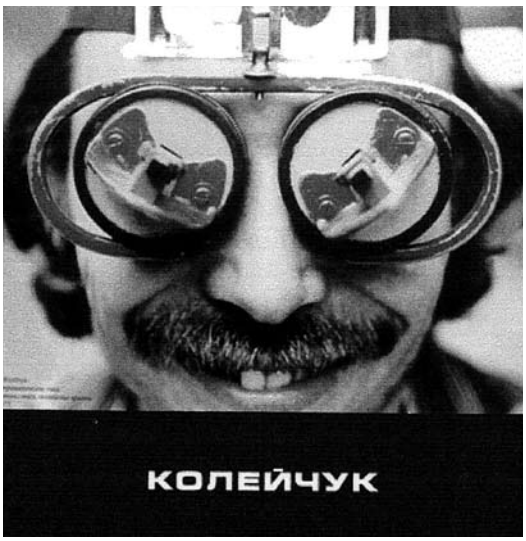
Cafe wall illusion, first described by Richard L. Gregory and Priscilla Heard, who named it after the tiled wall of a Pizza Kebab in Bristol. The lines in between do not appear parallel as they are.

Margareta Tillberg

Margareta Tillberg (Visiting Scholar, Växjö Universitet, Sweden, funded by the Swedish Research Council)

Design, Art and Cybernetics: Russia in the 1960s–70s

This project studies the role of the interaction between the observer and the observed in the elaboration of new design methods at the All-Union Scientific Institute for Technical Esthetics (VNIITE), a research institute for design founded in Moscow in 1962. In co-operation with artists, designers and musicians, the experimental results were to be applied in high priority fields such as industrial interiors, transportation and education. The project embraces artistic, ergonomic, physiological, psychological and technological/scientific aspects of design, architecture, and cybernetics. The application of various functional modes of cybernetic practices will be presented in a few case studies: in design (as a visual and organizational re-structuring system to produce a more effective and a worthier place to live and work in) and in art (as environments, performances).



Viacheslav Koleichuk (born in 1941, architect, theoretician, constructor, artist, who worked at VNIITE from 1977–94) wearing goggles of his own design, producing a kaleidoscopic vision for himself. Photograph, 1977, Exhibition catalogue Viacheslav Koleichuk, Moscow, 2001

Jeremy Vetter (Postdoctoral Fellow, University of Pennsylvania, U.S.A.;
as of January 2007, Assistant Professor, Dickinson College, Pennsylvania, U.S.A.)
Knowledge, Environment, and Field Work in the American West in the 19th and 20th Centuries

Jeremy Vetter

The project emphasizes the diversity of ways of organizing the production of knowledge in the field in the American West during the railroad era—including surveys, field networks, stations, and quarries. It brings together evidence from a wide range of field-science disciplines, including paleontology, botany, zoology, ecology, archaeology, meteorology, geology, and agricultural science. The central focus is on divisions of labor, both within the practice of scientific field work and the larger geographical relations between regions of global science. While the history of science has traditionally focused on research leaders, this project aims to uncover the hierarchical division of labor that makes up rigorous scientific field work, from leaders to subordinate contributors, and crossing the conventional boundaries that have divided publishing scientists from their technicians, field hands, and other assistants.

Mr. Peter Wood and child at Amarillo, Texas, weather station. Photograph, June 1, 1903 (U.S. National Oceanic and Atmospheric Administration's National Weather Service Collection, Image ID: wea00911)

Marga Vicedo-Castello (Postdoctoral Fellow, Harvard University, U.S.A.;
as of August 2006 Assistant Professor, University of Toronto, Canada)
The Nature of Mother Love: From Imprinting in Geese and Comfort in Monkeys to Attachment in Children

Marga Vicedo-Castello

The project examined the evolution of scientific views about maternal love in biology and psychology since WWII and their impact on social views about gender roles. What kind of care do children need and who should provide it? The answer to those questions affects personal decisions, social expectations and public policy about parental roles, as well as decisions in custody cases, adoptions, orphanages, and child-care in general. The theory of attachment is regarded today as an important part of child psychology, family therapy and psychiatry. Its historical roots lie in psychological research on child development, ethology, and primate research. Because attachment research has profound implications for social policies, the history of this

theory also illuminates the complex ways in which scientific views are incorporated into the wider society and reveals how the social context affects the directions of scientific inquiry.

Janina Wellmann

Janina Wellmann (Postdoctoral Fellow, Humboldt-Universität zu Berlin, Germany; as of September 2007 postdoctoral Fellow at the Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Israel)

Observing the In-Between. Learning to See the Microscopic in 19th Century Biology

The understanding of developmental processes was made possible only through the establishment of a new technique for the observation of complex biological processes by decomposing them into a final set of discrete moments, and then recomposing the process in terms of an orderly series of these moments. The ability to evoke a sense of a dynamic process out of a relatively short sequence of discrete observations lay in the choice of the specific 'snapshots' and in the way they were ordered as a series. Examining the microscopical work of a series of botanists and microscopical anatomists in the first half of the nineteenth century, the project shows how the history of microscopy in this period can be largely told in terms of this new technology of observation and depiction, with a focus on the discovery of division as the fundamental way of cell reproduction.

Graphic depiction of cell division. Eduard Strasburger, *Über Zellbildung und Zelltheilung*, Jena 1875, Taf. VI.

Kelley Wilder

Kelley Wilder (Research Scholar; as of July 2007, Senior Research Fellow, De Montfort University, Leicester, U.K.)

The Nature of Photographic Evidence in Science

Part of the reason photography caused such a sensation when its invention was publicly announced in 1839 was its outrageous promise to embody all the best traits of scientific observation. It was mechanical, indefatigable, optical, and consequently the most reliable method yet discovered of recording observations, especially those made on or with light. Although the tradition of using light sensitive materials was established well before this announcement, photography added the element of fixity, effectively establishing the possibility of permanent (or at least semi-permanent), automatic records of these observations. In the second half of the 19th century and the first decades of the 20th century, many scientists developed photographic methods as a way of conducting either experiments or observations with photographic apparatus. This project concentrates on the evidential nature of this sort of photographic record.

Zeeman Curve, photographed by Henri Becquerel, sent to Woldemar Voigt in a letter 1899. Goettingen State and University Library, special collections (Waldemar Voigt papers)

Ongoing Project

Between the Natural and the Human Sciences

MPIWG ORGANIZERS *Lorraine Daston, Bernhard Kleeberg, Fernando Vidal*
COOPERATING ORGANIZERS *Francisco Ortega* (Universidade do Estado do Rio de Janeiro/UERJ, Brazil), *Robert J. Richards* (University of Chicago, U.S.A.), *Alison Winter* (University of Chicago, U.S.A.)
COOPERATION PARTNERS Universidade do Estado do Rio de Janeiro/UERJ, Brazil; University of Chicago, U.S.A.; Centre Alexandre Koyré, Paris, France

This ongoing project sponsors research, conferences, and exchanges of junior and senior scholars in the interests of creating a common framework of inquiry for the history of the natural and human sciences. In 2006–7 two major projects were pursued under this rubric: *The Cerebral Subject: Brain and Self in Contemporary Culture*, and *The History of the Human Sciences.*

Project

The Cerebral Subject: Brain and Self in Contemporary Culture

DURATION 2004–2008
MPIWG ORGANIZER *Fernando Vidal*
COOPERATING ORGANIZER *Francisco Ortega* (Universidade do Estado do Rio de Janeiro/UERJ, Brazil)
COOPERATION PARTNER Universidade do Estado do Rio de Janeiro/UERJ, Brazil
Website: <www.brainhood.net>

The project largely takes place in the framework of a cooperation agreement between MPIWG and the State University of Rio de Janeiro. In 2006–2007, it received support through the extension of a grant from the PROBRAL scholars exchange program of the German Academic Exchange Service and the CAPES, a funding agency of the Brazilian Ministry of Education and Culture.

"Cerebral subject" designates not so much a scientific object as an anthropological figure: the human being as brain, the belief that the brain is the only part of the body required for personhood. The goal of the project is to study the history of this figure, and to explore its concrete consequences in different realms since the mid-twentieth

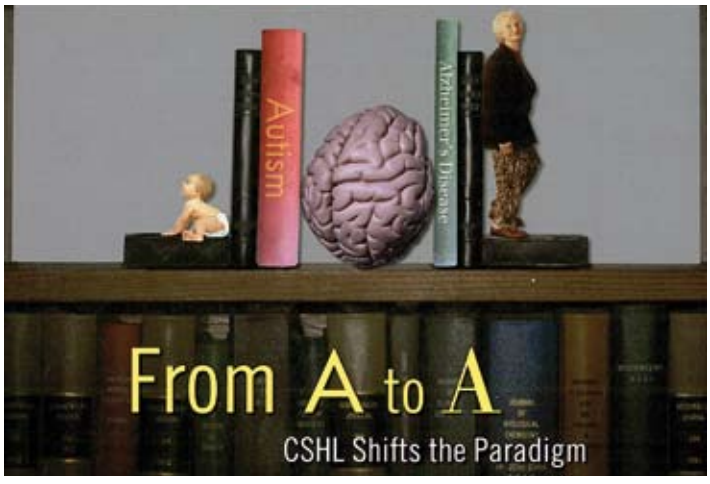
century. The cerebral subject has innumerable materializations both inside and outside philosophy and the neuroscientific and psychological fields—to mention just a few, in medical ethics (which deals with such issues as brain death, brain intervention techniques and neural grafting); in the rapid development of new "neuro" fields, from neurotheology to neuroeconomics; in the rise of "neurosecurity" or the "neurodiversity" movement; in the neurologisation of mental illness and deviant behavior; in an expanding galaxy of beliefs and practices that go from learning how to feel with one side of the brain, to various forms of neurohealthism, neuroesotericism and neuroeschatology. This project examines these developments not only from the perspective of the history and sociology of science and medicine since the mid-twentieth century, but also as the source of new definitions and experiences of the self.

Brain and Self in Contemporary Culture
Conferences

The Cerebral Subject. Practices and Representations in Contemporary Culture, Rio de Janeiro, August 2–4, 2006.

Organized in the framework of the cooperation between MPWIG and the Institute for Social Medicine of the State University of Rio de Janeiro, Brazil. Financed by the MPIWG, the State University of Rio de Janeiro, the Brazilian CAPES and FAPERJ, and the Instituto Bennett of Rio de Janeiro, with additional support from ETH Zurich, Switzerland, and the Institute for the History of Medicine and Public Health of the University of Lausanne, Switzerland.
ORGANIZERS *Francisco Ortega* (Universidade do Estado do Rio de Janeiro, Brazil), *Fernando Vidal* (MPIWG)

The belief that human beings are essentially reducible to their brains has become extremely powerful in contemporary societies. Especially since the mid-20th century, the anthropological figure of the "cerebral subject" has emerged as a major feature of industrialized and highly medicalized societies. In speaking of "practices and representations *in* contemporary society" the conference intended to emphasize that science is not only autonomous from society and has an external "impact" on it, but that it is inherently a set of cultural and social practices, and is enmeshed in other such practices. While this has always been so, the cultural rootedness of the neurosciences, and the neuroscientific presence in extra-scientific areas of society have never been so pervasive.



Cover of the magazine *Harbor Transcript* [Cold Spring Harbor Laboratory], vol. 27, no. 3, summer 2007

A publication entitled *The Neurosciences in Contemporary Society. Glimpses from an Expanding Universe,* edited by Francisco Ortega and Fernando Vidal, is currently under preliminary review.

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Brain and Self in Contemporary Culture
Planned Conferences

Neurocultures, February 20–21, 2009
ORGANIZERS *Nicolas Langlitz* (MPIWG), *Fernando Vidal* (MPIWG), in collaboration with the BIOS Centre of the London School of Economics. U.K.

Particularly since the "Decade of the Brain," various neuro fields have emerged. Neurotheology, neuroesthetics, neuropsychoanalysis, neuroeducation, and neuroeconomics seek to reform the human sciences on the basis of knowledge about the brain. Driven by the availability of brain imaging technologies, particulary PET and fMRI, these fields tend to focus on the quest for "neural correlates" of the behaviors and mental processes in question. The media, both popular and specialized, have covered these emergent fields extensively, as well as new forms of sociability and identity politics represented in the "neurodiversity" movement and various sorts of "neurocommunities." These developments show that neuroscientific knowledge is spreading rapidly beyond the confines of brain research proper into different areas of life and our culture as a whole. The workshop proposes to examine such constellations of ideas, practices, and social forms as "neurocultures."

Brain and Self in Contemporary Culture
Individual Projects

Vicente Barretto (Visiting Scholar, Universidade do Estado do Rio de Janeiro, Brazil, funded by PROBRAL):
Neurosciences and the Law
How have the neurosciences and neuroimaging technologies affected the notion of the human person that underlies legal decisions? The project focused on the impact of the neurosciences on juridical thought and practice, especially on the ideas of human dignity and human rights that are at the heart of the democratic states in which the exercise of power is constrained by the law.

Cristiane Brandão Augusto Mérida (Visiting Predoctoral Fellow, Universidado do Estado do Rio de Janeiro, Brazil, funded by PROBRAL)
The Neurosciences in the Courtroom
The brain sciences have played a role in criminology since the 19th century; recently, however, the field of "neurolaw" has emerged as an important player in the courtroom. Neurolaw comprises the presence of the neurosciences in the courts, especially in the form of the controversial field of "forensic neuroscience." The debates studied in the context of the project concern largely the role of organic brain defense (which replaces the traditional insanity defense) and the admissibility in court of neuroscientific evidence, particularly brain scans—two developments that are beginning to alter the theory of justice and the practice of the law.

Luciana Vieira Caliman

Luciana Vieira Caliman (Predoctoral Fellow, Universidado do Estado do Rio de Janeiro, Brazil, funded by German Academic Exchange Service, DAADa; as of September 2006 adjunct Professor and Postdoctoral Fellow of the Postgraduate Program of Psychology, Universidado do Estado do Rio de Janeiro, Brazil)

The History of Attention Deficit Hyperactivity Disorder

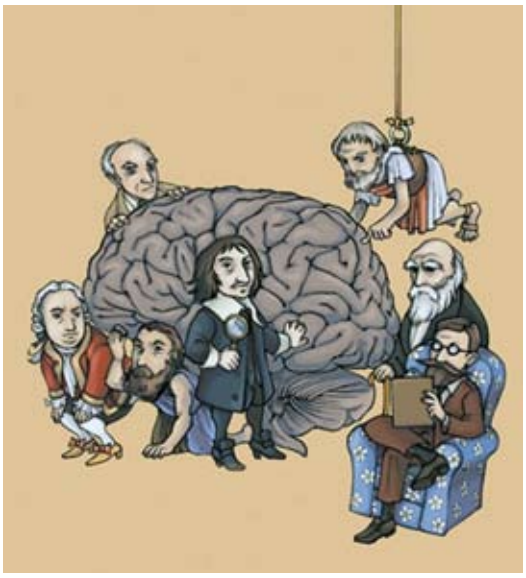
The dissertation (completed 2006) deals with the biologization of attention disorders in the late twentieth century. Both the American Diagnostic and Statistical Manual of Mental Disorders (DSM) and the International Classification of Diseases (ICD) began to describe mental pathologies in a language of individual susceptibility, molecular and genetic risk, and brain dysfunction. The controversial diagnostic category "Attention Deficit Disorder" (ADD), now "Attention Deficit Hyperactivity Disorder" (ADHD), was established and expanded to include adulthood. In the process, the inattentive individual came to be understood as, essentially, an inattentive brain.

Illustration from the famous German children's story *Zappel-Phillip,* first published in 1844

Nicolas Langlitz

Nicolas Langlitz (Postdoctoral Fellow, MPIWG, University of California, Berkeley, U.S.A.)

Neurophilosophers, Neuroscientists, and the Dreaming Brain



Book-cover of Patricia Smith Churchland's *Brain-Wise. Studies in Neurophilosophy.* Cambridge, Mass, 2002

In the last two centuries, human persons have come to be identified with their brains. In the 1980s, the anthropological, epistemological, and ethical consequences of this conception of ourselves as "cerebral subjects" became the subject matter of the novel philosophical subdiscipline of neurophilosophy. The project is a historical and ethnographic examination of neurophilosophy and addresses three general questions: (1) How did neurophilosophy come into existence and how can it be demar-

cated from previous as well as alternative contemporary forms of philosophical reflection on the brain? (2) How did and do neurophilosophers and neuroscientists relate to each other? What happens to their concepts and ideas when they cross disciplinary boundaries? (3) How do neurophilosophers seek to espouse a certain *cultura animi,* a rejuvenation of philosophy as both a way of life and an ethical cultivation of the soul?

Rossano Cabral Lima (Visiting Predoctoral Fellow, Universidado do Estado do Rio de Janeiro, Brazil, funded by PROBRAL)

Autism: From Disorder of the Mind to Brain Pathology

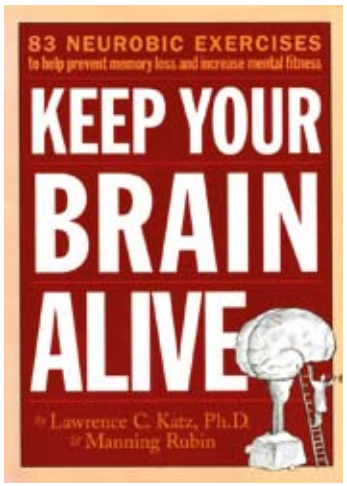
Since the 1940s, autism has moved from being considered a "disorder of affective contact whose causes are essentially psychogenic, to being seen as a "disorder of the brain" with, sometimes, a genetic component. The research focused on the factors, both in the medical field and in the wider culture of Western societies, that account for such diagnostic transformations.

Francisco Ortega (Visiting Scholar, Universidade do Estado do Rio de Janeiro, Brazil, funded by PROBRAL)

Brain Fitness and Neurobics from the 1840s to the Present

The project examines how the neurobics literature reproduces commonplaces of earlier self-help literature, even going back to the nineteenth century, with an updated scientific vocabulary. Among those practices, "neuroascesis," or a cerebral self-discipline aimed at maximizing brain performance, has gained considerable momentum. This particular culture is socially significant in that it contributes to form neurosocialities and neuroidentities. Identifying oneself as a cerebral subject implies adopting a biosocial criterion of social grouping, as can be seen in support groups for bearers of different diseases and neurodegenerative disorders and their families.

Francisco Ortega



Book-cover of Lawrence Katz's and Rubin Manning's bestseller *Keep Your Brain Alive: 83 Neurobic Exercises to Help Prevent Memory Loss and Increase Mental Fitness.* New York, 1999

Maria Paula Sibilia (Visiting Scholar, UniversidadeFederal Fluminense, Rio de Janeiro, Brazil, funded by PROBRAL)

Digitialized Memory and the Cerebral Subject

The project examines how various forms of corporality relate to the rise of the anthropology of the cerebral subject since the second half of the 20th century, partly focusing on the popularization of theories about memory, and on speculations about the "digital" manipulation and erasure of memories as an instance of the digitalization of the cerebral subject.

Fernando Vidal

Fernando Vidal (Research Scholar, MPIWG)

The Cerebral Subject: Brain and Self in Contemporary Culture

Working towards a cultural history of the belief that "we are our brains" and a topography of the growing "neurocultural" universe, the project focused largely on two areas. One is the emergence of neuroethics as a new discipline that since the early 2000s has received wide media coverage, and undergone an extraordinarily rapid institutionalization and professionalization. The other area is the elaboration of the "cerebral subject," or the belief that persons are essentially their brains, in film, especially in movies of the 1940s through the 1970s where the brain itself appears as a main protagonist, as well as in movies that, since the 1980s, have capitalized on the memory theory of personal identity.

The "superpowers of the brain" in the company of the most expensive meals in the world, vampires, the clash of civilizations, the cars of the future, and ET's landing in India. Cover of the popular Brazilian magazine *Superinteressante,* August 2006

Rafaela Teixeira Zorzanelli (Visiting Predoctoral Fellow, Universidade do Estado do Rio de Janeiro, Brazil, funded by PROBRAL)

The Neuroscientific Transformation of the Psychosomatic Field

Current practices in the psychosomatic field are increasingly influenced by the neurosciences. Such clinical entities as fibromyalgia, myofascial syndrome, irritable bowel syndrome, temporomandibular disorders or restless leg syndrome, which stimulated the study of the relationship between physical and mental factors, are being redefined in neurobiological terms. The project deals with how the understanding and treatment of these classically "psychosomatic" conditions, which were earlier understood from a holistic and psychogenetic perspective, are being transformed by the conviction that the human being can be defined primarily in terms of his or her brain.

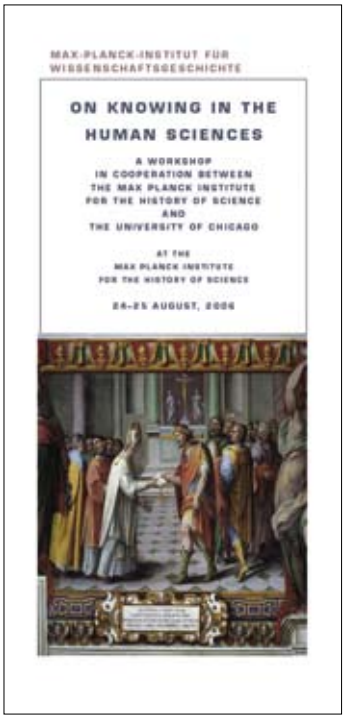
Project

The History of the Human Sciences

MPIWG ORGANIZER *Lorraine Daston*
COOPERATING ORGANIZERS *Robert J. Richards* (University of Chicago, U.S.A.), *Alison Winter* (University of Chicago, U.S.A..)
COOPERATION PARTNERS University of Chicago, U.S.A.; Centre Alexandre Koyré, Paris, France

The History of the Human Sciences
Conferences

On Knowing in the Human Sciences, August 25–26, 2006
MPIWG ORGANIZERS *Lorraine Daston* (MPIWG), *Robert J. Richards* (University of Chicago, U.S.A.), *Alison Winter* (University of Chicago, U.S.A.)



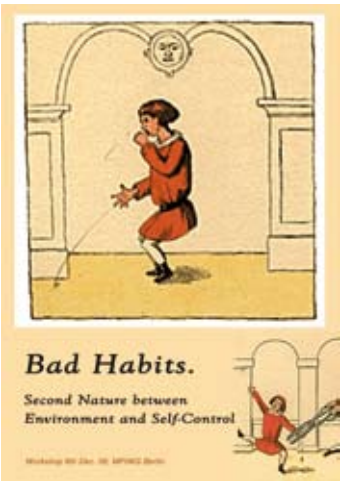
What kind of knowledge do the human sciences produce? Can the human sciences grow, discover, invent, probe, prove, explain, predict—in short, create knowledge as it has come to be defined on the basis of successes in the sciences of life, matter, and energy? This workshop brought together a small group of scholars and students to explore the knowledge-making practices of the human sciences. In contrast to the rich recent literature on the history of scientific practices, there has been almost no sustained historical inquiry into the practices of the human sciences. Yet it is out of these practices that disciplines crystallize. Taught since the early nineteenth century in university seminars, the skills by which historians learn to ferret out archival secrets, philologists to construct text stemmata, economists to model mathematically, art historians to look at a painting, anthropologists to go into the field, literary scholars to read a text—all these skills create disciplines, as both a well-bounded domain of inquiry and a distinctive habitus.

On the Responsibilities of the Human Sciences,
University of Chicago, October 20–21, 2006.
ORGANIZERS *Lorraine Daston* (MPIWG), *Robert J. Richards* (University of Chicago, U.S.A.), *Alison Winter* (University of Chicago, U.S.A.)
COOPERATION PARTNER Franke Center for the Humanities, University of Chicago, U.S.A.

Scientists exercise (or should exercise) various modes of responsibility: representations well grounded in the evidence; appropriate attributions; restraint on generalization; fair treatment of other races, nationalities, groups; illustrations that are not molded to the ends of argument; consideration of the psychological state of subjects.

For instance, a scientist might offer an illustration as evidence for a conclusion, when it more properly ought to be regarded as a pedagogical aid to make clear the theory at issue. On the other side of the text, historians bear responsibility to their readers and to the subject of their concern. The workshop posed questions of responsibility on hand from both historical and contemporary examples taken from sociology, psychoanalysis, psychology, film studies, history, and the neurosciences.

Bad Habits. Second Nature between Environment and Self-Control,
December 9, 2006
ORGANIZER *Bernhard Kleeberg* (MPIWG/Universität Konstanz, Germany)



Nineteenth-century discourses on the social question show an increasing interest of economists and social engineers, physicians and psychologists, pedagogues, or philanthropists in the environmental and structural causes of poverty. Often, their respective explanations referred to habitual modes of behavior, practices and attitudes, to *bad habits* in the sense of weak will, lack of self-control, bad character, unrestrained appetites, barbarism, and the like. In order to explore new perspectives for research and build up an international research-network, the workshop assembled scholars working on related aspects in 18th to 20th century approaches to instinctive and emotional behavior, socio-cultural norms and moral economies, practices of self-control and social discipline.

Ruptures: Music, Philosophy, Science, and Modernity,
July 26 – 28, 2007
ORGANIZERS *Martin Brody* (Wellesley College, U.S.A.), *Arnold Davidson* (University of Chicago, U.S.A)

The conference brought together composers, performers, musicologists, historians of science, and philosophers from Europe and the United States for intensive discussion of the notions of discontinuity, rupture, tradition, and innovation in modern and contemporary science and music. These have been dominant themes in the twentieth-century historiography of music, philosophy, and science, a striking convergence of narratives among disciplines that otherwise seldom intersect. The conference included scholarly presentations as well as concert performances, bridging the gap between traditionally distinct intellectual paradigms: historiography, epistemology, aesthetics, performance, and composition. The comparison and confrontation between science and music allowed to rearticulate concepts and practices in the history of science, stimulating new directions in interdisciplinary research.

The History of the Human Sciences
Planned Conferences

Crisis? What Crisis? Causes, Contexts, and Consequences of the "Crisis in Psychology" in the Early 20th Century,
October 10–12, 2008
ORGANIZERS *Ludmila Hyman* (MPIWG), *Thomas Sturm* (MPIWG)

Psychologists from the late 19th century until the 1930s diagnosed their discipline as being in crisis, a reaction against the high expectations connected with the new psychological laboratories, institutes, journals, societies, and research practices established since the 1870s. Many had hoped that these new frameworks would guide psychology upon the secure path of an experimental and, thereby, proper science. However, by 1900 these expectations were met by doubts and criticisms. The early twentieth-century debate dealt with fundamental questions: Were the results of the new experimental studies to be trusted? Would different experimental approaches converge towards a unified theoretical and methodological framework? Could psychology become a respected science like physics, chemistry, or astronomy? The workshop will explore both the historical contexts and the current relevance of the debate for psychology and the history and philosophy of science.

What Are the Human Sciences? Traditions, Histories, Reflections,
Paris, September 2009
ORGANIZERS *Jacqueline Carroy* (Centre Alexandre Koyré, Paris, France), *Lorraine Daston* (MPIWG), *Jan Goldstein* (University of Chicago, U.S.A.)

Les sciences humaines, die Geisteswissenschaften, the social sciences and the humanities: simply to name the major divisions of knowledge dedicated to the study of things human in the major European languages is to evoke contrasting traditions concerning what is to be investigated—and how and why. These disjunctions are signs of different national traditions and institutions, for the most part established since the eighteenth century. The corresponding histories have played an active role in shaping the self-image and agenda for the human sciences: the past has been made to serve as prologue, justification, alternative, and cautionary tale for the present. The purpose of the conference is to reflect upon the significance of the distinct traditions and uses of the history of the human sciences, rather than to take them for granted. The chronological framework will be the eighteenth through the twentieth centuries and francophone, anglophone, and germanophone traditions supply the subject matter.

The History of the Human Sciences
Individual Projects

John Carson

John Carson (Visiting Scholar, University of Michigan, Ann Arbor, U.S.A., funded by the University of Michigan, Ann Arbor)

Mental Ability and the Birth of Medical Jurisprudence

The project investigates the relations between the medical and legal communities that developed during the nineteenth century around the issue of individual mental ability and competency, focusing in particular on the concept of idiocy. By teasing out the complex ways in which physicians, mental philosophers, asylum keepers, lawyers, and judges constructed notions of mental deficiency, the project reveals the range of ways in which individuals could be categorized according to their mental ability, the meaning of these abstract categorizations when applied to specific situations, and the means by which knowledge generated in one context could, or could not, become persuasive within another.

Philip Kitcher

Philip Kitcher (Visting Scholar, Columbia University, New York, U.S.A., funded by Columbia University)

Naturalistic Ethics

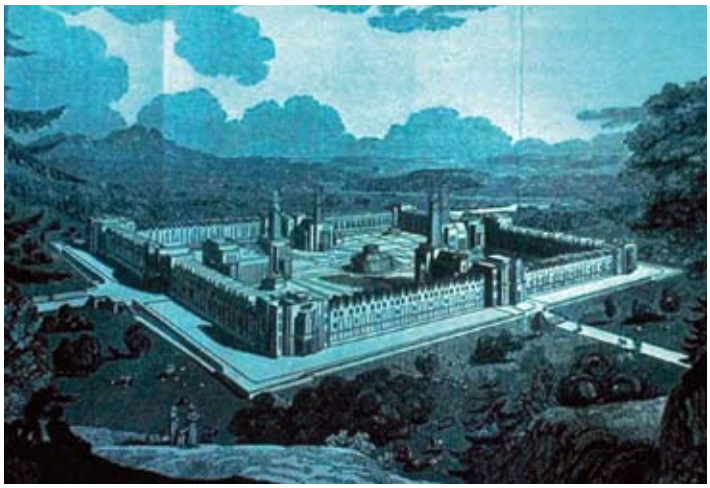
This naturalistic approach to ethics elaborates a very general philosophical stance, pragmatic naturalism, which fuses ideas from the classical pragmatists (particularly James and Dewey) with the opposition to mysterious entities and processes that is the hallmark of naturalism. Central to this approach is the thought that we can understand human practices—the sciences, religion, mathematics, and ethics—by analyzing the historical processes that have produced them in their current forms. Following themes from Dewey, the task is conceived not as developing any complete system of ethics, but of going on from where we are.

Bernhard Kleeberg

Bernhard Kleeberg (Research Scholar; as of October 2007, Assistant Professor, Universität Konstanz, Germany)

Raising the Standard of Living. The History of a Concept, 1750–1900

The project studied the emergence of structural and mechanical explanations of the "social problem" in the 19th century: mechanisms of (cultural) evolution, social environment, physiological conditions and anthropological dispositions of the poor. Embracing statistical methods and referring to observations from social surveys, the advocates of these approaches presented their newly gained knowledge in form of tables, diagrams, architectural drawings, and maps. Claiming that government interference was necessary, they dismissed traditional accounts of poverty that relied on divine or individual (moral) providence and questioned the distinction between deserving and undeserving poor. Central to their program was the possibility of improving living standards.



Model Colony for the Poor at New Harmony, Indiana (1826).
Robert Owen, Richard Ketchum ed., *The American Heritage Book of the Pioneer Spirit,* p. 252., 1959 (Library of Congress, Prints and Photographs Division, Washington, DC. LC-USZ62-1045)

Margaret Schabas (Visting Scholar, University of British Columbia, Vancouver, Canada)

Hume's Political Economy

The project takes Hume's dozen or more essays on economic subjects and imbeds them in the context of his moral and political philosophy. Topics include "Temporal Dimensions in Hume's Monetary Theory," and "Thought Experiments in Hume's Political Economy."

Margaret Schabas

Udo Thiel (Visiting Scholar, Australian National University, Canberra, Australia, funded by the Australian National University)

Self-Consciousness and Personal Identity in Eighteenth-Century Philosophy

The book project deals with the notions of self-consciousness and personal identity in eighteenth-century German, French, and British philosophy. The book's aim is twofold: (1) to provide an account of the development of this topic in the eighteenth century, and critically to evaluate the contributions of both "major" and "minor" thinkers of the period; and (2) to explain the philosophical arguments in their historical context. This means that developments outside the narrow area of what is today called "philosophy" are taken into account. These include, for example, developments in the history of science and theology.

Udo Thiel

Ongoing Project

Gender Studies of Science

MPIWG ORGANIZERS *Christine von Oertzen, Annette Vogt*
COOPERATIONS "Women and Gender in the History of Science and Medicine: State of the Arts and Future Perspectives." Cooperation between the MPIWG (Coordinator: *Christine von Oertzen)* and the Wellcome Trust Centre for the History of Science and Medicine, London, U.K. (Coordinator: *Helga Satzinger)*

The analytical category of gender comes close to being an anthropological universal, structuring almost all known cultures—their economies, polities, institutions, and thought systems. Historically, science has been no exception. Department II supports a number of studies on this topic on an ad hoc but ongoing basis.

Gender Studies of Science
Planned Conferences

Women and Gender in the History of Science and Medicine: State of the Arts and Future Perspectives, August 29, 2008
ORGANIZERS *Christine von Oertzen* (MPIWG)*; Helga Satzinger* (Wellcome Trust Center for the History of Medicine, London, U.K.)

Research on the history of women and gender in science has expanded considerably in the recent past and has, at the same time, become more and more diverse. This small workshop with a few leading scholars in the field aims to evaluate and synthesize the research on women and gender in the history of science and medicine of the past decade, and to identify promising avenues for future research. The workshop also serves to conceptualize two conferences in 2009 and 2010, to be hosted in Berlin and London respectively. These conferences will give junior and senior researchers the chance to present current work in progress.

Gender Studies of Science
Individual Projects


Hannah Lotte Lund

Hannah Lotte Lund (Coordinator of the Research Network on the History of Scientific Objects, MPIWG)
Jewish Salonières in Berlin circa 1800
The project focuses on the forms and results of the communication that took place in Jewish open houses in Berlin around 1800. Theoretically, in a time when women and Jews were excluded from almost any public career and most of the public places, a salon gave them the opportunity to circumvent this exclusion. By inviting members

of the public, politicians, authors, actors, to their private homes, the women were able to participate in the intellectual discourse of their time. Many prominent writers on the women question around 1800 attended salons regularly. Some of the most influential gender theories of that time, by Wilhelm von Humboldt or Friedrich Schlegel, were literally written on salon tables. In what way did the salon experience influence the men's ideas on woman in general?

Duchess Anna Amalia of Saxony Hosting a Soiree.
Watercolor by Georg Melchior Kraus, Goethe-Nationalmuseum, Weimar, Germany, around 1795

Christine von Oertzen (Research Scholar, MPIWG)

Gender, Science, Internationalism: A Transnational History of Female Academic Networking, 1917–1950

Christine von Oertzen

The book project is an account of the formation and fortunes of a new, international academic community of women, the International Federation of University Women (IFUW). It depicts how the IFUW took shape, and tracks the Federation's activities across five decades, examining the shifting political, social, and intellectual contexts in which the organization sought to implement its ambitious goals. The work deals with the actors and concepts, programs and strategies of the Anglo-American dominated umbrella organization, but with special attention to what the IFUW meant for female academics and scholars from Continental Europe, and particularly for those from Germany. The entangled past of the IFUW and the German Federation of University Women reveals a history of a female academic network across national borders and academic cultures, scientific disciplines, and generations.

International Convention of the IFUW 1932 in Edinburgh. The IFUW leadership is getting ready to marching to the opening ceremonies, with the Mayor of Edinburgh and the President of the University of Edinburgh. (Courtesy International Federation of University Women, Geneva)

Annette Vogt

Annette Vogt (Research Scholar, MPIWG)

Women Scientists at the Berlin University and in the Kaiser Wilhelm Society

The book on women scientists (published in 2007) draws a multitude of national and international comparisons between disciplines, institutions and persons, including comparisons of the conditions for male and female scientists. The study consists of two "long durée" studies about women scientists at the Berlin University (from 1899 until 1945), and in the Kaiser Wilhelm Institutes (from 1911 until 1945). A supplement takes into account the development from 1945 until 1948/1949. Other topics include the involvement of women scientists in the different resistance movements against the Nazis and the impact of this history for contemporary debates about women's role in science and society.

Members of the Chemical Department, Deutsche Forschungsanstalt for Psychiatry (KWI) in Munich, ca. 1930. On the left is Lydia Pasternak. (Photo: Private Collection)

Ongoing Project

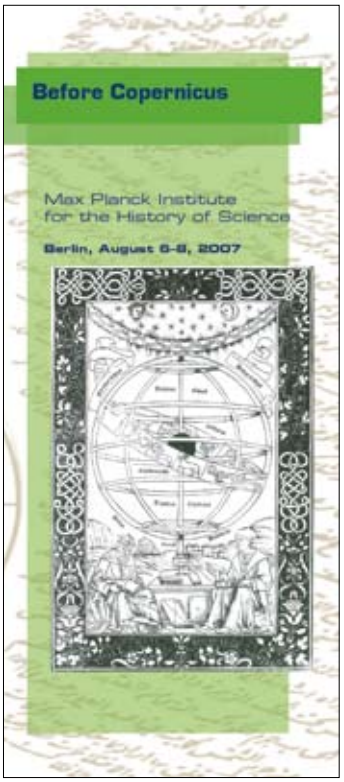
Science in Circulation: The Exchange of Knowledge among Islam, Judaism, and Christianity, 9th–17th Centuries

MPIWG ORGANIZER *Lorraine Daston*
COOPERATING ORGANIZERS *Rivka Feldhay* (University of Tel Aviv, Israel), *Jamil Ragep* (McGill University, Canada), and *Sally Ragep* (McGill University, Canada)
COOPERATION PARTNERS McGill University, Canada; American Council of Learned Societies; Member Institutions of ISMI Board (see below)

Working Group

Before Copernicus: The Cultures and Context of Scientific Learning in the Fifteenth Century
ORGANIZERS *Rivka Feldhay* (Tel Aviv University, Israel), *Jamil Ragep* (McGill University, Canada)

The project aims to investigate the encounter and cross-fertilization among the Eastern and Western learning traditions that constituted astronomical knowledge in the century before Copernicus and had an impact on his work. The Working Group consists of scholars specializing in history of astronomy, history of science, intellectual history and cultural history of the Islamic, Byzantine-Greek, Jewish and Western-European traditions. Geographically, the scope of the project stretches from Samarkand and Istanbul to Eastern, Central, and Western European countries.



The main questions posed by the Working Group are: (1) What was the status of astronomical models in the Eastern and Western astronomical traditions? (2) What was the relationship of astronomy to mathematics and to physics, and what was the epistemological status of astronomical arguments in those traditions? (3) How was the relationship between appearances and theoretical presuppositions conceived? What was the status of the un-

observable or invisible in astronomy? (4) What was the status of the principles of motions in astronomy—physical or metaphysical—and how were these related to the understanding of terrestrial motion? (5) What was the social status of astronomers and how was it related to astrological and medical practices? (6) How could models of writing, reading and publishing in Europe affect the reception of the work of Copernicus? (7) What was the image of Islam and the Ottomans among Europeans in the 15th century and how could it affect the reception of Islamic traditions?

The first meeting of the group took place in December 2006, the second in August 2007, and a third one is planned for December 2008. As with other MPIWG Working Groups, the meetings focus on the discussion and revision of precirculated papers. The final product will be a collectively authored book that will offer a re-evaluation of the rich conversation between different traditions and disciplines that constitutes the relevant context for interpreting Copernicus' contribution.

Members

- *Nancy Bisaha* (Vassar College, U.S.A.)
- *Christopher S. Celenza* (Johns Hopkins University, U.S.A.)
- *Raz Chen-Morris* (Bar Ilan University, Israel)
- *Ihsan Fazlioglu* (Istanbul University, Turkey)
- *Rivka Feldhay** (Tel Aviv University, Israel)
- *Maria Mavroudi* (Princeton University, U.S.A.)
- *Robert Morrison* (Whitman College, U.S.A.)
- *Jamil Ragep** (McGill University, Canada)
- *Sally Ragep** (McGill University, Canada)
- *Michael Shank* (University of Wisconsin at Madison, U.S.A.)
- *Edith Sylla* (North Carolina State University, U.S.A.)

(* indicates Working Group members who were also Visiting Scholars at the MPIWG in connection with the *Before Copernicus* project)

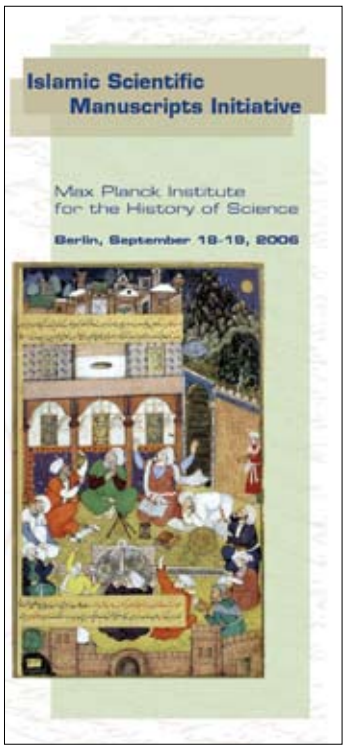
Science in Circulation
Islamic Scientific Manuscripts Initiative (ISMI)

MPIWG ORGANIZER *Lorraine Daston*
COOPERATING ORGANIZERS *Jamil Ragep* (McGill University, Canada), *Sally Ragep* (McGill University, Canada)
COOPERATION PARTNERS McGill University, Canada; American Council on Learned Societies

Member Institutions of the ISMI Board: Institute for the Study of Muslim Civilizations, Aga Khan University, London, U.K.; Archimedes Project, Harvard University, U.S.A.; Filologia Semítica, Universitat de Barcelona, Spain ; Encyclopaedia Islamica Foundation, Tehran, Iran; Institute for the History of Arabic Science, Aleppo Univer-

sity, Syria; Institute for the History of Science and Technology, Moscow, Russia; Institute of Ismaili Studies, London, U.K. Warburg Institute, London, U.K.; The Written Heritage Research Center, Tehran, Iran

The ISMI project aims to make available a vast array of information about the exact sciences in the premodern Islamic world. Through the internet, this material will be accessible without charge both to researchers and experts in the field and to the educated public worldwide. It will be an online database that contains the works of some 1,700 authors who span the entire Islamic world from Islamic Spain to India and the borders of China, beginning in the eighth century and continuing until the nineteenth. These works in astronomy, mathematics, physics, geography, mechanics, and related disciplines number in the thousands and are represented, conservatively speaking, by tens of thousands of manuscript copies spread throughout the world.



The first meeting of the ISMI Advisory Board was held at the MPIWG 18–19 September 2006. In December 2007 a delegation representing the MPIWG and the ISMI project and logistically supported by Professor Raza Ansari traveled to India for two weeks to survey manuscript collections in Aligarh, Patna, and Hyderabad and to establish ties with the National Mission for Manuscripts in New Delhi.

Completed Project

Knowledge and Belief (2003–06)

MPIWG ORGANIZERS *Lorraine Daston, Bernhard Kleeberg, Fernando Vidal*
COOPERATION PARTNERS Princeton University, U.S.A.; McGill University, Canada

In its final year, two working groups *(Natural Theology* and *The Epistemology of Belief)* and one conference *(Miracles as Epistemic Things)* associated with this project concluded publication of their results, while the third working group *(Before the Revolutions: The Fifteenth Century)* formed the basis for a new group on pre-Copernican science in multicultural context (see *Science in Circulation: The Exchange of Knowledge among Islam, Judaism, and Christianity, 9th–17th Centuries)*.

Knowledge and Belief (2003–06)

Working Groups

Natural Theology

MPIWG ORGANIZERS *Bernhard Kleeberg, Fernando Vidal*

MEMBERS *Rivka Feldhay* (Tel Aviv University, Israel), *Bernhard Kleeberg* (MPIWG), *Scott Mandelbrote* (University of Cambridge, U.K.), *Joan L. Richards* (Brown University, U.S.A.), *Laura Ackermann Smoller* (University of Arkansas at Little Rock, U.S.A.), *Fernando Vidal* (MPIWG)

The contributors to the *Science in Context* issue "Believing Nature, Knowing God" started working together on the history of natural theology, one of the major ways in which the relationship between knowledge and belief has been construed within the history of science. From the 17th to 19th centuries, "natural theology" designated the knowledge of God drawn from the "book of nature," in contrast to knowledge of God contained as revelation in the "book of scripture." The way the terms "knowledge" and "belief" are usually employed implies a dichotomy. While knowledge seems to require belief, belief does not seem to necessitate knowledge. Knowledge stands on the side of objectivity, proof and science; belief, on the side of subjectivity, opinion and faith. In practice, knowledge and belief have been much more intimately linked than is suggested by the usual dichotomies. When examined in specific historical cases, the epistemic and cognitive states of knowledge and belief turn out to function together as a crucial element for the context of science. Procedures to gain knowledge about nature entail intellectual and social mechanisms aimed equally at producing belief in the value and legitimacy of the methods used and the evidence generated. If authors engaged in natural theological activities affirm or discover religious truths by their study of nature, at the same time they express their faith in an epistemology that trusts the perceptions of the senses and the faculty of reason.

