Winter School

Modes of Technoscientific Knowledge

Dates: 19-25 January, 2014

Location: Chalet Giersch, Manigod, France (http://www.giersch-stiftung.tu)

Organization: Université Paris 1 Panthéon - Sorbonne, Technische Universität Darmstadt, French-German ANR-DFG program GOTO (www.goto-objects.eu), BiCoDa Alliance (http://www.bicoda.info).

Topic overview: Following the "practical turn" in history of science and science studies in the late decades of the 20th century, a "thing turn" has occurred in the philosophy of science and technology. Epistemology scholars are more and more concerned with "thing knowledge" rather than with theoretical representations (Baird 2004). The technological dimension of science is no longer to be seen as a mere mediation between mind and reality for the sake of theoretical representation, theory-testing or practical application. "Epistemic things" and "experimental systems" (Rheinberger 1997), models and simulations (Morrison & Morgan 1999, Varenne 2007) and other technological artifacts are reconsidered as indispensable partners in the making of scientific knowledge. But how are we to identify and conceptualize the epistemic roles of technology in *technoscientific research*?

As long as technoscience is assimilated with a highly application-driven enterprise aiming at remaking the world, most philosophical studies focus on the "impacts" of technoscientific applications on environment, society, or ethics and their regulation to the detriment of epistemology. However, the view of current technosciences as socio-political constructs arising less from "purely scientific" goals than from larger institutional, economic and cultural contexts does not preclude addressing their epistemic strategies *qua* technoscience (Bensaude-Vincent 2009; Bensaude-Vincent et al. 2011; Nordmann 2012). On the contrary, if technosciences are not only hybrids of science and technology but research projects that embody socio-political values, projects and agendas, then it is even more crucial to reconsider their epistemic status. Far from considering science (or a particular idealization of it) as "the" norm of knowledge and technoscience as a corrupted or contaminated form of it, the purpose is to characterize technoscientific knowledge as such in order to delineate an *epistemology of technoscience* as a distinctive enterprise with its own epistemic values and its own ways of producing knowledge as well as new forms of ignorance.

This PhD and advanced graduate winter school seeks to explore the epistemology of technoscientific knowledge on the basis of a number of case studies ranging from recent technosciences such as nanotechnology or synthetic biology, to more traditional ones, such as chemistry, pharmacy or metallurgy. The purpose is to disentangle the historical, sociological, anthropological and philosophical implications of the epistemology of technoscience. Along with stimulating topics, the school offers above all a convivial place of exchange between PhD students and more advanced scholars from various countries.

Lecturers: Bernadette Bensaude-Vincent (Univ. Paris 1 Sorbonne); Alfred Nordmann (Technische Univ. Darmstadt); Astrid Schwarz (University of Basel); Sacha Loeve (Univ. Paris 1 Sorbonne); Xavier Guchet (Univ. Paris 1 Sorbonne) ; Anne-Françoise Schmid (Ecole des Mines Paris) ; Jean-Pierre Llored (Free Univ. of Bruxelles). To be confirmed: Hans-Jörg Rheinberger (H. Prof. MPIWG Berlin); Cyrus Mody (Rice University).

Topics of inquiry include (but are not limited to):

History, sociology and anthropology of techno-epistemic cultures

Epistemological considerations may be a key driver of technoscientific research. A number of research fields now integrated in highly-visible umbrellas such as nanotech and synthetic biology have already long histories behind them. Some examples are molecular electronics (Mody 2009) molecular machines (Schummer 2006; Loeve 2010; Grote and O'Malley 2011), bioinformatics, bioenergetics, thin-film and membrane technology, fine particle engineering, protein design, electrochemistry, quantum computing, spintronics, etc. Each of these fields has its own figureheads, shared narratives, paradigmatic objects, and perhaps its own "style of reasoning" (Hacking 2004). Each may be partly resistant to socio-political projects, outlive current ones, and opportunistically embrace subsequent research & innovation policy waves (Jones 2011). This points out to the significant role epistemological considerations may play in the constant reshaping of technoscientific research communities.

- What role do epistemological differentiations play in technoscientific research fields' historical dynamics, community-building, boundary work, and material cultures?
- What are techno-epistemic cultures? How are they made, what are they capable of?
- What are the implications of addressing technoscientific knowledge for the historical, sociological or anthropological study of technoscience?

