WTMC Training and Supervision Program

- Lay-out of the WTMC Training and Supervision Program
- WTMC Research Skills and Crafts (Final Attainment Aims)
- WTMC Core Literature

Lay-out of the Training and Supervision Program

PhD students participating in one of the academic groups affiliated with WTMC obtain their training locally in their own institution and nationally from the Graduate Research School.

The *local component* is provided by the local institution and in particular by the supervisor responsible for the PhD student. Increasingly, however, the local component is more formally organized in local graduate schools. The local component includes supervision and training to compensate for gaps in students' prior training, such as language skills, and provides for training in general academic skills and career planning. Moreover, PhD students participate in local research colloquia. For more information about the local component: see the WTMC Research Skills and Crafts.

The *national component* is organised by the Graduate Research School WTMC. WTMC teaches the PhD candidates to translate classical and contemporary approaches to the study of science, technology and society into their own research approach and research design. In addition, it teaches the PhD candidates the methodologies to study the relationship between science, technology and society, the skills necessary to communicate their work to the international research community, and the skills to translate societal and cultural problems into questions of science and technology studies and vice versa. This means that the training prepares both for academic and professional career options, even though the large majority of WTMC graduates acquires positions at universities and research institutions.

The WTMC PhD program is English-language-based, and has two phases. The first two years of the program introduce students into the broad field of studies of the relationship between science, technology and society, and provide training in particular skills. During each of these first two years, students attend two three-day workshops and one five-day summer school (so six events in two years). Workshops are organised around specific themes (linked to the three clusters of questions around which WTMC is organized), while the summer school is organized around both a theme and an anchor teacher. The anchor teachers are leading international scholars from the field.

Through a unique system of alternating themes and skills, every student is trained in each of the three research themes twice, and is introduced into each of the six key methods of qualitative research: interviewing, (participant) observation, historical document analysis, citation analysis, discourse analysis and action research. At the same time, every workshop and summer school is tailored to timely topics in STS and to the group of PhD candidates following the program at a particular moment in time.

Two teaching coordinators prepare for the themes and literature for these workshops and schools (and the dissertations days, see below), and invite the WTMC lecturers. Each student presents his or her work at least once during the first two years of the program. All workshops and schools are in English and have often attracted international participants, partially through the EU-Network of Excellence PRIME, and partially as a result of publicity on WTMC provided during international conferences.

In the next phase of their PhD research, students are enabled to present their own work for discussion at Dissertation Days. WTMC schedules two Dissertation Days per year, to which national and international discussants are invited. PhD students are entitled to attend one dissertation day each year in order to present some work-in-progress, either a paper or a dissertation chapter. Texts are distributed in advance. Each Dissertation Day ends with a dinner so that PhD students can maintain and extend their network of contacts with peers and senior scholars in their field. The overview below summarizes the full training program.

<table>
<tr><th></th><th>National-level component</th><th>Local component</th></tr>
<tr><td>1st year</td><td>o Three-day Workshop
o Three-day Workshop
o Five-day Summer School</td><td rowspan="4">o Supervision of PhD research
o Attention for individual deficiencies
o Literature & reading groups
o Language courses
o Didactic courses

Participation in colloquia</td></tr>
<tr><td>2nd year</td><td>o Three-day Workshop
o Three-day Workshop
o Five-day Summer School</td></tr>
<tr><td>3rd year</td><td>o Dissertation Day
o Dissertation Day</td></tr>
<tr><td>4th year</td><td>o Dissertation Day
o Dissertation Day</td></tr>
</table>

Acquiring academic and professional skills is highly important in the WTMC graduate training program. Workshops and summer schools invite students to reflect critically on theoretical and methodological approaches and on their own research design and findings. In addition to training into the six research skills, there is training in skills such as structuring the thesis, writing review articles, composing abstracts for conferences, writing research proposals for funding, and the art of redrafting.

These elements of the training always have the form of “activities” for which the students have to prepare assignments, usually *individual* ones. These assignments are discussed in small groups and by the training coordinators, who make sure that the students acquire feedback. All students are provided with extensive and formalized written feedback on the obligatory presentation of their research projects. The training coordinators also talk shortly with all PhD students individually during each workshop and school to monitor the trajectory towards the dissertation in an informal and stimulating atmosphere.

Interaction among the students is crucial. That is why the workshops, summer schools and dissertation days are residential. This enables WTMC to “build” generations of

STS scholars who know, trust and will find each other in future research collaborations. WTMC sincerely believes in the significance of mutual trust for high quality and prolonged academic collaborations.

The basic structure of the WTMC training program has not changed in the past years. The only exception has been the replacement of the annual two-day winter school by two one-day dissertation days per year. This has been done to give the senior students more options a year to have their chapters and papers discussed. Moreover, the maximum number of PhD students attending the workshop and schools has been raised from 25 to 30 students, and in 2010 WTMC has organized one extra workshop (so 3 instead of 2). Both measures have been taken to accommodate the increasing number of PhD students enrolled in the school.