Bernhard Kleeberg, Fernando Vidal, eds. Believing Nature, Knowing God Special issue of *Science in Context* (vol. 20, n° 3, September 2007)

- *Fernando Vidal and Bernhard Kleeberg,* "Introduction: Knowledge, Belief, and the Impulse to Natural Theology"
- *Rivka Feldhay,* "Thomist Epistemology of Faith: The Road from 'Scientia' to Science"
- *Laura Ackerman Smoller,* "Astrology and the Sybils: John of Legnano's *De adventu Christi* and the Natural Theology of the Later Middle Ages"
- *Scott Mandelbrote,* "The Uses of Natural Theology in Seventeenth-Century England"
- *Fernando Vidal,* "Miracles, Science, and Testimony in Post-Tridentine Saint-Making"
- *Joan L. Richards*, "In Search of the 'Sea-Something': Reason and Transcendence in the Frend/De Morgan Family"
- *Bernhard Kleeberg,* "God-Nature Progressing: Natural Theology in German Monism"

The Epistemology of Belief

ORGANIZER *Lorraine Daston* (MPIWG)

MEMBERS *Mary Baine Campbell* (Brandeis University, U.S.A.), *Lorraine Daston* (MPIWG), *Arnold I. Davidson* (University of Chicago, U.S.A.), *John Forrester* (University of Cambridge, U.K.), *Simon Goldhill* (University of Cambridge, U.K.)

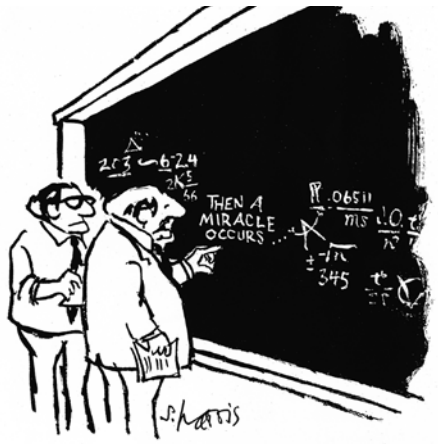
The aim of the group was to reflect on the bases of reasonable belief in science and scholarship now, in light of several decades of dissatisfaction with prevailing philosophical models of the relationship between knowledge and belief—and also in the context of recent political attacks on the credibility of science and scholarship. The multi-authored article (1) set forth the main features of the standard, "Enlightenment" model of knowledge and belief; (2) surveyed the criticisms advanced by scholars and scientists to the standard model; and (3) outlined what an alternative model of knowledge and belief that is more, not less faithful to reality might look like.

Mary Baine Campbell, Lorraine Daston, Arnold I. Davidson, John Forrester, and Simon Goldhill, "Enlightenment Now: Reflections on Knowledge and Belief," *Common Knowledge* 13 (2007): 429–450.

Miracles as Epistemic Things

ORGANIZER *Fernando Vidal* (MPIWG)

This book project resulted from a workshop held in October 2004 and has been accepted for publication by Brill. The purpose of this book is to explore the problems raised by miracles as exemplary objects of both knowledge and belief, to bring miracle-making into the purview of the history of science broadly conceived, and to explore the theme beyond the rubric of "science and religion." The theological issues concern the existence and powers of supernatural agents other than God (e.g. demons who might produce apparent miracles), or the place of the miraculous in the economy of salvation. The metaphysical issues concern the very possibility of miracles, and through it, the nature of nature and the boundaries that separate it from the supernatural; and the epistemological ones, the establishment of these boundaries by means of practices that involve theorizing and applying such notions as fact, evidence, causality, and probability.



"I THINK YOU SHOULD BE MORE EXPLICIT HERE IN STEP TWO."

Cartoon by Sidney Harris. (Courtesy of the artist)

Fernando Vidal, ed. Miracles as Epistemic Things

- *Thomas Wetzstein,* "Proving the Supernatural. Miracles, Sanctity, and the Law of Evidence in Medieval and Early Modern Canonization"
- *Laura Smoller,* "Authentic Miracles in Public Form. Canonization and the Authentication of Miracles in the Case of Vincent Ferrer (d. 1419)"
- *Gábor Klaniczay,* "The Construction of Healing Miracles in the Age of Medieval Canonization Processes"
- *Gianna Pomata,* "Making Room for Doubt. Medical Testimony in Late 17th Century Canonization Proceedings"
- *Fernando Vidal,* "Trust, Knowledge, and Miracles in Prospero Lambertini's Doctrine and Praxis"
- *Nancy Caciola* and *Moshe Sluhovsky,* "The Discernment of Spirits in Medieval and Early Modern Europe"
- *Elisabeth Claverie,* "The Work of Testing an Apparition and Its ‚Grammars.' The Case of Medjugorje"
- *Andrew Keitt,* "Cutting the Gordian Knot of Spiritual Imposture. Feigned Sanctity in 16th and 17th Century Spain"
- *Arnold Davidson,* "Representing the Stigmata: Miraculous Event, Mystical Experience"
- *Vittorio Casale,* "The Role of Images of Saints and Miracles in Canonization Ceremonies in the Late 17th and Early 18th Centuries"
- *Claire Gantet,* "Hans Engelbrecht (1599–1642) and the Uncertainty of Protestant Miracles"
- *Scott Mandelbrote,* "English Protestants and the Meaning of Miracles"

Short-term Visiting

Pre- and Postdoctoral Fellows 2006–7

- *Zeynep Celik* (Massachusetts Institute of Technology, U.S.A., funded by the Center for Advanced Study in the Visual Arts): Kinaesthetic Impulses: Space, Performance, and the Body in German Architecture, 1870 – 1914
- *Christopher DiTeresi* (Visiting Predoctoral Fellow, University of Chicago, U.S.A.): Visualization and Experiment in Early Entwicklungsmechanik
- *Anna Echterhölter* (Visiting Predoctoral Fellow, Humboldt-Universität zu Berlin, Germany): Epistemic Values in Obituaries of Scientists (1760 – 1860)
- *Maurizio Meloni* (Visiting Postdoctoral Fellow, Università la Sapienza di Roma, Italy): Molecular Dasein: Living and Thinking in a Neurobiological Era
- *Alessandro Pajewski* (Visiting Predoctoral Fellow, University of Chicago, U.S.A.): The Role of the Emotions in Nineteenth-Century Evolutionary Theory
- *Alireza Taheri* (Visiting Predoctoral Fellow, University of Cambridge, U.K.): Comparative Study of Freud and Nietzsche on Guilt

- *Tuomo Tiisala* (Visiting Predoctoral Fellow, Helsingin Yliopisto, Helsinki, Finland, funded by the Finnish Cultural Foundation): Historical Epistemology and Philosophy
- *Sophia Vackimes* (Postdoctoral Fellow, The New York School for Social Research, U.S.A., funded by the Max Planck Research Network on the History of Scientific Objects): The Aesthetics of Genetic Engineering (for an abstract of the project see p. 155)
- *Cecelia Watson* (Visiting Predoctoral Fellow, University of Chicago, U.S.A.): The Art of Science: William James and John La Farge
- *Mechthild Widrich* (Visiting Predoctoral Fellow, Massachusetts Institute of Technology, U.S.A.): Performative Monuments. Commemoration in Postwar Europe
- *Rafael Ziegler* (Visiting Predoctoral Fellow, McGill University, Canada, funded by the Canadian Social Science and Humanities Research Council): Visions Need Accounts — Essays on Political Perception and Action in a Statistical Age

Short-term Visiting Scholars 2006–7

- *Hannah Baader* (Kunsthistorisches Institut (MPI), Florence, Italy, funded by Kunsthistorisches Institut, Florence): A Visual History of the Mediterranean
- *Marie-Noëlle Bourguet* (Université de Paris-Denis Diderot VII, France): Note-Taking by Scientific Travelers
- *Monika Dommann* (Universität Zürich, Switzerland, funded by Schweizerischer Nationalfonds): Copying in Libraries: A History of Science, Technology, and Law
- *Mechthild Fend* (University College of London, U.K., funded by Princeton University, U.S.A.): History and Representation of Skin in late 18th and 19th Century France
- *Hannah Ginsborg* (University of California, Berkeley, U.S.A., funded by the University of California, Berkeley, U.S.A.): The Normativity of Nature: Empirical Concepts, Aesthetic Experience, and Teleology in Kant's *Critique of Judgment*
- *Matthew L. Jones* (Columbia University, U.S.A., funded by U.S. National Science Foundation): Early Modern Calculating Machines
- *Fabien Locher* (Centre Nationale de Recherche Scientifique, Paris, France): Geomagnetic and Meteorological Expeditions in the Early Nineteenth Century
- *Wolfgang Schivelbusch* (New York University, New York, U.S.A.): The Mythology, Physiology, and Economics of Air
- *Danny Trom* (Centre National de Recherche Scientifique, Paris, France, funded by Centre National de Recherche Scientifique): Seeing Landscapes: The Politics of Nature in late 19th Century Germany
- *André Turmel* (Laval University, Quebec City, Canada, funded by Laval University): Scientific Observation and Developmental Psychology
- *M. Norton Wise* (University of California, Los Angeles, U.S.A., funded by the University of California, Los Angeles): Bourgeois Berlin and Laboratory Science

Department III

Anonymous. n.d. [Table with laboratory equipment in the field].
Photography. Università di Torino, Biblioteca Angelo Mosso

Department III

Experimental Systems and Spaces of Knowledge

Director: *Hans-Jörg Rheinberger*

Department III is headed by Hans-Jörg Rheinberger. Most of the research activities of the department revolve around the practical, conceptual, and cultural conditions of scientific innovation. Since the early modern period, scientific activity has been associated with the exploration of novel, uncharted ground. Today, the sciences have become a predominant factor of social and cultural innovation; they have penetrated all domains of modern everyday life. But if the essence of science resides in the production of new knowledge, a question of fundamental importance arises for the historian of science: how do scientists manage to produce knowledge that can be considered reliable, although their work essentially deals with objects that still lie in the realm of the unknown, and although time and again they have to be ready to discard knowledge that was believed to be certain?

In one way or another, the projects of Department III are devoted to exploring the dynamics of scientific change. The working group on the experimentalization of life focuses on the relation among science, technology, and the arts around 1900. The working group on the cultural history of heredity explores the long-term changes in the very concept of heredity. And the working group on knowledge in the making centers on the activities of drawing and writing as exploratory techniques in science, art, and literature. Many, although not all by far, of the case studies are located in the broad field of the life sciences: from the beginnings of the exploration of heredity in eighteenth-century agriculture and medicine to the most recent developments in molecular genetics; from classical and romantic natural history to experimental physiology; from gardening around 1800 to synthetic biology of the present.

Within the last 150 years in the sciences, the constellations of expertise, of model organisms, instruments, and experimental arrangements have developed into separate disciplines with remarkable stability, physiology being a good example. But disciplines have also dissolved, such as, most recently, molecular biology, and given way to new and different research fields. Experimental objects, instruments, methods, concepts, and specialists have changed fields; they have been reconfigured in ever-new constellations with concomitant unprecedented developments.

To explore these dynamics in depth, the research projects of the department are organized around topical domains with a long-term perspective, embedded in a multidisciplinary horizon. The individual projects of the research scholars usually take three to five years, those of the postdoctoral fellows two years. New projects are selected in such a way as to provide a certain amount of overlap with ongoing research activities in one of the domains. This allows for the development of individual research agendas, while encouraging the emergence of new common projects extending over disciplinary and epochal boundaries.

For many years, the department has also worked on the development of a "Virtual Laboratory." The Virtual Laboratory is a web-based platform devoted not only to collecting and making accessible a broad range of textual and pictorial sources, but also to constructing an electronic research and publication environment.

Since the founding of the department in 1997, three topical domains have shaped our work. They will briefly be described before reporting on the work in the period between 2006 and 2007.

History and Epistemology of Experimentation

Philosophers and historians of science agree that since the early modern period, the experiment has been at the center of the process of knowledge creation. Detailed investigations on the varieties of experimentation, however, are of relatively recent origin. Indeed, upon closer inspection, it turns out that there is no such thing as "the" experimental method. Rather, different forms and styles of experimentation have developed over time and are to be distinguished from one another. They are connected with particular phases of scientific work, and they characterize particular experimental cultures of certain time periods or disciplines. In addition, experiments often gain a life of their own that leads researchers away from their original goals and convictions. Often enough, phenomena that initially were seen as artifacts or disturbances became the center of attention, and methods that were seen as unproblematic data collection devices moved into the focus of epistemic interest. The historical dynamics of the sciences can only be understood properly if all possible forms of experimentation are taken into account in their own right, without elevating one of them to an ahistorical model of "the" good experiment.

History of Objects and Spaces of Knowledge

A decisive aspect of scientific innovation lies in selecting, adapting, and at times also turning away from particular objects. Unicellular organisms, sense organs, or populations, for instance, are not scientific objects in and of themselves; they become scientifically meaningful only inasmuch as they come to represent interesting phenomena such as organismic reproduction, the boundaries of perception, or supra-individual biological processes. Model organisms are a particularly interesting category

of objects for the history of the life sciences in this context. These objects, as a rule, are embedded in real and symbolic spaces within which they are manipulated, and which they shape in turn. Natural cabinets, laboratories, the "field" of the zoologist or the anthropologist, but also "virtual" environments, such as the paper surface of the laboratory protocol or computer simulations are instances of such spaces whose emergence and configuration we investigate in historical detail.

Formation of Concepts and Uses of Theory

Not least, processes of scientific innovation express themselves in the formation of new concepts and theories. We are less interested in a traditional history of ideas and concepts than in the concrete roles concepts and theories play in scientific practice. We are interested in the organizing function of concepts when experiments are being devised and conducted; in their role in the creation of research domains and scientific disciplines; in the relations between verbal and pictorial argumentation in the historical development of the life sciences; in the movement of metaphors between scientific and extra-scientific texts; and in particular in the function of writing and drawing in the emergence of figures of thought.

Together, the research projects of Department III contribute to a perception of the dynamics of scientific research that is characterized, above all, by historical contingency. Within the history of the sciences, whole disciplines derive their origin from accidental constellations of technical artifacts and their further development depends on achievements that may have their point of departure in other disciplines. The dissemination and solidification of technologies may result, and in their new form, may impinge on neighboring areas. There appears to be no "logic" of research that would, based on one particular method, forever yield scientific progress toward an anticipated goal. An idea that counts as revolutionary for today's science may reveal itself as an obstacle tomorrow; a technology that has beneficial applications now may deploy destructive effects in the future. Science, as a thoroughly human undertaking, has to be analyzed in all its historical and cultural ambivalence.

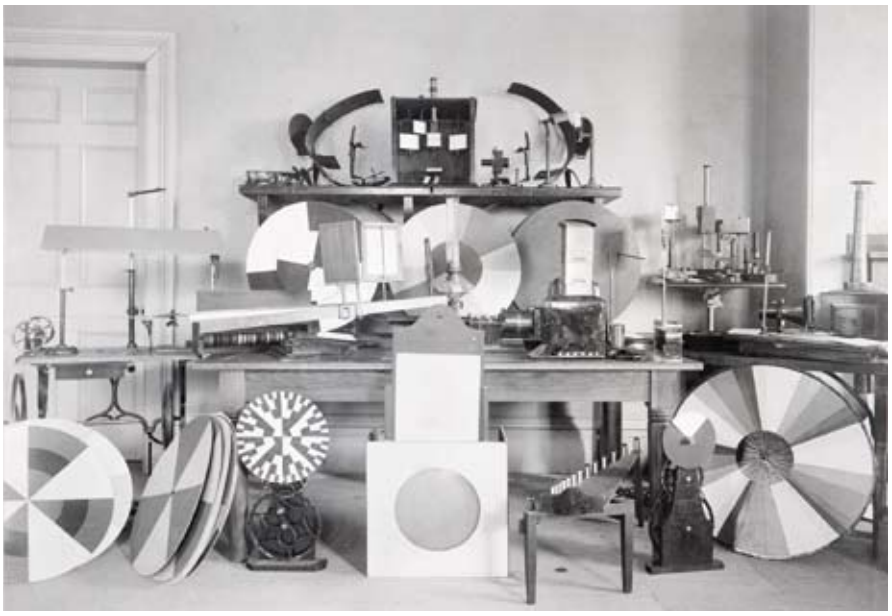
Project

Experimentalization of Life

RESEARCH SCHOLARS *Julia Kursell, Henning Schmidgen*
POSTDOCTORAL FELLOWS *Philipp von Hilgers, Britta Lange*
PREDOCTORAL FELLOWS *Christian Reiß, Sandra Pravica, Viola van Beek, Katrin Solhdju, Björn Brüsch*
VISITING SCHOLARS *Elfrieda and Erwin Hiebert, Rand B. Evans*
COLLABORATIONS Bauhaus Universität Weimar (Fakultät Medien); Hermann von Helmholtz-Zentrum für Kulturtechnik (Humboldt-Universität zu Berlin); Zentrum für Literatur- und Kulturforschung, Berlin; Freie Universität Berlin (Institut für Deutsche und Niederländische Philologie)
FUNDING VolkswagenStiftung, "Focus on the Humanities" of the Fritz Thyssen Stiftung and the VolkswagenStiftung, MPIWG

General Description of the Project

Focusing on the history of the experimental life sciences, the project develops a cultural history of experimental systems. It deals with the spaces, bodies, and traces that emerged in and were created by the "experimentalization of life" during the nineteenth and early twentieth centuries—inside and outside of laboratories. In particular, the project investigates experiments that were carried out in spaces such as soundproof rooms and test tubes, the physiological laboratory and the horticultural institute, prisoner of war camps and entire cities. It studies experimental practices involving cells and tissues, eyes and ears as well as nerves and brains taken from hu-



Anonymous. 1892. Harvard Psychological Laboratory in Dane Hall: Instruments for Experiments on Sight. Photograph. (Harvard University Archives call # HUPSF Psychological Laboratories (7))

man and animal bodies. It also explores the drawings, protocols, and notes of laboratory scientists, naturalists, and architects, comparing and contrasting them to marks produced by means of kymographs, ergographs, gramophones, and cinematographs. While describing and investigating these cultures of experiment in various contexts, the overall aim of the project is to contribute to an "epistemology of disturbances." The project highlights the role of friction, resistance, and misreadings as crucial aspects of the material and semiotic processes that lead to the production of experimental knowledge in science, technology, and the arts.

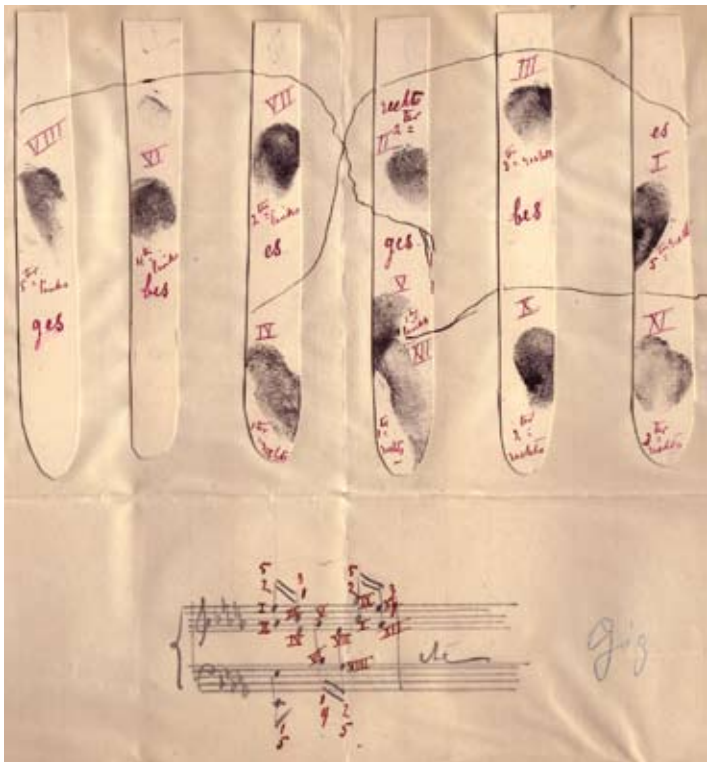
Experimentalization of Life
Individual Projects

Julia Kursell (Research Scholar)

Historical Epistemology of Hearing (1850–2000)

The project investigates key concepts and practices that have contributed to our present understanding of sound, hearing, and music. After 1850, knowledge of acoustics, which had been guided by the symbolic code of music well into the nineteenth century, began to be transformed into an experimental science of hearing. Through research on the history of media and the material culture of experimentation, the aim of this project is to show the understanding of hearing as historically changing, and thereby contribute to the current reorientation of research in the human sciences that deal with sound, hearing, and music.

Julia Kursell



Fingerprints from piano pedagogue and pianist Elisabeth Caland, registered by pianist Marie Jaëll and psychologist Charles Féré. (BNU Strasbourg, Fonds Marie Jaëll)

The project is divided into three parts, each of them focusing on a different historic constellation. The first part is a book project titled "Ear and Instrument—Hermann von Helmholtz's *On the Sensations of Tone as a Physiological Basis for the Theory of Music,*" which analyzes the relation among physiology, psychology, and the aesthetics of the acoustic around 1850. In 1856, Helmholtz started to work on the physiology of hearing. He developed a theory of hearing, according to which the ear analyzes complex waveforms by resolving them into their sinusoidal components. The devices used to study this theory produced sounds that were not present in nineteenth-century music, and the aesthetics of music that Helmholtz had called upon to corroborate the physiological theory of hearing eventually collapsed. If Helmholtz left it to aesthetics to draw the line between sound and music, the music of the 20th century, in the wake of Helmholtz, abandoned this distinction. In other words, his treatise *On the Sensations of Tone* suggested aesthetic experiments whose outcome was open.

The second part, "Experimentalization of Hearing: Moscow 1920–1930," deals with attempts to reconcile the diverging disciplines of aesthetics and scientific investigation into hearing in the early Soviet Union. Part three, "Music and Media after 1945," explores the history of composition from the perspective of media studies. In musical composition of this time, knowledge of the mechanisms of hearing came to be a prerequisite for the creation of music.

Henning Schmidgen

Henning Schmidgen (Research Scholar)

Chronos and Psyche: The History of Physiological and Psychological Time Experiments

This project deals with the history and epistemology of physiological and psychological time experiments. Following Hermann von Helmholtz's pioneering investigations into the propagation speed of stimulations in living nerves, a considerable number of nineteenth-century scholars started studying the time animal and human organisms require to respond to stimuli of all kinds (optical, acoustical, tactile, etc.). After 1850, two main strands of research were established. On one side, the investigations of scholars such as Albert von Bezold, Gabriel Valentin, Julius Bernstein, and Etienne Jules Marey contributed to defining and demarcating, within physiology, the field of "nerve and muscle physics." On the other side, the time experiments conducted by Franciscus Donders, Wilhelm Wundt, Edward Scripture, Hugo Münsterberg, and Alfred Binet led to the establishment of "experimental psychology."

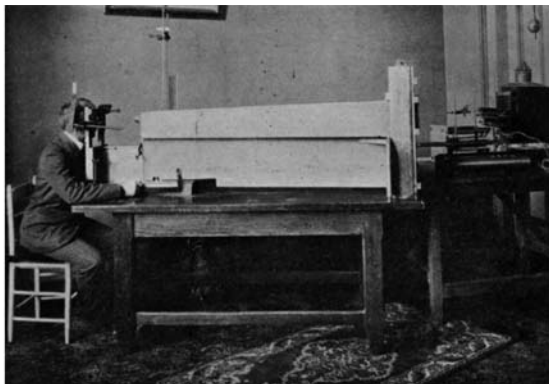
Instead of merely accepting these disciplinary and/or institutional labels, the project argues that these developments can be studied as the history of one experiment, or "experimental system," that emerged and evolved over time, while bifurcating in sometimes surprising ways. As a consequence, the concrete materiality of experimental set-ups is emphasized, as are the interactions among scientists, model organisms, and instruments that the set-ups entailed, and the technological as well as architectural surroundings that framed these practices. This approach provides the basis for demonstrating that physiological and psychological time experiments formed a network of "research machines" that constituted the backbone of theoretical debates and institutional developments.

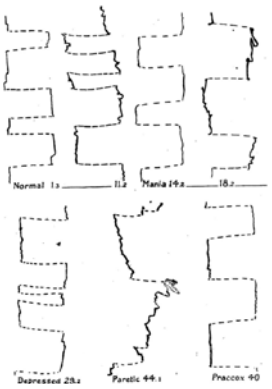
Philipp von Hilgers (Postdoctoral Fellow)

Mapping the Field of Vision: From Experimental Investigations of Reading to Pattern Recognition, 1860–1960

Philipp von Hilgers

Reading is one of the oldest cultural-technical achievements. However, around 1900, novel experimental practices transformed the process of reading into an object of scientific inquiry. This project investigates the extent to which the introduction of time-dependent media such as kymography and cinematography contributed to a rather dramatic shift in experimental perspectives: in reading studies, evidence was no longer provided by the human eye or attention, but by the frame of the recording media. As the paradigmatic investigations of Benno Erdmann and Raymond Dodge (1898) show, the new research on reading was characterized by two aspects. First, the instrumentally mediated perception of letters led to new knowledge about vision, revealing the constitutive role of small intervals of time. Second, the perception of single letters was no longer conceived of as an isolated mental act, but rather as a physiologically extended and time-consuming process.





Raymond Dodge's photochronograph for recording eye movements and the reproductions of various graphs of "healthy" and "mentally ill" readers. Allen R. Diefendorf and Raymond Dodge, "An experimental study of the ocular reactions of the insane from photographic records," Brain 31: 451–489, on p. 456, 1908

The project traces the steps from Erdmann and Dodge's research to the work of Warren McCulloch, Jerome Lettvin, Humberto Maturana, and Walter Pitts. This group of researchers carried out their studies in the era of cybernetics. Their experiments, which were defined by the possibilities of electron microscopy and electronic devices, led them to conclude that cognitive events were the result of the activity of nerves rather than the result of eye or body movements. In particular, the frog's retina was regarded as an independent neuronal net with its own inherent logic and tendency to code visual signals in a qualitative way. This logic could be translated onto paper, i. e., transformed into mathematical models. At the same time, it was conceived of as a potential system of electronic circuits.

Against this background, the project argues that new techniques can lead to radical breaks with the state of research that immediately preceded them. It also demonstrates that epistemic concepts can contribute to re-introducing almost forgotten theoretical models back into laboratory practice. These epistemic "folds" call for a broad but simultaneously deep approach to the history of science.

Britta Lange

Britta Lange (Postdoctoral Research Fellow)

A History of the Typical: Scientific Research in Prisoner-of-War Camps from 1915 to 1918

During the First World War, the governments of Germany and Austria encouraged scientific commissions to conduct studies in prisoner-of-war (POW) camps. Between 1915 and 1918, physical and cultural anthropologists, comparative philologists, linguists, musicologists, and lawyers gathered extensive data on "human material." These scholars considered the camps to be ethnographic research fields imported into Europe. In their eyes, the prisoners represented almost all foreign "nations" or "races," as the Central Powers waged war against the "whole world"—the other European nations and their colonies as well as against the Russian Empire and the United States.

Prisoners of war (here: Tatars) in front of an Edison phonograph, supervised by Carl Stumpf (right) and Georg Schünemann (center) from the Berlin Phonographic Commission. Wilhelm Doegen (ed.), Unter fremden Völkern. Eine neue Völkerkunde, S. 145, Berlin 1925

This project investigates the production and reproduction of the "typical" in this partly observational, partly experimental context: What were the (standardized) methods, presumptions, and strategic interests (e.g., personal and/or national competition) of the scholars involved? How did the specific conditions of the camp as well as the available recording technologies facilitate the distribution of images, voices, and body movements deemed to be "typical" of specific human races?

Based on recently discovered archival material, the project demonstrates how German and Austrian scientists (among them Felix von Luschan and Rudolf Poech) were eager to find and collect "typical" examples of different ethnic groups, so-called *Völkertypen* and *Rassetypen* using statistical methods that relied on complicated measurements, or simply by "seeing" and "feeling" the typical. These scientists not only wrote detailed descriptions of selected prisoners, they also took finger- and footprints, made plaster casts of hands, feet, and heads, and they produced phonographic and cinematographic recordings. Most of the POW camp scholars tried to implement pre-existing models of the "typical" in their field research. But as the example of physical anthropologist Egon von Eickstedt shows, they sometimes also realized that their mathematically deduced "racial types" differed significantly from what they

had taken to be "types" by watching and photographing the prisoners. This seems to be the ultimate irony of the POW camp research that this project investigates: scholars reported less on the "types" they had found, but much more on the problems in defining human "types."

Christian Reiß (Predoctoral Fellow)

The Way into the Laboratory: The Origins and Role of Model Organisms in the Experimental Life Sciences

Christian Reiß

This project investigates the role of model organisms in nineteenth- and early-twentieth-century physiology and zoology. Beginning in the mid-nineteenth century, experimentation became the method of choice in these fields. However, for successful experiments to be conducted, organisms had to be chosen, brought into the laboratory, stabilized, and finally integrated into the experimental setup.

The project argues that this process can neither be considered linear nor entirely driven by scientific rationality. One of the project's key examples is the Mexican axolotl *(Amblystoma mexicanum*), an amphibian nearly extinct in its natural habitat, although it populates aquariums in laboratories, households, and zoos all over the world. Initially brought to Paris in the course of France's colonial activities in the 1860s, curiosity soon turned this organism into a scientific object for studies concerning evolution, ontogeny, and physiology. At about the same time, aquarium fanciers started to adopt the axolotl as one of their most popular "pets." As this project shows, both developments went hand in hand, influencing each other by transfer of knowledge and technology. As a result, the axolotl was turned into a paradigmatic laboratory animal in the late nineteenth and early twentieth centuries. Among others, August Weismann (1834–1914) and his assistant Marie von Chauvin played an important role in turning the axolotl into a laboratory animal. Taking the axolotl's case as a model, the project emphasizes the history of animals in their specificity, tracing their trajectories across disciplines, across the border between science and the public as well as across the great divide between "civilized" and "colonized" countries.

Sandra Pravica (Predoctoral Fellow)

The Experimental Epistemologies of Gaston Bachelard and Edgar Wind

Sandra Pravica

This project is concerned with changes in epistemological accounts of scientific experimentation around 1930. The focus in the history of science on experimentation is usually considered to date only to the 1980s and 1990s. This recent "practical turn" has led philosophers and historians to reconsider various aspects of the process of producing, stabilizing, and objectifying scientific knowledge in the laboratory. In contrast, this project focuses on the 1930s and demonstrates that authors such as Gaston Bachelard and Edgar Wind chose experimentation as the key topic for epistemological reflection. Explicitly inspired by the upheavals of quantum physics and the theories of relativity, Bachelard and Wind relocated traditional problems in the philosophy of science to the realm of means and instruments of scientific research. In addition, they adopted a broad range of notions from biology, evolutionary theo-

ry, experimental psychology, musicology, and other discourses, e. g., "emergence" or "rhythm." In doing so, it will be argued, both authors developed strategies for opening the discourse of philosophy of science, from within, to practices of experimentation and suggested instructive approaches to "science as culture." Through a close study of Bachelard's and Wind's creative use of concepts, this project shows that, by distancing themselves from the normative projects in contemporary philosophy of science, the two authors proposed epistemologies that were constantly challenged by their applications and, more generally, by scientific innovation per se. The primary objective of this project is to spell out the philosophical and historical implications of these "experimental epistemologies."

Viola van Beek

Viola van Beek (Predoctoral Fellow)

Codes of Experimenting and Experimental Spaces Around 1900

Around 1900, the experimentalization of everyday life manifested itself as the revitalization of genres such as the experiment book, the widespread presence of experimental or avant-garde literature, the popularization of hands-on experiments in educational institutions like the *Urania* in Berlin and, above all, the widespread use of experiment kits for children. These kits started to become increasingly popular in the 1920s.

Experiment kit "Elektro" by Kosmos. Franckh'sche Verlagshandlung, around 1930 (private/Deutsches Museum, München)

This project investigates how this largely neglected genre contributed to the creation of experimental spaces outside the laboratory, in particular by providing specific "codes of experimenting." More than mere provisional set-ups at home experimental kits explicitly connected themselves to everyday things as objects of investigation and everyday knowledge as their framework of reference. Moreover, in their role as portable laboratories, chemistry sets, electricity kits, and physical cabinets (which, in their adult version, had already accompanied traveling scientists and intellectuals throughout the previous century) functioned as extensions of classrooms and lecture halls. To amateurs and dilettantes, they were available through trade catalogs and early forms of "mail-order" catalogs. The kits, which consisted of instruments, substances, and supplementary contents arranged in wooden, metal or paper boxes, illustrate the opening and expansion of experimental spaces in an exemplary manner. Together with their instruction manuals, the miniature laboratories provided structures in which experiments took place or *could* take place; as a result, they had

their own agency in the process of experimenting and reflecting knowledge and were not mere containers for experimentation. Instead this project suggests seeing them as creating novel spaces of knowledge that refer back to and unlock the experimental subject interacting with things.

Katrin Solhdju (Predoctoral Fellow)

Self-Experimentation: Crossing the Borders between Science, Art, and Philosophy 1840–1920

Katrin Solhdju

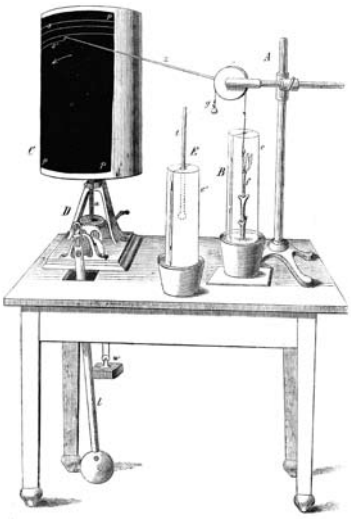
The aim of this project is to investigate the theories of knowledge that are inherent in experiments carried out on the researcher's own body and/or mind. At the same time, it explores how different practices of self-experimentation contributed to changing and shaping concepts of subjectivity and self-ness and vice versa. Three case studies are at its center. The first is devoted to Henry Head's neurological self-experiments on the recovery process, the second deals with drug-induced madness as investigated by French psychiatrist Jacques-Joseph Moreau de Tours, and the third focuses on the philosophical impact of Benjamin Paul Blood's self-experiments with laughing gas. On the basis of detailed historical and conceptual analyses, the project develops a theory of knowledge that highlights proximity and closeness rather than distance and neutrality, processes of subjective knowledge production rather than objective results of scientific investigations. Its main argument is that self-experiments expose a kind of knowledge production that forms a "minority" in the history of modern experimentation. In contrast to the dominant quest for objectivity, these experiments express and translate a "will" to adequately address phenomena that refuse to be approached in non-subjective ways.

Björn Brüsch (Predoctoral Fellow)

The Experimentalization of Gardening in Nineteenth-Century Germany

Björn Brüsch

Much of the promotion of Prussian "Landeskultur" in the early nineteenth century was closely connected to the use of the land as gardens. This project shows how this dynamic connection resulted in the establishment of an institution specifically aimed at providing gardeners with comprehensive scientific education: the *Königliche Gärtner-Lehranstalt* in Wildpark/Potsdam. Based on extensive archival material, the project reconstructs how the political, economic, cameralistic, practical, and aesthetic ideas of Karl vom Stein zu Altenstein, Peter Joseph Lenné, Karl Cranz, and others contributed to the formation of the Potsdam school for gardeners. It also demonstrates how this institution, in the process of its establishment, floated between Lenné's program of scien-



Auxanometer for determining and measuring growth in plants. Julius Sachs (ed.), Arbeiten des Botanischen Instituts in Würzburg. 1: 113, 1874

tific gardening and Cranz's practical horticultural orientation. While Lenné aimed at attaining intellectual respect for gardening by introducing a scientific and experimental approach, Cranz (and Altenstein) intended to provide gardeners with the basic skills that were deemed to be important in the cultivation of the Prussian land. By merging agrarian and horticultural utility, experimental cultivation and visual splendor, the *Gärtner-Lehranstalt* supported the state's basic industries in terms of an encompassing garden culture.

Experimentalization of Life
The Virtual Laboratory

[http://vlp.mpiwg-berlin.mpg.de]
The "Experimentalization" project created and continues to use and develop a "Virtual Laboratory" (VL). Online since 2002, the VL has become a unique archive and research tool for the history of the experimental life sciences in the nineteenth and early twentieth centuries. Currently, it offers more than 30,000 complete bibliographical references and displays a total of some 6,500 scanned items consisting of about 5,200 journal articles, 360 book chapters, 190 monographs and textbooks, as well as 180 trade catalogues of scientific instruments. In addition, it gives access to some 200 items that were digitalized in cooperation with archives and museums, including laboratory notebooks, article manuscripts, letters, graphical recordings, and photographs. Currently, the VL is extending its scope by integrating scientific films and phonographic recordings. In cooperation with institutions such as the Bundesarchiv-Filmarchiv, Berlin, and Berliner Phonogramm-Archiv, a collection of physiological and medical films, covering the span from the 1920s to the 1950s, are being included in the collections of the VL as are numerous wax-cylinder recordings of acoustic experiments from the period between 1900 and 1920. Similar projects were started with the Staatsinstitut für Musikforschung PK, Berlin (library collection on acoustics and instrument making), and the Museum für Naturkunde, Berlin (photograph collection).

Stills from a movie ("Hochschulfilm-Nr. C 507") on the production of tissue cultures. ca. 1940 (Bundesarchiv-Filmarchiv, Berlin)

As a research tool, the VL continuously enhances its search options. In addition to simple and advanced searches on bibliographical records, it offers similar exploration tools for the image database containing some 20,000 fully referenced and captioned drawings, curves, and photographs. At the same time, the VL has embedded search tools for specific purposes, e. g., the "trend-scout" for statistical analyses of bibliographical references over time.

Since 2006, the VL has provided users with a new work environment called myLab. This environment allows building, managing and sharing personal sub-sets of annotated objects found in the VL (bibliographical references, scans of published and/or unpublished texts, short biographies, sites) and beyond. myLab has proven to be an excellent teaching tool and is used by project members in their teaching on a regular basis.

The VL also offers highly attractive and powerful space for scholarly publication. Its essay section publishes short articles about the ongoing research work of the Experimentalization project. Articles are linked to other holdings, including short biographies, laboratory descriptions, and instruments in the digital library and other sections of the VL. Scholars from outside who are working on related topics and sources have started to use the publication site, which will be developed into a refereed online journal in the near future.

Assemblage of instruments used in Angelo Mosso's alpine physiology consisting of pick-axe, lantern and mitten. (Angelo Mosso Papers, Turin)

Experimentalization of Life
Activities Related to the Project

- Workshops and Exhibitions
  "ZwischenRäume": Castles in the Air; Idées fixes; Time Leaps. Three workshops organized together with the Helmholtz-Zentrum für Kulturtechnik (HU), the Zentrum für Literatur- und Kulturforschung, and the Institut für Deutsche und Niederländische Philologie (FU). Berlin, June 30, 2006, January 26 and June 15, 2007.
  "Physiologie des Klaviers." Concerts and talks, organized by Julia Kursell, together with the Musikinstrumenten-Museum SIMPK. Berlin, October 5 and December 12, 2006, and February 15, March, 8, April 12, May 3, June 7, July 5, and October 24, 2007.
  "Introspective Self-Rapports: Shaping Ethical and Aesthetic Concepts 1850–2006." Workshop organized by Katrin Solhdju. Berlin, May 5–6, 2006.
  "A Glance into the Prime of Prussian Culture: Karl Friedrich Schinkel's *Blick in Griechenlands Blüthe* and Prussian Cultural Narratives around 1820." Workshop organized by Björn Brüsch. Berlin, May 12–13, 2006.
  "Sounds of Science." International Conference organized by Julia Kursell. Berlin, October 5–7, 2006.

Poster to the series of talks and concerts "Physiologie des Klaviers", organized by Julia Kursell in collaboration with the Museum for Musical Instruments (SIMPK), Berlin. 2006/2007

"Life and Societies: Toward a New Ecology of the Living." International conference organized by Henning Schmidgen and Didier Debaise. Berlin, November 3, 2007.
"The Halfmoon Files: An Exhibition on Sound Recordings of POWs in Germany, 1915–1918," organized by Britta Lange together with filmmaker Philip Scheffner. Kunstraum Kreuzberg/Bethanien, Berlin, December 2007 to February 2008.
"The Ambivalence of Archives." Workshop organized together with the Helmholtz-Zentrum für Kulturtechnik and the Institut für Medizingeschichte (both HU). Berlin, January 17–18, 2008.

- Completed Dissertations
  Björn Brüsch, "The Advancement of Prussian Land and Culture: From the Horticultural Use of the Land to the Foundation of the Royal School for Gardeners" (2008).
  Katrin Solhdju, "Becoming Perspectival. Self-experimental Practices in the Sciences and their Philosophies (1840–1920)" (2008).

- Books
  Philipp Felsch, *Laborlandschaften: Physiologische Alpenreisen im 19. Jahrhundert,* Göttingen: Wallstein, 2007.
  Margarete Vöhringer, *Avantgarde und Psychotechnik: Wissenschaft, Kunst und Technik der Wahrnehmungsexperimente in der frühen Sowjetunion,* Göttingen: Wallstein, 2007.
  Julia Voss, *Darwins Bilder: Ansichten der Evolutionstheorie 1837–1874,* Frankfurt am Main: Fischer Taschenbuch Verlag, 2007.
  Sven Dierig, *Wissenschaft in der Maschinenstadt: Emil Du Bois-Reymond und seine Laboratorien in Berlin,* Göttingen: Wallstein, 2006.

- Upcoming Events
  "Physiologie des Klaviers II—Vorträge und Konzerte zur Wissenschaftsgeschichte der Musik." Concerts and talks, organized by Julia Kursell. Berlin, January 23, March 6, April 9, and June 11, 2008.

Project

A Cultural History of Heredity

RESEARCH SCHOLARS *Hans-Jörg Rheinberger, Christina Brandt, Bernd Gausemeier*
POSTDOCTORAL FELLOWS *Maria Kronfeldner*
VISITING SCHOLARS *Edna Suárez-Díaz*
SHORT-TERM GUEST RESEARCHERS *Carlos López Beltrán, Jonathan Harwood, Manfred Laubichler*
COLLABORATIONS ESRC Centre for Genomics in Society, University of Exeter (Staffan Müller-Wille); Universidad Nacional Autónoma de México (UNAM); School of Life Sciences at Arizona State University, Tempe; Center for Literary and Cultural Research, Berlin
FUNDING Government of Liechtenstein, DFG, German Academic Exchange Service (DAAD), British Council, British Academy, Conacyt (Mexico), and MPIWG

General Description of the Project

This project centers on the history of the scientific and technological practices in which knowledge of biological "heredity" became materially entrenched and the cultural contexts in which it unfolded its effects. Knowledge of heredity is taken here as encompassing much more than the scientific discipline of "genetics," namely a knowledge regime in which a naturalistic conception of inheritance gradually formed that came to influence all areas of modern society, including medical, jurisdictional, and political discourses. The aim of the project is to explore the changing practices, standards, and architectures of this regime as well as their particular historical conjunctions from a *longue durée* perspective.

The project is collaborative and interdisciplinary in its nature. It aims to draw together expertise from the history of science as well as other historical disciplines such as the history of medicine, law, economics, and art as well as political history and anthropology.

The backbone of the project is a series of five workshops, each concentrating on a specific "epoch" in the cultural history of heredity. The first, extending from the late seventeenth century to the 1780s, is the period in which heredity came into exis-

tence in several distinct fields, such as horticulture and pathology. During the second epoch, lasting to the middle of the nineteenth century, heredity became central to the life sciences. In the third, covering the period from 1870 to the 1930s, heredity became experimental and mathematical. During the fourth, from the 1930s to the 1970s, heredity went "molecular." And, finally, the fifth epoch, from the 1970s to the present, was characterized by the technological application and commodification of hereditary knowledge.

Three international workshops, focusing on the period from the seventeenth through the nineteenth century, took place in 2001–2005. In collaboration with the ESRC Centre for Genomics in Society, a fourth international conference on "Heredity in the Century of the Gene" was held at the University of Exeter in December 2006. Results of the first two of these workshops are presented in an essay collection published by MIT Press in 2007: *Heredity Produced. At the Crossroads of Biology, Politics, and Culture, 1500–1870.* A second volume is currently in preparation.