Epistemology of technoscience

How are we to consider technoscientific knowledge claims? Nanotechnologists for instance, often claim that they are not interested in application *per se*, and do rather see themselves as pursuing genuine knowledge by learning to manipulate atoms or molecular processes. Or else, synthetic biologists often "make a special claim for an epistemology of 'constructing' or making as the source of real knowledge" (O'Malley 2009, p. 381). Addressing technoscientific knowledge as such could prove fruitful for bringing some fresh air to epistemology, aside from—but still connected with—more traditional approaches that rest on well-established dichotomies such as representation/intervention, explanation /experimentation, realism/positivism, theory/reality, and the like. Besides, the epistemology of technoscience would also benefit from comparisons with the epistemology of models and simulations. If the technoscientific ways of making knowledge are alien to the scientific business of methodically assessing the truth of propositions, theoretically explaining or faithfully representing nature (Nordmann 2006; Daston and Galison 2007), then it is worth asking what kind of knowledge is technoscientific knowledge, and what kind of epistemology is needed to account for it.

- Who produces and beholds technoscientific knowledge? Researchers as individuals, as collectives? Instruments, experimental systems, simulation setups? Technoscientific objects or things themselves? Hybrid of sorts?
- How is technoscientific knowledge performed? By trial and error, question and answer, dialogue or colloquium with the object? By accessing, peering or participating to thing knowledge? By iteration, participation, self-representation, interconnection, intra-action, analogy? Is it tacit knowledge, and if so, how is it publicly validated?
- "Knowledge of control" or "knowledge as control"? "Human control over the object" or "things controlling each other"? In what sense can the achievement of control be genuine knowledge in its own right?
- "Knowing through making" (or "constructing" or "creating"): Does understanding precede making or the reversal? Is making a necessary and sufficient condition for understanding? A necessary but non-sufficient condition? Or a contingent but sufficient (good enough) condition? Or something else? Does the ability to create confirm a mental model or does it stand as a form of successful participation to the processes under investigation?

Ontology of technoscience

For technoscientific research, it makes no sense to separate theory and reality or mind and world and, only then, to see how they relate to one another (Nordmann 2006b). In this respect, technoscientific research may appear quite fundamental. As Gilbert Hottois remarked, mathematical and experimental physics may be content to formulate, in mathematical form, what happens on the occasion of a technological operation. Thus it refers exclusively to technological procedures, to the technical measurement and recording of the result of interactions. “The question of quiddity (what and what essence) is totally alien to it.” (Hottois, 1984, pp. 68-69). Some even talk about “ontological indifference” (Galison 2010): Technoscience would be science becoming indifferent to ontology. But it could well pluralize ontology, aside from the kind of scientific ontology framed by the opposition of realism versus instrumentalism.

- What exactly is known by technoscientific knowledge? Non natural artifacts? Artifacts continuous with nature? Nature as technological partner? Functions, processes, performances, behaviors, works, operations, capacities of control, means of action, design rules, engineering principles, effects of our own actions, objects, things, stuffs, substances, systems, dispositions, affordances, possibilities, individuals, singularities, patterns, generic features…?
- Which philosophies are pertinent to address and make sense of these questions?

Participation: The school welcomes PhD and advanced graduate students interested in addressing these issues from philosophy, STS, cultural studies, anthropology, and related fields (other backgrounds such as physics, chemistry or biology are also welcome). Each participant should propose a technoscientific “object” or case study (even a programmatic one) and contribute an approximately 10-page paper by December 15, 2013. A reader of texts will be distributed well in advance of the course.

Format: The course will comprise approximately 20 participants selected on the basis of submitted abstracts. The school will alternate lectures and discussion sessions involving participants and lecturers. There will be time also for skiing and hiking at one’s own leisure.

Cost: Participation in the course is free but participants are expected to pay their own travel expenses (transportation from Geneva or Annecy will be arranged). Accommodation and tuition are taken care of, leaving only a nominal amount of roughly 100 Euros for food and incidental expenses.

Please submit your abstract to Sacha Loeve (sacha.loeve@univ-paris1.fr) before October 15, 2013. Abstracts should comprise a brief description of your technoscientific object or case study, describing how it relates to the course theme(s) and briefly sketching the central issues you are facing with it. Since the course is interdisciplinary, the abstract should include some basic information about your approach and disciplinary context.