In addition, WTMC has introduced many novelties to enhance the quality of the *supervision*, the *early socialization* of the students into the program, and the *communication of final attainment aims* of the program to the students. As to the quality of *supervision*, WTMC has introduced a model Training and Supervision Plan (TSP), which lists information on: the objective of the PhD trajectory; the research plan; the supervision team; the PhD students' tasks, duties and rights in terms of research, training, and teaching; the frequency of supervision; evaluation; assessment after one year; and relationship of trust. In addition, WTMC organizes a bi-annual Supervisors' Days to train supervisors and exchange best practices in supervision.

As to the *early socialization*, WTMC has introduced an extensive welcome package for its PhD students. The welcome package includes information on the practicalities of the training program, the WTMC model Training and Supervision Plan, and information on WTMC's use of a website and wiki, including models for short descriptions of PhD research.

The *communication of the final attainment aims* to the PhD students has improved by providing the students with a list of WTMC core literature (see below), divided into 1. classics: works systematically introduced and discussed in the WTMC curriculum, 2. introductions and 3. works related to one of the three WTMC research clusters; and with a note on WTMC core research crafts and skills, with a very detailed list of final attainment aims (see below). As to the final attainment level of the PhD thesis itself, WTMC allows for two models: the dissertation based on published articles, and the booklength dissertation, which is usually based on at least three case studies. These models are regularly discussed at workshops and schools.

Recently the program has also been described in terms of the number of ECTS involved. As said, the *national component* in the WTMC PhD Training includes four workshops and two summerschools. Attending Dissertation Days in the third and second year is optional. Attending a workshop takes 32 hours (taken the day and evening programs together), attending a summerschool takes 56 hours, and attending a Disseration Day 8 hours. WTMC expects PhD students to spend at least 40 hours on the preparation (reading the literature, writing preparatory assignments) for each workshop and 80 hours for each summerschool. A Dissertation Day requires about 32 hours of preparation.

Since 1 ECTS stands for 28 hours, and with some rounding off of hours, we have come to the following ascription of ECTS to the *national component* of the WTMC Training Program:

- The program, including the Dissertation Days, is 25 ECTS
- The Workshops are 3 ECTS each (4 x 3 = 12 ECTS for the four Workshops together)
- The Summerschools are 5 ECTS each (2 x 5 = 10 ECTS for both Summerschools)
- The Dissertation Days are 1,5 ECTS each (2 x 1,5 = 3 ECTS for both Dissertation Days)

Together with the training and supervision within the *local component*, for which WTMC considers 15 ECTS good practice, the program is 40 ECTS.

Finally, WTMC has opened up discussions aimed at international collaboration with the European Association for the Study of Science and Technology (EASST) in the organization of summer schools. Vice versa, EASST has welcomed WTMC's list of Core Literature (see below) as a best practice example for PhD training in STS. In addition, Bielefeld University and Darmstadt University of Technology have approached WTMC for co-organizing summerschools in the upcoming years.

WTMC Research Skills and Crafts

The Netherlands Research School of Science, Technology and Modern Culture (WTMC)

Introduction

This note is intended for WTMC PhD candidates, their supervisors, the coordinators of the WTMC PhD Training Program, and for a general audience interested in Science and Technology Studies' research and teaching in the Netherlands. This note focuses on the research skills and crafts provided by the WTMC Training Program, and is the counterpart of the note on WTMC Core Literature (available on the WTMC website, www.wtmc.net).

The WTMC PhD Training Program is an intensive trajectory that contributes both to the production of high quality dissertations and to the education of skilled, independent researchers in STS—including Innovation Studies. The priority of WTMC summer schools and workshops is the training of all-round STS researchers, but the production of dissertations also requires the support of the universities participating in WTMC. This is the *national component* of the training. The design and implementation of the *local component* is ultimately the responsibility of the university in which the PhD candidate is based.

The *national component* includes training in research skills and crafts that independent STS researchers require. It aims to *broaden* the students' knowledge of and experience with STS *research skills* as well as to provide critical reflection on when and how to apply such skills. The training program offers a two-year cycle of workshops and summer schools that focus on the key themes and methods of current STS research. The national component of WTMC is geared towards providing an overview and 'taste' of a range of methods rather than the details of each and every method which should be acquired in the learning-by-doing of each project, supplemented by additional training where necessary. Moreover, the dissertation days (in which dissertation chapters are discussed in small groups) in the final phase of the WTMC training create a safe environment for intensive feedback on written work and help to foster further a close-knit network of STS researchers. The dissertation days encourage PhD candidates to reflect on their (thesis-related) choices and to respond to feedback on their work, while the network functions as a group for mutual support and exchange of experiences, also later in the careers of the PhD candidates.

The national component broadens the PhD candidates' knowledge of research skills and helps them to reflect on these skills in four ways, by:

1. Introducing the main themes and theories of STS research [Table I]
2. Providing an overview and introduction in the key methods and methodologies of STS research [Table II].
3. Practicing the written and oral presentation of research, as well as the appropriate giving and receiving feedback on presentations [Table III]
4. Reflecting on the academic and professional development of the PhD candidates, and on issues relevant to the successful completion of a PhD, including reputation, motivation, ambition, relations with supervisors [Table IV]

The first two stress the broadening dimension of the research skills and crafts training (about two-thirds of the skills training effort in the workshops and summer schools). The last two support self-reflection by PhD candidates (about one-third). In the next section, the four ways of training research skills and crafts are presented. The final section summarizes the division between the local and national components and provides an overview of a typical PhD trajectory and the skills and crafts that a PhD candidate can expect to acquire [Table V].