A Cultural History of Heredity
Individual Projects

Staffan Müller-Wille

Hans-Jörg Rheinberger

Hans-Jörg Rheinberger (MPIWG, Director) and *Staffan Müller-Wille* (Senior Researcher, Exeter)

Heredity. History and Culture of a Concept (Book Project)

Over the past two years, Hans-Jörg Rheinberger and Staffan Müller-Wille have been working on a book project aimed at a broader academic public and dealing with the *longue durée* history and culture of the concept of heredity from the early modern period to the recent developments in genomics. In this book we try to understand why it took such a long time for heredity to become a central figure of thought in the life sciences, and why it gained such overwhelming importance in the life sciences and the broader culture during the twentieth century. The first chapter of the book deals with premodern theories of generation. In the second chapter, we look at the formation of hereditarian thinking in dispersed domains such as politics and law, medicine, and in natural history, breeding, and anthropology from the eighteenth to the early nineteenth century. The third chapter focuses on early hereditarian syntheses in the life sciences of the later nineteenth century. Chapter four addresses heredity, race, and eugenics around the turn from the nineteenth to the twentieth century. The fifth chapter deals with the formation of genetics, and therefore heredity, as a discipline during the first decades of the twentieth century. Chapter six is devoted to the rise of molecular genetics around the middle of the twentieth century. Chapter seven gives an outlook on recent developments in gene technology and genomics as a new biotechnological regime.

Christina Brandt (Research Scholar)

Christina Brandt

Reproduction in Biology. Configurations between Science and Culture, 1900–2000

Today, biomedical research on reproduction and research on related topics such as stem cells are rapidly developing fields with controversial impacts on society and culture. Rather than concentrating on a specific disciplinary research field, Christina Brandt takes a broad look at the history of reproduction in biology.

"Reproduction" has a variety of meanings: it relates to different ways of propagating and multiplying, and it also refers to ways of making things similar or identical. In the latter sense reproduction means "replication" and has a bearing on molecular copying and cloning techniques. The fundamental role reproduction played, both as a subject under study and as an experimental technique, in twentieth-century life sciences is explored through a number of case studies dealing with reproduction research on the level of molecules, cells, and organisms. The focus is on (1) the history of cell biology (the emergence and reproduction of cell lines), (2) molecular biology and genetic engineering (the notion of replication and molecular copying techniques), and (3) developmental biology and embryo research. Here, a particular line of research concentrates on the history of cloning. This part of the project explores the emergence of the "clone" as a technical and epistemic object in different experimental systems and their cultural dimensions throughout the twentieth century. On an epistemological level, the study addresses questions of the relationship between material research practices and concept formation in twentieth-century life sciences.

In the 1970s, debates on cloning focused on the issue of serial replication: cover of the journal "Bild der Wissenschaft". July 1979

Bernd Gausemeier (Research Scholar)

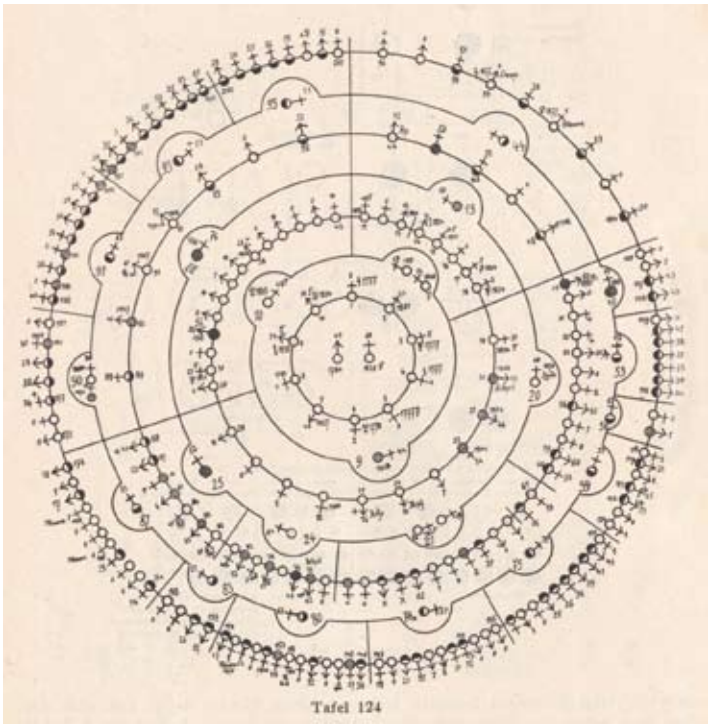
Bernd Gausemeier

Genealogy and Human Heredity in Germany in the Late Nineteenth and Early Twentieth Centuries

Genealogy was essential for the formation of a science of heredity as it provided the material basis of knowledge about hereditary transmission in various fields, including medicine, psychology, and animal and plant breeding. Yet genealogy is about more than the depiction of pedigrees and lineages. It reflects prevailing ideas about kinship and social order. A look at genealogical practices in the nineteenth and early twentieth centuries, therefore, may point to the political and social changes that led to the emergence of the modern notion of heredity.

Genealogical methods and ideas shaped not only the medical discourse about disease inheritance, but also a number of related developments in the late-nineteenth-century human sciences: concerns about the perils of inbreeding, fears about the decline of aristocratic or talented families, ideas about the evolution of "genius," and the turn to kinship studies in anthropology. The most import aspect, however, was the interaction between amateur genealogy and medical family research that evolved around

1900—a fusion of interests that proved to be of pivotal importance for the rise of the eugenics movement and that generated the biopolitical vision to create genealogical surveys revealing the kinship structures and the hereditary composition of complete populations.



Pedigree of a family with high susceptibility to tuberculosis and cancer.
Max von Gruber/Ernst Rüdin, Fortpflanzung, Vererbung, Rassenhygiene. Illustrierter Führer durch die Gruppe Rassenhygiene der Internationalen Hygiene-Ausstellung 1911 in Dresden, München 1911

Maria Kronfeldner

Maria Kronfeldner (Karl Schädler Postdoctoral Research Fellow)

The Anthropological Concept of Culture in the Context of Evolutionary Debates

Maria Kronfeldner investigates how the anthropological concept of cultural inheritance developed in the beginning of the twentieth century in the face of a changing landscape of knowledge about evolution and heredity. Her main case study is on anthropology. When, in the beginning of the twentieth century, American anthropology was in the process of becoming an academic discipline, Alfred L. Kroeber (1876–1960) used Weismannian ideas about non-Lamarckian heredity ("hard inheritance") to contrast it with a concept of cultural inheritance that he considered methodologically necessary for cultural anthropology.

Anthropologist Alfred L. Kroeber and Ishi, member of the Yahi tribe, 1911.
The concept of culture was for Kroeber a conceptual tool for the explanation of similarities and differences between people and groups of people; yet, in his hands it also became the very thing (beyond the visible similarities and differences) that cultural anthropologists seek to explain.
(UC Berkeley, Phoebe Hearst Museum of Anthropology)

Kroeber not only created a gap between nature and nurture, but also an epistemic object—culture—that justified the existence of a new specialist for this object—the cultural anthropologist. Kroeber established culture as a separate entity by

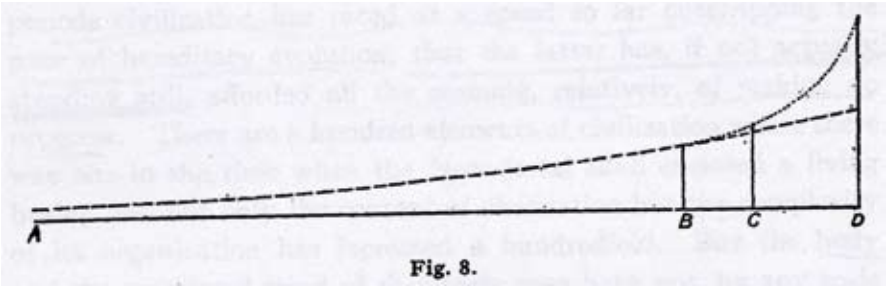


Fig. 8.

With this graph, Kroeber intended to illustrate his cultural determinism, in which culture (dotted line) is a form of heredity, changing in an analogous and autonomous manner to biological heredity (dashed line) and physical persistence (continuous line).
Kroeber, The Superorganic, 1917

claiming that its dynamic is independent of changes in biological inheritance. The case study not only explores how Kroeber developed his views, but also shows that the received view on the history of heredity wrongly assumes that Weismannism has only furthered hereditarianism, i.e., the belief that all human traits are explained by heredity. This view of Weismannism ignores that the development of the concept of hard inheritance (and the corresponding denial of Lamarckian inheritance of acquired characteristics) had a bi-directional historical effect. Far from ignoring non-hereditarian inheritance, by decoupling nature and nurture, it made room for cultural inheritance as a separate process, whereas previously cultural inheritance had been linked too closely to biological inheritance to have significance on its own.

Edna Suárez-Díaz (Visiting Scholar, Universidad Nacional Autónoma de México)
Representation and the Construction of Knowledge in Molecular Evolution
The aim of this project is to develop an analysis of the production and representation of knowledge in the field of molecular evolution from its beginnings in the early 1960s to the rise of bioinformatics and comparative genomics in the 1990s. The analysis takes place at three different levels. At the micro-level, molecular evolution offers a place to investigate the role of experiments and techniques in different scientific traditions and the ways in which they are connected with specific practices of representation. The goal is to extend a previous study in experimental traditions in nucleic acid hybridization to cover the role of electrophoresis in theoretical population genetics and the effects of protein and DNA sequencing on the construction of phylogenies and comparative genomics.


Edna Suárez-Díaz

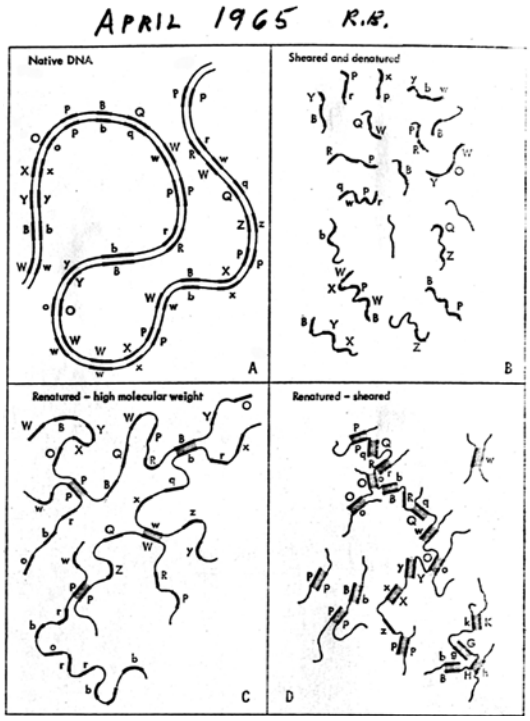


Diagram for Renaturation of DNA, with handwriting by Roy J. Britten.
Yearly Report 1964, Carnegie Institution, Department of Terrestrial Magnetism, Biophysics, p. 318

At the disciplinary level, the project aims to offer an account of how the idea of informational molecules came to provide a powerful rhetoric for a new style of evolutionary study. By developing a new vocabulary, scientists such as Emile Zuckerkandl, Walter Fitch, and Roy Britten helped to create not only a linguistic convention, but a technical, social, and political frontier between the new molecular evolutionists and the "old" organismal evolutionists.

At a transdisciplinary level, molecular evolution has been constitutive in the development of the bioinformatics revolution. The elaboration of the first computer programs as early as 1966 for the construction of trees based on molecular data and the first databases on proteins illustrate this point. The project includes a study of the symbiosis between computer technology, bioinformatics, and genomics as a result of the Human Genome Project.

A Cultural History of Heredity
Projects of the Short-term Guest Researchers

- *Carlos López Beltrán* (Universidad Nacional Autónoma de México): "The Influence of Biological and Medical Theories in Racial Classification of Humans."
- *Jonathan Harwood* (Centre for the History of Science, Technology & Medicine, University of Manchester): "Europe's Green Revolution: The Rise and Fall of Peasant-Friendly Plant-Breeding in Central Europe, 1890–1945."
- *Staffan Müller-Wille* (ESRC Centre for Genomics in Society at the University of Exeter): "Heredity. History and Culture of a Concept."
- *Manfred Laubichler* (School of Life Sciences, Arizona State University, Tempe, AZ): "Regulation and the Origin of Theoretical Biology."

A Cultural History of Heredity
Activities Related to the Project

Research Collaborations
In the context of this project, two research collaborations have been funded by the DAAD and the British Council and the Mexican Conacyt.

The Gene and Its Legacy. Historical and Philosophical Issues in Genetics and Genomics
MPIWG and ESRC Research Centre for Genomics in Society at the University of Exeter (DAAD/British Council, July 2005–August 2007)
This joint project was aimed at a historical and philosophical investigation of the processes of experimental research, data collection, and implementation of genetic knowledge that promote a gene-centered view in the life sciences and beyond. The collaboration included short research stays of visiting scholars, two one-day workshops in Exeter and Berlin, as well as jointly organized sessions at History of Science Society meetings and conferences of the International Society for the History, Philosophy and Social Studies of Biology.

Evolution and Heredity: Genetics and Epigenetics
MPIWG and Universidad Nacional Autónoma de México (DAAD/Conacyt, January 2007–December 2008).
The intent of this project is to forge a close cooperation between the two research groups at the MPIWG and UNAM concerned with the history, philosophy, and sociology of hereditarian and evolutionary thinking from the second half of the nineteenth century up to the present time. The aim is to engage in a collective analysis of modern naturalistic thinking about nature, man, and society, to study cultural, national, and local differences, and to shape and provide the conceptual tools necessary to accomplish this goal. In addition, the project will enable a group of highly motivated doctoral and postdoctoral students to participate in the exchange program. In 2007, two German scholars (Maria Kronfeldner and Stefan Willer) traveled to Mexico City for research stays of three to four weeks at the UNAM campus. Two Mexican scholars (Ana Barahona and Sergio Martinez) and three Mexican PhD students (Erika Torrens, Vivette García and Fabrizzio Guerrero) traveled to Berlin for research.

- Workshops
  "Heredity in the Century of the Gene. A Cultural History of Heredity IV."
  Fourth international conference of the project, Exeter, December 11–14, 2006.
  "Times of Cloning. Historical and Cultural Aspects of a Biotechnological Research Field." International conference organized by Christina Brandt in collaboration with Giuseppe Testa (Branco Weiss Fellow "Society-in-Science"), Berlin, March, 1–4, 2007.
  "Reproduction in the Century of the Gene." One-day workshop, Berlin, March 30, 2006.

- Books
  Hans-Jörg Rheinberger, *Epistemologie des Konkreten. Studien zur Geschichte der modernen Biologie.* Frankfurt am Main: Suhrkamp, 2006.
  Staffan Müller-Wille and Hans-Jörg Rheinberger (eds.), *Heredity Produced: At the Crossroads of Biology, Politics, and Culture, 1500–1870.* Cambridge: MIT Press, 2007.
  Edna Suárez-Díaz (ed.), *Variedad Infinita: Ciencia y Representación, un Enfoque Histórico y Filosófico.* México: UNAM/Editorial Limusa, 2007.

- Upcoming events
  "History of Plant Breeding Since 1880," March 28–29, 2008, organized by Jonathan Harwood and Staffan Müller-Wille.
  "Graphing Genes, Cells, and Embryos: Cultures of Seeing 3D and Beyond," June 12–15, 2008, in collaboration with Sabine Brauckmann, Tartu University; Denis Thieffry, University of Marseille; and Gerd Müller, Konrad Lorenz Institute, Altenberg.
  "Writing the History of Genomics," October 29–November 1, 2008, organized by Edna Suárez-Díaz and Vincent Ramillon.
  "Making Mutations: Objects, Practices, Contexts," January 13–15, 2009, organized by Luis Campos, Alexander v. Schwerin, and Bernd Gausemeier.

Project

Knowledge in the Making.
Drawing and Writing as Research Techniques

RESEARCH SCHOLARS *Christoph Hoffmann, Barbara Wittmann*
POSTDOCTORAL RESEARCH FELLOWS *Omar Nasim, Christof Windgätter*
COLLABORATIONS Research Group at the Kunsthistorisches Institut in Florenz: *Karin Krauthausen, Jutta Voorhoeve*
RESEARCH NETWORK Yale University (Rüdiger Campe); Hermann von Helmholtz-Zentrum für Kulturtechnik, Humboldt-Universität, Berlin (Werner Kogge); Technische Universität Berlin (Cornelia Ortlieb); Universität Wien (Wolfram Pichler and Wolfgang Pircher).
FUNDING Fritz Thyssen Stiftung, Max Planck Society (Strategic Innovation Fund), and MPIWG

General Description of the Project

"Knowledge in the Making" started as a research project in the fall of 2006. Since March 2007 it has been considerably enlarged into an inter-institutional research initiative of the Max Planck Institute for the History of Science in Berlin and the Kunsthistorisches Institut in Florenz (Max Planck Institute). Two working groups have been established that include four scholars in Berlin and two in Florence. Meetings of the project members take place every three months. The Florentine group focuses on the aesthetic and poetic power of drawing and writing in modern art and literature (1850–2000). Studies include "Paul Valéry's *Cahiers* (1894–1945)—Drawing and Writing as a Practice of Thought" (Karin Krauthausen) and "Drawing in Contemporary Art: Notation, Expression, and Experiment" (Jutta Voorhoeve). For further details, see the report of the Kunsthistorisches Institut in Florenz.

The working group in Berlin has taken the recent interdisciplinary discussion on representational practices in the sciences as its starting point. Scientific representation is conceived as an active *process* that partly limits experience, partly enriches the observed phenomena, and partly enables completely new experiences. The manifold forms of "paper work" used in the context of scientific research are certainly no exception. Observational records and research notebooks filled with lists, tables, scribbles, and sketches constitute a genuine epistemic space from which knowledge emerges.

It is our main premise that the stylus—although a comparatively simple and apparently unsophisticated instrument—plays a decisive role in the production of knowledge. Many objects and phenomena become available and comprehensible only through drawn and written records. In particular cases, such as in psychology or pedagogy,

the production and analysis of drawings and written material become themselves a method of research. Stylus, pencil, and pen have the power to mediate. They translate observations into two-dimensional, and thus easily reproducible, texts and images; they concretize cognitive processes and in this way open up an interaction between perception and reflection, between the securing of phenomena and the formation of theses. In short, the activity of writing and drawing constitutes one of the most critical steps in scientific research: the step from preliminary and sometimes ambiguous data to stable facts.

Research on the function of drawing in modern science usually focuses on time spans in which stylus and paper provided the exclusive means for the fixation and reworking of research objects. Writing procedures in turn are mainly discussed in the narrow context of mathematical and chemical symbolism. However, with our project we want to emphasize that drawing and writing have maintained their ubiquitous presence and technical potential even within the complex and abstract cultures of modern science and scholarship. The target period—1800 to 2000—saw an intense competition between "old" and "new" media. Therefore the project will examine the tension between handwriting and drawing on the one hand and mechanical, photographic, and digital recording technologies on the other. The analysis of the various forms of their interaction will open up new perspectives on the relative utility of writing and drawing under the shifting epistemological and cultural conditions of modernity. Moreover, the epistemological approach of the project permits a direct comparison of the research methods of the natural sciences, the humanities, and the arts. We will deal with graphic recording techniques in the natural and human sciences within a broad context that embraces both artistic and technical recordings. Attentiveness to the simplest instruments of scientific observation will reveal parallels between the two cultures of inquiry, in particular concerning their common "techniques of creativity."

Knowledge in the Making
Individual Projects

Christoph Hoffmann

Christoph Hoffmann (Research Scholar)

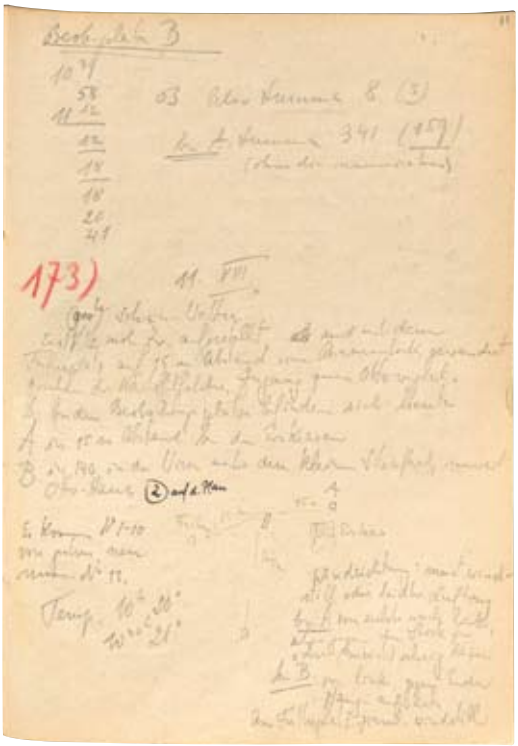
Epistemic Writings

Analyzing the contribution of writing to the production of scientific knowledge begins with a shift of attention. Rather than using the multitude of papers that typically remain from scientific activities as a source for reconstructing particular processes, the focus is on them as monuments of writing practices.

The major subject of the project is a study of notebooks and observational journals from the period between 1870 and 1950. It was in the late nineteenth century that division of labor and "mechanization" deeply altered the conditions of scientific practice. The notebook plays a double role in this respect: it is a means of administration and it offers a space for reworking the output of experiments and observations. The notebooks of the physicist and philosopher of science, Ernst Mach, provide a fasci-

nating example of the diversity and richness of writing practices covered under the heading of keeping notes. One particular feature of Mach's notebooks is the combination of drawing and writing in the reworking of observational data and the development of theoretical approaches.

While Mach's notebooks represent a laboratory-based type of writing, the observational journals of the biologist Karl von Frisch provide access to the writing space of a field researcher from the 1940s. In those years, von Frisch was occupied with his studies on the dances of bees for which he received the Nobel Prize in 1973. Kept in a day-by-day format, his journals tell us that recording an experiment involves more than just writing down results. Notes or sketches showing the location of the beehives, remarks on the changing weather conditions, records of the behavior of individual bees—all formed a kind of diary both of the animals under observation and of the scientific observer.



Observational journal of Karl von Frisch. Bayerische Staatsbibliothek Munich, Manuscripts Division, August 1944

A second part of the project deals with the records of post-mortem examinations. Here the aim is to reconstruct the function of writing as a recording technique in a particular scientific workplace. Of interest is the standardization of the writing process, the actual way in which the process is conducted, the use of forms, the teaching of writing down a protocol, the individual styles of recording, the evaluation and reworking of the records for scientific publications, and the changes that the regimen of recording experienced over the decades. Post-mortem records differ from many other scientific records in one major way: observers have to deal in the strictest sense with irreproducible phenomena. In most cases, only the record remains of the object under investigation.

Barbara Wittmann

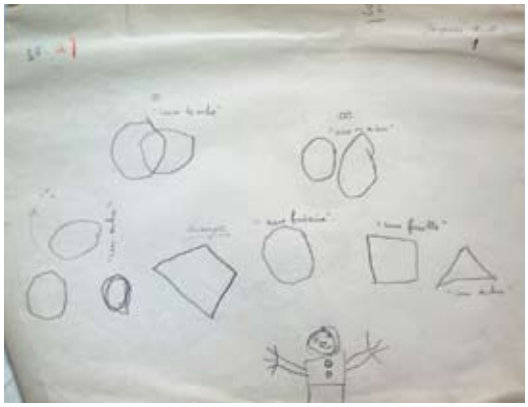
Barbara Wittmann (Research Scholar)

Meaningful Scribbles. Children's Drawings as Psychological Instruments, 1880–1950

The institutionalization of child psychology around 1900 was accompanied by techniques of observation and experiment that separated scientific attention from the education and everyday care of children. The experimental application and interpretation of children's drawings became one of those techniques. Whereas before 1880, children's drawings were seen as mere scribbles and not considered to be of any aesthetic or heuristic value, soon after psychologists and psychoanalysts such as James

Mark Baldwin, James Sully, William Stern, George-Henri Luquet, Karl Bühler, Melanie Klein, and Jean Piaget came to consider drawings to be a major diagnostic device in the investigation of children. Like children's play and their stories, the "artistic production" was (and still is) believed to reveal sensomotoric functions and spatial perceptions, to give proof of children's intelligence and social development, and to document their psychic disposition and etiology.

The emergence of children's drawings as diagnostic tools was supported by different methods, techniques and tests that were developed to interpret what previously had been considered "meaningless." These interpretative practices had to control the dynamics of drawing and the transference between the child and the scientist. The experimental set-ups and tests framed and stabilized the scribbles: certain qualities of children's drawings were isolated; single gestures and motifs were repeated again and again. In this way, psychology began to conceive children's drawings as a more or less orderly process through which the visualization of irregular psychic symptoms and dysfunctions was enabled. Children's drawings were embedded and transformed into a calculated procedure that allowed the scientist to be surprised by unexpected phenomena.



Drawing of a 4 year old child (Jacques) from Jean Piaget's experiments on the child's conception of space.
The Jean Piaget Archives, University of Geneva, around 1945

The operationalization of children's drawings in psychology is certainly a special case in the history of drawing as a scientific instrument. Whereas all other kinds of scientific inscriptions are produced by scientists or commissioned artists, children's drawings can only be made by the scientific object itself. Still, the drawings produced in experimental and diagnostic contexts should not be considered as immediate "self-portraits," because they do not contribute to the constitution of subjectivity directly, but to its mediation and objectification. Thus, the historical reconstruction of the experimentalization of children's drawings around 1900 promises to illuminate the practices and methods through which an everyday activity was transformed into a research technique and how it shifted between these functions.

Omar W. Nasim (Postdoctoral Research Fellow)

Constructing the Heavens. Drawings of Nebulae in Victorian Science

With the arrival of new and powerful telescopes came the development of sidereal astronomy, and thus a focused and increased interest in objects beyond our solar system. One of the central astronomical objects of this development was certainly the nebula. Many nineteenth-century astronomers spent much time, money, energy, and skill in understanding, observing, and cataloging these nebulae. A conspicuously distinctive feature of this effort was the mass of drawings of nebulae that were produced. While looking through giant telescopes, hundreds of preliminary and preparatory sketches were made in observing books, from which many detailed drawings were

Omar W. Nasim

made, sometimes with measurements and other times without. Selected figures were engraved and etched for publication in important scientific journals and astronomical catalogues. Some representative figures were further reproduced in popular works on astronomy. We are therefore confronted with an array of uses for these drawings: from the private everyday task of data gathering, to grand speculations related to the Nebular Hypothesis and the Plurality of Worlds thesis.

The project will examine the nature of these sketches and figures particularly in relation to the production of knowledge and the stabilization of ambiguous scientific objects. Particular emphasis is placed on the role played by the sketches as observational and research tools in the process of astronomical work done on nebulae. Much of the project's focus, therefore, will be dedicated to the day and night books, the ledgers, and the catalogues that were all prepared at various stages of astronomical research and observation. It is in these sources that one finds and is thereby able to track the various layers, forms, and processes of material development of the sketches of nebulae.

A large spiral shaped 'nebula.' Rough-sketch made by an assistant of the 3rd Earl of Rosse. Birr Castle Archives, 1848

Christof Windgätter

Christof Windgätter (Postdoctoral Research Fellow)

Typography of Knowledge. The Layout Policy of the Internationaler Psychoanalytischer Verlag (1919–1938)

In our culture, the production, distribution and evaluation of printed texts is still a central aspect of science. Despite new technologies, a major part of our scientific memory is archived, managed, reworked, and handed down in the form of printed matter. Against this background, the project focuses on layout strategies as a missing subject in the history of science. Its aim is to examine the epistemic function of the design tools of print. The basic assumption is that books, journals, and other printed matter are neither merely reading objects nor just the multiple expressions of an author's intentions. Rather the graphic reality of printed texts influences and guides what can be understood through the act of reading. Typefaces, therefore, are regulations; their figurative appearance has to be considered as a condition of the constitution, mobilization, and socialization of scientific knowledge.

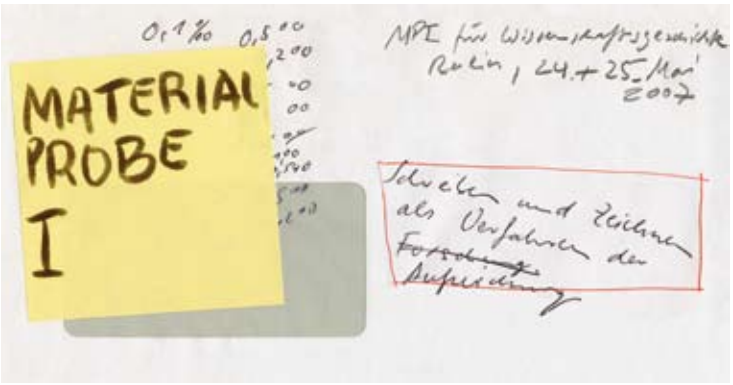
The particular perspective of this project is directed towards the Internationaler Psychoanalytischer Verlag (IPV), founded in 1919 in Vienna by a group around Sigmund Freud and shut down in 1938 by the Nazis. The IPV published all the titles of the contemporary psychoanalytical movement—Freud's books starting in 1920, the first psychoanalytical dictionaries, the *Almanach*, the four leading journals as well as the first edition of Freud's collected writings.

To investigate the IPV layout strategies, six areas of study will be considered, which together aim at an *epistemology of the IPV* and demonstrate that it introduced the practice of *corporate design* in the field of scientific publishing. The areas of study include the following: (1) The chronology of the IPV's events, business affairs, and collaborations. (2) The naming politics of the IPV, delineate psychoanalysis. (3) The logo of the IPV, which was the Oedipus Vignette. (4) The color of the IPV books and journals, which, starting in 1924/25, were produced in yellow bindings or covers. (5) The typography of the books, for which the "Bernhard Modern" font was often conspicuously used. (6) The appearance of the shop windows for which the IPV books and journals were produced, ultimately represented the fundamental changes in product display and production processes in the publishing business around 1900.

Oedipus vignette.
Internationaler Psychoanalytischer Verlag

Knowledge in the Making
Activities Related to the Project

- Workshops
  Materialprobe 1: "Datensicherung. Zeichnen und Schreiben als Verfahren der Aufzeichnung." Workshop at the MPIWG, Berlin, May 23–24, 2007.
  Materialprobe 2: "Symptomatik des Zeichnens und Schreibens." Workshop at the Kunsthistorisches Institut in Florenz— Max Planck Institute, Florence, October 15–16, 2007.



Nachlese/Afterthoughts 1: "Vor dem ersten Strich/Before the First Line" (together with Wolfram Pichler, Universität Wien; Ralph Ubl, Committee on Social Thought, University of Chicago), Berlin, August 1, 2007.

- Upcoming events
  Seminar: "Logik des Verfahrens," Wissenschaftskolleg zu Berlin, March 19, 2008.
  Nachlese/Afterthoughts 2: "Schreibszenen"/"Writing Scenes" (with Rüdiger Campe, Yale University), MPIWG Berlin, June 10, 2008.
  Nachlese/Afterthoughts 3: "Kritzel und Schnipsel"/ "Scrips and Scribbles" (with Hans-Jörg Rheinberger, MPIWG, Berlin), Kunsthistorisches Institut in Florenz—Max Planck Institute, Florence, July 17, 2008.
  Materialprobe 3: "Notes—Sketches—Scribbles: Writing and Drawing as Creative Tools," Yale University, New Haven, November 13–15, 2008.
  Workshop: "Wissen im Druck. Zur Epistemologie der Buchgestaltung zwischen 1850 und 1950," MPIWG Berlin, December 12, 2008.

Project

Generating Experimental Knowledge: Experimental Systems, Concept Formation, and the Pivotal Role of Error

RESEARCH SCHOLARS *Uljana Feest, Hans-Jörg Rheinberger*
POSTDOCTORAL RESEARCH FELLOW *Igal Dotan*
PREDOCTORAL FELLOW *Lambert Williams*
SHORT-TERM VISITING COLLABORATION PARTNER *Thomas Dohmen, Giora Hon, Jutta Schickore*
COLLABORATIONS Philosophy Department, University of Haifa (Giora Hon); Historisches Seminar, University of Wuppertal (Friedrich Steinle); Department of History and Philosophy of Science, Indiana University Bloomington (Jutta Schickore)
FUNDING German-Israeli Foundation, MPIWG

The project started in 2004, culminated in an international research conference in the summer of 2007 at the University of Wuppertal, and was completed in the fall of 2007. It consisted of two working groups, one was based at the University of Haifa (Giora Hon as principal investigator, Galina Granek as postdoctoral fellow, Thomas Dohmen as doctoral student), the other at the MPIWG in Berlin. The project was supported by the German-Israeli Foundation. To facilitate and implement exchange and cooperation among all group members, there were regular meetings, bringing together the groups at Haifa and Berlin, to discuss the progress of individual projects and relevant literature. Moreover, two workshops and a final conference were held at which the results of individual group members as well as the work of international scholars were presented.

General Description of the Project

Experimentation, a core procedure of modern science, has received new attention in the history and philosophy of science in the last two decades. While a wealth of new perspectives has opened up, one essential feature has remained largely unanalyzed—the very role of experiment as a *knowledge-generating* procedure. This was the starting point of our project, which aimed at developing a broader understanding of how knowledge is gained, shifted, and revised in experimental research. Three focal issues were explored: experimental systems, concept formation, and the pivotal role of error.

The experimental-systems perspective is informed by the work of Ludwik Fleck and others, who early on drew attention to the genesis of scientific facts, arguing that modern scientists, as a rule, do not deal with single experiments in the context of a clearly delineated theory. Experimental scientists deal with clusters of experiments that are usually not well defined and do not provide definitive answers. In an endlessly changing pattern, experimental systems combine elements that historians and philosophers of science have long sought to separate: research objects, theories, technical arrangements, and instruments as well as disciplinary, institutional, social, and cultural dispositions.

Recent studies have made clear that, to account for the epistemic variety in the details of experimental practice, one needs to differentiate several levels of conceptualization. Relying on certain instruments, procedures, and concepts that are taken as unproblematic is necessary for experimentation to succeed. At the same time, scientific activities and conceptualizations are constantly being attuned to each other as the experimental process unfolds. A specific type of experimentation becomes delineated when focusing on these processes: the exploratory experiment. It follows distinct guidelines and epistemic principles. In many cases, it leads to the revision of existing concepts and the formation of new concepts, which leads eventually to stability and the ability to express experimental results in more general terms.

A claim to knowledge within a certain system of research may be found in time—by various means—to be erroneous. But the variety of what "error" or, more generally, "going wrong" can mean is huge and has so far been studied only insufficiently from an epistemological perspective. This project built on the assumption that significant insight into the epistemic dynamics of experiment may be gained by asking what constitutes an error within an experiment. One is thereby directed away from the individual experiment to a broader system.
The individual projects pursued as part of this group each drew on one or more of the analytical frameworks outlined above.

Generating Experimental Knowledge

Individual Projects

Igal Dotan

Igal Dotan (Postdoctoral Research Fellow)

Natural Selection in the Lab: Background Knowledge and its Role in the Evolution of Experimental Systems

In his project, Igal Dotan addressed the role played by background knowledge in the experimental generation of knowledge. Taking as a starting point various previous accounts of background knowledge (e.g., Popper, Bunge, and Aggassi), Dotan placed this issue in the theoretical context of Rheinberger's notion of the experimental system. Dotan focused particularly on the relationship between theoretical and experimental considerations in scientific research. He approached the issue with a detailed study of a particular branch of evolutionary genetics, namely, that which studies the process of aging by means of populations of fruit flies. Dotan produced several papers, some exploring theoretical aspects of this research, others focusing on experimental systems.

Uljana Feest

Uljana Feest (Research Scholar)

Exploring Implicit Memory: On the Interrelation between Operationalizations, Concept Formation, and Experimental Artifacts

Uljana Feest investigated the interrelation between concept formation and experimentation, using as a case study the emergence of a new research field within experimental cognitive psychology and cognitive neuropsychology. This field deals with a cluster of phenomena that are variously described as "implicit memory," "implicit learning," or "procedural knowledge." Hence, the emergence of this research field went hand in hand with the formation of a cluster of concepts. In Feest's project, special emphasis was placed on the concept of "implicit memory" and the experimental paradigms that are associated with the investigation of the phenomenon in question. The original thesis pursued in her project was the idea that operational definitions of concepts and operationalizations of research questions are central points of reference for the experimental investigation of the purported phenomenon. Feest is currently finishing a book manuscript that includes the case study about implicit memory.

Lambert Williams

Lambert Williams (Predoctoral Fellow)

Complexity: 1960–2000

The project of Lambert Williams examined the emergence and dispersion of the sciences of complexity from 1960 to the present. Particular emphasis was placed on the work done in "virtual experimentation," "experimental mathematics," and other trends in modeling and simulation technique. The project scrutinized how concrete knowledge claims spring out of an interwoven mesh of simulated entities, evolving technological arrangements, a sometimes less-than-seamless correspondence between theory and phenomenology, and so on. In his research, Williams not only provided some detailed investigations of the above contexts, but also reflected upon historiographical issues concerning the level at which to pitch a history of new disciplinary formations. Lambert Williams is currently finishing his dissertation at Harvard.

Generating Experimental Knowledge
Projects of Visiting Collaboration Partners


Thomas Dohmen

Thomas Dohmen (Predoctoral Fellow, University of Haifa)

Context and Error in the Epistemology of Scientific Experiment

In his PhD project, Thomas Dohmen started out with the aim of evaluating how analyzes from recent contextualist epistemologies can be applied to philosophical issues that arise within the context of experimentation. His thesis—that the possibility of experimental error should lead to skeptical questions—was explored by means of a detailed historical and philosophical study of electron microscopy. Rather than addressing universal questions, his approach was to analyze the ways in which scientists and instrument makers attempt to optimize their instruments in their efforts to rule out all possible sources of artifacts. In the course of his research, Dohmen used and specified the notion of *comparison* as crucial to all attempts at calibration and validation. Dohmen presented several conference papers in the course of the project. He is currently completing his PhD dissertation.

Generating Experimental Knowledge
Activities Related to the Project

- Workshops

  "Error in Experimental Science." Workshop organized by Giora Hon, Haifa, May 8–10, 2005.

  "Generating Knowledge with Microscopes." Workshop organized by Uljana Feest and Jutta Schickore, Berlin, June 23–26, 2006.

  "Generating Experimental Knowledge." International conference organized by Friedrich Steinle, Wuppertal, June 14–16, 2007.

- Books

  Jutta Schickore and Friedrich Steinle (eds.), *Revisiting Discovery and Justification. Historical and Philosophical Perspectives on the Context Distinction,* Dordrecht: Springer 2006.

  Giora Hon, Jutta Schickore, and Friedrich Steinle (eds.) (2008): *Going Amiss in Experimental Research.* Boston Studies in History and Philosophy of Science, Springer (forthcoming)

Other Projects of the Department

Senior Researchers

Hans Erich Bödeker (Research Scholar)

Modern Natural Jurisprudence and the Social Sciences

Hans Erich Bödeker's research project aims at a critical and empirically informed investigation of the emergence of the social sciences as a relatively distinct field. The modern natural-law discourse stands out among the European traditions of thought that helped to shape the social sciences. Its theoreticians provided the general theoretical framework for questions concerned with human nature, state and society, history, agency, wealth, and distant peoples. Emphasizing the natural-law tradition, the study suggests a quite different narrative from the traditional one for the rise of the social science discourse. The focus is on the intellectual developments of the German Enlightenment and its European context.

The investigation analyzes the general *problématique* of continuities and ruptures in the emergence of the social sciences. The interplay between the conceptual change and the contemporary macro societal context of state formation processes will also be brought to prominence. Such an inquiry into the rise of the social sciences brings together research areas such as the cultural history of the German Enlightenment, the history of the scholarly book, the history of scholarly practices (reading habits, traveling, observation, comparison, collecting), the history of political thought, and historical semantics, particularly *Begriffsgeschichte*.

Ursula Klein

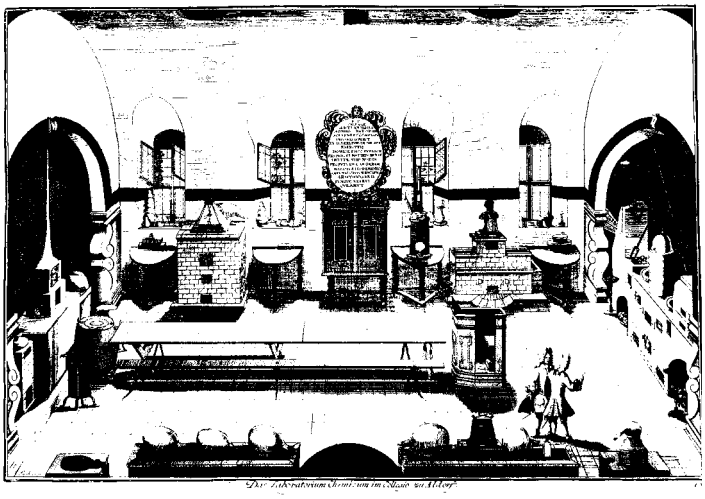
Ursula Klein (Research Scholar)

Technoscience avant la lettre

The systematic and stable interconnection of scientific and technological practices and institutions into a "technoscience" is usually considered to be a feature of the twentieth century, with forerunners in the second half of the nineteenth century. This project studies comparatively stable intersections of learned inquiries into nature and artisanal (or "technological") practices in a much earlier period, namely from the late seventeenth until the early nineteenth century. In certain laboratories, innovative workshops, and specialist marketplaces of that period, artisanal skill and technical competence were combined with learned knowledge about nature derived from experience. Numerous university chairs, professional schools, economic and philosophical societies, academies, and journals were founded that fostered innovation in the practices of making, while simultaneously contributing to the scientific understanding of nature. Central to this project are forms of such advanced expertise at sites where commerce, practices of making, and learned natural knowledge intersected.

First results of the project have already been published, including the book (with Wolfgang Lefèvre, Department I) *Materials in Eighteenth-Century Science. A Histori-*

cal Ontology (Cambridge: MIT Press 2007) and an edited book manuscript (with E. C. Spary, Wellcome Institute, London) entitled *Between Market and Laboratory: Materials and Expertise in Early Modern Europe, 1500–1800* (currently under review for publication by MIT Press). The project continues further in two respects. It aims at a detailed description and analysis of intersecting practices of eighteenth-century German apothecaries, mining officials, assayers, and academic chemists, based on archival material as well as a large number of experimental reports published in the new professional journals of the period.



The laboratory of the University of Altdorf. Johann G. Puschner, Amoenitates Altdorfinae oder eigentliche nach dem Leben gezeichnete Prospecten der löblichen Universität Altdorf [...]. Nürnberg: Michahelle, ca. 1720 (Courtesy of the Niedersächsische Staats- und Universitätsbibliothek, Göttingen)

In addition to historical studies of concrete ways in which artisanal expertise and experimental inquiries into nature intersected, a second research strand studies issues concerning the history and philosophy of science and technology more broadly. These are (1) laboratories and their development from the late seventeenth until the middle of the nineteenth century, (2) styles of experimentation and their historical transformation, including a comparison of experimental history with experimental philosophy in the early modern period, and a comparison of experimental analysis in nineteenth-century chemistry, physics, and the life sciences, and (3) problems formulated under the auspices of an historical epistemology as compared to problems of a historical ontology.

Carsten Reinhardt (Visiting Scholar, University of Regensburg, now University of Bielefeld)

Scientific Methods and Expertise, Nineteenth to Twentieth Centuries

Carsten Reinhardt's work at the Institute concentrated on the history of scientific methods and expertise in the nineteenth and twentieth centuries. Successful claims of nineteenth-century scientists to represent nature in objective terms bolstered their status as legitimate experts. Furthermore, their ability to act—for example, to synthesize new (and useful) substances, to find hidden traces of precious (or dangerous) materials, to combat diseases—greatly amplified their impact. The potential of scientific methods determined the legitimacy and authority of scientific expertise. To be effective, methods had to be linked to societal demands. This process constitutes

the *longue durée* history of today's knowledge society postulated by sociologists. The project has been divided into three parts:

1 Science and the Law

In mid-nineteenth-century Germany, both analytical chemistry and the legal system underwent profound transformations. In court, chemical experiments and measurements supplemented and substituted other forms of expert opinion. The project attempted to determine how the evidence judged at the bar related to the evidence scrutinized at the bench.

2 Regulatory Science

The consequences of industrialization and the mass consumption of technical goods have been an issue since the late nineteenth century. In the 1960s, the focus changed from discrete domains to the environment at large. The project tried to reconstruct the social networking that both separated and connected science and policy and aimed to encircle the boundary objects involved.

3 The Meaning of Methods

The third part of the project tried to clarify the epistemic conditions, social structures, and historical phases of the making of methods in twentieth-century science. The phenomenon to be observed may be called inner-scientific expertise. Method-oriented scientists, for example, had a crucial impact on adapting physical methods to chemistry. For such scientists, methods were the final outcome of their work.