*****Important dates*****

Submit short abstract before October 15, 2013

Notification of acceptance: October 20, 2013

Submit paper by: December 15, 2013

Course dates: January 19-25, 2014

Indicative list of references:

Davis Baird, *Thing knowledge: A philosophy of scientific instruments* (Berkeley: University of California Press, 2004).

Bernadette Bensaude-Vincent, *Les vertiges de la techoscience. Façonner le monde atome par atome* (Paris: La Déccouverte, 2009).

Bernadette Bensaude-Vincent, "Biomimetic Chemistry and Synthetic Biology: A Two-way Traffic Across the Borders", *Hyle – international Journal for Philosophy of Chemistry* 15-1 (2009).

Bernadette Bensaude-Vincent, "Discipline-building in synthetic biology", *Studies in the History and Philosophy of Biological and Biomedical Sciences* 44-2 (2013).

Bernadette Bensaude-Vincent and Xavier Guchet, "Nanomachine: one word for three different paradigms", *Technè* 11-1 (2007).

Bernadette Bensaude-Vincent, Sacha Loeve, Alfred Nordmann, Astrid Schwarz, "Matters of Interest: The Objects of Research in Science and Technoscience", *Journal for General Philosophy of Science*, 42-2 (2011).

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Martin Carrier & Alfred Nordmann (eds.), *Science in the context of application. Boston studies in the philosophy of science* 274 (Dordrecht: Springer, 2010).

Hasok Chang, *Inventing temperature. Measurement and scientific progress* (New York: Oxford University Press, 2004).

Aslistair Crombie, *Styles of scientific thinking in the European tradition: The history of argument and explanation especially in the mathematical and biomedical sciences and arts*, vol. 3. (London: Duckworth 1994).

Lorraine Daston (ed.), *Biographies of scientific objects* (Chicago, London: University of Chicago Press).

Lorraine Daston & Peter Galison, *Objectivity* (New York: Zone Books, 2007).

Peter Galison, "The pyramid and the Ring: The Rise of Ontological Indifference" Lecture at the Centre for the Humanities of the University of Utrecht, 2010, November 11.

Xavier Guchet, "Nature and Artifact in nanotechnologies", *Hyle – international Journal for Philosophy of Chemistry* 15-1 (2009).

Mathias Grote, "Purple matter, membranes and 'molecular pumps' in rhodopsin research, *Journal for the History of Biology (2012).*

Mathias Grote & Maureen O'Malley "Enlightening the lifesciences: the history of halobacterial and microbial rhodopsin research". *FEMS Microbiology Reviews* 35-6 (2011).

Ian Hacking, *Representing and intervening. Introductory topics in the philosophy of natural science* (Cambridge: Cambridge University Press, 1983).

Ian Hacking, *Historical onrtology*, (Cambridge MA: Harvard University Press, 2004).

Donna Haraway, *Modest_witness@Second_millenium. FemaleMan©_meets_Onco-mouse™: Feminism and technoscience* (New York: Routledge, 1997).

Rom Harré, "The Materiality of instruments in a metaphysics for experiments". In H. Radder (Ed.), *Philosophy of scientific experimentation* (Pittsburgh, PA: University of Pittsburgh Press, 2003).

Rom Harré & Jean-Pierre Llored, “Molecules and Mereology”, *Foundations of Chemistry* 15-2 (2013).

Katherine Hayles, K. (Ed.), Nanoculture: Implications of the new technoscience (Chicago: University of Chicago Press, 2004).

Jochen Hennig, “Changes in the design of scanning tunneling microscopic images from 1980 to 1990”, *Technè* 11 (2007).

Gilbert Hottois, *Le signe et la technique. La philosophie à l’épreuve de la technique* (Paris: Aubier 1984).

Hottois, Gilbert, “Technoscience”. In *Encyclopedia of science, technology and ethics*, vol. 4, ed. Carl Mitcham. (New York: Macmillan Reference, 2005).

Don Ihde, & Selinger, E. (Eds.). *Chasing technoscience* (Bloomington, IN: Indiana University Press, 2003).

Richard A. L. Jones, “What has nanotechnology taught us about contemporary technoscience?” In Zülsdorf T. B., Coenen C., Ferrari A., Fiedeler U., Milburn C., Wienroth M., (éd.), *Quantum Engagements: Social Reflections of Nanoscience and Emerging Technologies* (IOS Press , Amsterdam 2011).