Crafts and skills addressed during the WTMC training program

The WTMC program includes training in skills and crafts that support the education of PhD students into independent STS researchers. This training has two dimensions: broadening the students' knowledge and experience of research skills, and reflecting on the appropriate use of these skills. The goals of 'broadening' are attained by introducing the students to the main themes of STS research, as well as by providing basic training in specific STS methods. Tables I and II (as well as Tables III and IV below) provide an overview of the **final attainment aims** of the WTMC training program, and how often we offer the training elements that actually help to reach the aims. These tables, as well as tables III and IV, are used by the coordinators when planning the workshops and schools, and inform the PhD candidates on what they may expect in terms of skills and crafts training during the program.

Table I (broadening): Introducing the main themes and theories of STS research

Acquiring in-depth knowledge of classic and contemporary insights in the relationships between science, technology and modern culture.	● ● ●
Developing the capacity to use this knowledge in one's own research	● ● ●
Acquiring insight into the development of STS as an interdisciplinary field in relation to its 'founding disciplines'	● ●
Acquiring the ability to recognize the societal and cultural aspects of one's research, and to connect these to results from STS	● ●
Acquiring the ability to apply results from STS to policy, management and design contexts	● ●

● = every two years
● ● = every year
● ● ● = every workshop/summer school

Table II (broadening): Training in the key methods and methodologies of STS research

Developing knowledge of six key methods of STS: • interviewing • (participant) observation[1] • historical document analysis • citation analysis • discourse analysis • action research	●
Developing the ability to assess the appropriateness of different methods for different research questions	● ● ●

[1] Interviewing and participant observation are key methods for ethnographic fieldwork.

In addition to broadening the PhD candidates' knowledge of STS literature and methods, the WTMC curriculum also aims to facilitate reflection by the PhD candidates on their own work, style and ambitions. This is elaborated in Tables III and IV.

Table III (reflection): Practising the written and oral presentation of PhD research

Developing writing skills (e.g. writing an outline for thesis, review, peer review report, abstract, article, and funding application)	● ● ●
Developing the oral skills to participate in academic debates in English	● ● ●
Developing the ability to develop and maintain (international) contacts in STS	● ●
Developing the oral skills to present one's research in English	●

Table IV (reflection): Academic and professional development

Acquiring the ability to situate one's research in the context of STS	● ● ●
Relating one's own work to one's ambitions and future prospects within and beyond academia, job orientation within and outside of academia, writing a *curriculum vitae*	● ●
Reflecting on learning processes during a PhD trajectory: iterative cycles, common pitfalls	●
Developing insight in and taking responsibility for one's own research process, and facilitating good supervision	●
Maintaining motivation and dealing with criticism	●
Recognizing one's professional responsibilities to society and the ethical dimensions of one's research	●

Overview of Skills and Crafts for a PhD track: The local component

This section provides an overview of the skills and crafts that are essential to learn or develop during the trajectory from PhD candidate to award of the PhD degree. It can serve as a checklist for PhD candidates and supervisors to see whether the student is on track in terms of developing research skills. The skills and crafts are presented by following the various phases of doing research and writing a thesis. Actual research practices often do not follow such a linear pattern, but the structure is convenient for the purpose of an overview.

In addition, a distinction is made between skills largely provided in the national component of the WTMC training program, and those that are primarily the responsibility of the local university. In the local component, the PhD candidate may acquire skills by following additional courses, but usually the student will learn-by-doing in the everyday practice of research, and in interaction with supervisors and colleagues. The WTMC wiki provides information on locally available courses such as literature retrieval, time management, academic writing in English, preparing for job interviews, and additional training in particular methods.

Table V: Overview of research skills and crafts: National and local components

Research skills & crafts	WTMC component	Local component
Formulating a research question		
Writing a research proposal, formulating research questions		X
Orientation to research topic & relevant literature		
Understanding one's empirical field of research		X
Acquiring an overview of STS theories & literature, positioning one's research (and its societal and cultural aspects) in terms of STS theories	X	
Choosing theories & literature relevant to research project		X
Linking empirical issues to theoretical ones	X	
Recognizing the ethical dimensions of one's research	X	
Fine-tuning research questions		X
Planning & formulating an approach		
Operationalising research questions		X
Understanding research as an iterative process	X	
Time management		X
Doing the 'actual' research		
Acquiring an overview of STS methods, positioning one's own methods within STS	X	
Choosing methods for empirical research, learning-by-doing particular methods in-depth		X
Linking empirical data to particular theories		X
Learning to listen to criticism and incorporating this in research	X	
Limiting the scope of research		X
Monitoring & reflecting on one's own progress, identifying gaps in skills/knowledge, learning to ask for supervision & advice	X	
Reporting & writing		
Writing a thesis outline	X	
Presenting research orally	X	
Writing different genres (e.g. review, peer review report, abstract, article, funding application)	X	
Acquiring the ability to apply results from STS to policy, management & design contexts	X	
Writing academic English		X
Ambitions, jobs & networking		
networking skills, asking questions at presentations/conferences	X	
Relating one's work to ambitions within & beyond academia, job orientation, writing a CV	X	

Core literature WTMC

Draft May 2009

Introduction

The Dutch national research school WTMC seeks to analyze, understand and explain the manifold and intricate relationships between science, technology and modern culture. This, of course, is an interdisciplinary effort that draws from and contributes to various research traditions, each with their own literatures. In this overview we list the core literature of the research school WTMC. The aim of this list is threefold:

- it provides an introduction to the intellectual and academic aspirations of WTMC;
- it helps PhD students to locate their studies within a broader set of literatures;
- it supports the ongoing reflection of research agendas within WTMC.