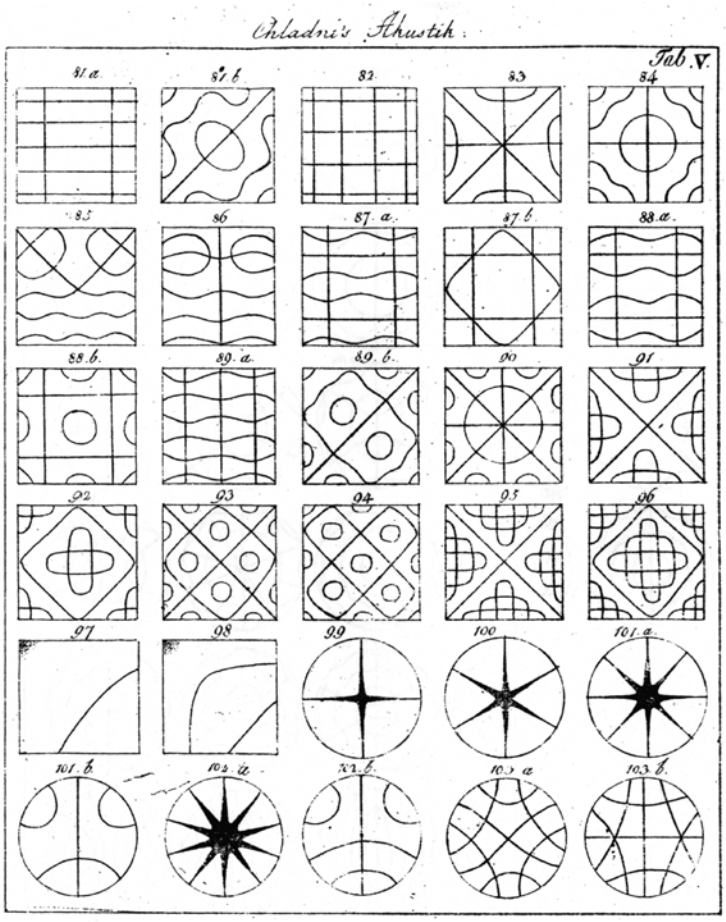
Laura Otis

Laura Otis (Visiting Scholar, Emory University, Alexander von Humboldt Fellow)

Thinking with Images, Thinking with Words

Some psychologists and literary scholars maintain that human thought is verbal by nature and that without language-based narratives, human identity would not even be possible. Others, from the arts as well as the natural sciences, insist that images are thoughts, offering their own experiences as evidence. Since examples of visual and verbal thinking are so often personal, both visually and verbally oriented individuals have had trouble convincing others of the validity of their thoughts. This project will bring together the insights and findings from a wide range of fields about the degree to which people think visually and verbally.

The foundation of this multi-disciplinary project is a historical study of late eighteenth- and early- to mid-nineteenth-century scientists who had overlapping interests in vision, sound, and language and who attempted to "translate" between sensory modalities, among them the German acoustician Ernst Chladni, the British inventor Charles Wheatstone, the British physicist Thomas Young, the British physician Peter Mark Roget, the British photographer Henry Fox Talbot, and the German physicist and physiologist Hermann von Helmholtz. Once this historical foundation is in place, the aim of the project will shift to a comparative reading of the latest findings and insights of neuroscientists, psychologists, philosophers, and literary scholars on the visual and verbal aspects of human thought. These findings will be supported and



Some of Ernst von Chladni's sound figures, created by sprinkling sand on a metal plate and stroking the edge with a violin bow.
Ernst Florens Friedrich von Chladni, Die Akustik, Leipzig: 1802; Reprint, Hildesheim: Georg Olms, 2004

challenged by the results of interviews with people from a wide range of professions who identify themselves as visually or verbally oriented. Juxtaposing the findings of contemporary and past scientists with the claims of lay individuals, this project will question accepted notions of what counts as evidence and will reassess the epistemological value of anecdotes.

Daniel Speich (Visiting Scholar, Federal Institute of Technology, Zurich)

Knowledge and Development. Technology and Science in the Postcolonial Culture of Development

Daniel Speich

Since World War II, a complex system of international technical cooperation and development aid has evolved that prominently structures knowledge about the North–South divide. The history of the development business has been analyzed repeatedly by economists, historians, and political scientists who singled out political or moral motives of donors and, most importantly, dealt with the question of why aid so often failed. Daniel Speich's project follows a somewhat different line. It suggests understanding the aid industry as a new global culture within which forms of knowledge play a key role as agents of coherence. The main argument is that the internal cohesion of postcolonial development culture reached a critical dimension towards the end of the 1960s, allowing for system stability and growth despite rather unfavorable changes in the politico-economic environment. Three case studies describe the role

of scientific and technical knowledge in the perception of social change: an international organization (UNDP), a recipient country (Kenya), and a donor context (Switzerland).

The project aims at a historical reconstruction of the techniques through which economics came to shape the objects under scrutiny. Research during the stay at the Institute first focused on the gross domestic product (GDP) and other highly aggregate indicators of economic performance. A second line of inquiry was to ask to what extent economic research could be considered experimental. The project understands the shaping of the Kenyan national economy in the 1960s as an experimental practice in which modes of knowledge production and economic policy interventions were inextricably intertwined.

Other Projects of the Department

Postdoctoral Fellows

Safia Azzouni

Safia Azzouni (Postdoctoral Research Fellow)

The Popular Science Book: A New Genre between Literature and Science in the Late Nineteenth and Early Twentieth Centuries

The project explored the emergence of popular science books in Europe during the second half of the nineteenth century and the role these books played in the transfer—and the production—of knowledge. Popular science was written not only by scientists, but also by professional popularizers. These authors—journalists, poets or former scientists—often had their background in two fields: science and literature.

Over the course of the nineteenth century, the interest poets took in scientific experimentation and innovation continuously increased. Scientific topics and methods influenced positivist literary theory and the naturalistic movement in France and Germany. Accordingly, the research project addressed the question of the extent to which the genesis of the popular science book was linked to the literary developments of the time.

Azzouni's project focused on exemplary case studies from the realm of German popular science writings. Among the writers dealt with were the theorist of naturalism Wilhelm Bölsche, one of the most famous German popularizers up to the 1930s, and the mathematician, physicist, and philosopher Kurd Laßwitz, one of the first German science-fiction authors. In addition, Azzouni investigated the part popularizers took in the philosophical debate over *Geisteswissenschaften or Kulturwissenschaften.*

- Related Workshops

  "Dilettantismus als Beruf—Professional Dilettantism: Wissenschaft und Kultur im Spannungsfeld Experte—Laie." Workshop organized together with Uwe Wirth, Zentrum für Literatur- und Kulturforschung (ZfL), Berlin, July 14–16, 2006

  "Wissen für Alle! Popularisierung der Wissenschaften zwischen Belehrung, Manipulation und Aufklärung." A public discussion between Andreas Daum (University at

Buffalo, SUNY), Jürgen Kaube (Frankfurter Allgemeine Zeitung), and Jürgen Renn (MPIWG), organized together with Milena Wazeck (Department I) in the context of "Das Jahr der Geisteswissenschaften," Berlin, June 6, 2007.

Didier Debaise (Postdoctoral Research Fellow)

Constructing a Speculative Approach to Heredity on the Basis of Pierre Sonigo's Work

Didier Debaise

This project aimed at analyzing the reasons, the forms, and the effects of a radically Darwinistic position in contemporary French biology—in particular, the position of Pierre Sonigo and Pierre Kupiec. Kupiec and Sonigo wrote a very controversial book in 2000 called *Ni Dieu ni gène,* in which they tried to develop a new theory of heredity no longer based on the notion of information. They argued for coming back to a genuinely Darwinian model applied to all parts of the body, in particular to the cells. In their alternative model, notions such as "resource," "variation," "environment," and "population" play a major role.

Didier Debaise's research developed in three parts: In the first part, he compared this new form of Darwinism to Darwin's own texts and followed the transformation of concepts such as "variation" and "population." His main objective was to clarify what a "genuine" Darwinism could mean, and what kind of concepts and general orientations it requires. In the second part, he analyzed the specificity of Sonigo's Darwinism as compared to other contemporary Darwinistic approaches, such as Richard Dawkins's. The focus was on Sonigo's claim that he was—in contrast to other neo-Darwinians—a non-reductionist. In the third part of his research, Debaise tried to link Sonigo's approach to a tradition of philosophers including Alfred North Whitehead, Henri Bergson, and Gilbert Simondon who explicitly integrated Darwinian claims into theories of knowledge.

- Related Workshop
  "Life and Societies. Toward a New Ecology of the Living." MPIWG, November 2007

Hyo Yoon Kang (Postdoctoral Research Fellow)

Patent Classification and Scientific Taxonomies: Law as a Space of the History of Science?

Hyo Yoon Kang

Hyo Yoon Kang's project explores the interdisciplinary space between science and law, and more specifically, makes use of the relationship between scientific taxonomies and patent classification to examine the interaction between these two knowledge practices. Both are examples of practices of ordering and structuring information into manageable and more or less visible entities—entities that are made to relate to other entities through determinate variables and pathways. Although the International Patent Classification (IPC), administered by the World Intellectual Property Organization, is primarily a legal taxonomy by which technological and scientific inventions are hierarchically ordered, it also plays a central role in re-inscribing such objects' intellectual and material properties by delimiting the scope of proprietary claims that can be made over them.

The aim of the project is to investigate—from the perspective of patent law—how the IPC simultaneously engages in defining and reconstructing a scientific object's "intrinsic nature." The project approaches the IPC as an epistemic tool that creates commodities (patents) by articulation of what constitutes the essence of a scientific object. From this perspective, the IPC and the practice of patent classification form an interface between a "legal history" of scientific objects and proprietary boundaries within the field of scientific practice itself. In other words, the IPC seemingly represents an unofficial site of scientific classification; however, it is a site engendered and negotiated by both science and law.

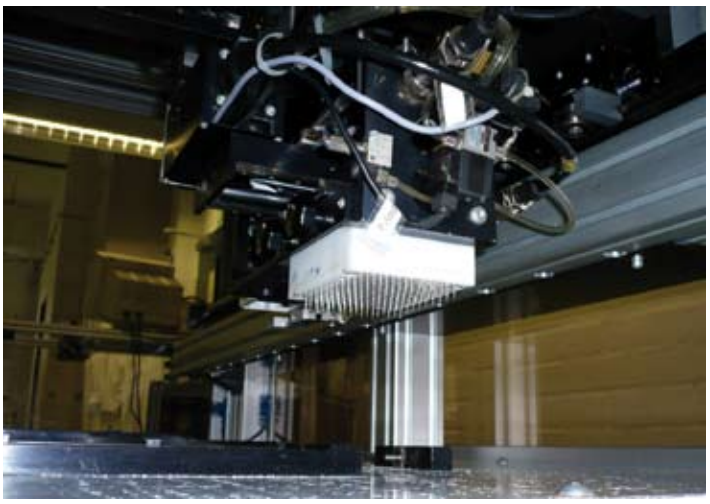
Vincent Ramillon

Vincent Ramillon (Postdoctoral Research Fellow)

The Material Culture of Genomics: Instruments, Organizations, and the Transformation of Knowledge Production

This project targets the history of genomics by focusing on the material practices constitutive of this field of research and their relation to the transformations of the way research is organized. In particular, the automation of the mapping and sequencing procedures since the 1980s is of central interest to an understanding of the many reconfigurations observed in genomics. Automation imposed itself as a major topic for genomics in the very early discussions on the organization of large-scale sequencing projects around 1986–1988. The design and use of automata able to perform the various tasks required by sequencing, such as DNA library processing or sequence determination, rapidly became one of the most important fields of technological innovation applied to genomics.

Automation was understood as a means to replace human labor with machines apparently performing the same tasks. However, automation is never a mere process of replacement, and the use of these technologies engendered novel practices that shaped the field of genomics in many ways. Historically, the transformations throughout the 1990s can be read as emerging from the progressive differentiation of a managerial rationality and associated practices in the production centers and laboratory networks. Beyond these sociological transformations, the transfer of automation technologies from sequencing to other types of experimental procedures has also played a critical role in the fabrication of novel experimental practices and the theoretical reconfigurations of molecular genetics in the second half of the 1990s, known first as "post-genomics" and "functional genomics," and later theorized under the unified label of "systems biology."



Clone-picking robot used at the Max Planck Institute for Molecular Genetics (Berlin) to process DNA libraries.

Olivier Thiery (Postdoctoral Research Fellow)

History, Anthropology, and Philosophy of Neonatal Intensive Care and "Premature Babies"

Olivier Thiery

In the first year of his project, Olivier Thiery focused on the historical aspects of neonatal care. He looked into the history of scientific knowledge about premature babies, showing that they emerged as a distinct epistemic object only at the beginning of the second half of the twentieth century, when they started to be defined by their age and not, as in the past, by their weight. He also looked into the evolution of medical practices and technologies of intensive care in pediatrics from the end of the nineteenth century until today, from microcatheters to breathing machines, from specialized milks to pain management.

The second year of work at the Institute was focused on anthropological and philosophical aspects of the medical practices around premature babies, based on ethnographic fieldwork conducted during four months in a French intensive care unit. The fieldwork consisted of a close observation of medical practices, habits, imitations or inventions, diagnoses, uses of machines, instruments, objects, examinations of the babies, relations with the parents, but also observation of the babies themselves. The philosophical questions basically concerned the links between what one could call the "modes of existence of the babies" and the "modes of action/passion" of the doctor and nurses. More than producing a simple description of the routines, acts, humans and non-human entities allowing the "fabrication of existence," the idea was to focus on the situations of tension in which babies appear in the stream of action as a kind of immanent exteriority, a set of multiple and uncertain possibilities constraining the doctors and pushing them into a passive state of being.

Sophia Vackimes (Postdoctoral Research Fellow, History of Scientific Objects Network)

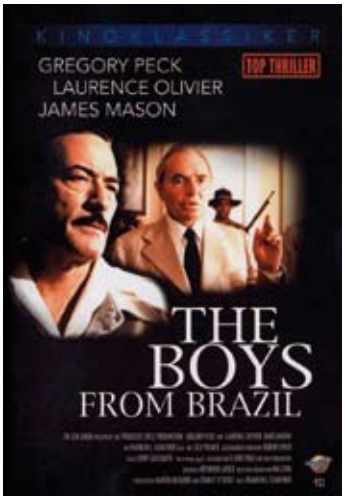
The Genetically Engineered Body: A Cinematic Context

Sophia Vackimes

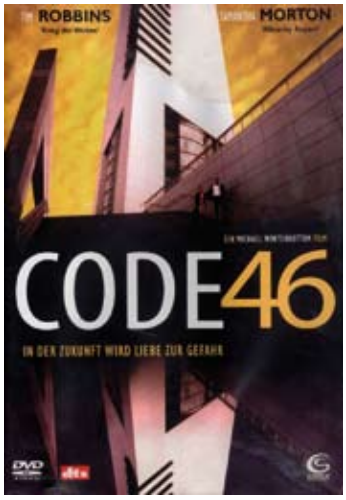
Contemporary research in the area of cloning has provoked intense media coverage and heated public discussion. Much of the controversy and debate surrounding research on cloning for both therapeutic and reproductive purposes revolves around the work performed in the creation and utilization of human embryos. The public has fearful perceptions of the work that scientists perform and is shocked by the moral and ethical implications of the technology. A recent survey by the Wellcome Trust confirmed that the public gets most of its information on science and technology from informal sources such as mass media; films are often quoted to express negative notions about science.

This study seeks to go beyond a facile condemnation of the cinematographic industry to give coherence to the various cultural elements that make up the content of films that in one way or another inform the public about genetics, cloning, and/or genetic engineering. Its purpose is to shed light on how films act as depositories of valuable cultural information/misinformation and how they might create consensus on the work of science. In analyzing *The Boys of Brazil,* Franklin J. Schaffner (1978); *The Island of Doctor Moreau,* John Frankenheimer (1996); *Gattaca,* Andrew Niccol (1997);

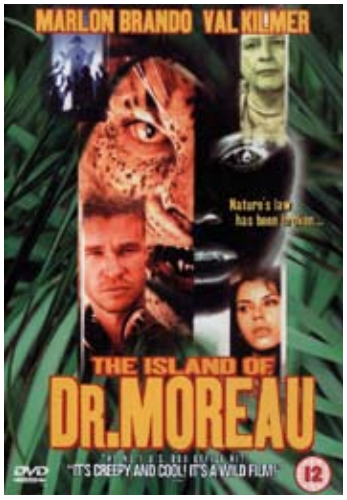
and *Code 46,* Michael Winterbottom (2003) among others, Sophia Vackimes lays out the elements that compose a spectacle where the ethical tensions of our time as well as the parameters of scientific work are played out.



Genetics and historical commentary are prominently put before large audiences. The Boys From Brazil, Schaffner, 1978



Oedipus and other great myths are transformed into critiques on scientific research. Code 46, Winterbottom, 2003



Evil science or research for the good of humanity: genetic experimentation. The Island of Doctor Moreau, Frankenheimer, 1996

Christina Wessely

Christina Wessely (Postdoctoral Research Fellow)

"Astronomy of the Invisible": Cosmological *Weltanschauungen* around 1900.

In 1886 the German engineer, inventor, and scientist Werner von Siemens announced the beginning of an "age of science" in Germany at a *Meeting of German Scientists and Medical Doctors.* National progress would be gained through the advancement of scientific knowledge, whereas pseudoscientific superstitions and prejudices would eventually die out as the powerful "light of science" superseded these "children of a former darkness." Despite this vision of a modern society at the turn of the century, Germany and Austria would witness the rise of a large number of theories that hardly met Siemens's previously expressed expectations for a new role of scientific knowledge. The Theory of the Hollow Earth *(Hohlweltlehre),* the Anti-Gravitation Doctrine *(Antigravitationslehre),* and the New Theory of Geocentricity *(Neue Geozentriklehre)* all offered spectacular images of the universe, insisting that the cosmos could not be fully understood through an exclusively rational approach, but necessitated intuition and fantasy as equally important foundations of scientific knowledge. Most of these new *Weltanschauungen* came in the shape of universal cosmogonies. Within only a few years, some of these theories became extremely popular and gained tens of thousands of enthusiastic adherents, despite strong rejection from academic scholars, who marked these theories as pseudoscientific fantasies.

The project deals with the social and political conditions that made the enormous success of these theories possible and inquires into the specific circumstances that led to this odd renaissance of cosmological *Weltanschauungen* in the first three decades of the twentieth century—a period of time that is commonly considered to be the age

of modern science. It takes the most popular of these ideas, the Cosmic Ice Theory *(Welteislehre),* as an example to show that these phenomena were not anachronistic, marginal ideas brought forward by some obscurantists but, rather, that these forms of "scientific esotericism" were an integral part of the discourse of modern science.

- Related Workshops
  "No Guarantees. Innovative kulturwissenschaftliche Forschung unter unsicheren Bedingungen." Workshop organized with Oliver Hochadel, Anton Holzer et al., *International Research Center for Cultural Studies/Vienna* (IFK) Vienna, April 27–30, 2006
  "Pseudo-Wissenschaft. Konzeptionen von Nicht-Wissenschaftlichkeit in der Wissenschaftsgeschichte." In cooperation with the DFG research focus "Science, Politics and the Public," Department of History, Department of Contemporary History (University of Vienna). Vienna, November 29–December 2, 2006.

Gábor Zemplén (Visiting Guest Researcher, Budapest University of Technology and Economics)

Experimentation and Scientific Debates

Gábor Zemplén

Gábor Zemplén worked on a monograph on seventeenth-century debates about modificationist theories of color and Newton's theory of light and colors. His work included the analysis and incorporation of novel theories of argumentation—especially the pragma-dialectical model developed by the Amsterdam school of argumentation—into the study of scientific controversies. He also published articles on the incorporation of the history of science into science education and in courses developing reflective judgment, and has developed modules for reconciling nature of science modules with social-constructivist approaches. Zemplén was also affiliated with the group "Generating Experimental Knowledge," studying the use of experimental descriptions in scientific debates.

- Related Workshops
  "Generating Knowledge with Microscopes." Workshop organized with Uljana Feest and Jutta Schickore, Berlin, June 23–26, 2006.
  "Kuhn and Relativism." Workshop organized with Márta Fehér, Budapest, September 11–12, 2006.

Short-term Visitors and Their Projects

- *Theodore Arabatzis* (Department of Philosophy and History of Science, University of Athens): "The Electron's Hesitant Passage to Modernity, 1913–1925."
- *Beat Bächi* (Institute for History, Federal Institute of Technology, Zurich): "Artificial Vitamin C. Roche and the Politics of a Chemical Body, 1933–1954."
- *Bruno Belhoste* (Université de Paris 1 Panthéon-Sorbonne): "Paris as a Public Space of Science during the Late Enlightenment and the Romantic Age (1770–1840)."
- *Silvia Caianiello* (Istituto per la Storia del Pensiero Filosofico e Scientifico Moderno, CNR, Naples): "Modularity in Evolutionary Developmental Biology."
- *Luis Campos* (History Department, Drew University): "Contemporary History of Synthetic Biology."
- *Karine Chemla* (REHSEIS, CNRS & Université de Paris Diderot): "Epistemological Cultures."
- *Tobias Cheung* (Humboldt University Berlin): "Agent Theories and Regulatory Models in the Life Sciences, 1900–1950."
- *Moritz Epple* (Historisches Seminar, Johann Wolfgang Goethe University Frankfurt): "An Unusual Career between Cultural and Mathematical Modernism: Felix Hausdorff, 1868–1942."
- *Ragnar Fjelland* (Center for the Study of the Sciences and the Humanities, University of Bergen): "Newton and Goethe on Reality and Scientific Method."

Goethe's Color Circle. Goethe Museum Frankfurt, 1809

- *Jean-Paul Gaudillière* (CERMES, Paris): "History of the Industrial Uses of Biological Knowledge."
- *Elodie Giroux* (Institut d'Histoire et de Philosophie des Sciences et des Techniques, Université de Paris 1 Panthéon-Sorbonne): "A Philosophical Inquiry into the Concepts of Health and Disease in the Context of Risk Factor Epidemiology."
- *Thierry Hoquet* (Département de Philosophie, Université de Paris Ouest, Nanterre): "Darwin against Darwin? The Readings of *The Origin of Species*."

- *Catherine Jackson* (University College London): "Analysis and Synthesis in Nineteenth-Century Organic Chemistry."
- *Ilana Löwy* (CERMES, Paris): "History of Cancer Risk and Preventive Surgery for Feminine Cancers."
- *Barbara Orland* (Center for History of Knowledge, Federal Institute of Technology and University of Zurich): "Economies of the Body. Transforming Knowledge Regimes on Nutrition and Regeneration from the Eighteenth to the Nineteenth Centuries"
- *Maria Rentetzi* (Department of Humanities, Social Sciences and Law, National Technical University of Athens): "Radium as a Trafficking Material."

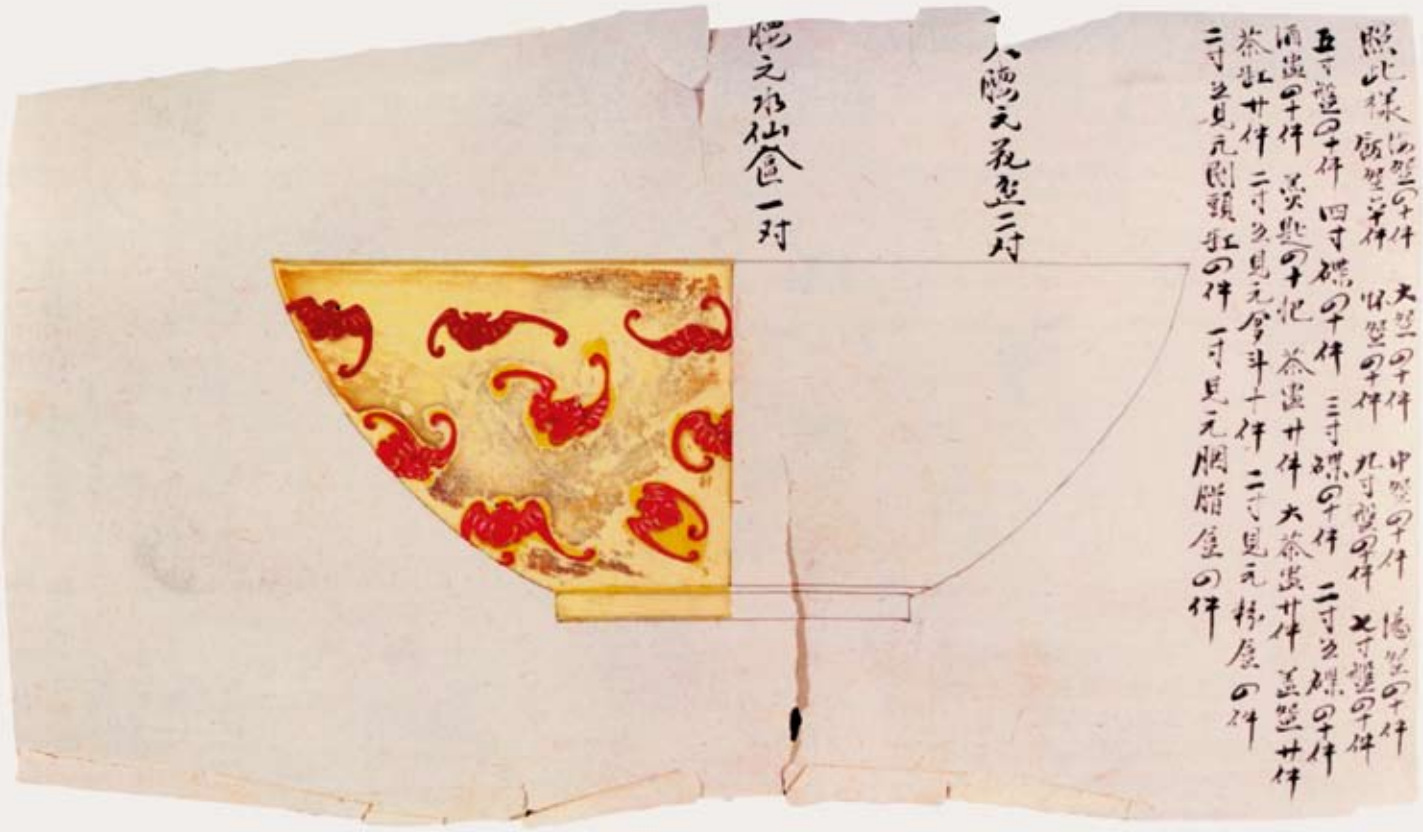
Left: The interior view of a radium emanatorium where patients are being treated with radon, designed by Radium Chemical Company Inc. in the 1920s

Right: Vita Radium Suppositories for men's sexual rejuvenation were produced by the Home Products Company of Denver around the 1930s, for confidentiality reasons shipped to costumers in a plain wrapper.

(Courtesy of Paul Frame, Health Physics Historical Instrumentation Collection, Oak Ridge Associated Universities)

- *Robyn Smith* (Carleton University, Ottawa): "Encountering Hermes in the Unknown: Exploring Experimental Vitamin Research during WWI."
- *Benjamin Steininger* (Humboldt University Berlin, University of Vienna): "A Cultural History of the Concept of Catalysis in the First Half of the Twentieth Century."
- *Viktoria Tkaczyk* (Free University of Berlin): "Unready to Take Off: Failed Flight Attempts in Early Modern Europe."

Independent Research Group I + II



"100 bats on yellow ground",
blueprint for a set of bowls of different size
(ink on paper, colored, 16.2 x 27.2 cm,
Palace Museum Beijing. Wang Guangyao:
Zhongguo gudai guanyao zhidu. Beijing
2004, p. 57)

Independent Research Group I

Concepts and Modalities:

Practical Knowledge Transmission

Director: *Dagmar Schäfer*

Historical research in recent decades has opened new ground concerning questions of discursive attitudes, economic growth and civic responsibility. The new focus on this period in Chinese history as one of commercialization and intellectual renewal raises questions about this period's technological development and in this regard its culture of innovation. The project offers an approach utilizing a variety of perspectives towards evaluating the impact a culture's tradition of knowledge transmission in the field of practical knowledge (technology) has on innovation capability. The issue of the relation between practical and theoretical knowledge was singled out, and will now be investigated by the newly established Partner Group at the Institute for the History of Natural Science, Chinese Academy of Science in Beijing, PR China. A cooperation with the Palace Museum has been initiated. It concentrates on the role of the court as a place for the appropriation of knowledge with a special focus on archival materials such as storage devices, sketches, tools, and models.

The Independent Research Group I at the MPIWG focuses on how technical knowledge was perceived, transmitted and evaluated to form a distinct, yet changing, "knowledge culture" and comprises research subjects in the period from the Song to the mid-Qing Dynasty (10th–18th Century). Promoting three fields of interest, written, material and social factors, the first phase concentrated on the role and context of technology in written culture.

Project

Written Traditions of Technical Knowledge

Written culture reflects the changing attitude towards technological knowledge from a historical perspective and influences its role in society and state. Moreover, transferring knowledge of a technical nature in text-form poses questions about transmissibility and purpose, about the given role of author as a surveyor of knowledge of a non-literary nature and about the general assessment of historical categories of knowledge such as "technical" and "technology".

Quite a variety of traditional Chinese genres of text provide descriptions and evaluations of technology. The project distinguishes between three forms: firstly, monographic writings which deal exclusively with practical matters; some of them embrace a comprehensive selection of technology, some are smaller elaborations on one technique. Secondly it singles out smaller text units that dealt with particular technologies (or the products derived from this technology) but were not independently transmitted. These kinds are collected in encyclopedic compilations or constitute part of miscellaneous private jottings (*biji* 筆記), where they are contextualized with other topics (sometimes from morals to ghost stories). Others are incorporated into more systematic collections like 'household books' etc. As a third group the project identifies local monographs and their chapters on 'local production (*tuchan* 土產)' respectively 'foods and commodities (*shihuo* 食貨)', in which local officials report on products as well as technologies, offering close insights into the role of technology in various localities and exemplifying the varied landscape of technological endeavor across time and space.

These different kinds of texts serve (in addition to administrative texts, archive materials and artifacts) as sources for the various parts of the project. They are moreover addressed as issues concerning the embedding of technological knowledge within traditional Chinese written culture. Scrutinizing place and position of technological information within a certain text—as well as the function and role of this information in context—has up to now never been properly addressed for China. Investigating the various forms and embeddings of written assessments of technology facilitates a better understanding of the cultural influences on technology, its dissemination and development. How were these texts evaluated by Chinese tradition? How did the author legitimize his text and in what tradition did he see his work? Where and how do technological descriptions placed within a work also deal with other matters? Furthermore the biography of the author, his expertise and his interest in this specific matter as well as his terminological or hermeneutical background are taken into account. What readership does the author anticipate and which impact does his documentation of technical details have? Is the reader intended to recover the knowledge from the text to perform or supervise the technology himself or does the information just satisfy intellectual curiosity?

One example of the implications of textual evidence is a text published in 1561 by Qi Jiguang 戚继光 (1528–1587). Qi was a successful general and high military official of the Ming Dynasty. Biographical sources characterize him as a practitioner, rather than an administrator. In 1561, at the climax of his career, he published a comprehensive treatise on military strategy that was distributed among his officers to train their soldiers in their campaign against the Japanese *wokou* 倭寇 pirates. Various editions and references verify that his work was widely distributed among professional soldiers and also handed around in literati circles. Qi Jiguang addressed the use of Western weapons side by side with traditional martial arts. He delineated in detail the construction of the harquebus (*niaochong* 鳥銃), offering detailed descriptions of the major technical details. He also precisely illustrated the fastening nut and bolt needed to lock the trigger mechanism. Nuts, or screws, and bolts were by that time already widely in use in China, and their earliest mention dates back to the year 1490. Yet, as we learn from Joseph Needham, they were exclusively used in Western-style weapons until the 18th century.

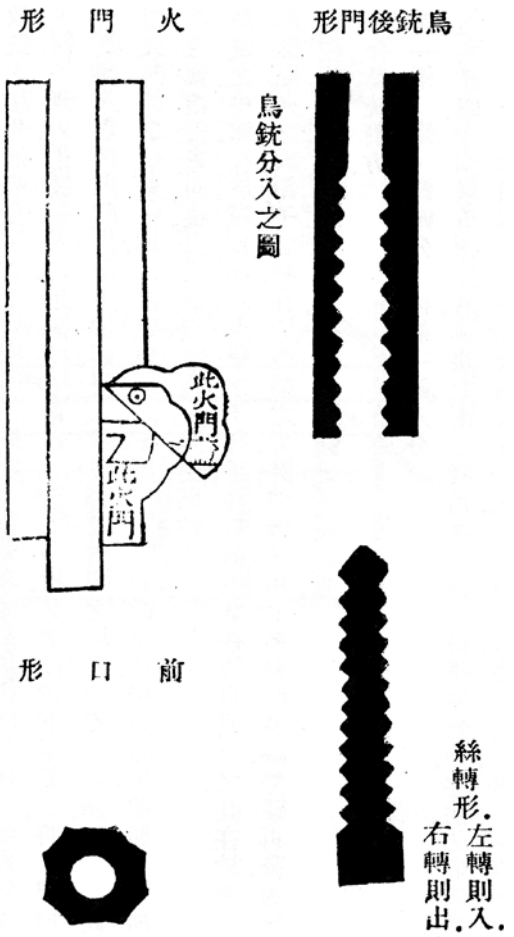
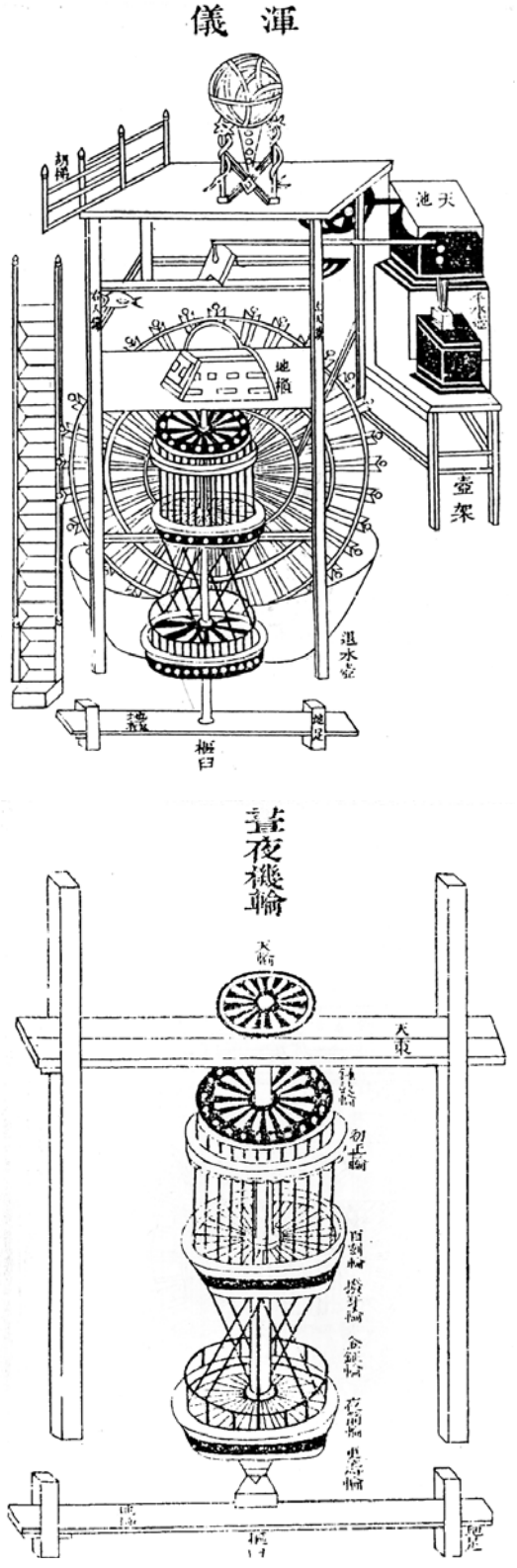


Diagram of a harquebus (niaochong) with fastening nut and bolt, Qi Jiguang, Jixiao xinshu, Hualian chubanshe, 1561, (Taibei: Taiwan Commercial Press, 1978). P. 208

Qi Jiguang's description, although emphasizing the usefulness, agility and easy handling of this construction, did not change this. His documentation made the technical information available and distributed it widely, yet the knowledge was not separated from its context. The fastening nut and bolt concept was neither described in other texts nor applied in other fields, such as architecture or machine building. The availability of this information in literati and expert military circles did hence not inspire further innovations.

Starting in 10th Century, literature with a technical content appeared on the expanding market for print-matter. They addressed a huge variety of topics, from highly specialized descriptions about the production of Chinese ink, sugar or cotton cloth, to treatises informing about basic agricultural techniques; from the latest achievements in astronomical instrument-making to standards in architecture. Su Songs 蘇頌 (960–1279) *Xin Yixiang fayao* 新儀像法要 *(Essential Methods of the new Astronomical Equipment)* from 1094, for example, describes explicitly in text and illustration the details of an astronomical clock he had devised.



Song's astronomical lock, Su Song, Xin yixiang fayao, from Ren Jiyu ed., Zhongguo kexue jishu dianji tonghui, jishu juan 1, Zhengzhou: He'nan jiaoyu chubanshe, 1994, S. 315

The *Lu Ban jing* 魯班經 (The Classic *Lu Ban*) from the 15th Century gives instructions for carpentry. Yet, both texts did not primarily serve to pass on technical details. Su Song aimed at imperial support, presenting his ideas and the results of a stately project under his supervision to the Emperor. His treatise constitutes a written counterpart to the monumental project itself, emphasizing the duty of the state to engage in such matters. His treatise was not intended to spread technical details nor was this achieved by his work.

In the case of the carpentry manual *Lu Ban jing*, the book seemed to have changed its purpose over time. Although offering comprehensive insights into house construction and carving techniques the ritual contents became more important. In the end the book itself acquired ritual status as it was handed down from one generation to the next. Ritual rulings and geomantic spiritualism then set the value of this book for carpenters, while they disregarded the technical details. From the 14th century on, the *Lu Ban jing* was in fact used by carpenters only as a quasi-religious icon of their craft.

The mentioned works assign technology a cultural and socio-political function that, although meant to enhance the value of technology, sews the seeds that put technology in the rear of epistemological inquiry. The practical usefulness of the contents was either not intended from the outset or it retreated in the course of time into the background, while the context gained meaning and significance. The example of Qi Jiguang illustrates how technical descriptions were made available in texts, and nevertheless ignored, thus indicating to the difficult role that written sources played in the transmission of practical knowledge. Scrutinizing the particular intentions that an author had for the compilation of his work and the impact of his documentation of technical content, opens a new view to the purpose and role of technological writings in Chinese culture. Pursuing a systematic approach, a relational database is conceived (see description below), subsuming a broad text basis for further inquiries into the diversity of the contents and functions of written documentation. It

is designed to allow direct access to the original texts in the future. Offering a front end in English, it furthermore opens these sources to a wider non-sinologist user-group in a searchable environment.

The individual projects, which started in October, 2006, concentrate on distinct modes of cultural and intellectual processing of technology in China. A project on the "Historization of Innovation" focuses on the changing perception of the material and technological basis and development of Chinese civilization, asking how innovation and change in this material base had been adjusted to culturally and intellectually. A second project, scrutinizing biographies of master craftsmen in Chinese historiography, reflects on the way in which historically acknowledged personalities engaged with technology, how they and their skills were valorized and which attitudes and role were assigned to this group in society. A third project focusing on architectural writings unravels the interaction of craftsmen and scholars in the knowledge sphere of architecture and the way in which such manuals affected the recognition of this discipline as a field of knowledge in later periods.

Stately concerns and fears constitute another important area of assessing, controlling and integrating practical knowledge in a society. Since the 14th century the Chinese state under the leadership of the Ming Dynasty engaged itself more and more in the production of goods such as textiles, porcelain, lacquer ware etc. The example of the state run silk manufactories during the Ming period shows that the officials gave great importance to the transmission of knowledge and the question of how to disseminate innovative techniques and products effectively. High-level ministers in the central government were responsible for such issues and had to guarantee the functionality and efficiency of the state enterprises. In sectors such as silk and porcelain production, the imperial household intervened directly. Within the political discourse the bureaucratic apparatus developed a variety of measures to ensure a continuous transfer of innovative techniques from the private to the public sector. Archival materials, memorials to the throne and local reports as well as the state manuals and collections on the economic history of that period allow us to chronologically retrace how the central government exerted control on knowledge flow, for example, by scheming the craftsman's mobility. They reveal that technology became a political issue. In these processes the public and private sectors were assigned new roles in knowledge transmission which in turn gave rise to political and philosophical discussions among concerned scholars on how to deal with craft knowledge.

An interesting example for this process is Qiu Jun 丘濬 (1421–1495) and his exemplifications on the "value of work (*gongyong* 工用)" presented in the *Daxue yanyi bu* 大學衍義補 *(Supplement to the Explanations of the great Knowledge,* 1506). In his political handbook addressed to upper level officials in the central and provincial government, Qiu Jun expounded the problem of the increasing level of skills that the craftsmen of his time pursued. He equated artfulness and subtlety in crafts with 'licentiousness (*zi* 恣)', conversely, he judged the growing discrimination of craft professions positively. The text lists for the recruitment of service levies verify that the working process during this period was subdivided into small units. The growing variety of professions was not based on a proliferation of techniques.

Incorporating craft manufacture systematically into the state enterprise, the first emperor of the Ming Zhu Yuanzhang 朱元璋 (1382–1398) challenged the officials' self image. He forced them to administer skills which they themselves did not master and which were below their social level. Qiu Jun met this challenge in a subtle intellectual way, one that allowed the official to reinforce his ability to preside over the central position within the state: they encouraged the modulisation of practical work and controlled the skill level of the specialists with ritual specifications. Through the modulisation, as described by Lothar Ledderose, the tasks of the individual were simplified. Workers, performing few recurring actions, could thus be easily trained and became interchangeable. The scholar official in turn was needed as an administrator, who possessed the overview and the ability to put the pieces in the mosaic together. Thus the officials gained control over the expertise of the craftsman. Art historian and Sinologist Martin Powers traces similar developments during the Han period (202–220 B.C.) on the basis of the decoration on ritual vessels. He interprets their changing complexity in design as a result of a new social order, in which the officials established their control over practical activities in the state. At first glance, the later decorations seem more complicated and proof of higher skill than the earlier versions. Closer inspection reveals a repetitive structure that has been performed according to standard specifications. Variety was performed only within the limits of standardization. In such a culture the expert is the administrative official. He knows the standards and how to execute the creative tasks within the given parameters. He seeks refuge in subtle alterations, not in revolutionary novelty. Through a few measures the officials could thus secure a controlling function over craft knowledge essentially affecting the conditions of innovative force. Discussions like that of Qiu Jun are one particular outcome of the subtle and many-layered processes incepted by the technological and economic development in Ming and Qing times whereby the man who works with his head positions himself in relation to the man who works with his hands.

Locating Technological Knowledge in Chinese Traditional Writing—A Database

Martina Siebert, Dagmar Schäfer, Cathleen Paethe

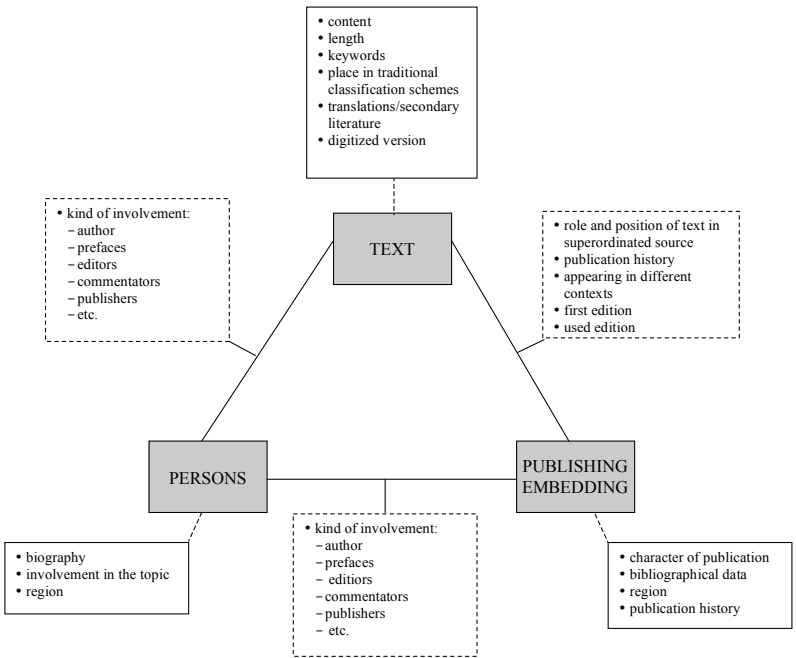
Technological issues and practical know-how are a recurring theme in the Pre-modern Chinese written tradition, addressed in various literary genres with varying purposes. Disclosing the contextual embedding of technological content, the database provides a means to develop a new trajectory of knowledge classification in Pre-Modern China, evaluating in which nexus practical issues were considered worth knowing and how this changed in the period from the 10th to 18th century.

Although monographs concentrating exclusively on technology are exceptional in Chinese history, numerous works contain scholarly elaborations relevant to technology. Dispersed among essayistic writings, poetry, entries in Chinese encyclopedic reference books *(leishu)* etc., there are signs that scholars demonstrated a keen interest in practical issues. Designed to outline the technological knowledge contained in all these different sources, the database locates technological knowledge within its writ-

ten and biographical framework. Following the idea of technology as an "object of knowledge", its classification within the framework of the book thus becomes the major focus of study, while the book in turn is positioned within the career and biography of the author and within its publication history.