Werner Kogge & Michael Richter, “Synthetic biology and its alternatives. Descartes, Kant and the idea of engineering biological machines”, *Studies in the History and Philosophy of Biological and Biomedical Sciences* 44-2 (2013).

Hugh Lacey, “Reflections on science and technoscience”, *Scientiae Studia*, 10 (2012).

Johannes Lenhard, “Nanoscience and the Janus-Faced Character of Simulations”, Baird D., Nordmann A., Schummer J. (dir.), *Discovering the Nanoscale* (IOS Press, Amsterdam, 2004).

Johannes Lenhard, Günter Kuppers, Terry Shinn, *Simulation: Pragmatic Constructions of Reality* (Dordrecht: Springer, 2007).

Jean-Pierre Llored, “Emergence and Quantum Chemistry”. *Foundations of Chemistry* 14-3 (2012).

Jean-Pierre Llored, “Towards a Practical Form of Epistemology: The Case of Green Chemistry” *Studia Philosophica Estonica* 5 (2013).

Sacha Loeve, “Sensible Atoms: A Techno-aesthetic Approach to Representation”, *NanoEthics* 5-2 (2011).

Sacha Loeve, “About a Definition of Nano: How to Articulate Nano and Technology?” *Hyle – international Journal for Philosophy of Chemistry* 16-1 (2010).

Sacha Loeve, “From setting the distance to adjusting the focus” (review of *Science transformed*), *Metascience* 2 (2012).

Anne Marcovich and Terry Shinn, “Regimes of science production and diffusion: towards a transverse organization of knowledge”, *Scientiae Studia* 10 (2012).

Cyrus Mody and Hyungsub Choi, “The Long History of Molecular Electronics: Microelectronics Origins of Nanotechnology”, *Social Studies of Science*, 39-1 (2009).

Cyrus Mody, *Instrumental Community: Probe Microscopy and the Path to Nanotechnology* (Cambridge, MA: MIT Press, 2011).

Michel Morange, “A Critical Perspective on Synthetic Biology”, *Hyle – international Journal for Philosophy of Chemistry* 15-1 (2009).

Mary S. Morgan, Margaret Morrison (eds.), *Models as mediators: Perspectives on natural and social science* (Cambridge, New York, Melbourne: Cambridge University Press 1999).

Alfred Nordmann, “Collapse of distance: Epistemic strategies of science and technoscience”, *Danish Yearbook of Philosophy* 41 (2006).

Alfred Nordmann, “From Metaphysics to Metachmistry”, in D. Baird, E. Scerri, L. McIntyre (eds)., *Philosophy of Chemistry: Synthesis of a new discipline*, Boston Studies in the Philosophy of Science (Dordrecht: Springer, 2006b)

Alfred Nordmann, “Object lessons: towards an epistemology of technoscience”, *Scientiae Studia* 10 (2012).

Alfred Nordmann, Hans Radder, Gregor Schiemann, *Science Transformed? Debating Claims of an Epochal Break* (Pittsburgh University Press, 2011).

Maureen A. O’Malley, “Making knowledge in synthetic biology: Design meets Kludge”. *Biological Theory* 4 (2009).

Maureen A. O’Malley, Powell, A., Davies, J. F., & Calvert, J., “Knowledge-making distinctions in synthetic biology, *BioEssays* 30 (2007).

Hans-Jörg Rheinberger, *Toward a history of epistemic things*: *Synthesizing proteins in the test tube* (Stanford, California: Stanford University Press, 1997).

Joachim Schummer, “Gestalt Switch in Molecular Image Perception: The Aesthetic Origin of Molecular Nanotechnology in Supramolecular Chemistry”, *Foundations of Chemistry* 8 (2006).

Anne-Françoise Schmid et Jean-Marie Legay, *Philosophie de l’interdisciplinarité. Correspondance (1999-2004) sur la recherche scientifique, la modélisation et les objets complexes* (Paris : Pétra, 2004).

Anne-Françoise Schmid (dir), *Epistémologie des frontières* (Paris : Pétra, 2012).

Astrid Schwarz, “The becoming of the experimental mode”, *Scientiae Studia* 10 (2012).

Gilbert Simondon, *Du mode d’existence des objets techniques* (Paris : Aubier, [1958] 1989).

Franck Varenne, *Du modèle à la simulation informatique* (Paris: Vrin, 2007).