The list of core literature is organized into three categories: classics, introductions and research clusters. The first, the *classics*, is a list of books that operate as a landmark in the broad, yet distinguished field of WTMC research. These scholarly works have introduced a new perspective that has been proved to be useful - and they still inspire the today's researchers. Their contribution to the field is uncontested, although their factual claims may have been challenged, as it should. The classics are systematically introduced and discussed in the WTMC PhD workshops.

The second list, of *introductions*, is in particular useful for new entrants in the field. The classics, of course, are also informative, but may require more background knowledge. The introductions provide an overview of the main perspectives, methods and findings of the research field of WTMC.

The third category, the *research clusters*, proposes a grouping of the many lines of research in WTMC. Within each of the clusters some key references and journals are suggested to orient the individual researcher. They are also used in the programs of the PhD workshops. Together, the research clusters are a demonstration of the richness and excitement of the research school WTMC.

The overview ends with a list of journals that are important for the research school WTMC and an Appendix of annotations of some of the works listed in this overview.

Classics

- Thomas S. Kuhn, 1970, *The Structure of Scientific Revolutions.* Chicago: University of Chicago Press (2nd ed.).
- Karl R. Popper, 1963, *Conjectures and Refutations.* London: Routledge and Kegan Paul.
- L. Fleck (1935), *Entstehung und Entwicklung einer wissenschaftlichen Tatsache. Einführung in die Lehre vom Denkstil und Denkkollektiv* Schwabe und Co., Verlagsbuchhandlung, Basel (English translation: *The Genesis and Development of a Scientific Fact*, Chicago: University of Chicago Press, 1979)
- Bruno Latour and Steve Woolgar, (1979), *Laboratory life: The social construction of scientific facts*. London: Sage (2nd edition 1986)
- Nathan Rosenberg, 1982, *Inside the Black Box: Technology and Economics.* Cambridge: Cambridge University Press
- Derek J. de Solla Price, 1963, *Little Science, Big Science*, New York: Columbia University Press
- Robert K. Merton, 1973, *The Sociology of Science: Theoretical and Empirical Investigations*. Chicago: University of Chicago Press, esp. part 3, 4 and 5.
- Lewis Mumford, 1934, *Technics and Civilization*. New York: Hracourt, Brace, and World Inc.
- Michel Foucault, 1975, *Surveiller et Punir*. Parijs: Gallimard. Nederlandse vertaling 1989, *Discipline, Toezicht en straf: de geboorte van de gevangenis*, Groningen: Historische uitgeverij
- Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers through Society.* Cambridge, MA: Harvard University Press.
- Dosi, G., Freeman, C., Nelson, R., Silverberg, G., & Soete, L. (1988). *Technical change and economic theory*. London: Pinter.
- Hughes, T. P. (1983). *Networks of Power, Electrification in Western Society, 1880–1930.* Baltimore: Johns Hopkins University Press.
- W. Bijker, T. P. Hughes & T. J. Pinch (Eds.), (1987) *The social construction of technological system,* Cambridge: MIT Press.
- M. Douglas (1987), *How Institutions Think*, 1987, London: Routledge.

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Introductions

General introductions:

- Jasanoff, Sheila, Gerald E. Markle, James C. Petersen, and Trevor Pinch, eds. (1995). *Handbook of Science and Technology Studies*. London: Sage.
- E. Hackett, O. Amsterdamska, M. Lynch, J. Wajcman eds. (2007) *New Handbook of Science, Technology, and Society*, Cambridge: MIT Press.
- Bauchspies, W. K., Croissant, J., & Restivo, S. (2006). *Science, technology, and society: a sociological approach*. Malden, MA: Blackwell Publishing.
- Sismondo, S. (2004). *An Introduction to Science and Technology Studies.* London: Blackwell Publishers

Introductions into the "W of WTMC:

- Biagioli, M., 1999, The science studies reader, New York and London: Routledge.
- David J. Hess, 1997, Science Studies. An Advanced Introduction. New York: New York University Press.
- Rob Hagendijk, 1996, *Wetenschap, Constructivisme en Cultuur*. Amsterdam: Universiteit van Amsterdam. (in Dutch).
- Barry Barnes, David Bloor and John Henry, 1996, *Scientific Knowledge. A Sociological Analysis.* London: The Athlone Press.

Introductions into the "T" of WTMC:

- Wiebe Bijker and John Law (1992) - *Shaping Technology / Building Society: Studies in Sociotechnical Change,* Cambridge, MA: MIT Press.
- Donald MacKenzie and Judy Wajcman (Eds.) (1999) *The Social Shaping of Technology.* McGraw Hill Education (second ed., first edition 1985)
- Collins, Harry and Pinch, Trevor (1998) *The Golem at Large: What You Should Know about Technology* (Cambridge Cambridge University Press).