Furthermore the database brings particular attention to genres less immediately identifiable as technical writing and to the mode in which authors dressed up technology in these texts. Scrutinizing the notion of stagnancy, the database illuminates the subtle changes performed when these texts were re-used in different publishing contexts. Thus the database also provides a guide through the monumental and the apparently marginal remnants of Chinese technological documentation, of benefit to interdisciplinary research. The attached diagram illustrates the information collected. There is information directly connected with the description and evaluation of the content of the source itself, information on the embedding that source is published in and on the biographical details of those involved—from authors to publishers. At the junctions of these sets of information the role and intention of the various involved actors and the position of the source within its different publishing context is elucidated.

A collection of Chinese historical texts on science and technology in the facsimile (*Zhongguo kexue jishu shi tonghui* 中國科學技術史通匯) and the source texts in focus of the research group members constitute the first fundament of data. Accessible online from the outset (planned July 2008), the project is designed to successively involve competent researchers from the fields of Chinese Studies and History of Technology to expand the entries with their annotations and add new ones. The database facilitates research in the field by providing a bibliographical and biographical reference tool to specialists and a broader audience in English and it seeks to establish a platform for the future exchange of expertise and analysis concerning writing on technology in Chinese history.



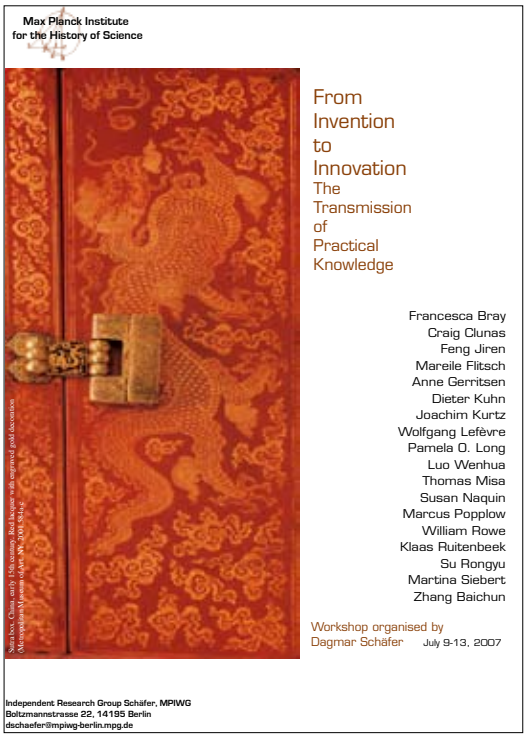
Workshop and Book Project: From Invention to Innovation

The workshop in July 2007 examined concepts and modalities that influenced practical knowledge and its transmission in pre-modern China. Identifying the factors involved in the development, transmission and perception of technology from an interdisciplinary perspective was the focus. On the basis of the workshop a volume is being collated and edited by Dagmar Schäfer provisionally titled *Towards a Cultural History of Technology in China.*

The history of technology in China presents a unique challenge for the traditional Western history of science which has not yet been adequately met: how was China so successful at inventing, establishing and maintaining technological markers of civilization such as papermaking and printing, the manufacture of compasses and of silk, for 2000 years. Many books list and expound the details of a specific technology; the nuts and bolts of paper-making or ceramics, for example, have been explained ad infinitum. This volume, however, focuses on the flux of stagnation and innovation that was the reality of Chinese civilization.

On a theoretical level the contributions examine and clarify the concepts and modalities that influence practical knowledge transmission. On the practical level technological development in China is scrutinized from the viewpoint of how technical knowledge was perceived, transmitted and evaluated to form a distinct, yet fluctuating "knowledge culture". This is a completely novel approach in Chinese studies.

Of interest to students and experts in the fields of East-Asian Studies, the History of Technology, and Knowledge Transmission the volume presents an interdisciplinary and cross-cultural perspective based on the work of renowned scholars. Experts give a comprehensive overview into a sphere of knowledge that characterizes Chinese culture: the Scholarly Arts, the sphere of documentation; the Agora, the sphere of aggregation; Imperial Technology, the sphere of appropriation and the Internode, the sphere of communication. Historians of Western Technology grasp this unprecedented opportunity to scrutinize each sphere and identify the points that reflect universal technological experience as opposed to culturally specific characteristics. The book will contribute methodologically to both the study of technology and knowledge transmission.



Individual Projects

Martina Siebert

Martina Siebert (Research Scholar)

Historicized Innovation: Knowledge Tradition and its Encounter with the New

Investigating which concepts of invention and innovation in technology were prevalent in traditional China and how they changed, this project embraces texts from the 10th to early 18th century. A sediment layer of Chinese approaches to invention and innovation is found in the encyclopedic assemblages of the 'Origin of Things' (*wuyuan* 物原). These 'things' encompass a comprehensive spectrum, among others natural and meteorological phenomena, such as heaven and hail, official agencies, cultural and material achievements, and species of flora and fauna. The 'origin' or 'beginning' of these various things differs accordingly. Technology, its artifice and artifacts, is spread through the various sections in these works. Investigating how this genre evolved, what intentions and interests the authors and compilers had, the project analyzes the reception of new things and the assessment of technological change by Chinese literati. Which things did they consider vital for Chinese civilization and civilizing processes? What role did they assign to technology and its development historically?

Assembling references from other written sources, *wuyuan* encyclopedias encompass creative acts performed by ancient saints, chance discoveries, interrelated sequential evolutions, changes in use broadening the usability of a technology, foreign imports that were incorporated into Chinese tradition etc. A systematic approach identifies types of invention and marks out stereotypes. Major results were presented on the first workshop of the research group in July 2007 and will be included into the forthcoming book project.

The extension and first publication of the *Shiwu jiyuan* 事物紀原 *(Notes on the Origin of Things and Affairs)* in the year 1472, conventionally ascribed to Gao Cheng and the 12th century, marks the beginning of the upsurge in *wuyuan* writing traditions. It ends with the publication of the *Gezhi jingyuan* 格致鏡原 *(Mirroring the Origin of Things to be Investigated for the Maximization of Knowledge)* compiled by Chen Yuanlong (1652–1736). Between these two points in time and in the course of the Song, Yuan, Ming and early Qing dynasties, intellectuals dedicated ten more compilations to 'origins', some of which were reprinted many times, keeping the genre alive over almost nine centuries. Relating to each other, the volumes progressively grew in content and size, and finally added up to 100 *juan* in Chen Yuanlong's compilation. The *wuyuan* topos evolved into a scholarly means used in the various forms of writing to establish historicity and to understand and interpret the development and pattern of the world. The increasing economic prosperity of Ming time, fostering the awareness of ever-new things, added to the popularity of the genre among scholars.

During the second phase, the project disentangles how the encyclopedically collected 'origins' were re-distributed among the learned elite and how these writings influenced their assessment of and approach to contemporary technological expertise and new artifacts.

Probing into the notion of China's orientation towards the past, the project employs the scholarly obsession with identifying 'origins' as a tool to disclose the modes by which Chinese culture appreciated new things and reflected on technological change and progress.


Martin Hofmann

Martin Hofmann (Postdoctoral Fellow)

A Philological Archaeology of Master Craftsmen

In the classical woodcut schemes of Confucian ideology, the craftsman together with the merchant is situated at the lowest tier of society, outranked by both the scholar and the farmer. Ruled by a class that based its self-recognition on scholarly learning, it is generally believed that this view prevailed in Chinese society from the 10th century until the Republican era. Yet, the scholarly interests of Song dynastic intellectuals also included to a great extent technological and practical issues. The Mongol rulers of the Yuan-period imposed their social system on the Chinese state, elevating the craftsman and practitioner. The Ming dynasty, although emulating the seemingly scholarly ideal of their chosen predecessors the Song, incorporated craft production into crucial sectors of the state system. The Qing dynastic Manchu rulers reconstituted the Ming emphasis on state manufacture and expanded the export of silk and porcelain goods. Concentrating on biographical writings, the project investigates the tension between the prevalent ideological scheme and the changing historical reality of master craftsmen. The reception of the craftsman in historical writing and the construction of identities in biographies and eulogies reflect these changes in societal placement.

The project starts its investigation with a compilation prepared during the early 20th century, the *Zhe jiang lu* 哲匠錄 *(Collected Biographies of Master Craftsmen)*. This collection of Chinese historical documentations of craftsmen from the early period until the Republican era was compiled by Zhu Qiqian 朱啓鈐 (1872–1964), an eminent Chinese scholar and politician facing the dominance of Western technology and science. Pooling materials from manifold literary sources, this compilation provides a comprehensive fundus of biographical material.

Zhu Qiqian pursued his project patterned after the style of western systematic and scientific approaches. He aimed at establishing a large-scale research project reappraising Chinese material culture as a whole by preserving, systematizing and analyzing textual sources as well as cultural relics. For this purpose Zhu assembled Chinese scholars trained in Western architecture together with master craftsmen of the imperial workshops and invited Westerner scholars researching Chinese material culture to participate in the project. The *Zhe jiang lu* is a fragment, an unfinished endeavor, only complete in three of the planned fourteen craft disciplines. As its stands it allows us to scrutinize how the traditionally educated Chinese elite, such as Zhu Qiqian, appraised and re-invented their own cultural heritage in the light of Western concepts of science and technology and under the pressing need to reconstitute their cultural pride and establish national identity .

Feng Jiren (Postdoctoral Fellow)

Chinese Building Manuals and Traditions of Architectural Technology

Examining technical manuals on architecture, this project looks into the distinctive cultural connotations reflected from their technical contents, reconstructing the intellectual setting for preserving tradition and engaging in innovation in the building profession.

Feng Jiren

Since the tenth century, master craftsmen, scholars, imperial architects or officials summarized practical building technology and methods. The architectural knowledge presented in their writings often served as guidance for contemporary building practice, some developing into a paradigm for professionals and literati alike in the domain of architecture.

An important issue of this project is how the practical knowledge of architecture was constructed, how it was preserved as tradition, and how Chinese craftsmen and writers dealt with the conflict between maintaining tradition and incorporating technical invention.

One of the research discoveries thus far is the identification of the two groups, craftsmen and literati, as the interplaying forces for formulating the knowledge field of architecture. A basis for this research was results obtained from a philological inquiry into the semantic meanings of the professional terminology in the 12th-century official building manual *Yingzao Fashi* (Building Standards, 1103). The terminology used in this central writing on Chinese architecture presents a mixture of literary and vernacular language. Its nomenclature of bracketing presents a powerful metaphorical system: bracketing elements are likened to flowers and flowering trees, and it is important to notice that such architectural conceptualization was shared by craftsmen and literati. Indicating a great impact of literature upon Song (960–1279) craftsmanship, it suggests an ongoing interaction between craftsmen and the learned society.

A significant result achieved during the first research term was that scholars and craftsmen were working towards shared architectural vocabularies and knowledge since the Song period. Ming-Qing (1368–1911) scholars who built on the legacy of the Song more actively engaged in the making of building methods. Focusing on case studies of some building manuals reveals that Chinese literati constructing architectural knowledge in manuals, venerated fanatically on the rare classics, an attitude which affected the process of technical innovation and digestion of tradition. For instance, Song accounts suggest that the tenth-century Classic of Timberwork *(Mujing)* served as guidance for building practices for almost one hundred years, prior to the official building standard *Yingzao fashi.* Nevertheless, the primitive stage of modular systems in the *Mujing* did not reflect reality. In fact, artifactual evidence substantiates that a more comprehensive modular system had been in practice. The *Mujing's* impact on building practice, to a great extent, lies in the fact that it ended the long-term silence of technical manuals on architecture in history, yet its impact on actual practices in architecture can be deemed as minor. Thus the importance assigned to it in Chinese architecture is largely a literary construct, and not an effect of its actual usage.

"Complete map of the central axis from the Daqing gate to the Kunning Palace" Gugong Palace, Beijing (ink on paper, no date)

Its influence was prolonged by Song professionals' and literati's fanatical veneration of it as a rare technical classic. Even when craftsmen depended on the *Mujing* less and less and actually created new technologies, they still claimed that their designs "followed" the *Mujing*. This was independent of the fact that actual practices had already long changed. Scholars also liked to associate favorite building designs to the principles of the *Mujing*. The case of the *Mujing* provides an example that the practical knowledge constructed in writings mainly served as an ideal of Chinese professionals and scholars in the domain of architecture. Its impact on building practice thus lies beyond its technical relevance.

Oral and Visual Transmission

Under this heading socio-cultural issues, knowledge mobility across space and the social context of artisans are addressed.

Social-cultural issues refer to esoteric tradition, popular religion and the ritualization of technologies. A structural overview helps to understand in which way guilds' structure and religion served as a protective/disseminative framework that affected the spread of inventions and innovation geographically and cross-disciplinarily. Issues of knowledge mobility focus on interregional transmission within the Chinese cultural sphere. Case studies will be conducted regarding the knowledge transmission to and from the imperial court as well as across regions.

The social context of artisans, their social interactions and artisan routines and norms determine the dynamics of shared learning within technological knowledge. Innovation is identified within this framework as a multi-faceted outcome of technological nexus, of explicit and implicit professionalism, social structures and institutional setting.

Palace Museum Cooperation and Book Project

Dagmar Schäfer, Luo Wenhua, Guo Fuxiang, Wang Guangyao, Xu Xiaodong, Zhang Qiong, Zhang Shuxian

In collaboration with the Palace Museum, Beijing, the transfer and appropriation of knowledge by the court and central government is investigated. Based on archival materials and artifacts, this collaboration issues a new look at forms of knowledge transmission beyond textual evidence, unfolding the various means and media of knowledge production. In collaboration with the Palace Museum, the National Library and the First National Archive all located in Beijing, access is granted to design sketches and architectural plans, craft tools, samples, devices and models used for the communication of new technologies, designs and ideals, that will provide part of the research basis for the material transmission of practical knowledge.

The book project of the collaboration, which started in September 2007, features as its major topics the exchange of technological knowledge between different actors in China: between China and its tributary states or foreign countries; between the elite and the common people, or the official and the craftsman; between regional and central government or urban and rural populace. These levels of knowledge transmission will be exemplified using six fields of accomplishment: enamel techniques, architecture, porcelain, jade carvings, metallurgy and silk embroidery.

Technological Landscapes—China Historical GIS

Dagmar Schäfer, Martina Siebert

Mapping technologies is increasingly being used in the humanities for research and as a tool for the representation of data. Individual projects are exploring its potential from various directions. Comprehensive in outlook and approach, the China GIS project on Technological Landscapes currently assembles data in the regions of China to develop a basic understanding of regional technologies and their distribution in space and time. The project includes reconfiguring of the existing data produced by the Shanghai Tongji University and Harvard-Yenching Institute's China Historical GIS (CHGIS), to serve as backdrop against which to display the finds of the "Technological Landscapes" project and research data of future and other projects on China. Easy handling and extensibility are major prerogatives for its technical basis that, though primarily designed for individual purposes, is aimed to accomplish a universal interface for geo-referenced historical research and the publication of its results.

Specifically, the project assembles information about technological development in pre-modern China in the period from the 10th to 18th century. Different kinds of geo-referenced finds are taken into account: accounts of state owned production sites, lists of regional products compiled for local monographs and archaeological finds etc. The CHGIS provides an acknowledged source for basic geo-data on populated places and historical administrative units for the period of Chinese history between 222 BCE and 1911. This data is recompiled according to new adaptable technology and reconfigured for display and research usage on an openly accessible platform. Building on this foundation stone, the joint project of the newly established partner group at the IHNS/CAS and the research Group are using this data to locate the finds of the project in space and time.

Material Transmission: Tools, Machinery and Products

Models and sketches provide a way of transmitting practical knowledge across distances without personal contact. Their role in Chinese history is unclear. On the basis of various resources, technical heuristics are a major focus of this project, the history of three-dimensional model building and the application of construction drawings in craft culture.
Furthermore selected processes of procedural and idiosyncratic inventions and innovations are dealt with. Case studies scrutinize (1) the environment that generates invention and (2) track how a technology is distributed in materia in pre-modern China (see Palace Museum Cooperation).

The Relationship between Practical and Theoretical Knowledge

Among the manifold factors that influence technical knowledge, its dissemination and development, a significant factor is its epistemological positioning, i. e. how it is defined and received in particular domains. Dissecting when and how practical and theoretical knowledge interact or are distinguished as viable means of inquiry thus adds an important viewpoint to understand how knowledge is produced in a culture. Developing a project in collaboration with the IHNS/CAS, the research group founded a new approach to how knowledge is produced in the fields of technology and in the field of the sciences. A number of projects exploring the "Borderlines and Intersections: Knowledge Spheres in Pre-Modern China, 10th–17th Centuries, were set up conjointly.
Inaugurated in September 2007 the Partner Group concentrates on the relationship between practical and theoretical knowledge in the Chinese cultural realm defining hierarchical and vertical knowledge spheres as a basis of inquiry. From the viewpoint of intellectual, social, geographical, political, and/or organizational features, the projects look at the internal structure of knowledge spheres in which technology and practical knowledge occurred and their external linkages. This provides a new conceptual basis for research on Chinese knowledge about nature and man, technology and its development. Comprising the period from the 10th to 18th century, the projects of the first phase concentrate on the Song Dynasty 10–13th century, looking at a time that gendered great creativity, transformations in technology and systematic approaches to knowledge about nature and man.

In pre-modern China knowledge spheres were subject to and defined by the goals to which the specific knowledge was geared. Knowledge about nature and man, i.e. scientific knowledge, and knowledge about practical or technological issues were contextualized within these spheres and linked to external issues. The borderlines and intersections of these knowledge spheres shifted because Chinese society experienced tremendous changes during the period in focus. During this long period cultural and economic centers shifted back and forth from north to south. Urban culture developed and rural life was transformed by changing agricultural methods and new crops. The state engaged in various forms and fields of production. Trade and foreign contact provided another significant incentive for the construction and production of knowledge.

All these factors combined to form the uniquely Chinese construct in which scientific and technical-practical knowledge was placed and thus developed. The project investigates the location of and relation between various knowledge spheres in order to provide an authentic lens through which Pre-modern China's scientific and technological knowledge can be seen and assessed. Six research projects in the fields of astronomical knowledge, alchemy, agriculture and sericulture are being pursued and will work in close cooperation with the MPIWG Research Group in the future.

Visiting Scholars

Sun Xiaochun

Sun Xiaochun

Xiaochun Sun, Institute for the History of Natural Science (IHNS) of the Chinese Academy of Sciences, P. R. China, studied the interaction of cosmological thinking, calendar making and astronomical measurement as reflected in astronomical instrument making in Northern Song China (960–1127). This study led to the research proposal on *Borderlines and Intersections: Knowledge Spheres in Pre-Modern China, 10–18th Century,* which was approved by the Max Planck Society as the central theme of research of the Partner Group of the Max Planck Institute for the History of Science (MPIWG) at the IHNS. Sun Xiaochun was appointed head of the Partner Group. His study here also contributed considerably to his new dissertation on *State and Science in Northern China,* which he defended successfully in 2007 for his second Ph. D. at the University of Pennsylvania, U.S.A. A joint article on the role of astronomical treatises during the 11th century has been compiled.

Guan Xiaowu

Guan Xiaowu

Conducive to first inquiries into the issue of material artifacts and the investigation of large scale edifices in irrigation engineering and machinery, Xiaowu Guan concentrated on the three aspects of transmitting, preserving and performing knowledge of the Grand Waterwheel of Lanzhou. The origin of the technical knowledge of the waterwheel was traced by way of analysis of the technical contexts prevalent in the districts surrounding Lanzhou before the appearance of the water wheel. The evolution of the waterwheel and its technological development was sketched and the uses of the Grand Waterwheel and its role in the history of Lanzhou was analysed.

Devoting his attention to analyzing, researching and categorizing his archival materials, Guan Xiaowu incorporated new approaches to his investigations in collaboration with the group. Using the sixteenth century to the present history of the waterwheel of Lanzhou as a test case the fragmentary evidences relating to its evolving showed examples of technical knowledge in the making. The accomplished results of the project have three parts: 40 pages of material and several key tables in Chinese have been completed; a primary English draft of the results was written and is expected to be completed at the end of April; and a presentation of the study will be presented at the workshop "Artisanal Practice and Popular Culture in Late Imperial China" organized by Dr. Philip Cho at the Institute for the History of Natural Science, Chinese Academy of Sciences in Beijing on June 19–20, 2008.

Joachim Kurtz

Joachim Kurtz

Joachim Kurtz, Emory University, U.S.A. studied the rhetoric of innovation in late imperial China, focusing on the hybrid persuasive strategies used in Jesuit works introducing European technology. Emulating both Chinese literary conventions and European suasory devices, Jesuit missionaries and their local collaborators used a wide array of rhetorical means to bridge the distance between foreign and native learning, embed novelty in cherished traditions, and shroud potential heterodoxy in accepted terms while simultaneously highlighting the unique value of the technologies they advertised. The goal of this study was to trace the continued refinement of the Jesuits' rhetorical arsenal in response to mixed reactions from Chinese audiences.

Ma Biao

Ma Biao

Professor Ma intensified his research into the pronunciation of the measure word "石" in the time of the ancients. He investigated the philological and material find of archaeology relation to units of measurement in pre Han time. He thus contributes substantially to founding a new basis on investigating artifacts related to scientific and technological knowledge production. Exemplifying by way of its philological and linguistic basis, Professor Ma could demonstrate that the phonological misconception of "shi" by historical research had lead to crucial fallacies about the recognition of measurements in China, the actual tool and its usages. Providing a first inquiry into the issue of material factors of knowledge production, his work divulged the difficulties in correlating textual recognition with artifact evidence.

During his stay Ma Biao successfully completed his article *"Research on the Ancient Chinese Pronunciation of the Measure Word 石"* (in Chinese). Thorough discussions with Professor Karine Chemla from the Centre National De La Recherche Scientifique (CNRS) in France about the history of measurements and weights in the Qin und Han Dynasties were held.

Nakayama Shigeru

Nakayama Shigeru

Within his project of new paradigms in post-industrial society, Prof. Nakayama mainly worked on a new ecological perspective, with particular emphasis on post-68 Germany with access to German literature. During his stay, he obtained another Cyber-perspective, which is rooted in post-68 California. This latter development has become his new research focus.

19th century painting tools: palette with oil paints, scetch indicating color positions, paper enveloppes with pigments.
See Project: Practical Knowledge Traditions and Scientific Change, 1750–1870. p. 185

Independent Research Group II

Experimental History of Science

Director: *H. Otto Sibum*

The research performed by the independent research group can be divided into two different but related projects: "Science and the Changing Senses of Reality Circa 1900" and "Practical Knowledge Traditions and Scientific Change, 1750–1870." The former has been completed, and the results will be published as a double volume of *Studies in the History and Philosophy of Science in September 2008*. Below you will find a brief description of the project and its contributors.

Project

Science and the Changing Senses of Reality Circa 1900

The turn of the century is commonly considered as a period of major changes in science and society and hence been studied extensively. However, attention was drawn to its reworking, in order to probe possibilities to reconstructing experiential spaces. i.e. to explore ways of studying the cognitive implications the material culture of science and the body techniques employed. By bringing together historians of science, art and culture studying the turn of the century, we wanted to better understand the changing experiential spaces of scientists and artists' symbolic and material expressions circa 1900.

At the turn of century, those experiencing subjects working in science, arts, and the humanities articulated diverse and often contradictory statements. For example, in 1900, observers of science were told that progress in science was based on a collective and rather expensive program of the "extension of the senses."[1] In this view, physics was mainly regarded as experimenting with newly designed instruments whose purpose was to refine the human senses or even to create new ones. These "artificial fine senses" would provide access to sensory worlds with new physical phenomena.

1. Otto Wiener, *Die Erweiterung unserer Sinne.* Akademische Antrittsvorlesung gehalten am 19. Mai 1900. Leipzig: Verlag von Johann Ambrosius Barth, 1900, pp. 1–43.

And, indeed, X-rays and the electron are just two famous examples thereof. Moreover, according to Otto Wiener, only walking along this path into the new millennium would guarantee progress. At the same time Wiener's colleague Max Planck reminded his audience not to place too much trust in the often errant human senses. The real world and its universal laws were to be found beyond sense perception, and deanthropomorphization was the precondition of progress in physics.

At the turn of the century, a number of different intellectual positions could be found and hence some actors were puzzled by the flux of developments they were experiencing. Felix Auerbach, the physicist from Jena with a strong interests in writing a developmental history of physics (*Entwicklungsgeschichte der modernen Physik*), regretted tremendously that he could not tell where science at the turn of the century would be going.[2] At a time when new discoveries were made nearly every day and the unity of nature was believed to be at stake, Auerbach was not able to present a bird's eye view from which the scattered scientific experiences of the nascent twentieth century would make sense.

2. Felix Auerbach, *Entwicklungsgeschichte der modernen Physik.* Zugleich eine Übersicht ihrer Tatsachen, Gesetze und Theorien. Berlin: Verlag von Julius Springer, 1923, p. 1.

Historians of science have tackled this period extensively, and we are familiar with famous attributions such as the "end of classical physics" and the "rise of modern physics" represented by quantum mechanics and relativity theory. But was the classical simply replaced by the modern? *Richard Staley* presented a more nuanced picture. He looked at how physicists expressed their experience with changes in the discipline at the turn of the century. To Staley, it seemed more plausible to argue that the so-called modern physicists worked hard to establish their new persona by creating the distinction between the "classical" and the "modern." Physicists at the turn of the century invented the modern to mark their scientific work as being different to the past.

More generally speaking, the project aimed at making visible what scientists, artists, and scholars were actually doing in their laboratories and studios. How did they experience the fluctuations in their field of research? In what ways did they try to make sense of this open-ended process of change?

One of the key issues in all of their studies of scientific objects was the role of sensory experience in the process of generating knowledge. What were their thoughts on this? The contradictory positions held by Ernst Mach and Max Planck are the most well known and Mach's view is epitomized in his statement about the new physics: "It would be very peculiar if the experience of the world would transcend itself through it's refinement and nothing else from the world would be left than unreachable phantoms."[3] Of course, Mach defended a strong sensationalist position that even questioned the assumption that atoms are real. But as we will see, various other important intellectual positions on the role of sensory perception can be found between Mach and Planck.

3. Ernst Mach, *Die Leitgedanken meiner naturwissenschaftlichen Erkenntnislehre und ihre Aufnahme durch die Zeitgenossen.* In Physikalische Zeitschrift XI, (1910) pp. 599–606, 604.

Felix Auerbach went so far as to tell his readers to question the very notion of natural phenomenon. He suggested to name X-rays not a natural but a physical phenomenon because they were artificially created by Röntgen in his laboratory. And hence with regard to methods used in the physical sciences, he suggested that it was no longer appropriate to speak of discovery but rather of invention.

"X-rays are not a 'natural phenomenon.' Until Röntgen there weren't such, they have been invented by him (this expression is more appropriate than the conventional

'discovered'); and in case it turns out that there are such rays in nature, this does not change the issue essentially."[4]

4. Auerbach, 1923, p. 5. On this issue see also H. Otto Sibum, *What Kind of Science is Experimental Physics?* In Science, 306 (2004) pp. 60–61.

Methodologically speaking, for Auerbach and many of his colleagues, physicists behaved as engineers who implicitly transformed the traditional understanding of scientific observation through their work. Experimentally working scientists no longer observed phenomena; observation was always intervention, too, and in their laboratories, physical realities were created. But as the following cases will show, this was a complex process of molding and being molded by the object of study. It is striking to see how this changing experiential space of science stimulated fruitful debates and reflections about the hidden entities being studied and to examine what role these artificial fine senses and the inquiring subject played in constituting the new scientific objects.

The available historical material, however, required us to further focus our attention. Hence we decided to discuss the cases in which the actors attempted to shift the scale of sensory experience, i. e., to explore phenomena that were out of reach of the common human senses. Furthermore we focused on the research fields in which the actors attempted to make invisible entities visible.

Charlotte Bigg

Charlotte Bigg engaged with the recurring issue of shifting scales between microscopic and macroscopic dimensions and how the realization progressively emerged that the physical laws governing the macroscopic world were not always adequate for describing the submicroscopic one. She focused on the research of Jean Perrin in the 1900s, in particular his use of Brownian motion to produce evidence of the existence of atoms and in favor of the kinetic theory. His results were described by many contemporaries, and subsequently by historians, as the first direct proof of atomic and molecular reality. Bigg's work examined the different strategies developed by Perrin for bridging the macro- and submicrophysical realms and making the latter accessible to the senses—although neither atoms nor molecules were ever actually seen, and in fact very few visual representations were shown and published in connection with these experiments. This instance provides a good example of how visualizing, representing, and convincing were interwoven in the production of evidence—about the submicrophysical realm circa 1900.

Richard Noakes analyzed the uneasy relationship between physics and the "occult sciences" in the decades around 1900. For some, there was no relationship at all; for others a relationship existed but they did not agree on what it looked like. Many physicists converged with spiritualists, theosophists and others in interpreting X-rays, the electrical theory of matter, and other aspects of the 'new' physics as powerful ways of rendering psychic and occult effects scientifically more understandable. Noakes showed that physicist-psychical researchers were content to ally the "new" physics with religion because it helped vanquish awkward associations with materialism. They also tried to justify the value of their experimental skills by emphasizing their expertise in investigating subtle physical effects and their ability to create tests that respected the delicate conditions of séances.

In his article "Crafting the Quantum," *Suman Seth* investigated the early quantum physics of Arnold Sommerfeld. His study of the development of the older quantum theory nicely illuminates what Sommerfeld meant by improving "die Technik der

Quanten." Crafting the quantum—as Seth translates it—draws our attention towards the existence of subcultures of theoretical physics, one of which is Sommerfeld's research, which is exemplified by the rich connotations of the German word Technik. Sommerfeld did not mean that he would merely take a "nuts and bolts" approach to quantum physics and allow others such as Planck or Einstein to undertake the philosophy of it. Rather, he understood his theoretical research as combining the engineering character of physical research with an aesthetic sensibility.

David Bloor

David Bloor compares the work of British and German engineer physicists and their attempts at *Sichtbarmachung*. A concerted effort was made in the discipline of fluid mechanics to make hidden and fleeting processes visible and to capture the results photographically. The photographs taken by H. S. Hele-Shaw in the 1890s showing the flow of a "perfect," frictionless fluid were one such attempt. Another case involved the photographs of boundary-layer separation taken by Ludwig Prandtl. Bloor's concern in both cases was the relation of the photographs to the reality that was actually or putatively portrayed in the photograph.

David Aubin was engaged with another new and most exciting physical phenomenon that became visible in a physicist's laboratory at the turn of the century: the "spontaneous emergence of forms in inanimate matter," now known as "self-organization." This phenomenon demonstrated the permeability of the border between the fields of physics and the life sciences. By experimenting with liquids of different viscosity, the French physicist Henri Bénard observed in all cases the formation of cells that tended to stabilize into a hexagonal shape after a short period of instability. Bénard's research hinged heavily on the use of cinematography, which he regarded as the only means to properly represent the phenomena in question. His work sparked various important discussions about the relation between organic and inorganic matter as well as between mathematical and experimental physics.

Hans-Jörg Rheinberger

Hans-Jörg Rheinberger described how biologists at the turn of the century came to conceptualize and define the hidden entities presumed to govern the process of hereditary transmission. With that, the stage was set for the emergence of genetics as a biological discipline that came to dominate the life sciences of the twentieth century. The annus mirabilis of 1900, with its triple re-appreciation of Gregor Mendel's work by the botanists Hugo de Vries, Carl Correns, and Erich Tschermak, can be seen as a turning point after which theorizing about heredity and experimentation—selecting pure lines and Mendelian crossing—became tightly connected. Finally, with Wilhelm Johannsen, a Danish plant physiologist, heredity was defined as "the presence of identical genes in ancestors and descendants." Although Johannsen himself refused to speculate about the material nature of the genes—and, indeed, experimenting with pure lines and analyzing their crosses did not require such knowledge—the genes, the "atoms of biology," came to dominate the life sciences for the rest of the twentieth century.

Ilana Löwy argued that Ludwik Fleck's understanding of scientific observation as a social and cultural process stemmed not only from his practical experience as a bacteriologist and serologist, but also from confronting ideas developed by other Polish thinkers. Two elements in Fleck's biography stand out as potential sources of his interest in the indeterminacy of visual evidence: his work as the head of the laboratory of skin and venereal diseases in the city hospital of Lvov (a position he

occupied after he failed to obtain a full-time research job), and his unorthodox view on the variability of bacterial species. Fleck's interest in selective observation and interpretation of visual evidence was deeply rooted. Fleck's reflective stance about his experience at the bench was unusual, however, as scientists are seldom inclined to analyze their own practices. Two Polish thinkers might have provided Fleck with conceptual tools that enabled him to question the production of scientific facts: the physician and philosopher of medicine Zygmunt Kramsztyk (1848–1920) and the mathematician, philosopher, and painter Leon Chwistek (1894–1944).

Cristina Chimisso looked at the eroding boundary between the theoretical and technical parts of science through the eyes of the philosopher Gaston Bachelard. For him, scientists did not simply observe or directly capture essences, but rather *technically* manipulated and indeed created the object of their knowledge. Bachelard pointed out that the only possible study of corpuscles is technical, that is to say it is done by using experimental apparatus; in his own words, "of all corpuscles of modern physics, one can only do a phemenotechnical study." He continued that in phenomenotechniques, no phenomenon appears naturally, no phenomenon is a given. His original concept of "phenomenotechnique" supports his revision of traditional philosophical views concerning the existence and essence of things. His position is one of the many intellectual takes on what constitutes physical realities.

Robert Brain discussed the graphic recording instrument as a new sense that makes invisible processes visible and thereby mediates between science and the arts in important ways. The applications of self-recording instruments expanded dramatically in the second half of the century when they were recognized as an emblematic and ubiquitous fixture of nearly every scientific discipline. Some called graphical recording "the universal language of science." Graphical inscription thereby acquired a new authority by enabling apprehension to shift from tactile to visual. This observational position made possible a new kind of formalist observation in the sciences, in which complex dynamic processes were reduced to relatively simple visual and quantitative relations.

Étienne-Jules Marey's graphical recording instruments provided arresting images of a range of new and previously unseen phenomena. These glimpses into "invisible worlds," "fugitive and imperceptibly slow occurrences" and the "infinitely small" stimulated widespread public fascination throughout the late nineteenth century and raised important questions among artists about the relation of physiology and aesthetic perception. At the turn of the century in the cultural arts, the lexicon of early modernism reigned supreme in discussions of the meaning of this new sense of reality.

In his work, *Brain* argued that a critical condition that enabled many of the turn-of-the-century modernist movements in the arts was the exchange of instruments, concepts, and representational media between the sciences and the arts. One route of interaction came through physiological aesthetics, the attempt to "elucidate physiologically the nature of our aesthetic feelings" and explain how works of art achieve their effects. Physiological aesthetics provided the terms for new formalist languages of art and criticism, and in some instances suggested optimistic, even utopian, possibilities for art to remake human individuals and societies.

Bettina Gockel invited us to rethink the expression "Art does not display the visible; it makes visible." The artist Paul Klee understood artistic work as a rational contribution to generating knowledge about culture and nature. This theme of the close relation between artistic and scientific methods recurs repeatedly in Klee's voluminous notes and diaries, but nowhere as succinctly as in Klee's essay "Exact experiments in the realm of art": "Where intuition is tied to exact scientific research, the progress of such research is advanced; intuition heightened by exactitude is superior." Intuition was Klee's term for the artist's task of developing the inner self into a receptive apparatus that elevates the artistic product over subjective and moral meanings. The artist, in other words, aligns his or her position with that of a sensitive instrument in the task of "making visible" (*Sichtbarmachung*) through the various material media of artistic practice. Very much like the scientists committed to the technical extensions of the senses in experimental research, Klee assumed that all knowledge—scientific and artistic—was rooted in anthropomorphism.

Doris Kaufmann's contribution showed that the artists' oscillation between the modern and the primitive echoed broader movements among European intellectuals. She argued that the primitivist turn had as much to do with colonialism as with other intellectual preoccupations. In the period between 1880 and 1930, two interrelated problems in particular were important to the centrality of primitivism as a conceptual framework in the emergence of transdisciplinary *Kulturwissenschaften* in Germany. (1) the question of the origin, existence, and modes of operation of "other" forms of thought and consciousness, which in contemporary terms were often characterized by a series of synonyms—primitive, archaic, pre-logical, savage, or mystical. This question pointed at the European dimension of the primitivism debate. (2) the research interest in these "other" modes of thought gave rise to a self-reflective epistemological question: How could "the other," that is, other forms of thought, be recognized if the researcher belonged to a particular historically determined European mode of thought and perception?

Gadi Algazi studied the process of making invisible movements visible in Norbert Elias's grand project, *The Process of Civilization* (1939). Elias's project aimed at reconstructing invisible movement—both the slow tempo of long-term historical change and the modification of psychic structures and embodied dispositions. To do this, he resorted to uncommon devices. By treating historical texts as constituting a series amenable to a rudimentary discourse analysis, he constructed an imagined "curve of civilization" serving as an approximation of the hidden process of change. Elias's curve was not supposed to represent individual past states, but movement itself, its direction and pace. This novel concept of historical representation was related to the perception of cinema as a new medium making actual movement visible. But beyond its use in imagining how one could telescope long-term historical process, cinema also held the promise of serving as a microscope, by making the minute movements of the human body, gestures, and manners available for close inspection.

Project

Practical Knowledge Traditions and Scientific Change, 1750–1870

Arianna Borelli, Frédéric Graber, Anna Märker, Annik Pietsch, H. Otto Sibum, Simon Werrett


Arianna Borelli


Frédéric Graber


Anna Märker


Annik Pietsch


Otto Sibum


Simon Werrett

Project II aims at investigating a historical period spanning the mid-eighteenth to mid-nineteenth centuries in which modern science was coming into being, a period critical for the investigation of the fruitful and reciprocal interactions between science and other forms of knowledge. It was the age of Enlightenment with its ideal of promoting "useful knowledge." As historians have come to realize the close ties between epistemology and praxis, so too their terminology for this time has come into question. Economic historians who once spoke of the industrial revolution can now be heard referring to the "Industrial Enlightenment." Historians of science, once comfortable with the "second scientific revolution" followed by the concept of the rise of "a quantifying spirit" now stress the importance of the geographical dimension of knowledge creation in the Enlightenment period.

What does it mean to work in a scientific workplace, to labor in a scientific laboratory? What kind of knowledge is situated in these specialized performances of work? These are the questions at the heart of the project—questions that took on new meaning in the period just discussed. Originally the terms "episteme," "scientia," "science," and "Wissenschaft" meant knowledge or skill in general. It is only over time that they became specialized terms to denote a more certain and authoritative form of knowledge than "ordinary knowledge." This linguistic divide is often mirrored by a social distinction between those who work with their heads and those who work with their hands. It even contributed to a cultural distinction between western European lands (and former colonies) that practiced modern science and those that did not.

Doctoral and postdoctoral researchers have participated in this project.

Annik Pietsch is finishing her studies of the production of oil paintings in Germany and the hitherto unrecognized connections between art, industry, science, and even philosophy. *Frédéric Graber* has expanded his study on the water works of French engineers to a comparative study between French and German cultures of engineers.

Anna Märker has continued her studies on the notion of "useful knowledge" in this period. *Arianna Borrelli* is tracing the early development of thermometric measurement practices and the related concepts of heat and cold. *Simon Werrett* has finished his research on fire-workers' knowledge and its importance for the development of natural philosophy.

The project has also attracted attention outside the Institute and the discipline. Collaboration began with the Ecole des Hautes des Etudes en Sciences Sociales (*Kapil Raj*, EHESS) in Paris. The project has further sparked an initiative to explore the research theme more broadly. With former members of the research group *Suman Seth* and *Trevor Pinch* (Cornell University) and ethnologist *Richard Rottenburg* (Halle University/MPI for Social Anthropology), we plan to convene three interdisciplinary conferences. The first one will be held in October 2008 at Cornell University (2009 at Uppsala University, 2010 at Halle University). In the first meeting, called *Places of Knowledge: Relocating Science, Technology and Medicine*, we will explore the research theme's potential for science and technology studies. We seek to put into dialogue analyses addressing technoscience in colonial and postcolonial contexts with work on artisanal knowledge, citizen science, and other forms of knowledge and sites of practice. We are seeking contributions that examine these places, the types of material and knowledge produced within them, and the sorts of communities and institutions that facilitated the means of knowledge production.

However the flourishing project of the independent research group will not be continued at the MPI in Berlin after 2007. Its research leader, *H. Otto Sibum*, was offered the endowed Hans Rausing Chair of History of Science and the directorship of the Office for History of Science at Uppsala University, Sweden. Other members of the research group have also been successful in taking up positions at universities and research institutions in France, England and Germany.

Collection of *Trematoda*, Natural History Museum, Berlin

Joint Activities

International Research Network

History of Scientific Objects

MPIWG ORGANIZERS *Lorraine Daston, Jürgen Renn, Hans-Jörg Rheinberger*
Website: http://scientificobjects.mpiwg-berlin.mpg.de

Impressions of the Wandering Seminar
Fotos: Wandering Seminar
Collage: Jan Kaminski

The 2005 established International Research Network is dedicated to the material culture in the history of science and in particular to the investigation of the diverse functions and concepts of scientific objects.
The network is a cooperation of 22 members at 11 institutions in Europe and the U.S.A. It goes back to an initiative of the Max Planck Society to fund on an ad-hoc basis co-operations between Max Planck Institutes and other research institutions with the aim of accelerating development in new and exceptionally promising areas of investigations, and it was one of the first such networks to be approved.
Within the broad field of material culture the network members decided to address four principal foci: The emergence of new objects in scientific enquiry; the relationship between scientific artifacts (e.g. instruments) and technological systems; scientific things as historical evidence; the interaction among scientific things, images and texts.
On the founding meeting in 2005, four working groups were established to address these problems: Epistemic Objects; Images as Scientific Objects; Collections and Collecting; The Past of Science's Present and Future.

The principal aim of this collaboration is to promote an integrated interdisciplinary approach on the topic, involving junior and senior scholars in leading institutions worldwide.
Structurally the network aims not only at facilitating the exchange of scientific expertise and personnel, but more specifically at promoting and creating new formats of scientific exchange. To this end as a first project of the network the Wandering Seminar was launched, an intensive course on the theory and practice of the history of science as the history of objects taking place at various member "stations".
The network projects so far handled objects so diverse as oversize things, the working material of scientists and invisible epistemic objects such as the mathematical knot.
The network not only deals with the character of individual objects, but also with questions concerning the preservation, collection and representation of objects. To this end, the network aims at inspiring collaboration between scholars based at museums and academic historians of science. The network also promotes different kinds of publication, such as joint articles, mini-exhibitions and websites including filmed objects.

The MPIWG serves as the organizational base of the network. All three departments as well as the library and the IT-group are continuously involved in its projects. As part of its input into the network the Institute funds two two-year post-doc fellowships. Additionally, the MPIWG hosted workshops and meetings of the working groups. Claudio Pogliano stayed at the Institute as Visiting Scholar working on "The visual contagion in history of science".
The member input varies and includes privileged access to collections as well as co-organization of events. The network is also supported by and welcomes cooperation partners on a project basis.

The Max Planck Society provided the network with basic funding for a five-year tenure. 2008 sees a General Meeting of network members in Berlin, on which the agenda for the 2nd half of the Network will be set.

Network Members

- *Prof. Günter Abel*, Technische Universität Berlin, Germany
- *Prof. Jochen Brüning*, Humboldt-Universität zu Berlin, Germany
- *Prof. Lorraine Daston*, MPIWG
- *Prof. John Forrester*, University of Cambridge. U.K.
- *Prof. Peter Galison*, Harvard University, U.S.A.
- *Prof. Paolo Galluzzi*, Institute and Museum for the History of Science, Florence, Italy
- *Prof. Michael Hagner*, ETH Zürich, Switzerland
- *Dr. Nick Hopwood*, University of Cambridge, U.K.
- *Prof. Friedrich Kittler*, Humboldt-Universität zu Berlin, Germany
- *Prof. Eberhard Knobloch*, Technische Universität Berlin, Germany
- *Prof. Wolfgang Krohn*, Universität Bielefeld, Germany
- *Prof. Peter Lipton*(+), University of Cambridge, U.K.
- *Prof. Thomas Macho*, Humboldt-Universität zu Berlin, Germany
- *Prof. Everett Mendelsohn*, Harvard University, U.S.A.
- *Prof. Dominique Pestre*, Ecole des Hautes Etudes en Sciences Sociales, Paris, France
- *Prof. Claudio Pogliano*, Università di Pisa, Italy
- *Prof. Jürgen Renn*, MPIWG
- *Prof. Hans-Jörg Rheinberger*, MPIWG
- *Prof. Simon Schaffer*, University of Cambridge, U.K.
- *Dr. Christian Sichau*, Deutsches Museum, Munich, Germany
- *Prof. Jakob Tanner*, Universität Zürich, Switzerland
- *Prof. Helmuth Trischler*, Deutsches Museum, Munich, Germany
- *Prof. Peter Weingart*, Universität Bielefeld, Germany

History of Scientific Objects

Working Groups

The Past of Science's Present and Future

MEMBERS *Peter Galison* (Harvard University, U.S.A.), *Wolfgang Krohn* (Universität Bielefeld, Germany), *Dominique Pestre* (EHESS, Paris, France), *Simon Schaffer* (University of Cambridge, U.K.), *Peter Weingart* (Universität Bielefeld, Germany)

A notable strength of the Network lies in the realm of science and politics. Within the broader context of researching historical perspectives on Science, Society and the Political, a workshop on the *Relation of Politics to the History of Science*, organized by Peter Galison, Dominique Pestre and Simon Schaffer, took place at the Centre Alexandre Koyré in Paris on 22 June 2007. Points for discussion were a. o.: the shift between what has been called the "cold war physics bubble" and the apparent dominance of environmental—biotechnical sciences; the move toward a number-dominated form of evaluation of the sciences; the rise of a quantitative, neo-liberal system of assessment; Government secrecy and classification.
The next activity of this group will be a workshop on *Governance of and through science and numbers: notions, categories and tools* (s. below).