Introductions into the "MC" of WTMC:

- During, S., (ed.), (1993), *The Cultural Studies Reader*, London and New York: Routledge.
- Thomas Misa, Philip Brey & Andrew Feenberg (eds) (2003) , *Modernity and Technology*, Cambridge, MA: MIT Press.
- Latour, Bruno (2005) *Reassembling the Social: an Introduction to Actor-Network-Theory* (Oxford: Clarendon)
- Knut H. Sorensen and Robin Williams (Eds) (2002), *Shaping Technology, Guiding Policy: Concepts, Spaces and Tools*, Cheltenham, UK: Edward Elgar.

Research clusters

We think the various perspectives and themes within WTMC can be clustered into about 20 categories. See table. We also indicate the relative weight of the focus on Science (W), Technology (T) and/or Modern Culture (MC).

research cluster	**focus on W, T or MC?**
Sociology of science	W
Technology studies	T
Philosophy of science	W
Philosophy of technology	T
History of science	W
History of technology	T
Questioning modernity	MC
Innovation studies	T
Ethnography of science and technology	WT
Risk and uncertainty	TMC
Knowledge society	MC
Ethics of science and technology	MC
Cultural studies	MC
Governance of science and technology	WTMC
Public understanding of science and technology	WTMC
Technology assessment and participatory approaches	T
User studies	T
Scenarios and expectations	TMC
Sociology of health and the body	WTMC
Nature, space and environment	WTMC

research cluster	some key references
Sociology of science	Bloor, David, 1991 [1976] Knowledge and Social Imagery, Chicago: University of Chicago Press, 2nd edition.
	Pickering, Andrew (ed.), 1992, Science as Practice and Culture. Chicago: University of Chicago Press.
	Whitley, Richard, 1985, The Intellectual and Social Organization of the Sciences. Oxford: Oxford University Press.
Technology studies	MacKenzie and Wacjman, 1985 [2nd ed. 1999], The Social Shaping of Technology. Buckingham: Open University Press.
	Callon, M., 1986, 'The sociology of an actor-network: The case of the electric vehicle', in: Callon, Law and Rip (eds.), Mapping the dynamics of Science and Technology, pp. 77-102.
	Bijker, W.E., 1995, Of Bicycles, Bakelites and Bulbs: Towards a theory of sociotechnical change, Cambridge: MIT Press.
Philosophy of science	Gillies, Donald, 1993, Philosophy of Science in the Twentieth Century: Four Central Themes. Oxford: Blackwell
	Hacking, Ian, 1983, Representing and intervening: Introductory topics in the philosophy of natural science, Cambridge: Cambridge University Press.
Philosophy of technology	Val Dusek (2006) , Philosophy of Technology: An Introduction Blackwell Pub.
	Frederick Ferré (1995), Philosophy Of TechnologyUniversity of Georgia Press.
	Mitcham, Carl. (1994) Thinking through Technology: The Path between Engineering and Philosophy. University of Chicago Press. Chicago
History of science	Shapin, Steven, and Simon Schaffer, 1985, Leviathan and the Air-Pump. Princeton: University Press.
	Porter, T., 1995, Trust in numbers: The pursuit of objectivity in science and public life, Princeton University Press
History of technology	Merrit Roe Smith & Leo Marx (eds.),(1994) Does Technology Drive History? The Dilemma of Technological Determinism. Cambridge MA.: MIT Press
	Edgerton, D., 1999, 'From innovation to use: ten eclectic theses on the historiography of technology' History and Technology 16, pp.111-136.
	Ruth Oldenziel (1999) Making technology masculine. Men, women & modern machines in America 1870-1945, Amsterdam University Press
Critical approaches	Haraway, D.J., 1991, Simians, cyborgs, and women : the reinvention of nature, London : Free Association Books
	Latour, Bruno, 1993, We have never been modern, transl. by Catherine Porter. New York [etc.] : Harvester Wheatsheaf, cop. 1993. - Vert. van: Nous n'avons jamais été modernes. - Paris : La Decouverte, 1991.
	Misa, Brey & Feenberg (eds), Modernity & Technology, Cambridge, MA: MIT Press, 2003
Innovation studies	Garud, Raghu, and Peter Karnøe (eds.), (2001) Path Dependence and Creation. Mahwah , N.J.: Lawrence Erlbaum Associates.
	Utterback, J. M. (1996). Mastering the dynamics of innovation. Boston, Massachusetts: Harvard Business School Press.
	Coombs, R., Green, K., Richards, A., & Walsh, V. (2001). Technology and the Market. Demand, Users and Innovation. Cheltenham, UK: Edward Elgar.

Ethnography of science and technology	Collins, Harry M., 1985, Changing order: Replication and induction in scientific practice. London: Sage
	Knorr Cetina, Karin (1999), Epistemic Cultures. How the Sciences Make Knowledge. Cambridge: Harvard University Press.
	Hine, C. (2000). Virtual Etnography. London: Sage.
Risk and uncertainty	Ulrich Beck, 1992, Risk Society: Towards a new Modernity, Sage, London.
	Maarten Hajer, 1995, The Politics of Environmental Discourse: Ecological modernization and the policy process. Oxford: Clarendon Press.
	Jasanoff, S. 1990, The Fifth Branch: Science advisers as policymakers. Cambridge: Harvard UP.
Knowledge society	Gibbons et al., 1994, The new production of knowledge: the dynamics of science and research in contemporary societies. London, etc.: Sage.
	Beck, Giddens, Lash, 1994, Reflexive Modernisation: Politics, tradition, and esthetics in the modern social order. Cambridge: Polity Press.
	Castells, 1996 [second edition 2000], The Rise of the Network Society (The information Age, vol. 1), Cambridge: Blackwell Publishers.
Ethics of science and technology	Keulartz, J., M.Schermer, M.Korthals, T.Swierstra (Eds.) (2002). Pragmatist Ethics for a Technological Culture. Deventer: Kluwer Academic Publishers
	Mitcham, Carl, R Shannon Duval. (1999) Engineering Ethics. Prentice Hall. Upper Saddle River, New Jersey.
Cultural studies	During, S., (ed.), 1993, The Cultural Studies Reader, London and New York: Routhledge.
	DuGay, P., S. Hall, L. Janes, H. MacKay and K. Negus, 1996, Doing Cultural Studies – The Story of the Sony Walkman. London, Sage Publications.
Governance of science and technology	Sclove, R. (1995). Democracy and Technology. New York: Guilford Press.
	David Held, 1995, Democracy and the Global Order, Cambridge: Polity Press.
Public understanding of science and technology	Nelkin D. (1995), Selling Science. how the press covers science and technology Freeman Press, 1995
	Wynne, Brian (1996), "May the Sheep Safely Graze? A Reflexive View of the Expert-Lay Knowledge Devide."in Risk, Environment & Modernity: Towards a New Ecology/, edited by Scott Lash, Bronislaw Szerszynski, and Brian Wynne. London, etc.: Sage Publications, 44-83.
	Alan Irwin & Mike Michael (2003) Science, social theory & public knowledge, Milton Keynes: Open University Press
Technology assessment and participatory approaches	Rip, A., T. Misa & J. Schot, 1995, Managing Technology in Society, London: Pinter.
User studies	Oudshoorn, N., & Pinch, T. (2003). How Users Matter: The Co-construction of Users and Technology. Cambridge: MIT Press.
	M Lie & K Sorensen (1996) Making technology our own, domesticating technology into everyday life, Oslo: Scandinavian

	University Press
Scenarios and expectations	Brown, N., Rappert, B., & Webster, A. (2000). Contested Futures - a sociology of prospective techno-science: Aldershot.
Sociology of health and the body	Mol, A. (2002). The Body Multiple: Ontology In Medical Practice. Durham, NC: Duke University Press.
	Blume, Stuart, Insight and Industry. On the Dynamics of Technological Change in Medicine. Cambridge MA: MIT Press.
Nature, space and environment	Haraway, D. (1991). Simians, Cyborgs and Women: The Reinvention of Nature. New York: Routledge. P Macnaughten, J Urry Contested Natures - Sage: Thousand Oaks, CA, 1998
	Sarah Whatmore (2002), Hybrid Geographies: Natures Cultures Spaces, London: Sage.
	Peter Peters (2006), Time Innovation and Mobilities, London: Routledge

Some important WTMC Journals

WTMC scholars tend to write and read in the following journals (not complete):

- *Social Studies of Science*
- *Science, Technology and Human Values*
- *Science as Culture*
- *Research Policy*
- *Scientometrics*
- *Technology and Culture*
- *Krisis*(Dutch)
- *Economy and Society*
- *Sociology of Health and Illness*
- *Public Understanding of Science*
- *Technological Forecasting and Social Change*
- *Futures*
- *Science and Public Policy*
- *Theory, Culture and Society*
- *Genetics and Society*
- *Technology Analysis & Strategic Management*

Appendix: Annotations to the Core list of WTMC

May, 2009

CLASSICS

Merton – *The Sociology of Science*

Merton introduced concepts such as unanticipated consequences, self-fulfilling prophecy, middle-range theory, focused group interview and role-models. Within STS he is regarded as the founding father of social studies of science. In 'The Sociology of Science', Merton demonstrates the potential of seeing science no longer as the product of individual geniuses, but as the result of an institution pervaded by distinctive rules and as a community like any other kind of human community, with its own reward systems, career patterns and behavioral imperatives. By systematically studying the role of institutional norms in the scientific community, he defined the organizing principles of universalism, communism, disinterestedness and organized skepticism. Merton kept a clear distinction in place between the organization of science and the contents of the knowledge produced by it.

Kuhn – *Structure of Scientific Revolutions*

In this book, Kuhn argues against the view that scientific progress is linear. Instead, mature science develops through phases of "normal" science ("puzzle solving") and "revolutionary" science (transition from one paradigm to the next, brought on by uncertainty and crisis in existing theories). What ties members of scientific community together is not something external to their knowledge, but paradigms. With paradigms, Kuhn means dominant structures of thought and practices which define what questions can be asked, which vocabulary is to be used and what guidelines are to be followed for expanding knowledge, and which represent entirely different and incommensurate assumptions about the universe. Hence, sociology of science should also be sociology of scientific knowledge and Kuhn's book gave rise to the new sociology of scientific knowledge (SSK, strong program).