Images as Scientific Objects

MEMBERS *Lorraine Daston* (MPIWG), *Michael Hagner* (ETH Zürich, Switzerland), *Claudio Pogliano* (Università di Pisa, Italy), *Hans-Jörg Rheinberger* (MPIWG), *Renato Mazzolini* (Università di Trento, Italy)

In the last few years, historians of science, in collaboration with art historians, have carefully studied the technological, social and aesthetic dimensions of scientific drawings, photographs, diagrams, computer images etc. Still the material production of images deserves more research, as the aesthetic effects as well as the epistemic contents of an image depend crucially on the processes by which it is made. Another component that has been neglected hitherto is the question to what extent images and their production correspond to visual thinking as a mode of scientific reasoning.
The members came together in a founding meeting in August 2007 to discuss theoretical concepts of "image" and "visualization". A first workshop on how to write the biography of a scientific image is planned for 2008.

Epistemic Objects

MEMBERS *Günter Abel* (Technische Universität Berlin, Germany), *Uljana Feest* (Technische Universität Berlin, Germany), *Thomas Macho* (Humboldt-Universität zu Berlin, Germany), *Jürgen Renn* (MPWIG), *Hans-Jörg Rheinberger* (MPIWG), *Claudio Roller* (Technische Universität Berlin, Germany)

In order to provide a common discussion ground for historians of science as well as historians of art and philosophers, the group started operating with a deliberately

broad notion of epistemic object. According to that, epistemic objects are the types of things that attract our epistemic curiosity. Within a scientific context, they are the fundamental objects of research, such as viruses, electrons, or brain mechanisms. Since its first meeting in August 2007, the members met several times to discuss general aspects of the topic and prepare a broader international exchange. The first research colloquium (s. below) will deal a. o. with the dynamics of epistemic objects as well as their relations to signs and modeling. A second colloquium on the concept of "challenging objects" is being planned. In addition, a reading group on classical texts on epistemic objects was formed.

Collectings and Collecting

MEMBERS *Paolo Galluzzi* (Institute and Museum for the History of Science, Florence, Italy), *Helmuth Trischler* (Deutsches Museum, Munich, Germany), *Christian Sichau* (Deutsches Museum, Munich, Germany), *Friedrich Kittler* (Humboldt-Universität zu Berlin).

In the period covered by this report the first project in the framework of this group is being planned: a conference on the *Exhibition as Product and Generator of Knowledge* (s. below.)

History of Scientific Objects

The Wandering Seminar

PARTICIPATING NETWORK MEMBERS *Lorraine Daston, Hans-Jörg Rheinberger*, *Jürgen Renn* (MPIWG); *Jochen Brüning* (Humboldt-Universität zu Berlin, Germany); *Paolo Galluzzi (*Institute and Museum for the History of Science, Florence, Italy); *Michael Hagner (*ETH Zürich, Switzerland), *Nick Hopwood, Simon Schaffer* (University of Cambridge, U.K.); *Eberhard Knobloch* (Technische Universität Berlin, Germany); *Dominique Pestre* (EHESS, Paris, France), *Claudio Pogliano* (Università di Pisa, Italy); *Christian Sichau*, *Helmuth Trischler* (Deutsches Museum, Munich, Germany)

COOPERATION PARTNERS *Thomas Söderquist* (Medical Museion Copenhagen, Denmark); *James Bennett*, (Museum of the History of Science, Oxford, U.K.); *Robert Bud*, P*eter Morris* (Science Museum London, U.K.); *Thomas Schnalke* (Medizinhistorisches Museum Berlin, Germany); *Gottfried Böhm* (NCCR Iconic Criticism, Universität Basel, Switzerland); *Hans-Konrad Schmutz* (Naturmuseum Winterthur, Switzerland)

PARTICIPANTS *Gianenrico Bernasconi* (Humboldt-Universität zu Berlin, Germany), *Alison Boyle* (Science Museum London, U.K.), *Terje Brundtland* (University of Oxford, U.K.), *Jean Baptiste Fressoz* (EHESS Paris, France), *Jean Francois Gauvin* (Harvard University, U.S.A.), *Johannes Grave* (NCCR Basel, Switzerland), *Hanne Jessen* (Medical Museion, Copenhagen, Denmark), *Anna Märker* (MPIWG), *Daniela Monaldi* (Research Network Fellow, MPIWG), *Dario Moretta* (Università di Pisa, Italy), *Susanne Pickert* (MPIWG), *Nicholas Reeves* (University of Cambridge, U.K.),

Stefano Salvia (Università di Pisa, Italy), *Sophia Vackimes*, (Research Network Fellow, MPIWG), *Konstanze Weltersbach* (ETH Zürich, Switzerland)

Showcase with 20 Butterflies, Courtesy of the Humboldt-Universität zu Berlin, Museum für Naturkunde, Foto: Buddensieg

With this project the Network established a new format of international academic exchange: For eight weeks, 15 junior scholars, pre-docs and post-docs from different disciplinary backgrounds, traveled the most prominent museums and academic institutions in the history of science of Europe. The idea to form a "mobile summer school" for junior scholars working on the interface between museum and scientific research attracted cooperation partners Europe-wide. The program included talks to curators, lectures by historians of science and professional exhibition makers as well as visits to well known and unknown collections of the participating institutions. The seminarians experienced hands-on sessions in some of the leading collections of scientific objects in Europe, but also went "backstage" to storage rooms and cellars with science treasures and oddities. Museums and Institutions presented themselves as new sites for scientific inquiry while providing the seminarians with first hand information about the latest developments in the material culture of science.
The Berlin week of the Seminar was supported by presentations of various members of the Institute as well as by the Medical History Museum and the Natural History Museum, Berlin.

2007 saw the presentation of the Seminar's results in three different follow-up projects: the Wandering Seminar Website, a final Workshop, and an Exhibition displayed in the foyer of the MPIWG in August 2007.

Projects 2007

WS Exhibition
Objects in Transition
Exhibition, August 16–September 2, 2007, MPIWG
ORGANIZERS *Anna Märker* (MPIWG), *Susanne Pickert* (MPIWG), *Gianenrico Bernasconi* (Humboldt-Universität zu Berlin, Germany)

The central idea of this exhibition was that scientific objects are locally and historically context-dependent. Not only can scientific attention transform everyday things into scientific techniques and tools, but some material objects have to be transformed to become visible or presentable. Objects in transition illuminated the biographies of various objects: from everyday life into the spotlight of scientific curiosity, from specimen to souvenir, from model to toy and combined objects as varied as the eye

Goggles, late 20th century, by Pulsafe. Legacy of W. Brian Harland, Geologist. Plastic, 17x 10 x 6 cm, Wh. 6117. Courtesy of the Whipple Museum of the History of Science, Cambridge, Great Britain.

of a whale and treasure from the estate of geologist Brian Harland. The exhibition makers found cooperation partners in various institutions, such as the Whipple Museum, Cambridge, and the Museum of Natural History, Berlin. The catalogue Objects in Transition is available in 2nd edition.

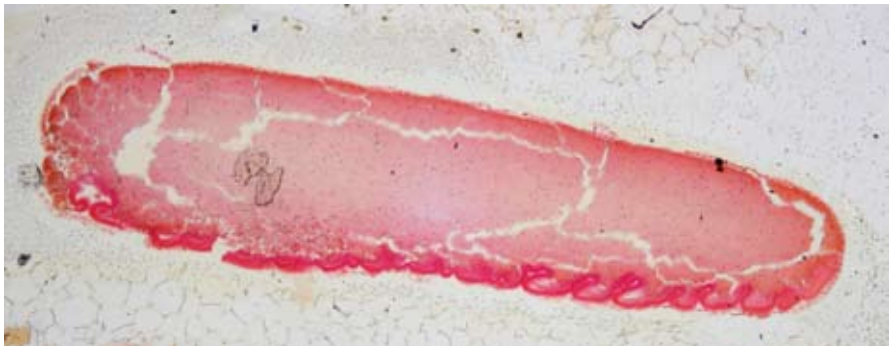
WS Workshop
Wandering Seminar on Scientific Objects
Workshop, 16–18 August 2007, MPIWG
ORGANIZERS *Sophia Vackimes* (MPIWG), *Konstanze Weltersbach* (ETH Zürich, Switzerland)

One year after they toured Europe, the participants of the Wandering Seminar presented their conclusions and questions on the concept of scientific objects.
The participants compared and questioned master narratives presented in science and technology museums, discussed the reconstruction of historical experiments and presented examples for the emergence, transformation and aesthetics of scientific objects.
The proceedings of this workshop were published as MP preprint.

WS Website
[http://scientificobjects.mpiwg-berlin.mpg.de/scientificobjects/home/WanderingSeminar.html]
ORGANIZERS *Hanne Jessen* (Medical Museion, Copenhagen, Denmark), *Daniela Monaldi* (MPIWG), *Dario Moretta* (Università di Pisa, Italy), *Stefano Salvia* (Università di Pisa, Italy), in cooperation with *Jan Kaminski* and the MPIWG IT-group.

What makes an object scientific? The virtual representation of what the participants called a "shared essay in the form of the Grand Tour" is especially dedicated to stimulate the discussion on the questions with which the seminarians went on tour. The visitor can leaf through the pages of a virtual travel journal and is invited to join the discussion forum on selected scientific objects, such as Einstein's blackboard or a plush penguin at the Scott Polar Institute.

Microscope Slides: Reassessing a neglected historical resource
[http://scientificobjects.mpiwg-berlin.mpg.de/scientificobjects/Slides]
Workshop, 20–23 September 2007, MPIWG
ORGANIZERS *Ilana Löwy* (CERMES, Paris, France), *Nick Hopwood* (University of Cambridge, U.K.); in collaboration with the Medizinhistorisches Museum, Berlin, the Museum für Naturkunde Berlin and the Humboldt-Universität zu Berlin, Dept. of Zoology.

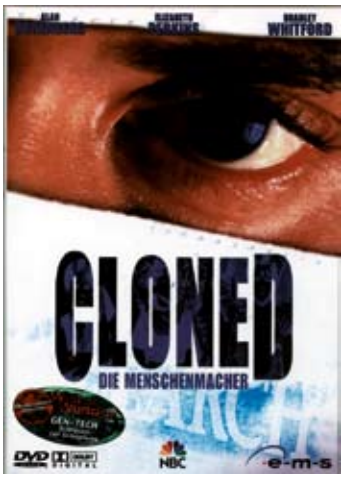


19th Century Microscopic slide of a *Hydrophilus piceus* made by the Zoologist Karl Heider, courtesy of Humboldt University of Berlin, Zoological Teaching Collection

As a first step towards a "slides-network", the workshop explored the preparation, uses and exchange of microscopic slides in different disciplines; it also questioned the links between slides and other objects such as models and 3D-images. The program included hands-on session in several historical scientific slide collections in Berlin. As turned out, microscopic slides, often regarded as relicts of laboratory work, deserve renewed scientific interest due to their status as "intermediary objects", on the boundary between the raw material and a finite scientific result. A jointly written article will be published in Isis. A follow-up workshop is planned for 2009, in cooperation with the Institute Pasteur in Paris.
A website for the project, Slides in Context, is in the making: it will present microscope slides as challenging objects and highlight the multifaceted relations between slides and other scientific objects such as models or drawings.

Post-Doc Projects

With her project on the artistic representation of genetically altered bodies Sophia Vackimes was working with Dept. II and III; Daniela Monaldi's investigation of the Bose-Einstein Condensates is part of the Quantum Physics Project of Dept. I. Both fellows took part in the Wandering Seminar in 2006 and co-organized its follow-up events in 2007.



CD cover for *Cloned*, a television film directed by Douglas Barr and released in 1988; itself cloned and turned into Godsend, directed by Richard Wells, and released in 2004 in a cinematic version

Sophia Vackimes

The Aesthetics of Genetic Engineering

The project considers in what measure cinema affects the public understanding of science, especially discussions on genetics and cloning. Its purpose is to understand how films act as rich depositories of information but not to argue whether or not films are not legitimate sources of scientific information or validation of scientific work. It does not argue whether or not films should be made under the strict supervision of scientific committees or whether or not they should seek the approval of scientific groups, as was the case with Gattaca, or whether or not they should hire consultants to verify the verisimilitude of scientific content. Rather, it seeks to comprehend the role that cinema has as cultural educactor.

Daniela Monaldi

Bose-Einstein Condensates

Daniela Monaldi examined the emergence of atomic Bose-Einstein condensates, a new kind of material objects predicted in 1924 by Einstein and produced for the first time in a physics laboratory at ultra-cold temperatures in 1995.
Atomic Bose-Einstein condensates are striking instances of the intersection of historicity and materiality. D. M. examined their coming into being as epistemic things and as material objects, as a case study on the historical evolution of the form of scientific inquiry that deploys laboratory artefacts to elucidate the laws of nature.

Upcoming Projects for 2008:

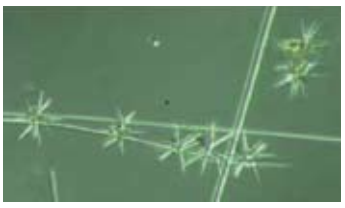
Invisible Seminar

Workshop, 7 March 2008, MPIWG
ORGANIZERS *Claudio Pogliano* (Università di Pisa, Italy), *Renato Mazzolini* (Università di Trento, Italy), *Michael Hagner* (ETH Zürich, Switzerland)

Despite the large amount of studies on scientific images published over the last decades, there is still no consensus about which questions and methods historians of science should apply to the investigation of visual records.
The first workshop of the Working Group "Images as Scientific Objects" will bring together ten junior scholars to write the biography of "scientific images that made a career". The articles will be published in Nuncius 2, 2009.

Epistemic Objects

Research Colloquium, 16–17 May 2008, Technical University, Berlin, Germany
ORGANIZERS *Hans-Jörg Rheinberger* (MPIWG), *Günter Abel*, *Uljana Feest*, *Claudio Roller* (Technische Universität Berlin, Germany)



Structures of a *Holascus Robustus*, Microscopic photo, courtesy of Humboldt University of Berlin, Zoolocial Teaching Collection

The first Research Colloquium of the Working Group aims at the elucidation of (1) the internal relations between linguistic as well as non-linguistic signs and epistemic objects, (2) the relation between modeling and epistemic objects, (3) the temporal dynamics of epistemic objects, and (4) the relations between epistemic objects and scientific experience. It is organized in cooperation with the Technical University, Berlin.

Governance of and through Science and Numbers: Notions, Categories and Tools
Workshop, 26–27 May 2008, Paris, France
ORGANIZERS *Dominique Pestre* (EHESS, Paris, France) and *Peter Weingart* (Universität Bielefeld, Germany)

This open discussion workshop is set up to document the forms of governance of and through science that recently developed. The concepts and categories to be analyzed include: knowledge society, civil society, risk society … but also robust knowledge, lay knowledge, users, consumers etc. Categories to be confronted would be governance, transparency, responsibility, sustainability; the tools include constant evaluation, audits of all forms, soft law, benchmarking, and quality management. The working group aims at building political and social *genealogies* of these concepts and tools, to consider where they come from, who promoted them, how they are/were concretely put into use, how they transform/ed social practices.

Seriality and Scientific Objects in an Age of Revolution, 1780–1848
Workshop, 16–17 June 2008, University of Cambridge, U.K.
ORGANIZERS *Nick Hopwood*, *Simon Schaffer* and *Jim Secord* (University of Cambridge, U.K.)

The workshop will focus on series as objects of scientific study and the technologies that made these objects visible. It will be co-sponsored by the University of Cambridge and the Network.

The Exhibition as Product and Generator of Scholarship
Conference, 27–28 November, 2008, Deutsches Museum, Munich, Germany
ORGANIZERS *Susanne Pickert*, *Christian Sichau*, *Helmuth Trischler* (Deutsches Museum Munich, Germany)

Exhibitions do more than merely visualize the results of research. They have the potential of stimulating scholarship and generating knowledge by posing new research questions. The Conference investigates the Exhibition not only as publication medium for a wider audience, but as forum to exchange scientific expertise. It is co-financed by the Network and the Deutsches Museum.

Upcoming Conference

What (Good) Is Historical Epistemology?

Max Planck Institute for the History of Science, Berlin, July 24–26, 2008
ORGANIZERS *Thomas Sturm* (Max Planck Institute for the History of Science)
Uljana Feest (Technische Universität, Berlin)

Theodore Arabatzis (Athens), *Peter Barker* (Norman, Oklahoma), *Jean-Francois Braunstein* (Paris), *Wolfgang Carl* (Göttingen), *Hasok Chang* (London), *Lorraine Daston* (Berlin), *Antonio Diéguez Lucena* (Malaga), *Uljana Feest* (Berlin), *Michael Friedman* (Stanford, Ca.), *Daniel Garber* (Princeton), *Michael Heidelberger* (Tübingen), *Paul Hoyningen-Huene* (Hannover), *Philip Kitcher* (New York), *Martin Kusch* (Cambridge, U.K.), *Chrysostomos Mantzavinos* (Witten), *Sandy Mitchell* (Pittsburgh, Pa.), *M. Norton Wise* (Los Angeles), *Jürgen Renn* (Berlin), *Hans-Jörg Rheinberger* (Berlin), *Robert J. Richards* (Chicago), *Margaret Schabas* (Vancouver), *Jutta Schickore* (Bloomington, In.), *P. Kyle Stanford* (Irvine, Ca.), *Barry Stroud* (Berkeley), *Thomas Sturm* (Berlin), *Mary Tiles* (Manoa, Hawaii), *Marcel Weber* (Basel), *Catherine Wilson* (New York)

The central purpose of epistemology, as traditionally understood, is to identify and justify the epistemic basis of knowledge, including scientific knowledge. While epistemology in this sense is one of the strongest branches of contemporary philosophy, its universalizing approach has been criticized in various ways. In particular, it has been suggested that knowledge is always situated in a context (biological, social, historical, material) and that epistemology cannot afford to ignore the features of this context. In this vein, recent decades have seen the emergence of naturalized, social, or feminist epistemologies.
One particular kind of challenge to traditional epistemology has been named "historical epistemology". Contrary to the other "alternative" epistemologies just mentioned, however, it is not widely known or discussed by contemporary philosophers, but has in recent years been appealed to mostly by historians of science. As it stands, there are various possible conceptions of historical epistemology:

- First, historical epistemology may be viewed as a branch of the *history of science*, namely one that looks at (a) the histories of epistemic *concepts* (e. g., observation, rationality, probability) or (b) the histories of the *objects* of scientific inquiry (e. g., heredity, life, gravity) or (c) the *dynamics* of scientific developments, as they can be extracted from an analysis of scientific texts or practices. Typically, proponents of such an approach favor a strong contextualization of scientific knowledge and its development, say, by studying the social and cognitive background and the material and experimental practices of science at different times and places.

- Secondly, historical epistemology may be pursued as a *philosophical project*, namely by thoroughly historicizing epistemology. It starts from the assumption that the standards and forms of what can count as knowledge have histories, which interact with various kinds of knowledge, most especially scientific knowledge. Such a project may then take at least two different directions: (1) One might claim that current epistemological questions and the standard philosophical methods of answering them are only historically relative, and no more valid than those of other times and places. (2) Or one might reject the assumption that to historicize is to relativize, and instead unsettle current epistemological questions and methods by exploring, in a serious historical vein, earlier alternatives in their own philosophical and scientific frameworks.

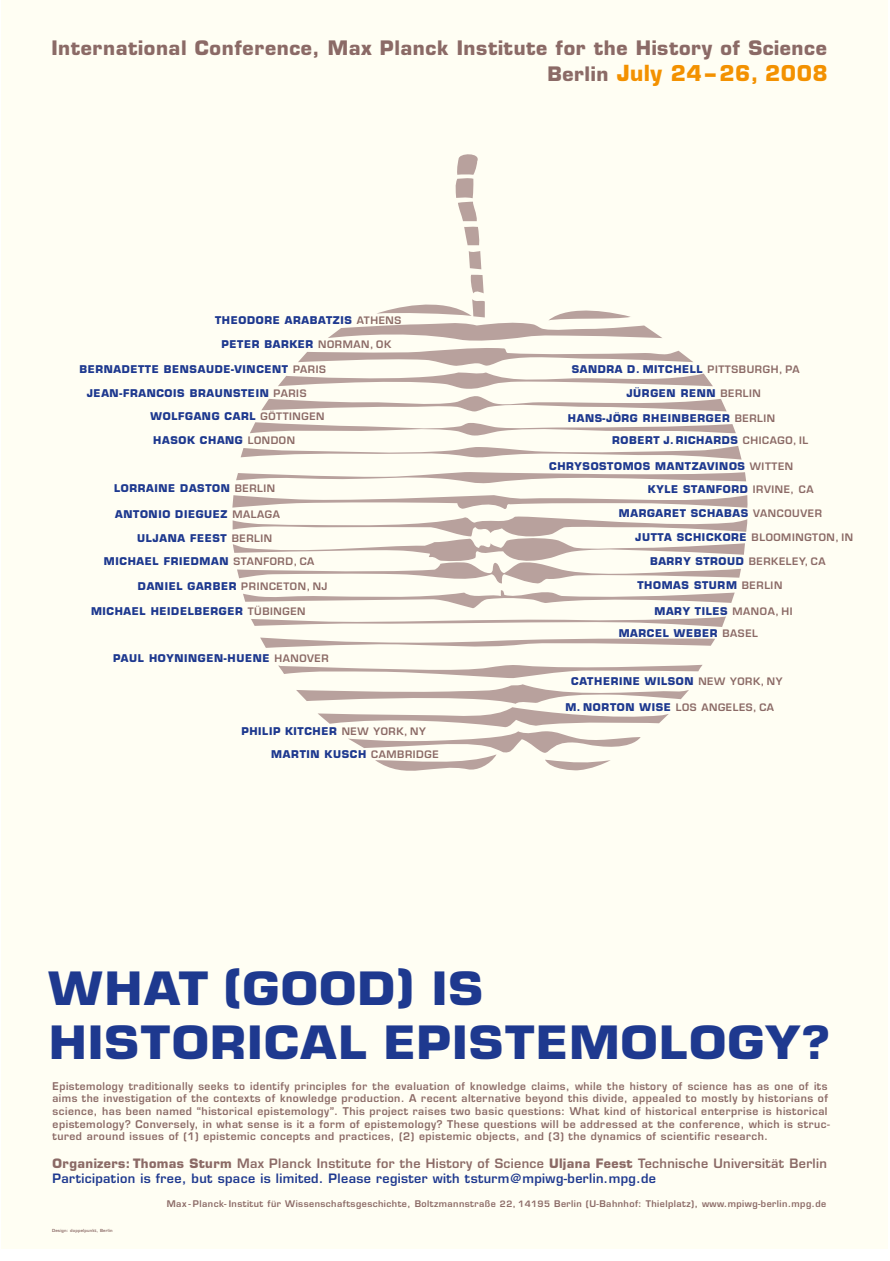
All of these construals of historical epistemology are faced with challenges. For example, even if its aim is "merely" historical, the choices of concepts, objects, and dynamics under study give rise to *historiographical* puzzles not only about the status and identity conditions of objects and concepts over time, but also regarding the methods by which historical developments are best to be studied. What, then, is the relationship (if any) between historical epistemology and the methodological turns towards the practices and material cultures of science? Furthermore, from the perspective of the *history and philosophy of science,* it may be asked what contributions historical epistemology has to make towards a genuinely philosophically informed history of science and/or to a genuinely historically informed philosophy of science. *Historians of philosophy*, again, have already for a while accepted the historicity of epistemological questions and their dependence upon past science. They also often acknowledge the possibility of replacing or reforming currently dominant questions in epistemology by looking at their history. Does historical epistemology offer any additional insights to such developments within the history of epistemology? Last but not least, *philosophical epistemologists* might object that the goal of identifying and justifying the epistemic basis of knowledge most likely cannot be achieved by asking historical questions about past science. Can a case be made that historical epistemology is a philosophically sophisticated project?

In these and other ways, the notion of historical epistemology brings to the fore a variety of debates that are located at the interface between philosophy and the history of science. The basic goal of the conference is to improve these debates by making more precise, and put to the test, different versions of historical epistemology. It will be structured, on the one hand, around specific themes from recent writings in historical epistemology—epistemic concepts, practices, and objects, and the dynamics that shape scientific research. On the other hand, the conference will also move to the level of both historical and philosophical reflection by asking: What kind of historical enterprise is historical epistemology? What are its basic assumptions, and what are their rationales? Moreover, in what sense is such a focus on epistemic categories and practices itself a form of epistemology? Can and should epistemology be done in this way?

Format of the Conference

The conference is structured along the following four themes:

1 Epistemic concepts and practices (e.g., observation, experiment, explanation)
2 Epistemic objects (e.g., temperature, viruses, brain function)
3 The dynamics of scientific research (e.g., cognitive modeling of scientific change)
4 Reflections about historiography and epistemology (what does historical epistemology teach us about the history of science, what does it teach us about epistemology?)



International Center for the History of Knowledge in Berlin

The cooperation between the Berlin Universities and the MPIWG has led to a formal cooperation agreement between the Max Planck Society, the Free University, and the Humboldt University; a comparable cooperation agreement with the Technical University is in preparation. As one of its first tasks, the scientific board of this project has outlined the following main goals and structural features of an International Center for the History of Knowledge in Berlin in the near future.

With its three universities, the Free University, the Humboldt University and the Technical University, as well as the Max Planck Institute for the History of Science, the city of Berlin harbors great potential for setting up an interuniversity internationally oriented center. This is the purpose of the cooperation agreement signed last year by the MPG, the FU and the HU in Berlin. For its part, the MPIWG is planning to establish two independent groups of junior scholars; the Humboldt University will add a tenure-track assistant professorship to its existing chair for the history of science; and the Free University is planning to set up a chair for the History of Science. In short, the history of science field will undergo significant staff expansion in Berlin. A comparable cooperation agreement is being pursued with the TU Berlin, which has begun setting up a field emphasizing research on cognition and knowledge; we hope to realize this agreement in 2008.

At present the humanities, and especially the smaller disciplines, are facing the challenge of repositioning themselves in a dynamic science landscape undergoing great change. The intersection between the subjects of the humanities and those of the natural and human sciences plays a particularly important role in this process. A prominent role pertains to the history of science, which is particularly suited to the role of serving as an interface between disciplines. In a sense, its core conception is interdisciplinary: thematically oriented toward understanding the development of the sciences, and especially—but not only—of the natural sciences, at the same time its methodology is anchored firmly in the historical sciences.

According to the results of a first discussion in the Advisory Board, the tasks of an International Center for the History of Knowledge can be described as follows.

Research

From the perspective of a historical epistemology, the history of science first of all can offer opportunities for reflection that allow interdisciplinary dialog to be directed toward a comprehensive cultural history of knowledge, rather than restricting it to purely pragmatic collaborations. If our current and future societies increasingly understand themselves to be knowledge societies, their conception of themselves

must be able to draw on a comprehensive cultural history of knowledge, and this history must undergo constant further development. Working to advance this development should be one of the core tasks of the center.

We see a further core task of an International Center for the History of Knowledge in the intensive cultivation and promotion of relations between the natural sciences on the one hand, and the humanities and social sciences on the other. Today such a dialog is demanded everywhere, but imperative for it to be conducted effectively are institutional structures that are not only stable, but also flexible. The center is to serve as a forum for this dialog, taking on the task of trying out new forms of confrontation between the various cultures of knowledge and conducting them with the commensurate perseverance.

A third task of the Center for the History of Knowledge in Berlin consists in networking the various historically oriented humanities and social sciences as broadly and effectively as possible. Even now, the Max Planck Institute for the History of Science offers work opportunities to scientists who concern themselves with the history of knowledge from a wide variety of backgrounds: art history and the history of literature, music history and even the history of architecture and technology. All of these areas have myriad connections with the historical development of knowledge and the sciences and, accordingly, their research efforts should also refer to each other and to such a history of knowledge.

Teaching

A Center for the History of Knowledge in Berlin could be a place to coordinate teaching, above all research-oriented teaching. For this the MPIWG would like to respond to the needs of the university partners by focusing the as yet scattered teaching activities of its staff. The teaching at issue here takes place not only in the humanities, but also in the natural sciences. MPIWG staff already offer a course (lecture and seminar) as part of the new Master's program for Biology at the FU Berlin. Yet another objective is to make Berlin an attractive location for foreign doctoral students in the history of science. This could pick up on graduate programs and schools that already exist or are being established now, but could also be expanded in the future by setting up an International Max Planck Research School, as part of the envisioned cooperation with the TU Berlin.

Expanding Cooperation Projects

At the current stage, the Scientific Advisory Board anchored in the cooperation agreement among the FU, HU and MPG appears to be a body well suited to organizing the center. Thanks to the participation of regular guests, further important cooperation partners are already represented such as the Prussian Cultural Heritage Foundation, the Center for Human and Health Sciences of the Charité Hospital, and the new In-

stitute of integrated Life Sciences at the Humboldt University which is in the process of being set up.

Infrastructure

The Center for the History of Knowledge is to feature an international guest program, which will include not only established academics, but also doctoral and postdoctoral scholars. This could make an ideal contribution to expanding the history of science research activities of the participating institutions, and to networking them, in particular with the international community of science historians. A guest program of this kind should also be accompanied by an attractive program of events at the center, tailored for the students of all three universities.

Finally, the International Center for the History of Knowledge will be able to fulfill its tasks, and just as important, to establish an internationally visible profile and identity, only with a coordinating office and premises of its own. This goal already seems realistic thanks to Berlin's current endeavors to encourage collaboration between the universities and non-university research institutions. The question as to where these premises should be set up is a matter for further discussion.

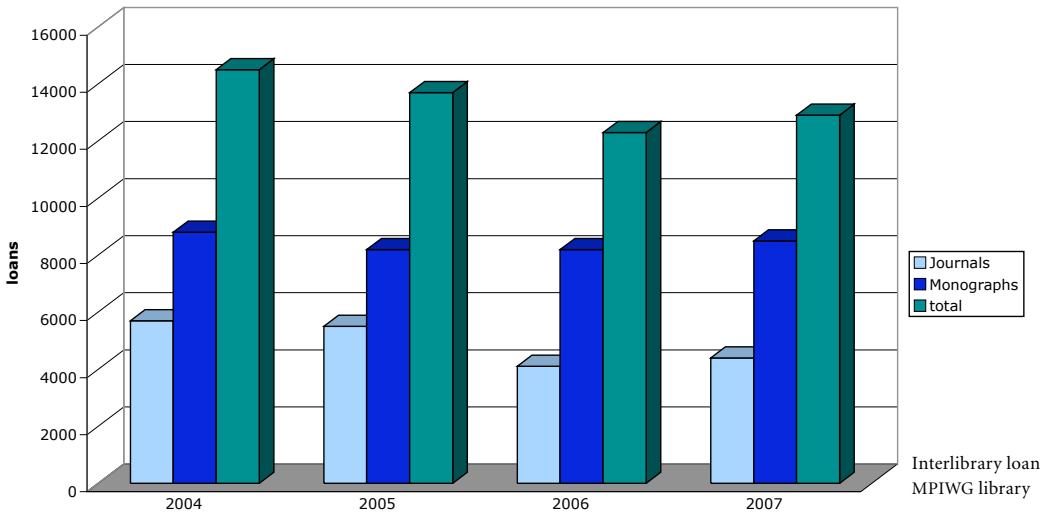
Knowledge Management

Robert Casties (Head of Library from April 2007 to Mai 2008), *Urs Schoepflin* (Head of Library), *Dirk Wintergrün* (Head of IT until April 2007 and from Mai 2008)

The Library and the Information Technology Unit (IT) aim to provide optimal access to both electronic and print resources. Their mission is to provide the best possible information services to the research groups of the Institute. They aim to construct an effective infrastructure for research in the history of science by exploiting the potential of new media for scholarly work and for disseminating research results.
To meet the evolving needs of the existing research groups at the Institute and to integrate new groups, particular attention was given to four specific activity areas: (1) the development of the digital research library including the digitization services and the enhancement of content provision by the acquisition of archival materials, (2) the implementation of the common IT-infrastructure for publication and research, (3) the support of the publication and dissemination of research results by a copyright clearing service and additional publication aids including information on the Max Planck Society's open access policy and the corresponding eDoc server as central repository, and (4) the development of new web sites for research projects and innovative tools.

The Library's collections and services

The Library has greatly benefited from the move to the new Institute's building in 2006. For the first time the collections could be consolidated and adequately presented together with optimized access to services and to reading space. The Library collections currently hold 60,000 volumes in print and over 25,000 historic works and materials in microform. Original archival resources contain some 10,000 items including mainly papers of physicists of the first half of the 20th century (Gehrke collection, Rupp correspondence, Einstein letters), the majority of which have been made available in digital form. Access to electronic resources has been substantially enhanced to include over 30,000 electronic journals and more than 100 full text and reference databases, largely as a result of the basic information provision of the MPG and of the National Licensing Program of the German Research Foundation. Complementing these resources, the interlibrary loan service has been in high demand and has attained a level of up to 14,000 loans p. a. Complementing the available holdings, this particular service priority of the Library allows for rapid document delivery providing books and articles from a wide network of national and international research libraries within days of a scholar's request and responding flexibly to new thematic user needs. Thus, the Library represents a central node of an information network, bringing flexibly together information of a wide range of relevant sources and making them available to the scholars at the Institute and at its future collaborative research centers.



Interlibrary loan activity of the MPIWG library

A common infrastructure for the Institute's web activities

The majority of electronic projects are now based on a common open source infrastructure which was developed within the framework of the ECHO initiative (European Cultural Heritage Online). This infrastructure integrates major research projects of the MPIWG, in particular the Virtual Laboratory (see Department 3) and the extensive collection of sources provided by the ECHO Project (see Department 1) and the Archimedes Project (see Department 1) as well as the digital collections of the Institute's library. Extensive work has been invested in new forms of representing knowledge in the form of virtual exhibitions in collaboration with Department 1.

Based on the integrative infrastructure, the Institute offers one of the largest research-related web sites within the Max Planck Society. The procedures developed in order to maintain this service have become a model for the design of the MPG-wide platform for scholarly work in the humanities (Scholarly Workbench) in the framework of the eSciDoc Project, a project financed by the Federal Ministry of Research and Education and jointly realized by the MPG and the FIZ Karlsruhe and in which the MPIWG is a direct cooperation partner. This cooperation is part of the eSciDoc Project's concept to take up, generalize and maintain the successful research driven developments from individual institutes as a long term service to the scholarly community, a role which goes beyond the MPG Institutes' individual missions.

Digital Research Library and enhanced access to content

The Library and the IT have together developed a special program for digitizing and presenting sources in the history of science in high quality color facsimiles from the Library's rare books collection and in grey scale images from the microform archive.

All digitized materials are made available in a web-based Digital Research Library. The program includes the establishment of a special digitization group within the Library which is equipped and qualified to digitize material on a high professional standard at a rate of 500,000 pages p. a. The workflow comprises procedures to upload the resulting images to the online presentation environment of the Digital Research Library and to securely archive the master files. The service is designed to flexibly react to new demands in the short term. The program is working closely with the research groups at the Institute who present their research on the Internet and who can immediately integrate the digitized sources in their presentation (ECHO Project, Archimedes Project, Virtual Laboratory, Epistemic History of Architecture, History of Mechanical Knowledge in China, Jesuit Sciences, Early Modern Engineering Drawings, Vision Project, History of Quantum Mechanics Project, Pratolino Project).

The Library has continued to acquire and make available archival materials as major new research resources and thus represents an innovative model on how to make archival materials immediately accessible to the research groups at the Institute and their international cooperation partners as well as to a larger scholarly public in the context of the Virtual Einstein Exhibition. The acquisition and continued digitization of the complete microfilms of the Archive for the History of Quantum Physics has for the first time allowed for web-based finding aids and for full electronic access to the material of the archive. It constitutes a decisive scholarly resource for the newly established international project group on the history of quantum mechanics.
The expansion of the scope of the Digital Research Library is continued by establishing a workflow of primary text acquisition and XML structuring to support structured XML annotations and lexical analyses performed on historical texts e. g. on mechanics. This expansion was in part made possible by additional funding from the special Library Program of the MPG aimed at innovative projects to enhance information provision at the institutes of the Humanities Section, for which the Library has successfully applied.

Modularity in exploiting new technologies to enhance research

The examples of the existing projects show that the demand for electronic tools and methods to enhance research is rapidly increasing. These demands can only be met by adhering to the strategy of building a flexible and modular infrastructure, whose building blocks can be individually combined to serve a wide range of diverse purposes.
Ever since the establishment of the IT group, the focus of the joint work of IT and Library has been on the development of tools for publishing primary sources and providing semantic access to these resources. These resources cover a broad variety of media types, from full texts in XML to audio tapes and videos. Several research web sites—jointly maintained by the projects and IT—give access to material relevant to the scholarly projects. These websites can only be successful if they can be maintained and extended to a large extent by the research groups to create up to date representations of their research. Therefore a standard set of modules is provided, which can

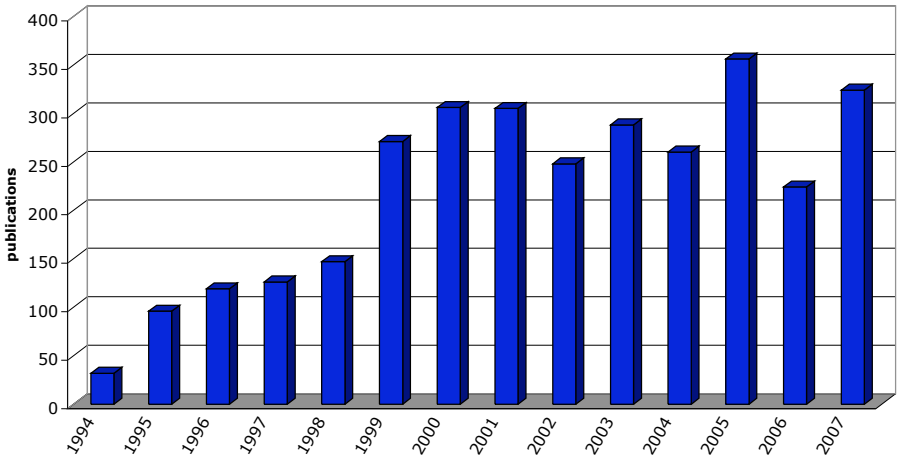
be flexibly combined to form new thematic web sites with only little additional work and a minimum of training for the scholars involved. The developed modules provide (1) an easy workflow to add new digitized material to the digital library, (2) a highly flexible image viewing environment, (3) a web based environment for the creation of electronic collections, (4) natural language technologies for the analysis of text written in a broad variety of languages, (5) an interface for integration of databases, and (6) tools for the design of textual and graphical navigation environments.

An additional new activity is the development of the OpenMind Project—a framework for generating and storing building blocks of knowledge and flexible networks of associations. OpenMind is intended to provide an alternative method of storing and processing data which is normally kept in relational databases. The database of the Islamic Scientific Manuscript Initiative (see Department 2) is a first test case for this new kind of work with scholarly data. The project also serves as a prototype to show how new representations of scholarly data leads to the generation of new networks of knowledge by extending the traditional concepts of a relational database.

The use of geographical information to show the spatial connectivity and transition of knowledge becomes more and more important in different research projects of the institute, in particular in the work of the Independent Research Group led by Dagmar Schäfer (see p. 161) as well as in the Research Network (see p. 189), the Globalization Project (see p. 54) and the VLP (see p. 128). The first prototypes showing the potential of visualization techniques of geographical data have been developed and will be extended to form more general tools.

Support of the scholarly publication and alternative dissemination process

To give our authors adequate support in dealing with copyright issues, transfer agreements and publisher contracts, the Library has established a copyright clearing service and offers advice to authors on publisher contracts and copyright transfer agreements.



Publication activity of scholars at the MPIWG

Following the Open Access policy adopted by the Max Planck Society to make available as many research results on the Internet as possible, the Library is responsible for uploading the Institute's bibliography and publication output (metadata and documents) to the MPG's central electronic repository for the documented research output of all institutes, the eDoc server. On this server, the searchable bibliographic data and—depending on the individual authors' agreements—the full text of the research results, presentations etc. are made available for either internal or open use.

To increase the acceptance of electronic publications particularly in the humanities, the alternative publication process has to be as easy as possible and the added value has to be immediate for the researcher. Therefore, the tools to publish comprehensive documents comparable to a classical monograph will have to be improved and the possibility to set stable links to sources are on the agenda. One of the main perspectives for future developments at the Institute is the integration of the publications tools into an environment available at every work place, accompanied by improved access tools to existing electronic resources and environments for collaborative work.

Web sites of the Institute

Web presentations have become an integrated part of research in different projects. These research web sites are jointly maintained by the researchers and the IT group, the sites give access to material relevant to their research interests and are part of their dissemination strategies of research results. Currently, 11 research sites are available

online: The Virtual Laboratory (VLP), European Cultural Heritage Online (ECHO), History and Foundation of Quantum Physics, Virtual Einstein Exhibition, Cuneiform Digital Library Initiative (CDLI), The Archimedes Project, Database of Mechanical Drawings, Islamic Scientific Manuscript Initiative (ISMI), Drawing with Optical Instruments (Vision), Research Network "History of Scientific Objects", Knowledge in the Making, The Virtual Einstein Exhibition in Pavia, "Wunderforschung", Max Planck Exhibition, History of Science in a Garden (Pratolino).
Parallel to the development of research oriented sites, the main web site of the Institute was completely redesigned. It offers now a comprehensive description of all current research projects at the Institute. The content of the project descriptions, of the personal home pages, and of the conference pages can be updated by the scholars themselves through a specially developed web interface. Conference papers can be exchanged among participants as part of a collaborative working environment currently under development.
The institute provides on its external and internal web sites in total approx. 2,000,000 digital items, i. e. images, movies, full text and database entries.

Collaboration and outreach

The Library and the IT were involved in several collaborative projects. The foremost two aims of cooperating with research and cultural institutions is on the one hand the sharing of rare and manuscript materials to enhance access to these resources for research purposes and on the other hand transfer of skills by sharing the expertise in maintaining digital projects to make these resources available on the internet. At MPG level, the ongoing cooperation with both the Bibliotheca Hertziana and with the Art History Institute in Florence is particularly relevant in these respects. Other important international cooperative projects include the MPIWG's partner group at the Institute for the History Natural Sciences at the Chinese Academy of the Sciences in Beijing, for which the Library provides expert advice and basic training.
Possible new collaborations were explored in the framework of a delegation of the Humanities Section of the MPG and of the Library visiting Ulan Bataar (Mongolia), where contacts with institutions holding cultural heritage led to a proposal of a Mongolian Competence Center for Digitizing Cultural Heritage supported by the Max Planck Society.

Finally, the Library and the IT were actively involved in discussions on the concept of the newly-founded Max Planck Digital Library (MPDL), which is to consolidate the central information management services of the MPG and host the eSciDoc infrastructure project, to which the MPIWG information services provided by the Library and the IT form a model counterpart at the level of the MPG Institutes. The strategic cooperation with the MPDL will provide the necessary support for further generalizing and maintaining the services developed at the Institute, integrate new services and secure long term availability and archiving of the scholarly results in a reliable environment so crucial to research.

Overviews

Research Scholars

Beurton, Peter (Dr. rer. nat. 1973 [biology], Dipl. 1977 [philosophy] Humboldt-Universität zu Berlin, habil. phil. 1987 [philosophy] Universität Potsdam), at the Institute since September 1994, associated scholar since April 2006. Area of work: Research strategies in biological evolutionary theory; modern darwinism and the philosophy of science.

Bigg, Charlotte (Ph. D. 2002 [history and philosophy of science] University of Cambridge), at the Institute as research scolar since July 2005. Area of work: Social and cultural history of the physical sciences (physics, chemistry, astronomy) in the 19th and 20th centuries, especially the history of optical instrumentation.

Bödeker, Hans Erich (Dr. phil 1983 [history], Ruhr Universität Bochum), at the Max-Planck-Institut für Geschichte, Göttingen, since October 1977; at the Institute for the History of Science since December 2006. Area of work: History of cultural practices (reading, writing, travelling, appropriation of music, sociability etc.) in the early modern period, history of the emergence of the social sciences (17th–19th centuries), historical semantics.

Bödeker, Katja (Dipl. 1998 [psychology], Dr. [psychology] Freie Universität Berlin 2004), at the Institute from November 1999 to December 2006. Area of work: Intuitive physics, cognitive anthropology, cognitive models of science.

Brandt, Christina (Dr. rer nat. 2002 [history of science] Technische Universität Braunschweig), at the Institute as research scholar since June 2003, research group leader since February 2006. Area of work: Reproduction in biology configurations between science and culture, 1900–2000.

Büttner, Jochen (Dipl. 1987 [physics] Freie Universität Berlin) at the Institute since 1998. Area of work: History of early modern mechanics.

Caraffa, Costanza (Laurea 1992 [architecture] Politecnico di Milano, Dr. phil. 2003 [art history] Freie Universität Berlin), at the Institute from Oktober 2006 to February 2007. Area of work: History of architecture and history of early modern urbanism in Italy and Europe; Domenico Fontana, fortuna critica; photography as a medium of research in art and cultural history.

Castagnetti, Giuseppe ([philosophy and history] University of Milano), at the Institute from October 1997 to September 2002 and since April 2003. Area of work: History of institutions of physics in the 20th century; history of quantum physics.

Casties, Robert (Dipl. 1998 [physics] Universität Hamburg, Dr. phil. nat. 2002 [history and philosophy of science] Universität Bern), at the Institute since January 2002. Area of work: Information technology project.

Dahl, Jacob Lebovitch (Ph. D. 2003 [Near Eastern Languages and Cultures] University of California, Los Angeles), at the Institute since October 2005. Area of work: Invention and early spread of writing; social history in early Mesopotamian societies; edition of Cuneiform texts in Syrian and French collections; research within the framework of the Cuneiform Digital Library Initiative.

Damerow, Peter (Dr. 1977 [mathematics] Universität Bielefeld, habil. 1994 [philosophy] Universität Konstanz), at the Institute since January 1997, associated scholar since January 2006. Area of work: History of science and education; individual and historical development of cognition; genesis of writing and arithmetic; history of mathematics and physics in ancient and early modern period. Einstein exhibition project.

Daston, Lorraine (A.B. 1973 Harvard University, Dipl. 1974 University of Cambridge, Ph.D. 1979 [history of science] Harvard University), at the Institute since July 1995. Area of work: History of probability theory and statistics; history of scientific objectivity; attention and observation in natural history, 16th–19th cs.

Dierig, Sven (Dipl. 1990 [biology], Dr. rer. nat 1995 [neurobiology] Universität Konstanz, habil. 2005 [history of science] Technische Universität Berlin), at the Institute from July 1997 to March 2006. Area of work: Urbanization, industrialization, and the place of experiment in 19th century physiology; the virtual laboratory.

Feest, Uljana (M. A. 1994 [psychology] Goethe-Universität, Frankfurt/M., Ph. D. 2003 [history and philosophy of science] University of Pittsburgh), at the Institute as research scholar from October 2004 to September 2006. Area of work: History and philosophy of scientific experimentation, especially psychology; history of the philosophy of science; relationship between the emergence of Gestalt psychology and logical positivism.

Fuchs, Brian (B.A. 1979, M.Phil. 1983 [classics] Yale University), at the Institute from November 1999 to December 2006. Area of work: Archimedes Project, ECHO Project, eSciDoc.

Gausemeier, Bernd (Dr. phil. 2005 [history] Universität Bremen), at the Institute as research scholar since June 2007. Area of work: Science and politics in the 20th century; history of biology, especially history of heredity.

Heesen, Anke te (Dipl. 1990 [cult. pedagogy] Universität Hildesheim, Dr. phil. 1995 [aesthetics und communication] Universität Oldenburg), at the Institute from October 1999 to September 2006. Area of work: History of (natural history-) collections and exhibitions (18th to 20th century); note-taking-practices of scientists; newspaper clippings and their status as information and visual fragment in the sciences and arts around 1900.

Hoffmann, Christoph (Dr. phil. 1995 [German literature], habil. 2004 [German literature] Europa Universität Viadrina Frankfurt (Oder), at the Institute since November 2004. Area of work: Epistemic writings (notebooks and records as research tools); history of observation and experiment; technologies of representation; sensory physiology (19th and early 20th century).

Hoffmann, Dieter (Dipl. 1972 [physics], Dr. phil. 1976 Humboldt-Universität zu Berlin, Dr. habil. 1989 [history of science] Humboldt-Universität zu Berlin, apl. Prof. 2003 Humboldt-Universität zu Berlin), at the Institute since December 1995. Area of work: History of physics in the 19th and 20th centuries, esp. Max Planck and institutional history of quantum theory; history of science in the GDR. Einstein exhibition project.

Hyman, Malcolm (Ph.D. 2002 [classical philology] Brown University), at the Institute since August 2004. Area of work: History of the language sciences; development of scientific terminology; science in Greek and Roman antiquity; general linguistics; digital humanities.

Kant, Horst (Dipl. 1969 [physics], Dr. rer. pol. 1973 [history & philosophy of science] Humboldt-Universität zu Berlin), at the Institute since October 1995. Area of work: History of physics in the 19th and 20th centuries (esp. atomic physics and institutional and social aspects).

Kern, Hartmut (M.A. 1988 [philosophy] Freie Universität Berlin), at the Institute since December 2001. Area of work: Information technology project.

Kleeberg, Bernhard (Dr. phil. 2002 [history] Universität Konstanz), at the Institute from September 2003 to December 2006. Area of work: 19th and 20th century political economy, evolutionary theory and anthropology, natural philosophy and theology, aesthetics of nature.

Klein, Ursula (Dr. phil. 1993, habil. 2000 [philosophy], apl. Prof. 2007 Universität Konstanz), at the Institute from July 1995 to August 1997 and since July 1998. Area of work: History and philosophy of the laboratory sciences; history of technoscience; classification and historical ontology.

Kurapkat, Dietmar (Dipl.-Ing. 1998 [architecture] Technische Universität Karlsruhe), at the Institute from Oktober 2005 to September 2007. Area of work: Epistemic history of architecture in connection with the archaeology of the Near East (especially the neolithic and early historic periods).

Kursell, Julia (Dr. phil. 2000 [Russian philology] Ludwig-Maximilians-Universität München), at the Institute since April 2004. Area of work: 20th century music and sound art; physiology and psychology of hearing (19th and 20th centuries).

Lefèvre, Wolfgang (Dr. phil. 1971 [philosophy], habil. 1977 [philosophy in connection with history of science] Freie Universität Berlin, apl. Professor [philosophy] Freie Universität Berlin), at the Institute since July 1994, associated scholar since March 2006. Area of work: History of science in connection with history of philosophy on the basis of social history; sciences in Greek antiquity; early modern physics and chemistry; history of biology (15th–18th centuries).

Lehner, Christoph (Dipl.-Phys. 1989 Universität München, Ph.D. [philosophy of science] 1997 Stanford University), at the Institute since January 2004. Area of work: History of modern physics, philosophy of physics, history of modern philosophy.

Lund, Hannah Lotte (M.A. 1999 [history/literature] Humboldt-Universität zu Berlin), at the Institute as coordinator at the network "history of scientific objects" since 2005. Area of work: Intellectual (women's) history; 18th century European cultural history.

Mayer, Andreas (M.A. 1994 [sociology], Universität Wien, Dr. rer. soc. oec. 2001 [sociology], Universität Bielefeld), at the Institute since March 2007. Area of work: History of the human sciences, history of medicine and physiology, historical anthropology of psychoanalysis and psychiatry (19th–20th centuries).

Munz, Tania (Ph.D 2007 [history of science] Princeton University, MA 2000 [history of science and technology] University of Minnesota), at the Institute since August 2007. Area of work: History of animal behavior studies, history of biology (19th and 20th century), animal communication, film and visual representations in animal behavior studies.

Oertzen, Christine von (Dr. phil. 1998 [history] Freie Universität Berlin), at the Institute since June 2005. Area of work: Academic organisations, networks, and biographies; science and gender in connection with social and cultural history, history of academic cultures in Europe and the United States, 19th and 20th centuries.

Osthues, Ernst-Wilhelm (Staatsexamen Lehramt Gymnasien 1981 [social sciences, german philology] Universität Göttingen, Dr. phil. 2004 [classical archaeology] Freie Universität Berlin), at the Institute since December 2004. Area of work: History of architecture, knowledge transfer in ancient societies.

Pietsch, Annik (Diplom 1988 [biochemistry] Freie Universität Berlin, B.A. 1990 [history of art] Technische Universität Berlin), at the Institute since July 1999. Area of work: Binding media. Painting techniques in art, science, and industry in 18th and 19th century Germany.

Presas i Puig, Albert (Dr. phil. 1995 [history of science] Technische Universität Berlin), at the Institute from May 2003 to April 2007. Area of work: Scientific relationship between Germany and Spain: Science, technological transfer, and international policy in the 20th century.

Reinhardt, Carsten (Dr. phil. 1996 [history of science] TU Berlin, habil. 2003 [history of science] Universität Regensburg, Professor 2007 [historical science studies], Universität Bielefeld), at the Institute from March 2006 to March 2007. Area of work: History of chemistry, industrial research, research methods, expertise (19th–20th centuries).

Renn, Jürgen (Dipl. 1983 [physics] Freie Universität Berlin, Dr. rer. nat. 1987 [mathematics] Technische Universität Berlin), at the Institute since March 1994. Area of work: History of early modern mechanics, history of relativity theory; interaction between cognitive and contextual factors in the history of science. Einstein exhibition project (Scientific Director).

Rheinberger, Hans-Jörg (M.A. 1973 [philosophy], Dipl. 1979 [biology], Dr. rer. nat. 1982, habil. 1987 [molecular biology] Freie Universität Berlin), at the Institute since January 1997. Area of work: Epistemology of experimentation.

Rieger, Simone (M.A. 1998 [linguistics and philosophy] Technische Universität Berlin), at the Institute from February 1999 to February 2008. Area of work: Coordination of the open access initiative "European Cultural Heritage Online" (ECHO).

Schäfer, Dagmar (Dr. phil. 1996 [sinology, japanology, political science], habil. 2005 [sinologie] Würzburg), at the Institute since May 2006. Area of work: History of technology/history of science in China 10th–18th centuries in connection with knowledge formation and transmission.

Schemmel, Matthias (Dipl. 1997 [physics], Universität Hamburg), at the Institute since January 1998. Area of work: History of relativity theory, history of early modern mechanics, history of Chinese science.

Schmidgen, Henning (Dipl. 1990 [psychology], Dr. phil. 1996 [psychology], M.A. 1997 [philosophy] Freie Universität Berlin), at the Institute from March 1997 to August 2005 and since July 2006. Area of work: Machines and bodies without organs in the history of science.

Schoepflin, Urs (Dipl. 1975 [sociology] Freie Universität Berlin), at the Institute as director of the library since September 1994. Area of work: Scientific information systems; scholarly communication; sociology and history of science; scientometrics; digital libraries; open access.

Schüller, Volkmar (Dr. rer. nat. 1972 [physics] Universität Greifswald), at the Institute since September 1994. Area of work: History of mathematics and physics (16th and 17th centuries).

Sibum, H. Otto (Dr. rer. nat. 1989 [physics] Carl von Ossietzky Universität Oldenburg; habil. 2001 [history of science and technology] Technische Universität Carolo-Wilhelmina zu Braunschweig), at the Institute from October 1995 to August 2007. Area of work: History of the physical sciences (17th until 20th century), particularly history of experience and experiment, embodiment of knowledge, material culture of science, precision measurement.

Siebert, Martina (Dr. phil. 2002 [sinology in connection with history of science] Freie Universität Berlin), at the Institute since October 2006. Area of work: History of traditional Chinese Sciences esp. Nature studies (10th to early 19th centuries); systems of classifying and evaluating knowledge (Chinese tradition and the process of modernization; China vs. West); history of technology; historization of technology and notions of progress.

Stalmann, Kai (Magister Artium 1989 [Germanistik, Religionswissenschaft], Dr. phil. 1997 [Literaturwissenschaft], computational linguistics 2004, research scholar at the Institute from March 2007 to May 2008. Area of work: Language processing [semantic clustering, automatic text classification], knowledge management, and information retrieval.

Sturm, Thomas (Dr. phil. 2007 [philosophy]) Philipps-Universität Marburg, at the Institute since 2005. Area of work: Early modern philosophy, esp. Kant; history and philosophy of psychology; current epistemology, philosophy of science, and philosophy of mind.

Valleriani, Matteo (Laurea 1990 [philosophy]), at the Institute since July 1998. Area of work: Professional knowledge of practitioners: Galileo as an engineer; Einstein exhibition project: knowledge and conception of the world; collaborative research center 644—"transformations of antiquity": weight, energy and force: conceptual structural changes in ancient knowledge as a result of its transmission.

Vidal, Fernando (A.B. 1981 Harvard University, M.A. 1984 [psychology] University of Geneva, M.A. 1986 [history and philosophy of science] University of Paris I – Sorbonne, Ph.D. 1988 University of Geneva, Habilitation 2001 Ecole des Hautes Etudes en Science Sociales), at the Institute as research scholar since September 2000. Area of work: History of psychology and anthropology, 16th–20th centuries; the self and the body in the Christian tradition; historicizing "brainhood" (the self as brain).

Vogt, Annette (Dipl. 1975, Dr. rer. nat. 1986 [mathematics] Universität Leipzig), at the Institute since September 1994. Area of work: History of sciences, esp. history of mathematics, in Germany, in the 19th and 20th centuries; history of Jewish scientists in Germany; history of women scientists in the 19th and 20th centuries from a comparative perspective.

Wazeck, Milena (Dipl. 2001 [political science] Freie Universität Berlin), at the Institut since June 2000. Area of work: The public controversy on the theory of relativity in the 1920s; the governance of science.

Wilder, Kelley E. (Dr. phil. 2003 [history of art] Oxford University), at the Institute from September 2005 to August 2008. Area of work: History of photography; photography and science.

Wintergrün, Dirk (Dipl. 1998 [physics] Technische Universität Berlin), at the Institute since January 2000. Area of work: Information technology project.

Wittmann, Barbara (Dr. phil. 1999 [art history] Freie Universität Berlin), at the Institute since November 2003. Area of work: Drawing as scientific practice (18th–21th centuries); history of psychology; history and theory of children's drawings.

Ziemer, Hansjakob (Dr. phil 2007 [modern history] Humboldt-Universität zu Berlin), at the Institute from June to November 2006 and since January 2008. Area of work: Coordinator of research network, since January 2008: cooperations and public outreach; cultural history of music and musicology and history of journalistic knowledge (19th–20th centuries).

Visiting Scholars and Research Fellows

Dr. Oscar João Abdounur (Visiting Scholar, Instituto de Matemática e Estatística, Universidade de Sao Paulo, Sao Paulo, Brazil, December 10, 2005–January 6, 2006; June 29–July 31, 2006): Mathematics and music in the Renaissance: From a cosmological-spekulative to a mathematic-empirical conception. (January 7–February 13, 2007; July 2–August 13, 2007): Renaissance music and the experimental science; historical relationships between mathematics and music on mathematics

education; effects of epistemological principles on the historical development of mathematical ideas: An investigation on the arithmetization of the theories of musical proportions.

Prof. Dr. Gadi Algazi (Visiting Scholar, Department of History, Tel Aviv University, Israel, July 24–August 24, 2007): Households of knowledge: Reshaping the scholarly habitus, 1300–1600.

Dr. des. Jan Altmann (Postdoctoral Research Fellow, September 1, 2005–August 31, 2006): Drawing as observing in the enlightenment.

Dr. Daniel Andersson (Postdoctoral Research Fellow, September 1, 2007–August 31, 2009): Self-observation and conscience in English protestant thought.

Prof. Dr. Theodore Arabatzis (Visiting Scholar, Department of Philosophie and History of Science, University of Athens, Greece, February 1–June 30, 2007): Hidden entities and their experimental manifestations.

Prof. Dr. Lígia Arantes Sad (Visiting Scholar, Departamento de Matemática, Centro de Ciências Exatas, Universidade Federal do Espírito Sante, Vitória, Brazil, October 23–November 24, 2007): Mathematics education of native Brazilians in the state of Espirito Santo: An intercultural perspective.

Dr. David Aubin (Visiting Scholar, Institut de mathématiques de Jussieu, Université Paris 6, France, October 1, 2006–February 28, 2007): Seeing structur, structuring sight: Bénard's cells an the visualization of self-organization.

Dr. Safia Azzouni (Postdoctoral Research Fellow, October 1, 2004–September 30, 2007): The popular science book: A new genre between literature and science in the late nineteenth and early twentieth centuries.

Dr. Hannah Baader (Postdoctoral Research Fellow, Kunsthistorisches Institut in Florenz, Max-Planck-Institut, Italy, January 1–April 30, 2007): Reconsidering the mediterranean: A visual history of the sea.

Dr. Massimiliano Badino (Visiting Scholar, Dipartimento di Filosofia, Università degli Studi di Genova, Italy, June 1, 2005–February 14, 2007): History of quantum mechanics: from Boltzmann to Planck; from Planck to Bose; the quantum revolution. (Postdoctoral Research Fellow, February 15, 2007–December 31, 2008): Thermodynamics and statistical mechanics from Boltzmann to Planck.

Beat Bächi (Predoctoral Research Fellow, Institut für Geschichte, Technikgeschichte, Eidgenössische Technische Hochschule Zürich, Switzerland, October 1, 2006–March 31, 2007): "Purely Swiss" Vitamin C: The cultural history of a sociotechnical innovation.

Dr. Crispin Barker (Visiting Scholar, Yale University, New Haven, Connecticut, U.S.A., October 21–December 22, 2006): Tying the ends together: The development of the telomere-telomerase hypothesis of aging and cancer, 1986–1996.

Prof. Dr. Vicente Barretto (Visiting Scholar, Deutscher Akademischer Austauschdienst, Direito, Universidade do Estado do Rio de Janeiro, Brazil, October 1–October 30, 2006): Neurosciences and the law.

Dr. Antonio Becchi (Postdoctoral Research Fellow, Dipartimento di Scienze per l'Architettura, Universitá di Genova, Italy, April 1, 2006–September 30, 2007): Epistemic history of architecture.

Viola van Beek (Predoctoral Research Fellow, July 1, 2007–June 30, 2009): Experimentieranleitungen und Experimentalräume.

Prof. Dr. Bruno Belhoste (Visiting Scholar, Dibner Institute for the History of Science and Technology, Massachusetts Institute of Technology, Cambridge, Massachusetts, U.S.A., July 1–August 31, 2007): Public knowledge and scientific networks in early 19th century Paris.

Prof. Dr. David Bloor (Visiting Scholar, Department of Sociology, University of Edinburgh, U.K., April 15–August 31, 2006; September 1–September 30, 2007): Rival theories of aerofoil, 1904–1926).

Dr. Christophe Bonneuil (Visiting Scholar, Centre Koyré d'Histoire des Sciences et des Techniques, Paris, France, May 1–June 30, 2006): History of plant genetics and breeding in the 20th century; comparative history of GM crops biosafety research in the U.S.A., Germany and France.

Arianna Borrelli (Postdoctoral Research Fellow, November 1, 2005–August 31, 2007; Visiting Scholar, September 1, 2007–August 31, 2009): The role of molecules in the development of quantum mechanics, with a special regard for the contribution of Michael Polanyi and Eugene Wigner.

Cristiane Brandão Augusto Mérida (Predoctoral Research Fellow, Deutscher Akademischer Austauschdienst, September 1–December 31, 2007): The cerebral subject: Impact of the neurosciences on contemporary culture.

Dr. Brita Brenna (Postdoctoral Research Fellow, University of Oslo, Senter for teknologi, innovasjon og kultur, Universitetet i Oslo, Norway, August 15, 2005–January 15, 2006): Nature in an 18th century natural history of Norway: Making common land for god, the king, science, and the public.

Björn Brüsch (Predoctoral Research Fellow, January 1, 2004–June 30, 2007): Experimentalization of gardening in nineteenth century Germany: Peter Joseph Lenné and the "Gärtner-Lehranstalt" in Wildpark/Potsdam.

Silvia Caianiello (Visiting Scholar, Consiglio Nazionale delle Ricerche, Roma, Italy, August 27, 2007–July 31, 2008): Historical and theoretical perspectives on modularity its role at the crossroad between Evo-Devo and synthetic theory of evolution.

Luciana Vieira Caliman (Predoctoral Research Fellow, Deutscher Akademischer Austauschdienst, Instituto de Medicina Social—IMS/VERJ, Laranjeiras, Rio de Janeiro, Brazil, April 1, 2004–August 31, 2006): The inattentive individual: Contributions to the history of attention.

Paloma Calle (Visiting Scholar, Departmento de Historia de la Ciencia, Instituto de Historia, Madrid, Spain, August 1–August 31, 2006): The case Cajal: On the centenary of the Nobel Prize in Medicine 1906.

Dr. Luis Campos (Postdoctoral Research Fellow, Drew University, Madison, New Jersey, U.S.A., October 1, 2007–September 30, 2008): Synthetic biology: Engineering life in the test tube.

Prof. Dr. John Carson (Visiting Scholar, University of Michigan at Ann Arbor, U.S.A., June 1–July 31, 2007): Mental ability and the birth of medical jurisprudence.

Zeynep Celik (Predoctoral Research Fellow, Center for Advanced Study in the Visual Arts (CASVA), Massachusetts Institut of Technology, Cambridge, U.S.A., September 1, 2005–August 31, 2006): Kinaesthetic impulses: Space, performance, and the body in German architecture, 1870–1914.

Prof. Karine Chemla (Visiting Scholar, Dibner Institute for the History of Science and Technology, Massachusetts Institute of Technology, Cambridge, Massachusetts, U.S.A., July 1–August 31, 2007): Cosmologie, calcul et histoire conceptuelle. Une approche anthropologique des mathématiques de la Chine ancienne.

Yue Chen (Predoctoral Research Fellow, Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, March 27–June 30, 2006; November 21, 2006–November 20, 2007): Mechanical knowledge in China: Western and Chinese origins of the Jie Xuann's cosmology.

PD Dr. Tobias Cheung (Postdoctoral Research Fellow, Kulturwissenschaftliches Seminar, Humboldt-Universität zu Berlin, Germany und Akademie Schloss Solitude, Stuttgart, Germany, March 1–November 30, 2007): Constellations between biology, anthropology, and philosophy 1900–1950.

Dr. Didier Debaise (Postdoctoral Research Fellow, October 1, 2005–December 31, 2007): Constructing a speculative approach to heredity.

Dr. Emmanuel Didier (Visiting Scholar, Centre National de la Recherche Scientifique, Centre de recherche sociologiques sur le droit et les institutions pénales/Immeuble Edison, Guyancourt, France, March 1–August 31, 2006): US survey statistics during the interwar period.

Christopher DiTeresi (Predoctoral Research Fellow, Conceptual and Historical Studies of Science, University of Chicago, Illinois, U.S.A., January 1–April 30, 2007): Practices for visualizing development processes.

Thomas Dohmen (Visiting Scholar, University of Haifa, Israel, July 1–December 31, 2006): Context and error in the epistemology of scientific experiment.

Dr. Monika Dommann (Postdoctoral Research Fellow, Schweizerischer Nationalfonds, Forschungsstelle für Sozial-und Wirtschaftsgeschichte, Universität Zürich, Switzerland, May 1–July 31, 2007): Multiplication/Regulation: The cultural history of copy and copyright.

Dr. Igal Dotan (Postdoctoral Research Fellow, Department of Philosophy, University of Haifa, Israel, November 15, 2004–November 14, 2007): Natural selection in the lab: Background knowledge and its role in evolution of experimental systems.

Dr. Maarten van Dyck (Visiting Scholar, Universiteit Gent, Belgium, September 1, 2007–February 29, 2008): Conceptual problems in early modern mechanics, with a focus on the works of Guidobaldo del Monte, Simon Stevin and Galileo Galilei.

Prof. Dr. Circe Mary Silva da Silva Dynnikov (Visiting Scholar, Universidade Federal do Espirito Santo, Vitória, Brazil, October 23–November 24, 2007): The reception of the theory of relativity in Brazil.

Anna Echterhölter (Predoctoral Research Fellow, March 1–August 31, 2007): Epimistic values in orbituaries of scientists (1760–1860).

Dr. Olaf Engler (Visiting Scholar, Zentrum für Logik, Wissenschaftstheorie und Wissenschaftsgeschichte, Universität Rostock, Germany, October 1, 2006–December 31, 2007): Scientific philosophy and modern physics, 1870–1930.

Prof. Dr. Moritz Epple (Visiting Scholar, Historisches Seminar, Wissenschafts-geschichte, Goethe-Universität Frankfurt am Main, Germany, January 1–March 31, 2007): Time, space, and geometry: Reflections of the Nietzschean mathemetician Felix Hausdorff at the interface of mathematics and epistemology.

Prof. Rand B. Evans (Visiting Scholar, East Carolina University, Greenville, North Carolina, U.S.A., September 1–September 30, 2007): Devices and methods used in the calibration of early timing devices in psychological research.

Dr. Ulrike Fauerbach (Postdoctoral Research Fellow, January 1–September 30, 2006): Building trade in Pharaonic Egypt.

Prof. Dr. Rivka Feldhay (Visiting Scholar, The Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Israel, October 1, 2005–July 31, 2006; July 10–October 10, 2007): Jesuits on statics, dynamics, mathematics, and astronomy between Galileo and Newton.

Dr. Mechthild Fend (Visiting Scholar, Princeton University, School of Historical Studies, Institute for Advanced Study, Princeton, New Jersey, U.S.A., August 1–August 31, 2006): History and representation of skin in 18th and 19th century France.

Dr. Jiren Feng (Postdoctoral Research Fellow, October 1, 2006–September 30, 2008): History of chinese art and architecture-cultural traditions of architectural technology as reflected in Chinese building manuals of the 15th to 19th century.

Dr. Dr. Erna Fiorentini (Visiting Scholar, Deutsche Forschungsgemeinschaft, Institut für Kunstgeschichte, Freie Universität Berlin, Germany, January 1, 2005–September 30, 2008): Vision and representation between aesthetic experience and scientific objectivity.

Adrian Fischer (Predoctoral Research Fellow, University of Minnesota, Minneapolis, U.S.A., June 18–July 22, 2007): On the history of the quantum-mechanical description of the anonmalous Zeeman effect.

Maja Fjaestad (Predoctoral Research Fellow, Bank of Sweden, Tercentenary Foundation, Avdelningen för teknik- och vetenskapshistoria, Sveriges största tekniska universitet, Stockholm, Sweden, September 15, 2007–September 15, 2008): History of the quantum mechanics: The dream of the breeder reactor: Utopian themes in Swedish nuclear power 1945–1980.

Prof. Dr. Ragnar Fjelland (Visiting Scholar, Senter for vitskapsteori, Universitetet i Bergen, Norway, September 1–December 15, 2007): On the lifeworld foundation of science.

Dr. Michael Fotiadis (Visiting Scholar, Department of History and Archaelogy, University of Ioannina, Greece, March 1–June 30, 2007): Practical of classical archaeology.

Prof. Dr. Gideon Freudenthal (Visiting Scholar, The Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Israel, September 1–September 30, 2006; August 20–September 30, 2007): Marxist historiography of science: Boris Hessen and Henryk Grossman.

Prof. Dr. Rodolphe Gasché (Visiting Scholar, Program in Comparative Literature Arts and Letters, University of Buffalo, New York, U.S.A., June 17–August 4, 2007): Europe: A concept, idea, or figure?

Mauricio Gatto (Predoctoral Research Fellow, January 1–June 30, 2006): Commentaries to the Pseudo-Aristotele's Mechanical Problems: Baldi (In Mechanica Aristotelis Problemata Exercitiationes 1621); Bianchi (Aristotelis Loca Matematica 1615); Guerara (In Aristotelis Mechanicas Commentarii 1627); Monantheuil (De Aristotelis Mechanica 1599); Piccolomini (Italian Paraphrases of the Mechanical Problems 1582); Tomeo (Latin Translation of the Mechanical Problems 1560).

Dr. Jean-Paul Gaudillière (Visiting Scholar, Centre de Recherche Médecine, Science, Santé et Société, Institut national de la santé et de la recherche médicale, Villejuif, France, January 1–June 30, 2006): From preparation to screening: The life sciences and the pharmaceutical industry in France and Germany, 1920–1970.

Dr. Bernd Gausemeier (Postdoctoral Research Fellow, Deutsche Forschungsgemeinschaft, October 1, 2004–May 31, 2007): Genealogy and Human Heredity in Germany, ca. 1850–1945.

Dr. Florentina Badalanova Geller (Visiting Scholar, Centre for Anthropology, The British Museum, London, U.K., June 1–August 31, 2007): ECHO Project: Iconography, Folk Bible and Folk Koran (Visiting Scholar, Royal Anthropological Institute of Great Britain and Ireland, London, U.K., December 17, 2007–January 16, 2008): Holy Scriptures: the Ur-Hypertext (verbal and visual codes of transmission of religious knowledge).

Prof. Dr. Mark Geller (Visiting Scholar, Alexander-von-Humboldt-Stiftung, Department of Hebrew and Jewish Studies, University College London, U.K., June 1–August 31, 2007): Relatonship between Babylonian magic and medicine. Globalisation of knowledge in antiquity. (Visiting Scholar, Department of Hebrew and Jewish Studies, University College London, U.K., December 17, 2007–January 16, 2008): Ancient Babylonian medicine (diseases of the eyes, ears, and nose).

Prof. Dr. Hannah Ginsborg (Visiting Scholar, Department of Philosophy, University of California, Berkeley, U.S.A., July 1–August 15, 2006; July 1–August 18, 2007): Primitive normativity: a Kantian perspective on rule-following and meaning.

Elodie Giroux (Predoctoral Research Fellow, Unité de Formation et de Recherche de Philosophie, Université Paris 1—Panthéon Sorbonne, Paris, France, October 1, 2005–May 15, 2006): Risk factor approach to disease: Shifts in medical thought and practice.

Prof. Dr. Michael Gordin (Visiting Scholar, Princeton Bicentennial Preceptorship, Program in History of Science, Princeton University, New Jersey, U.S.A., September 1, 2007–August 15, 2008): International history of the atomic monopoly, 1945–1949.

Dr. Frédéric Graber (Postdoctoral Research Fellow, Centre Alexandre Koyré, Centre de Recherche en Histoire des Sciences et des Techniques, Paris, France, September 15, 2005–September 30, 2007): Places of knowledge of engineering in French and German public works (18th and 19th century).

Christelle Gramaglia (Predoctoral Research Fellow, Centre Alexandre Koyré, Centre de Recherche en Histoire des Sciences et des Techniques, Paris, France, September 1, 2005–August 31, 2006): Ecotoxicology and expert/lay observations on pollution.

Prof. Dr. Anna Grimshaw (Visiting Scholar, Graduate Institute of Liberal Arts, Emory University, Atlanta, Georgia, U.S.A., January 1–February 28, 2007): Rethinking observational cinema.

Xiaowu Guan (Postdoctoral Research Fellow, Department of History of Science and Scientific and Technological Adminstration, Inner Mongolia Normal University, Huhhot, China, September 1, 2007–February 29, 2008): The ways to transmit, preserve, and perform the technical knowledge in the evolution of the grand water wheel of Lanzhou.

Dr. Karl Hall (Visiting Scholar, Közép-európai Egyetem, Budapest, Hungary, October 1, 2006–June 30, 2007): Reliable phenomena in industrial laboratories.

Prof. Dr. Jonathan Harwood (Visiting Scholar, Centre for the History of Science, Technology and Medicine, The University of Manchester, U.K., September 1, 2007–April 30, 2008): Europe's green revolution: the rise and fall of peasant-friendly plant-breeding in Central Europe, 1890–1945.

Dr. Michael Hau (Visiting Scholar, School of Historical Studies, Monash University, Victoria, Australia, November 1, 2005–January 31, 2006): High performance in elite sports: A cultural history of medicine, psychology, and society during the Weimar Republic and Nazism, 1918–1945.

Dr. Elfrieda Hiebert (Visiting Scholar, June 1–June 30, 2007): Exploring links between science and piano pedagogy during the late 19th century (1860–1910).

Prof. Dr. Erwin N. Hiebert (Visiting Scholar, Department of the History of Science, Harvard University, Cambridge, Massachusetts, U.S.A., June 1–June 30, 2007): The physics and mathematics of just intonation in the history of fixed-tone keyboard construction.

Dr. Philipp von Hilgers (Postdoctoral Research Fellow, Humboldt-Universität zu Berlin, Germany, February 1, 2006–April 30, 2008): Mapping the field of vision from experimental investigations of reading to pattern recognition, 1860–1960.

Martin Hofmann (Postdoctoral Research Fellow, Institut für Kulturwissenschaften Ost- und Südasiens, Universität Würzburg, Germany, June 1–September 30, 2007): Philology of master craftsmen.

Dr. Giora Hon (Visiting Scholar, Department of Philosophy, University of Haifa, Israel, June 17–July 31, 2007): Generating experimental knowledge; the history of the concept of symmetry.

Thierry Hoquet (Visiting Scholar, Département de philosophie, Université de Paris-X, Nanterre, France, March 12–May 12, 2006; March 1–April 30, 2007): Phylogeny and the direction of evolution.

Prof. Dr. Blahoslav Hruška (Visiting Scholar, Orientální ústav, Akademie ved Ceské republiky/Evangelická teologická fakulta, Univerzita Karlova, Praha, Czech Republic, May 1–June 30, 2006): Assyriology, history of the Ancient Near East, religious studies.

Prof. Dr. Danian Hu (Visiting Scholar, Department of History & The Asian Studies Program, The City College of New York, U.S.A., July 1–July 28, 2007): History of quantum mechanics.

Alexandra E. Hui (Predoctoral Research Fellow, Deutscher Akademischer Austauschdienst, Department of History, University of California, Los Angeles, U.S.A., July 15–December 31, 2006): Psychophysical investigations of sound sensation and the music culture of Germany, 1860–1910.

Dr. Ludmila Hyman (Postdoctoral Research Fellow, Carnegie Mellon University, Pittsburgh, Pennsylvania, U.S.A., September 1, 2007–August 31, 2009): Clinical observation and the making of historical psychology: The Soviet psycholgists L.S.Vygotsky, A.R. Luria, and A. N. Leontiev.

Dr. Catherine Jackson (Visiting Scholar, University College London, University of London, U.K., September 1–September 30, 2006; October 1–December 31, 2007): Analysis and synthesis in 19th century organic chemistry.

Jeremiah James (Predoctoral Research Fellow, Department of the History of Science, Harvard University, Cambridge, Massachusetts, U.S.A., January 1–May 31, 2007): Early history of X-Ray crystallography.

Prof. Dr. Michel Janssen (Visiting Scholar, University of Minnesota, Program in History of Science and Technology, University of Minnesota, Minneapolis, U.S.A., June 5–August 1, 2006): History of quantum physics.

Dr. Christian Joas (Postdoctoral Research Fellow, February 15, 2007–February 14, 2009): The origins of wave mechanics: Schrödinger's notebooks.

Prof. Dr. Matthew L. Jones (Visiting Scholar, U.S. National Science Foundation, Department of History, Columbia University, New York, U.S.A., May 1–May 31, 2007): Early modern calculating machines, statecraft, and thinking about thinking.

Hyo Yoon Kang (Postdoctoral Research Fellow, October 1, 2006–December 31, 2008): Patent classification and scientific taxonomies: Law as a space of history of science?

Susanne B. Keller (Postdoctoral Research Fellow, September 1, 2005–October 31, 2006): Picturing the inaccessible: Gazing under the earth's surface between empiricism and speculation, 18th to 20th Century.

Prof. Dr. Philip Kitcher (Visiting Scholar, Columbia University, Department of Philosophy, Columbia University, New York, U.S.A., October 1, 2007–May 31, 2008): Naturalistic ethics.

Stefanie Klamm (Predoctoral Research Fellow, May 1, 2006–April 30, 2008): Images in archaeology.

Fabian Krämer (Predoctoral Research Fellow, September 1, 2006–November 30, 2008): Reference structures in the study of nature.

Dr. Maria E. Kronfeldner (Karl Schädler Postdoctoral Research Fellow, March 1, 2006–December 31, 2008): The anthropological concept of culture in the context of evolutionary debates.

Dr. Joachim Kurtz (Visiting Scholar, Deptartment of Russian and East Asian Languages and Cultures, Emory University, Atlanta, Georgia, U.S.A., June 1–June 30, 2007): The rhetoric of innovation in late imperial Chinese writings on science and technology. (July 1–July 31, 2007): Rhetoric of innovation in late imperial Chinese texts.

Dr. Britta Lange (Postdoctoral Research Fellow, October 1, 2005–September 30, 2007): A history of the "typical" scientific research in prisoner-of-war-camps from 1915 to 1918.

Dr. med. Nicolas Langlitz (Postdoctoral Research Fellow, September 1, 2007–August 31, 2009): Neuropsychedelia the revival of hallucinogen research since the decade of the brain.

Prof. Dr. Manfred Laubichler (Visiting Scholar, Department of Philosophy, Arizona State University, Tempe, U.S.A., December 12, 2005–January 15, 2006; June 1–July 31, 2006; June 1–July 31, 2007): Book on Alfred Kühn. Regulation and the origin of theoretical biology.

Dr. Daryn Lehoux (Visiting Scholar, Classics and Ancient History, University of Manchester, U.K., August 1, 2007–July 31, 2008): Ancient science the roles of observation in theory formation and epistmology interactions of classification and observation.

Dr. Rhodri Lewis (Postdoctoral Research Fellow, Jesus College, Oxford, U.K., September 1, 2005–August 31, 2007): The arts of memory in early modern Europe.

Rossano Cabral Lima (Predoctoral Research Fellow, CAPES (Brazilian agency for the advanced training of university personnel, Instituto de Medicina Social, Universidade do Estado do Rio de Janeiro, Brazil, September 1–December 31, 2007): History of diagnosis of autism.

Dr. Fabien Locher (Visiting Scholar, Service d'Histoire de l'Éducation, Paris, France, October 2–October 29, 2006): History of scientific observation: Earth sciences (19th–20th century).

Prof. Dr. Ilana Löwy (Visiting Scholar, Centre de Recherche Médecine, Science, Santé et Société, Institut national de la santé et de la recherche médicale, Villejuif, France, May 1–July 31, 2006)

Prof. Carlos López Beltrán (Visiting Scholar, Instituto de Investigaciones Filosóficas, Universidad Nacional Autónoma de México, Coyoacan, Mexico, October 1, 2006–March 31, 2007): The influence of biological and medical theories in racial classification of humans.

Dr. Leoncio López-Ocón (Visiting Scholar, Departamento de Historia de la Ciencia, Instituto de Historia, Madrid, Spain, August 1–August 31, 2006): Scientific relationship between Germany and Spain during Cajal's lifetime.

Dr. Marie Claude Lorne (Postdoctoral Research Fellow, Department of Philosophy, University of Montréal, Quebec, Canada, August 1–September 30, 2006): Genetic information and positional information: How to think biological information at the molecular level?

Dr. Carmen Loza (Visiting Scholar, Deutscher Akademischer Austauschdienst, October 1–December 31, 2006): The adoption of andine mnemonic string registers (Quipus) by the Spanish colonial administration.

Prof. Dr. Biao Ma (Postdoctoral Research Fellow, Faculty of Literature, Yamaguchi University, Japan, July 1–August 31, 2007): Research on the Ancient Chinese pronunciation of the measure word.

Prof. Dr. Harro Maas (Visiting Scholar, Faculteit der Economische Wetenschappen en Econometrie, Universiteit van Amsterdam, The Netherlands, March 1–June 30, 2006): Representational practices in economics.

Anna Märker (Postdoctoral Research Fellow, Department of Science and Technology Studies, Cornell University, Ithaca, New York, U.S.A., October 1, 2005–August 31, 2007): The Notion of "Useful Knowledge" and the Emergence of Modern Science, 1750–1850.

Prof. Dr. Peter McLaughlin (Visiting Scholar, Philosophisches Seminar der Universität Heidelberg, Germany, July 15–November 14, 2006; March 1–June 30, 2007): Aristotele's mechanics and its reception in the Renaissance.

Fabrizzio McManus (Predoctoral Research Fellow, Universidad Nacional Autónoma de México, September 1–September 30, 2007): Complementarity or competition? Explanatory pluralism for animal sexuality: From evolutionary to constructivist perspectives.

Dr. Maurizio Meloni (Postdoctoral Research Fellow, University La Sapienca di Roma, Italy, September 1–October 31, 2007): Molecular Dasein living and thinking in a neurobiological era.

Dr. Erika Lorraine Milam (Postdoctoral Research Fellow, University of Maryland-College Park, U.S.A., September 1, 2007–December 31, 2008): Animal models of behavior: Anthropomorphim, zoomorphism, and cultures of observation.

Dr. Daniela Monaldi (Postdoctoral Research Fellow, April 25, 2006–March 31, 2008): Bose-Einstein condensates.

Prof. Dr. Shigeru Nakayama (Visiting Scholar, University of Tokyo, Japan, July 14–September 3, 2007): A comparison of what happened in Germany and Japan in 1968. Part of champ of civilisation.

Dr. Omar W. Nasim (Postdoctoral Research Fellow, University of Toronto, Ontario, Canada, April 1, 2007–March 31, 2008): Constructing the heavens: Drawings of nebulae in victorian science.

Prof. Dr. Horst Nowacki (Visiting Scholar, Technische Universität Berlin, Germany, since August 1, 2001): History of ship design and construction; creating shapes in civil and naval architecture: A cross disziplinary comparison.

Dr. Barbara Orland (Visiting Scholar, Kompetenzzentrum "Geschichte des Wissens," Eidgenössische Technische Hochschule Zürich, Switzerland, September 1 –November 30, 2006): The chemical economy of the body.

Prof. Dr. Francisco Javier Guerrero Ortega (Visiting Scholar, Deutscher Akademischer Austauschdienst, Universidade do Estado do Rio de Janeiro, Brazil, December 1, 2006–January 31, 2007): History of the body, history of the self.

Prof. Dr. Laura Otis (Visiting Scholar, McArthur Foundation, Department of English, Emory University, Atlanta, Georgia, U.S.A., June 17, 2005–August 15, 2006; July 1, 2007–August 15, 2008): Müller's lab: A family tree of scientific ideas.

Alessandro Pajewski (Predoctoral Research Fellow, University of Chicago, Illinois, U.S.A., May 1–July 31, 2007): Development of the historical sciences in the 19th century.

Prof. Dr. Katharine Park (Visiting Scholar, Department of the History of Science, Harvard University, Cambridge, Massachusetts, U.S.A., February 1–July 31, 2007): Observation and experience in medieval science, 1150–1450.

Dr. Manolis Patiniotis (Visiting Scholar, Department of History and Philosophy of Science, University of Athens, Greece, September 1, 2007–February 29, 2008): Periphery reassessed: Greek science in the 18th century.

Prof. Dr. Andrew Pickering (Visiting Scholar, University of Illinois at Urbana, Champaign, U.S.A., July 1–August 15, 2006): History of cybernetics.

Susanne Pickert (Predoctoral Research Fellow, partially funded by Gerda Henkel Stiftung, Institut für Geschichtswissenschaften, Humboldt-Universität zu Berlin, Germany, January 1, 2004–December 31, 2007): Description of the loca sancta of the Holy Land in high and late medieval travel accounts.

Prof. Dr. Trevor Pinch (Visiting Scholar, Department of Science and Technology, Cornell University, Ithaca, New York, U.S.A., July 1–July 31, 2007).

Prof. Dr. Claudio Pogliano (Visiting Scholar, Università di Pisa, Istituto e Museo di Storia della Scienza, Firenze, Italy, August 1–August 31, 2007): The visual contagion in history of science.

Sandra Pravica (Predoctoral Research Fellow, July 1, 2007–June 30, 2009): Experimental epistemologies around 1930: The concepts of Gaston Bachelard and Edgar Wind.

Silvia de Priven (Predoctoral Research Fellow, FAPESP, Centro Simão Mathias de Estudos em História da Ciência, Pontifícia Universidade Católica de São Paulo, Brazil, May 1–June 15, 2007): Theory of matter. Ideas on matter and life: From the physics of du Bois-Reymond to the neovitalism of Driesch.

Prof. Dr. F. Jamil Ragep (Visiting Scholar, McGill University, Institute of Islamic Studies, McGill University Montréal, Quebec, Canada, December 1, 2006–August 31, 2007): Islamic scientific manuscripts initiative (ISMI) project.