Mumford – *Technics and Civilization*

Mumford was a pioneer in the social study and constructive assessment of science and technology. He was one of the first writers to include 'machines and machine-makers', or 'technics' as he called it, as part of cultural history, giving rise to the field of study on history of technology. For him, the machine was as much an idea and ideal as a physical artifact. To understand technical change, Mumford combined cultural analysis with cultural ecology, history, geography and sociology. He analyzed the machine as having a life of its own, a life cycle in which technologies have reached potential maturity in the 20th century.

Foucault - *Surveiller et Punir*
Michel Foucault contributed to the sociology of knowledge by showing that what is considered "reason" or "knowledge" is itself subject to major culture bias. In his archeological and genealogical method, Foucault compares discursive formations of different periods to avoid a historiography that is based on the consciousness of individual subjects, and he explains causes of transition from one way of thinking to another as the result of contingent turns of history. Foucault is known for his critical studies of various social institutions, such as psychiatry and medicine, and for his work on the history of sexuality. In surveiller et punir, Foucault describes present day society as a disciplinary society for the institutional formation of subjects, in which power and knowledge are inextricably linked. He argues that institutions such as the army, prisons, the factory and the school discipline the bodies of their subjects through surveillance techniques (real and perceived) and through application of historically produced norms of acceptable behavior. Through hierarchical observation, normalizing judgment and examination individuals are 'normalized', reformed to live by society's standards or norms.

Rosenberg – *Inside the Black Box: Technology and Economics*
Rosenberg explores the historical link between the economy and the determinants and consequences of technological change. In his book, he reviews and criticizes economic approaches for missing the complexity of the dialectic between science and technology, and for black boxing technologies to quantities and cost reduction in economic models. Rosenberg argues that the specific features of individual technologies should be taken into account: product innovations have shaped the rate of productivity improvement, the nature of learning processes underlying technological change, the speed of technology transfer, and the effectiveness of government policies that are intended to influence technologies in particular ways.

Dosi – *Technical Change and Economic Theory*
This book is one of the key-texts behind economic and innovation studies approaches within STS. Twenty eight articles and seven prefaces are presented to chart an alternative economic theory which treats both technical and institutional change as endogenous processes and in which technical change is neither seen as demand-induced nor as without any order. The chapters are divided into parts on shortcomings of established theory, national systems of innovation, international dimension and formal modeling. The authors aim to criticize mainstream economics for its incomplete view of technological change by introducing topics like path dependence, positive feedback, the influence of diverse social institutions and agent diversity.

Popper – *Conjectures and refutations*
"We learn from our mistakes" is probably the most influential adage in 20th Century philosophy of science, and is the leading thought in Poppers falsificationist program. C*onjectures and refutations* brings together a series of essays in which Popper relates his epistemological and social philosophical work.

Fleck – *Genesis and Development of a Scientific Fact*
Fleck's *Genesis and Development of a Scientific Fact*, originally published in German in 1935 is said to be the first sociology of science publication and has been of great influence on, amongst others, Kuhn and Merton. Fleck in this book introduces the

concepts of the ‘thought collective’ and ‘thought style’ in a fascinating analysis of the development of the Wassermann reaction for the diagnosis of syphilis.

Latour & Woolgar – *Laboratory Life: The Social Construction of Scientific Facts*
Through (participant) observation at a laboratory of the Salk Institute for Biological Studies (USA), the first author followed closely the daily processes of scientific work –what scientists do and how and what they say– in order to unravel the social construction of scientific facts. This book is apart from being one of the first thorough anthropologies of science, rather unique in the acknowledgement that the authors’ account is also an example of a social construction of scientific facts.

Latour – *Science in Action*
This book gives a very vivid account of science and technology (‘technoscience’, as Latour calls it) in the making. By analysing the technoscience practice (‘follow the actor’) he describes what scientists and engineers actually do, the role of scientific literature, the activities of laboratories, the institutional context of technoscience in the modern world, and the means by which inventions and discoveries become accepted. Latour argues that the then common notion of ‘diffusion’ is not adequate to discribe this process of acceptance and, instead, analyses it as a translation process in which scientists and engineers try to enrol other actors.

Bijker, Hughes and Pinch – *The Social Constuction of Technological Systems*
This book contains a collection of papers first presented at a workshop at the University of Twente in 1984. It was one of the first international gatherings of researchers that were developing new approaches to analyse technical development in relation to its societal embedding. This meeting can be seen as one of he birthplaces of modern technology studies as an international community. The book contains early papers on the SCOT approach (Pinch and Bijker), Systems approach (Hughes) and Actor Network approach (Callon) along with many other studies that inspired later work in the field.

Thomas Hughes – *Networks of Power*
This book does two things. First, it provides an introduction to the analysis of Large Technical Systems. Central concepts to analyze such systems are ‘momentum’ (interdependencies in the system create a direction of developments that cannot easily be changed), ‘reverse salient’. Second, it is a detailed reconstruction of the moves by which Thomas Edison succeeded in creating networks of (electrical) power.

Douglas – *How Institutions Think*
Instead of describing organisational decisions as the outcome of negotiations between powerful individuals within the organisation, Mary Douglas argues in her book (an anthropological study) that organisational decisions are largely shaped by the institutional ‘culture’. In her terms, institutions exercise ‘social control of cognition’.