Sally P. Ragep (Visiting Scholar, McGill University, Institute of Islamic Studies, McGill University Montréal, Quebec, Canada, December 1, 2006–August 31, 2007): Islamic scientific manuscripts initiative (ISMI) project.

Dr. Vincent Ramillon (Postdoctoral Research Fellow, November 1, 2006–October 31, 2008): The two genomics: Ideology, insider's history and material practices.

Dr. Sandra Rebok (Visiting Scholar, Instituto de Historia, Madrid, Spain, June 20–July 19, 2006): German travelers in the 19th century (Spain, Latin America, U.S.A.).

Christian Reiß (Predoctoral Research Fellow, July 1, 2007–June 30, 2009): The way to the laboratory—origin and role of organisms in experimental systems in early life sciences.

Dr. Maria Rentetzi (Visiting Scholar, National Technical University of Athens, Greece, June 1–September 15, 2007): Radium as a trafficking material.

Sarah de Rijcke (Predoctoral Research Fellow, Netherlands Organization for Scientific Research, Heymans Instituut, Rijksuniversiteit Groningen, The Netherlands, January 1–March 31, 2007): Regarding the brain: Scientific practices of cerebral representation.

Dr. Ayako Sakurai (Postdoctoral Research Fellow, Department of Area Studies, University of Tokyo, Japan, November 1–November 30, 2006): Public scientific practices and urban reinvention in a mercantile city-republic: Civic scientific institutions in nineteenth century Frankfurt am Main.

Prof. Dr. Margaret Schabas (Visiting Scholar, Department of Philosophy, The University of British Columbia, Vancouver, Canada, May 1–June 30, 2007): Hume's political economy.

Dr. Arne Schirrmacher (Visiting Scholar, Deutsche Forschungsgemeinschaft, Münchner Zentrum für Wissenschhafts- und Technikgeschichte, Deutsches Museum, München, Germany, September 1, 2007–August 31, 2008): History of quantum mechanics. Science in communication in the 20th century.

Dr. Wolfgang Schivelbusch (Visiting Scholar, September 1–September 30, 2006): Historizising concepts of air.

Dr. Anne Secord (Visiting Scholar, Department of History and Philosophy of Science, Cambridge University, U.K., September 1–December 31, 2006): Taking 'Nature's Path' in eighteenth century Britain.

Prof. Dr. Suman Seth (Visiting Scholar, Department of History/History of Science, Princeton University, New Jersey, U.S.A., June 8–August 2, 2006): Theoretical physics in imperial Germany between 1890 and 1918.

Hanna Rose Shell (Predoctoral Research Fellow, Department of the History of Science, Harvard University, Cambridge, Massachusetts, U.S.A., May 1–June 30, 2007): Camouflage, animal skin, and the media of reconnaissance.

Dr. Maria Paula Sibilia (Visiting Scholar, DAAD und CAPES, Departamento de Estudos Culturais e Mídia, Universidade Federal Fluminense, Rio de Janeiro, Brazil, July 20–August 20, 2007): The cerebral subject: the impact of neurosciences in contemporary society.

Dr. Skúli Sigurdsson (Rathenau Senior Fellow, since April 1, 2007): History of science after 1800: mathematics, physics, philosophy; history of technology: electrification, technological systems; technology in museums; history of biotechnology: databases, civil liberties.

Dr. Robyn Smith (Visiting Scholar, October 1, 2007–September 30, 2009): Encountering Hermes in the unknown: exploring experimental vitamin research during World War I.

Katrin Solhdju (Predoctoral Research Fellow, January 1, 2004–December 31, 2006): Self-experimentation: crossing the borders between science, art, and philosophy, 1840–1920.

Dr. Daniel Speich (Visiting Scholar, Institut für Geschichte, Technikgeschichte, Eidgenössische Technische Hochschule Zürich, Switzerland, January 1–December 31, 2007): Knowledge and development technology and science in the postcolonial culture of development.

Benjamin Steininger (Predoctoral Research Fellow, September 1, 2006–February 28, 2007): The cultural history of the concept of catalysis.

Dr. Edna Maria Suárez-Díaz (Visiting Scholar, Filosofía e Historia de la Biología, Facultad de Ciencias, Universidad Nacional Autónoma de México, August 1, 2005–July 31, 2008): Representation and the production of knowledge in molecular evolution.

Prof. Dr. Xiaochun Sun (Postdoctoral Research Fellow, Institute for the History of Natural Science, Chinese Academy of Sciences, Beijing, China, January 8–April 8, 2007; Visiting Scholar, June 7–July 31, 2007): Measuring the heavens: Cosmos, computation and instrument making.

Alireza Taheri (Predoctoral Research Fellow, Darwin College, University of Cambridge, U.K., December 1, 2006–February 28, 2007): Comparative study of Freud and Nietzsche on guilt.

Dr. Udo Volkmar Thiel (Visiting Scholar, Australian National University, Department of Philosophy, Australian National University, Canberra, Australia, December 13, 2005–February 16, 2006): Self-conciousness and personel identity in eighteenth-century philosophy.

Dr. Olivier Thiery (Postdoctoral Research Fellow, Centre de Sociologie de L'Innovation, Ecole Nationale Supérieure des Mines de Paris, France, October 1, 2004–September 30, 2006): Contemporary history and ethnology of neo-natal medicine and prematures babies' care.

Prof. Dr. Miao Tian (Postdoctoral Research Fellow, Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, March 27–June 30, 2006): History of mechanics history of technology project: Development of mechanical knowledge in China an its interaction with other cultural traditions. (Visiting Scholar, September 1–November 30, 2007): Completion of the comprehensive Chinese edition and commentary of the first Chinese book on Western mechanical Qiqi Tushuo. (Concluding publication of the partner group project).

Tuomo Tiisala (Predoctoral Research Fellow, Helsingin Yliopisto, Helsinki, Finland, February 1–February 28, 2007): Changing conceptions of a priori knowledge from Kant to the present.

Dr. Margareta T. Tillberg (Visiting Scholar, Swedish Research Council—The Centre for Baltic and East European Studies (CBEES), Designavdelningen, Institutionen för teknik & design, Växjö universitet, Sweden, November 1, 2005–January 31, 2006; April 21, 2006–December 31, 2007): Observer observed in Soviet design institutes of the 1960s.

Viktoria Tkaczyk (Predoctoral Research Fellow, March 1–August 31, 2007): Unready to take off: Failed flight attempts in early modern Europe.

Dr. Danny Trom (Visiting Scholar, Centre National de la Recherche Scientifique, Groupe de Sociologie Politique et Morale, Ecole des Hautes Etudes en Sciences Sociales, Paris, France, September 1, 2005–June 30, 2006): Seeing landscapes: The politics of nature in late 19th century Germany.

Prof. Dr. André Turmel (Visiting Scholar, Departement of Sociology, Laval University, Québec City, Canada, January 1–January 31, 2007): Scientific observation and developmental psychology.

Dr. Sophia Vackimes (Postdoctoral Research Fellow, The New School for Social Research, New York, U.S.A., April 18, 2006–May 31, 2008): The genetically engineered body: A cinematic context.

Dr. Nuria Valverde (Visiting Scholar, Departmento de Historia de la Ciencia, Instituto de Historia, Madrid, Spain, October 1–December 31, 2006): Biography and politics of the brain.

Jeremy Vetter (Postdoctoral Research Fellow, Department of History and Sociology of Science, University of Pennsylvania, Philadelphia, U.S.A., September 1, 2005–December 31, 2006): Knowledge, environment, and field work in the American West in the 19th and 20th centuries.

Dr. Marga Vicedo-Castello (Postdoctoral Research Fellow, Department of the History of Science, Harvard University, Cambridge, Massachusetts, U.S.A., September 1, 2005–June 30, 2006): A history of scientific theories of the maternal instinct.

Prof. Dr. Eric Watkins (Visiting Scholar, Alexander-von-Humboldt-Stiftung, Department of Philosophy, University of California, San Diego, U.S.A., June 5–August 28, 2006): Kant on natural science. (Visiting Scholar, Department of Philosophy, University of California, San Diego, U.S.A., June 8–August 31, 2007): Immanuel Kant: natural philosophy.

Cecelia Watson (Predoctoral Research Fellow, The Commitee on Conceptual and Historical Studies of Science, University of Chicago, Illinois, U.S.A., September 1–December 31, 2007): A historical treatment of the artist and art critic John La Farge's impact on William James's intellectual development, considered in the context of late 19th and early 20th century exchanges between art and science.

Dr. Janina Wellmann (Postdoctoral Research Fellow, March 15–September 30, 2007): Observation of the in-between: Series and sequences in microscopy. 1850–1920.

Prof. Dr. Simon Werrett (Visiting Scholar, University of Washington, Seattle, U.S.A., July 1–December 31, 2006; June 1–August 31, 2007): War by other means: The art and science of fireworks in Europe, 1500–1850.

Dr. Christina Wessely (Postdoctoral Research Fellow, Historisch-Kulturwissenschaftliche Fakultät, Universität Wien, Austria, October 1, 2005–September 30, 2006): Cosmic ice theory—science, fiction and the public, 1894–1945.

Mechthild Widrich (Predoctoral Research Fellow, Massachusetts Institute of Technology, Cambridge, U.S.A., October 1–October 31, 2007): Performative monuments. Commemoration in postwar Europe.

Lambert Williams (Predoctoral Research Fellow, Department of the History of Science, Harvard University, Cambridge, Massachusetts, U.S.A., September 1, 2004–June 30, 2006): Historical and philosophical issues in complex systems; models and simulations.

Dr. Christof Windgätter (Postdoctoral Research Fellow, Humboldt-Universität zu Berlin, Germany, April 1, 2007–June 30, 2009): Knowledge through print.

Prof. Dr. M. Norton Wise (Visiting Scholar, Department of History, University of California, Los Angeles, U.S.A., May 15–July 31, 2006): Bourgeois Berlin and laboratory science.

Dr. Charles Wolfe (Postdoctoral Research Fellow, Departement de philosophie, Université du Quebec à Montreal, Canada, December 1, 2007–January 31, 2008): A materialist theory of organism.

Adrian Wüthrich (Predoctoral Research Fellow, University of Bern, Switzerland, April 1–August 31, 2007): History and philosophy of Feynman diagrams in particle physics.

Dr. Yunhong Xiao (Postdoctoral Research Fellow, Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, March 27–June 30, 2006): History of mechanics history of technology project: Development of mechanical knowledge in China an its interaction with other cultural traditions.

Dr. Chen-Pang Yeang (Visiting Scholar, Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, U.S.A., May 1–May 31, 2006): Radio-wave propagation and ionosphere studies, 1900–1950; noise.

Dr. Xiaodong Yin (Postdoctoral Research Fellow, Chinese Academy of Sciences, Institute for the History of Natural Sciences, Peking, China, October 1, 2007–June 30, 2008): History of quantum mechanics; completion of the comprehensive chinese edition and commentary of the first Chinese book on Western mechanical Qiqi Tushuo. (Concluding publication of the Partner Group Project).

Dr. Gábor Áron Zemplén (Postdoctoral Research Fellow, Budapesti Mıszaki és Gazdaságtudományi Egyetem, Budapest, Hungary, May 1–August 31, 2006): Scientific debates around the modificationist theories of colour.

Prof. Dr. Baichun Zhang (Visiting Scholar, Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, March 27–June 30, 2006; September 1–November 30, 2007): History of mechanics and history of technology project: Development of mechanical knowledge in China an its interaction with other cultural traditions; completion of the comprehensive Chinese edition and commentary of the first Chinese book on Western mechanical Qiqi Tushuo. (Concluding publication of the Partner Group Project).

Rafael Ziegler (Predoctoral Research Fellow, Department of Philosophy, McGill University, Montreal, Quebec, Canada, September 1, 2005–June 30, 2006): Of telescopes and footprints—(sustainability) indicators, statistical observation and political perception.

Rafaela Teixeira Zorzanelli (Predoctoral Research Fellow, Instituto de Medicina Social, Universidade do Estado do Rio de Janeiro, Brazil, September 1, 2006–January 31, 2007): The impact of neurosciences in the psychosomatic field.

Prof. Dr. Dahai Zou (Postdoctoral Research Fellow, Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, March 27–June 30, 2006): History of mechanics history of technology project: Development of mechanical knowledge in China an its interaction with other cultural traditions.

Collaborations and Other External Activities

Memberships

The Institute is member of the Agricola-Gesellschaft, the Gesellschaft für Wissenschaftsgeschichte and the Deutsche Gesellschaft für Geschichte der Medizin, Naturwissenschaft und Technik.

Professorships

Lorraine Daston is honorary professor at the Humboldt-Universität zu Berlin,
Dieter Hoffmann is außerplanmäßiger Professor at the Humboldt-Universität zu Berlin,
Ursula Klein is außerplanmäßige Professorin at the Universität Konstanz,
Wolfgang Lefèvre is außerplanmäßiger Professor at the Freie Universität Berlin,
Jürgen Renn is adjunct professor at Boston University and honorary professor at the Humboldt-Universität zu Berlin,
Hans-Jörg Rheinberger is honorary professor at the Technische Universität Berlin.

Cooperation Partners

Berliner Medizinhistorisches Museum der Charité
Bibliotheca Hertziana—Max-Planck-Institut für Kunstgeschichte, Rome, Italy
Centre Alexandre Koyré, Paris, France
Cluster of Exellence Topoi, Humboldt-Universität zu Berlin
Comenius Garten, Berlin
Consejo Superior de Investigationes Científicas, Spain
Department of Philosophy, University of Haifa, Israel
Deutsches Museum, München
Fakultät Medien, Bauhaus-Universität Weimar
Freie Universität Berlin
Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin
Hermann von Helmholtz-Zentrum für Kulturtechnik, Humboldt-Universität zu Berlin
Historisches Seminar, Universität Wuppertal
Indiana University Bloomington, U.S.A.
Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China
Istituto e Museo di Storia della Scienca, Florence, Italy
Kunsthistorisches Institut in Florenz, Max-Planck-Institut, Italy
Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie, Berlin
Max-Planck-Institut für ausländisches öffentliches Recht und Völkerrecht, Heidelberg
McGill University, Montreal, Canada
Monash University, Melbourne, Australia
Mongolian Academy of Science, Ulan Bator, Mongolia
Moritz-Schlick-Forschungsstelle, Universität Rostock
Museum für Naturkunde, Berlin
Opera di Santa Maria del Fiore, Florence, Italy
Palace Museum, Beijing, China
School of Life Sciences at Arizona State University, Tempe, U.S.A.
Sonderforschungsbereich Transformationen der Antike, Humboldt-Universität zu Berlin

The Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Israel
Universidad Nacional Autónoma de Mèxico
Universidade do Estado do Rio de Janeiro, Brazil
Università degli studi di Pavia, Italy
Universiteit van Amsterdam, The Netherlands
University of California at Los Angeles, U.S.A.
University of Chicago, U.S.A.
University of Exeter, U.K.
Wellcome Trust Centre for the History of Science and Medicine, London, U.K.
Zentrum für Literatur- und Kulturforschung, Berlin

Teaching Activities

Winter 2005/06

Christina Brandt: 15. Studientag Wissenschaftsgeschichte (Kolloquium, MPIWG)
Lorraine Daston: Natural Law in Early Modern Europe (Seminar, University of Chicago)
Uljana Feest: Erklären und Verstehen aus philosophischer und historischer Sicht (Proseminar, Freie Universität Berlin)
Erna Fiorentini: Comment on Barbara Maria Stafford's "The return of autonomy: From the aesthetic to the cognitive object", 6.2.2006 (Lecture Series "Ästhetische Autonomie?") (Lecture, Freie Universität Berlin)
Ursula Klein: Geschichte und Philosophie der experimentellen Wissenschaften—Stile des Experimentierens II (Kompaktseminar, Universität Konstanz)
Annik Pietsch: WMK MG 4.1 Werkstoff- und Materialkunde (Lecture, Fachhochschule für Technik und Wirtschaft Berlin)
Annik Pietsch: WMK MG 4.3 Werkstoff- und Materialkunde (Lecture, Fachhochschule für Technik und Wirtschaft Berlin)
Hans-Jörg Rheinberger: Die Historisierung der Epistemologie—Zur Geschichte des Nachdenkens über Wissenschaft im 20. Jahrhundert (Hauptseminar, Technische Universität Berlin)
H. Otto Sibum: Industrielle Aufklärung: Arbeit, Wissen, Wissenschaft (Seminar, Technische Universität Braunschweig)
Martina Siebert: Klassisches Chinesisch I (Sprachkurs, Humboldt-Universität zu Berlin)
Fernando Vidal: The Cerebral Subject in Literature and Film (Seminar, State University of Rio de Janeiro)
Annette Vogt: Lise Meitner und Friedrich Meinecke: Erinnerungspolitik in der Berliner Wissenschaft (with Peter Th. Walther) (Proseminar, Humboldt-Universität zu Berlin)

Summer 2006

Charlotte Bigg: Atombilder (atomic images) (Seminar, Humboldt-Universität zu Berlin)
Christina Brandt: Geschichte und Wissenschaftstheorie der Biologie (with Bernd Gausemeier) (Lecture and Seminar, Freie Universität Berlin)
Christina Brandt: Klonierung und Stammzellenforschung. Wissenschaftshistorische, kulturwissenschaftliche und ethische Aspekte (Seminar, Technische Universität Braunschweig)
Uljana Feest: Der Begriff der Beobachtung in der Philosophie des 20. Jahrhunderts (Proseminar, Technische Universität Berlin)
Bernd Gausemeier: Geschichte und Wissenschaftstheorie der Biologie (with Christina Brandt) (Lecture and Seminar, Freie Universität Berlin)
Anke te Heesen: Wissenschaft und Öffentlichkeit. Zwischen Res Publika Litteraria und Weltgesellschaft (Seminar, ETH Zürich)
Bernhard Kleeberg: Aggressionskulturen zwischen Vormoderne und Moderne (with Albert Schirrmeister) (Blockseminar, Humboldt-Universität zu Berlin)
Bernhard Kleeberg: Armut und sozialer Aufstieg—Theorien des Lebensstandards im 19. Jahrhundert (Kompaktseminar, Universität Konstanz)
Maria E. Kronfeldner: Der Begriff der Evolution in Biologie, Philosophie und Sozialwissenschaften (Blockseminar, Universität Regensburg)
Julia Kursell: Theorie und Praxis der Deklamation in der Avantgarde (Hauptseminar, Freie Universität Berlin)
Annik Pietsch: Konservierungs- und Restaurierungstechnik (Lecture, Fachhochschule für Technik und Wirtschaft Berlin)
Annik Pietsch: Konservierungs- und Restaurierungstechnik; Reinigung (Praktikum, Fachhochschule für Technik und Wirtschaft Berlin)
Annik Pietsch: WMK MG 4.2 Werkstoff- und Materialkunde (Lecture, Fachhochschule für Technik und Wirtschaft Berlin)
Martina Siebert: Klassisches Chinesisch II (Sprachkurs, Humboldt-Universität zu Berlin)
Annette Vogt: Emigranten—Remigranten: Von der Weimarer Republik ins deutschsprachige Nachkriegseuropa (with Peter Th. Walther) (Proseminar, Humboldt-Universität zu Berlin)

Winter 2006/07

Christina Brandt: Klassiker der Wissenschaftsgeschichte. Eine Einführung (Seminar, Technische Universität Braunschweig)
Anke te Heesen: Exhibition and Cultural Communication Management (Seminar, Universität für angewandte Kunst Wien)
Philipp von Hilgers: Medien und Zeit (Seminar, Humboldt-Universität zu Berlin)
Christoph Hoffmann: Parallelwelten. Das fremde Tier in Literatur und Wissenschaft, 1880–1930 (Seminar, Europa-Universität Viadrina Frankfurt/Oder)

Dieter Hoffmann: Max Planck (Lecture, Humboldt-Universität zu Berlin)
Carsten Reinhardt: Einführung in die Wissenschaftsgeschichte (Seminar, Universität Bielefeld)
Carsten Reinhardt: Geschichte des Expertenwissens (Seminar, Universität Bielefeld)
Hans-Jörg Rheinberger: Die Historisierung der Epistemologie, Teil II—Zur Geschichte des Nachdenkens über Wissenschaft im 20. Jahrhundert (Hauptseminar, Technische Universität Berlin)
Matthias Schemmel: Die Entstehung einer Wissenschaft: Mechanik von der Antike bis in die frühe Neuzeit (Proseminar, Universität Bern)
Matthias Schemmel: Transformationen des Raumbegriffs: Die Geschichte der Vorstellungen vom physikalischen Raum von der Antike bis in die Gegenwart (Seminar, Humboldt-Universität zu Berlin)
Martina Siebert: Klassisches Chinesisch III (Sprachkurs, Humboldt-Universität zu Berlin)
Thomas Sturm: Early Modern Philosophy of Mind and Psychology (Seminar, Universitat Autonoma de Barcelona)

Summer 2007

Christina Brandt: Geschichte und Wissenschaftstheorie der Biologie (with Bernd Gausemeier) (Lecture and Seminar, Freie Universität Berlin)
Christina Brandt: Von Menschen, Tieren, Dingen und Retorten. Naturwissenschaftliche Experimentalsysteme im 20. Jahrhundert (Seminar, Technische Universität Braunschweig)
Tobias Cheung: Texte zur Theorie und Epistemologie wissenschaftlichen Wissens (I) (Hauptseminar, Humboldt-Universität zu Berlin)
Bernd Gausemeier: Geschichte und Wissenschaftstheorie der Biologie (with Christina Brandt) (Lecture and Seminar, Freie Universität Berlin)
Christian Joas: Quantenmechanik (Seminar, Freie Universität Berlin)
Ursula Klein: Geschichte des Atomismus (Kompaktseminar, Universität Konstanz)
Maria E. Kronfeldner: Daniel Dennett: Darwin's Dangerous Idea (Proseminar, Freie Universität Berlin)
Dietmar Kurapkat: Bauaufnahme und Bauforschung (Praxisblöcke vor Ort und Projektbesprechungen) (Project integrated seminar, Technische Universität Berlin)
Martina Siebert: Klassisches Chinesisch IV (Sprachkurs, Humboldt-Universität zu Berlin)
Matteo Valleriani: Antike Wissenschaft und technologische Entwicklung in der Literatur der frühen Neuzeit. Das Beispiel der Hofliteratur im 16. Jahrhundert: Ariostos Orlando Furioso (Hauptseminar, Humboldt-Universität zu Berlin)
Fernando Vidal: Neuroascesis and Neuroethics: Discourses and Practices (Seminar, State University of Rio de Janeiro)

Winter 2007/08

Christina Brandt: Lebenswissenschaften um 1800 (with Bettina Wahrig) (Seminar, Technische Universität Braunschweig)
Tobias Cheung: Weltanschauung und Wissenschaft in Zeiten der 'Krise' (1870–1940) (Hauptseminar, Humboldt-Universität zu Berlin)
Lorraine Daston: Lives of the Mind (Seminar, University of Chicago)
Lorraine Daston: Observation in Early Modern Europe (Seminar, Folger Institute, Washington, D.C.)
Philipp von Hilgers: Medienbedingte Gleichzeitigkeiten und Ungleichzeitigkeiten des Wissens (Seminar, Humboldt-Universität zu Berlin)
Christoph Hoffmann: Erzählen als Problem (Einführung in das BA-Modul Literaturwissenschaft) (Seminar, Europa-Universität Viadrina Frankfurt/Oder)
Dieter Hoffmann: Orte der Wissenschaft in Berlin (Übung, Humboldt-Universität zu Berlin)
Ursula Klein: Francis Bacon: Experiment, wissenschaftliche Methode, Sozialutopie (Blockseminar, Universität Konstanz)
Maria E. Kronfeldner: Die Philosophie von William James (Blockseminar, Universität Regensburg)
Dietmar Kurapkat: Bauaufnahme und Bauforschung (Praxisblöcke vor Ort und Projektbesprechungen) (Project integrated seminar, Technische Universität Berlin)
Matthias Schemmel: Im Grenzbereich von Wissenschaftsgeschichte und Wissenschaftstheorie: Fragen einer theoretischen Wissensgeschichte (Proseminar, Humboldt-Universität zu Berlin)
Thomas Sturm: Early Modern Philosophy of Mind and Psychology (Seminar, Universitat Autonoma de Barcelona)
Annette Vogt: Von der Preußischen FWU Berlin zur HU Berlin: Wissenschaft und Politik in 3 Systemen (1919–1961) (with Peter Th. Walther) (Proseminar, Humboldt-Universität zu Berlin)

Hosted Scholars

The institutions listed below funded 35 scholars in 2006 and 41 scholars in 2007. The average duration of their stay was 5 months.

Alexander-von-Humboldt-Stiftung
Australian National University
Australian Research Council
Bank of Sweden, Tercentenary Foundation
CAPES (Brazilian agency for the advanced training of university personnel)
Center for Advanced Study in the Visual Arts (CASVA)
Centre National de la Recherche Scientifique
Columbia University, New York, U.S.A.
Consejo Superior de Investigaciones Scientificas, Spain
Consiglio Nazionale delle Ricerche, Italy

Deutsche Forschungsgemeinschaft
Deutscher Akademischer Austauschdienst
Dr. H. A.Vögelin-Bienz-Stiftung für das Staatsarchiv Basel Stadt, Switzerland
Economic and Social Research Council, U.K.
Fondation des Treilles, France
Freie Universität Berlin
Fritz-Haber-Institut der Max-Planck-Gesellschaft
Fritz-Thyssen-Stiftung
Fundação de Amparo à Pesquisa do Estado de São Paulo, Brazil
Gerda Henkel Stiftung
German-Israeli Foundation for Scientific Research and Development
Institut National de la Santé Et de la Recherche Médicale, France
Kunsthistorisches Institut in Florenz
Leverhulme Trust, U.K.
Liechtenstein Fonds for the History of Science
McArthur Foundation
McGill University, Montreal, Canada
Netherlands Organization for Scientific Research
Princeton Bicentennial Preceptorship, U.S.A.
Princeton University, U.S.A.
Research Foundation—Flanders (FWO)
Schweizerischer Nationalfonds
Social Sciences and Humanities Research Council of Canada
Swedish Research Council—The Centre for Baltic and East European Studies (CBEES)
U.S. National Science Foundation
University of California at Berkeley, U.S.A.
University of California at Los Angeles, U.S.A.
University of Cambridge, U.K.
University of Copenhagen, U.S.A.
University of Michigan at Ann Arbor, U.S.A.
University of Oslo, Norway
VolkswagenStiftung

Conferences, Workshops, and Colloquia

Workshops and Conferences

18 January 2006: Kunstmaschinen. Spielräume des Sehens zwischen Wissenschaft und Ästhetik
30 March 2006: Cultural History of Heredity
1–2 April 2006: 'Materia technologica'—Rohstoffe in historischer Perspektive

22 April 2006: 15. Studientag Wissenschaftsgeschichte
5–6 May 2006: Introspective Self-Rapports: Shaping Ethical and Aesthetic Concepts 1850–2006
12–13 May 2006: A Glance into the Prime of Prussian Culture: Karl Friedrich Schinkel's "Blick in Griechenlands Blüthe" and Prussian Cultural Narratives around 1820
13 May 2006: Lange Nacht der Wissenschaften
18 May 2006: La politique des grands nombres. Autour d'Alain Desrosières (organized with Centre Marc Bloch, Berlin ans Centre Alexandre Koyré, Paris)
5–9 June 2006: History of Scientific Objects (meeting of the Wandering Seminar)
9–11 June 2006: Historical Perspectives on "Erklären" and "Verstehen"
23–24 June 2006: Generating Knowledge with the Microscope
26–30 June 2006: History of Scientific Observation
30 June, 2006, 26 January, and 12 June 2007: ZwischenRäume: Castles in the Air; Idées fixes; Time Leaps. Three workshops organized with the Helmholtz-Zentrum für Kulturtechnik, HU Berlin, the Zentrum für Literatur- und Kulturforschung, and the Institut für Deutsche und Niederländische Philologie, FU Berlin
14–16 July 2006: Dilettantismus als Beruf—Professional Dilettantism
20–23 July 2006: Inside the Camera Obscura
29 July 2006: 1. Studientag "literature & science"
2–4 August 2006: The Cerebral Subject. Practices and Representations in Contemporary Culture. Organized with the Institute for Social Medicine of the State University of Rio de Janeiro, Brazil
3–5 August 2006: The Making of Materials II
24–25 August 2006: On Knowing in the Human Sciences
18–19 September 2006: Board Meeting of the Islamic Scientific Manuscripts Initiative
5–7 October 2006: Sounds of Science—Schall im Labor (1800–1930)
5 October and 12 December, 2006, 15 February, 8 March, 12 April, 3 May, 7 June, 5 July, and 24 October, 2007: Physiologie des Klaviers. Concerts and talks, organized with the Musikinstrumenten-Museum SIMPK Berlin
20–21 October 2006: On the Responsibilities in the Human Sciences. Organized with the University of Chicago
30 November–2 December 2006: Ways of Regulating: Therapeutic Agents between Plants, Shops and Consulting Rooms
1–2 December 2006: From Real Life to Still Life
7–9 December 2006: Creating Shapes in Civil and Naval Architecture—A Cross-Disciplinary Comparison
9 December 2006: Bad Habits. Second Nature between Environment and Self-Control
11–13 December 2006: A Cultural History of Heredity IV
13–16 December 2006: Before Copernicus
23–25 January 2007: GIF Working Group Meeting: Jesuit Mechanics
1–4 March 2007: Times of Cloning. Historical and Cultural Aspects of a Biotechnological Research Field

22–24 March 2007: Precarious Matters. The History of Dangerous and Endangered Substances in the 19th and 20th Centuries
13 April 2007: 16. Studientag Wissenschaftsgeschichte
24–25 May 2007: Wissen im Entwurf 1
24–25 May 2007: Materialprobe 1: Datensicherung. Schreiben und Zeichnen als Verfahren der Aufzeichnung
31 May–3 June 2007: Lay Participation in the History of Scientific Observation
6 June 2007: Panel Discussion: Wissen für alle! Popularisierung der Wissenschaften zwischen Belehrung, Manipulation und Aufklärung
14–16 June 2007: Generating Experimental Knowledge
23–29 June 2007: Eleventh Marcel Grossmann Meeting. On Recent Developments in Theoretical and Experimental General Relativity, Gravitation, and Relativistic Field Theories
2–6 July 2007: HQ-1 Conference on the History of Quantum Physics
3–6 July 2007: The History of Scientific Observation
9–13 July 2007: From Invention to Innovation. The Transmission of Practical Knowledge
14 July 2007: 2. Studientag "literature & science"
26–28 July 2007: Ruptures. Music, Science, Philosophy, and Modernity
1 August 2007: Nachlese/Afterthoughts 1: Vor dem ersten Strich/Before the First Line
6–8 August 2007: Before Copernicus (2)
16–18 August 2007: Meeting of the Wandering Seminar
16 August–2 September 2007: Objects in Transition: Exhibition of the Wandering Seminar
20–22 September 2007: Microscope Slides: Reassessing a Neglected Historical Resource
28–30 September 2007: Wunder. Organized with the Comenius Garden Berlin
4–6 October 2007: Marc Bloch und die Krisen des Wissens—Marc Bloch et les crises du savoir
15–16 October 2007: Materialprobe 2: Symptomatik des Zeichnens und Schreibens
3 November 2007: Life and Societies. Toward a New Ecology of the Living
16 November 2007: Galilean Lectures. Berlin Edition 2007: Galileo and Technology
18–23 November 2007: Dahlem Workshop: The Globalization of Knowledge and its Consequences
11–12 December 2007: Symposium for the 125th Anniversary of Max Born

The Institute's Colloquia

19 April 2006 *Martin Barnes* Visual Culture of Science
31 May 2006 *Thomas Gieryn* History of Science and Sociology of Science
7 June 2006 *James Bennett* Curating the History of Science
14 June 2006 *Jakob Tanner* Producing Knowledge, Appropriating Knowledge
2 August 2006 *Michael Eckert* Fluid Dynamics in the Early 20th Century—a Challenge for the Historian of Science

23 August 2006 *Anna Märker, Susanne Pickert* The "Wandering Seminar" of the Max Planck Research Network "History of Scientific Objects"
29 November 2006 *Dagmar Schäfer, Martina Siebert, Feng Jiren* From Invention to Innovation: Cultural Traditions of Technical Development in China 10th to 18th Century
13 December 2006 *Kelley Wilder, Simone Rieger, Urs Schoepflin* Fair Use. Scholarly Publishing and the Issues of Cultural Heritage, Visual Images, Reproduction Fees, and Copyrights
17 January 2007 *Ernst Homburg* Groping Along the Track. A Historical Perspective on Industrial and Academic Research
21 February 2007 *Lorraine Daston, Jürgen Renn, Hans-Jörg Rheinberger* What Is Historical Epistemology?
7 March 2007 *Lothar Beck, Harald Müller, Urs Schoepflin* Scholarly Publishing and Issues of Copyright Law and Archival Law
25 April 2007 *Dieter Kuhn* Science and Technology in China—History and Historiography (1): Technology in the Context of Chinese Civilization: Tracing the Roots of the Chinese homo faber.
23 May 2007 *Benjamin Elman* Science and Technology in China—History and Historiography (2): Catholics, Protestants, and the Transmission of Science to Imperial China
18 July 2007 *Nathan Sivin* Science and Technology in China—History and Historiography (3): Europe, East Asia, South Asia, Middle East: One History of Science or Many?
28 November 2007 *Jean Gayon* The book: "Heredity Produced—At the Crossroads of Biology, Politics, and Culture, 1500–1870" edited by Staffan Müller-Wille and Hans-Jörg Rheinberger

Academic Achievements and Scientific Awards

Completed Dissertations

Björn Brüsch (see p. 130), *Luciana Vieira Caliman* (see p. 98), *Susanne Pickert* (see p. 87), *Christelle Gramaglia* (see p. 78), *Hanna Rose Shell* (see p. 89), *Matthias Schemmel* (see p. 29), *Katrin Solhdju* (see p. 130), *Milena Wazeck* (see p. 47–48).

Appointments

Jan Altmann (Predoctoral Research Fellow September 2005–August 2006) was appointed as Research Fellow at the Internationales Forschungszentrum für Kulturwissenschaften Wien.

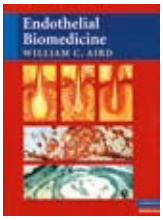
Safia Azzouni (Postdoctoral Research Fellow October 2004–September 2007) was appointed as Alfried Krupp Junior Fellow 2007/2008 at the Alfried Krupp Wissenschaftskolleg Greifswald.
Beat Bächi (Predoctoral Research Fellow October 2006–March 2007) was appointed as Research Scholar at the Institute for Science and Technology Studies (IWT), University of Bielefeld.
Bruno Belhoste (Visiting Scholar July–August 2007) was appointed as professor of history of science at the Université Paris 1 Pathéon-Sorbonne.
Cornelius Borck (Karl Schädler Postdoctoral Research Fellow April 1998–March 2001) was appointed as professor of history of medicine and science at the Universität zu Lübeck.
Brita Brenna (Postdoctoral Research Fellow August 2005–January 2006) was appointed as Researcher at the the University of Oslo, Centre for Technology, Innovation and Culture, Norway.
Luciana Vieira Caliman (Predoctoral Research Fellow April 2004–March 2005) was appointed as Associate Professor and Postdoctoral Fellow at the Postgraduate Program of Psychology, Universidado do Estado do Rio de Janeiro, Brazil.
Zeynep Celik (Predoctoral Research Fellow September 2005–August 2006) was appointed as Paul Mellon Fellow at the Center for Advanced Study in the Visual Arts, National Gallery of Art, Washington D.C., U.S.A.
Tobias Cheung (Postdoctoral Research Fellow March–August 2007) was appointed as Heisenberg Fellow at the Humboldt-Universität zu Berlin, Kulturwissenschaftliches Seminar.
Jacob Lebovitch Dahl (Research Scholar April 2007–September 2008) was appointed as University Lecturer at the Oxford University, U.K.
Sven Dierig (Research Scholar July 1997–March 2006) was appointed as Manager of Science Communication at the Institut für Nanotechnologie, Forschungszentrum Karlsruhe GmbH, Germany.
Igal Dotan (Postdoctoral Research Fellow November 2004–November 2007) was appointed as Project Manager at the the Center for Futurism in Education, Ben-Gurion University, Beer Sheva, Israel.
Ulrike Fauerbach (Postdoctoral Research Fellow January–January 2006) was appointed as wissenschaftliche Referentin at the the German Archaeological Institute, Dept. Cairo, Egypt.
Uljana Feest (Research Scholar October 2003–September 2006) was appointed as Forschungsdozentin at the Institut für Philosophie, Wissenschaftstheorie, Wissenschafts- und Technikgeschichte, Technische Universität Berlin, Germany.
Brian Fuchs (Research Scholar May 2001–December 2006) was appointed as Researcher at the eSciDoc project of the Max Planck Society.
Elodie Giroux (Predoctoral Research Fellow October 2005–May 2006) was appointed as Maitre de conférences at the Université de Lyon 3.
Frédéric Graber (Postdoctoral Research Fellow) was appointed as Professeur Agrégé at the Institut National de Recherche Pédagogique, Lyon, France.
Christelle Gramaglia (Predoctoral Research Fellow September 2005–August 2006) was appointed as Research Fellow at the Centre Machinisme Agricole Génie Rural Eaux et Forêts, Montpellier, France.

Susanne B. Keller (Research Scholar September 2005–October 2006) was appointed as Research Associate at the Altonaer Museum für Kunst und Kulturgeschichte, Hamburg, Germany.
Bernhard Kleeberg (Research Scholar September 2003–December 2006) was appointed as Juniorprofessor at the Universität Konstanz, Germany.
Dietmar Kurapkat (Research Scholar October 2005–September 2007) was appointed as wissenschaftlicher Mitarbeiter at the Technische Universität Berlin, Germany.
Rhodri Lewis (Postdoctoral Research Fellow September 2005–August 2007) was appointed as Tutorial Fellow in English Language and Literature at the St. Hugh's College, University of Oxford, U.K.
Anna Märker (Postdoctoral Research Fellow October 2005–August 2007) was appointed as Lecturer in the History of Medicine at the Oxford Brookes University, U.K.
Susanne Pickert (Predoctoral Research Fellow January 2004–December 2007) was appointed as Scholar in Residence at the Deutsches Museum, Munich, Germany.
Carsten Reinhardt (Research Scholar March 2006–March 2007) was appointed as Professor at the Institute for Science and Technology Studies (IWT), University of Bielefeld, Germany.
Matthias Schemmel (Research Scholar July 2003–March 2008) was appointed as Head of Junior Research Group at the Excellence Cluster 264 "Topoi".
H. Otto Sibum (Research Group Director October 1998–August 2007) was appointed as Hans Rausing Professor of History of Science and the Director of the Office for History of Science at the Uppsala University, Sweden.
Katrin Solhdju (Predoctoral Research Fellow January 2004–December 2006) was appointed as wissenschaftliche Mitarbeiterin at the Zentrum für Literaturforschung, Berlin, Germany.
Anke te Heesen (Research Scholar October 1999–September 2006) was appointed as Director of the University Museum and Professor für empirische Kulturwissenschaft at the University Tübingen, Germany.
Jeremy Vetter (Postdoctoral Research Fellow September 2005–December 2006) was appointed as Assistant Professor for Environmental History and History of Science at the Dickinson College, Pennsylvania, U.S.A.
Janina Wellmann (Postdoctoral Research Fellow March–September 2007) was appointed as Postdoctoral Fellow at the Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Israel.
Kelley Wilder (Research Scholar September 2005–August 2008) was appointed as Senior Research Fellow at the De Montfort University, Leicester, U.K.

Awards

The exhibition "Albert Einstein, Chief Engineer of the Universe" was awarded the International Museum Communication Award in bronze.
Charlotte Bigg's dissertation "Behind the Lines: Spectroscopic Enterprises in Early Twentieth-Century Europe" was awarded the Paul-Bunge-Preis of the Gesellschaft Deutscher Chemiker.

The thesis of *Christina Brandt*, "Metapher und Experiment. Von der Virusforschung zum genetischen Code," was awarded the Dalberg-Preis für transdisziplinäre Nachwuchsforschung by the Bauhaus Universität Weimar.
The article "Darwinian 'blind' hypothesis formation revisited" by *Maria Kronfeldner* was awarded the Karl Popper Essay Prize 2006/07 of the British Society for the Philosophy of Science.
Anke te Heesen, Research Scholar at the MPIWG 1999–2006 was awarded the prize of the Aby-Warbung-Stiftung Hamburg 2006.
Laura Otis, Visiting Scholar at the MPIWG, was awared the Prize for the Outstanding Book in the History of the Neurosciences by the International Society of the Neurosciences (ISHN).
Hans-Jörg Rheinberger was awarded an honorary doctorate by the ETH Zurich and the Cogito Prize 2006.
The thesis of *Matthias Schemmel* "The English Galileo: Thomas Harriot's Work on Motion as an Example of Preclassical Mechanics" was awarded the Georg-Uschmann-Preis für Wissenschaftsgeschichte from the German Academy of Sciences Leopoldina and the prize for junior scientists from the Georg-Agricola-Gesellschaft.
Henning Schmidgen's essay "The Donder's Machine: Matter, Signs, and Time in a Physiological Experiment, ca. 1865" was awarded the 2007 Schachterle Prize.
Margarete Vöhringer, Predoctoral Fellow at the MPIWG between 2001 and 2004, was awarded the Wilhelm-Ostwald-Anerkennungspreis 2007.
Janina Wellmann, Fellow at the MPIWG between 1999 and 2007, was awarded the Förderpreis 2008 of the Berlin-Brandenburg Academy of Sciences and Humanities.



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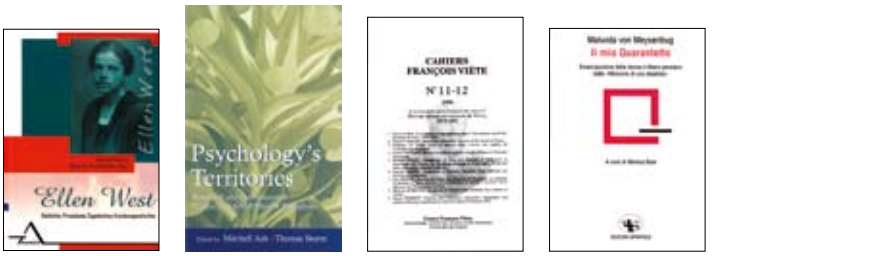

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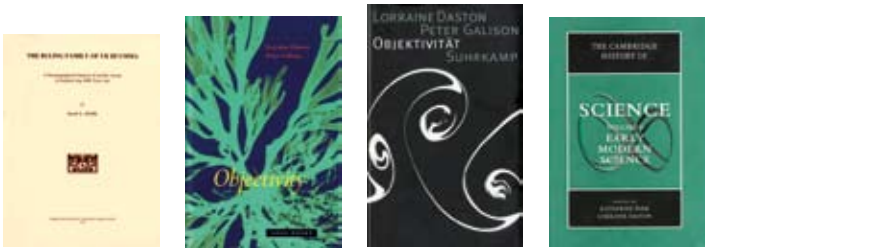

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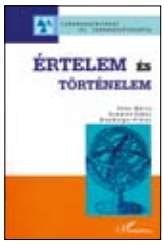

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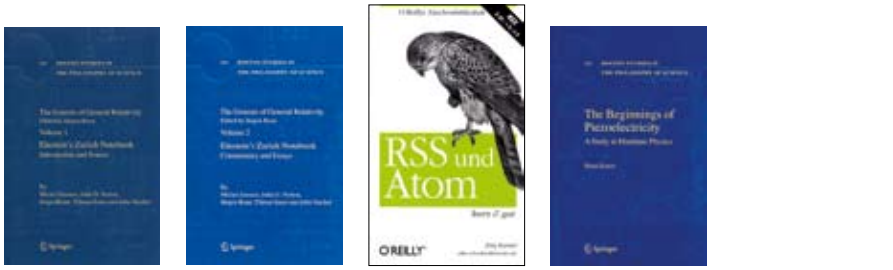

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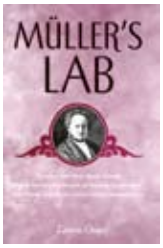

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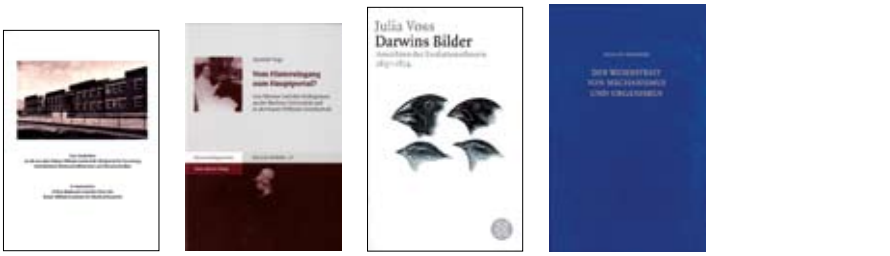

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