INTRODUCTIONS

Sismondo – *Introduction STS*
This book provides an introduction into the major debates that have shaped STS. It deals with sociological questions as well as the philosophical issues (positivism, the

Duhem-Quine thesis, falsification). The various standpoints in these debates are introduced, commented upon and illustrated with examples.

Bijker and Law – *Shaping technology/building society: Studies in sociotechnical change*.
This is the product of one of the famous Twente workshops which take place every few years. The Bijker, Hughes & Pinch (1987 – *Social construction of technological systems*) and Misa, Brey & Feenberg (2003 – *Modernity and Technology*) volumes are also the products of Twente workshops. This book has 10 chapters plus an introduction and a 'postscript' by Bijker and Law. This is where you will find Latour's descriptions of doors and keys and the various ways responsibility and action can be delegated to both humans and non-humans. There is also an article by Akrich and one by Akrich & Latour together, which are both often cited in discussions of scripts, de-scription and in-scription.

MacKenzie and Wajcman – *The social shaping of technology*
The first edition of this book was one of the very first books to both introduce the 'social shaping' approach and to bring together important articles from a range of sources. The first edition has four parts. The first includes an excellent introductory essay by the editors together with four classic articles/extracts from books by Langdon Winner, Thomas Hughes, Ruth Schwartz Cowan and Cynthia Cockburn. The other three parts cover production, domestic and military technologies, including some older classic texts from Karl Marx and Harry Braverman as well as newer, more clearly STS texts. The second edition is similarly structured, though instead of a part devoted to domestic technologies there is one devoted to reproductive technologies. Eleven of the 30 chapters in the second edition are the same as the first edition. The new additions are indeed new, having themselves been published after the appearance of the first edition. These are both extremely useful edited collections, which include some familiar names but also ones likely to be less familiar. If you are ever teaching an 'introduction to STS' course, these would be good books to use for students unfamiliar with STS but able to read 'original' texts. The editors wrote a new introduction for the second edition which probably seemed like a good idea at the time. In retrospect, it probably wasn't necessary as the introduction to the first edition is much better and more substantive – setting out clearly different approaches to studying the technology-society relationship, explaining what technology is and how it should be understood as social. If you have the choice, read the introduction to the first edition.

Collins and Pinch – *The Golem at Large. What you should know about technology*
This is the second in a series of books – the first was about science (1993) and the most recent about medicine (2005). Collins and Pinch introduce the golem, a creature from Jewish mythology, made by humans of clay and water, an animated being that neither knows its own strength nor its own ignorance. The golem is used by Collins and Pinch as a metaphor for technology (and science and medicine), drawing attention to the ways in which technology is a product of human activities. Drawing on the STS tradition which focuses on controversies and failure (often associated with the Edinburgh Strong Program, and Collins' interpretation of it), the book presents a series of case studies including the role of the Patriot anti-missile missile in the Gulf War, the Challenger space shuttle explosion, alternative airplane fuels, the Chernobyl nuclear disaster, economic modeling and the contribution of lay expertise to the

analysis of treatments for AIDS. These latter two are particularly interesting, as the case study of economic modeling is a good example of using STS insights to look at something usually considered to be a social science, and the second because it prepares the ground for more recent work by Collins on expertise.

During – *The Cultural Studies Reader*
The *Cultural Studies Reader* offers a wide historical overview of original contributions by such writers as Barthes, Adorno, Lyotard, Stuart Hall, Bourdieu and Spivak (and many more), each with an introduction by the editor pointing at further readings, as well as a wealth of topics, ranging from the city to multiculturalism, to shopping centres and sports. During's introductory essay provides for a good overview of the field.

Misa, Brey and Feenberg – *Modernity and Technology*
Modernity and Technology provides for a collection of papers connecting modernity studies with the sociology and philosophy of technology, ranging from theoretical explorations in the first part to empirical studies in the second to political questioning of technology in the last.

Sorensen and Williams – *Shaping technology, guiding policy*
Shaping technology, guiding policy offers a collection of essays that both theoretically and empirically explore relations between technology and policy, bringing together STS and institutional economic perspectives. The book is written mainly by northern European authors (from the Scandinavian countries, the UK and the Netherlands) and contains a very useful glossary of theoretical concepts (including their origins and references).

Quality Assurance in Training and Supervision Program

Selection of PhD students
The PhD students are selected by the institutes within which they acquire a position, yet the WTMC director decides which of the PhD students applying for enrolment in WTMC will be accepted. Criteria are the relevance of the research for the WTMC research program, the quality of the Training and Supervision Plan, and the reputation of the supervisor.

WTMC cannot directly influence the male/female ratio of PhD students, yet we can raise the issue when discussing the improvement of selection procedures during WTMC Supervisors' Days. However, since 57 percent of the PhD students are female at the moment (June 2010) and 43 percent are male, and since we need more female staff members to get a balanced male/female ratio in terms of staff in the future, there is no immediate need to intervene in the current situation.

Selection of supervisors
WTMC supervisors are assessed upon their request for becoming a WTMC member (in which international peer-reviewed publications and experience in supervising are paramount). Moreover, WTMC trains its supervisors through bi-annual Supervisors' Days.

Model Training and Supervision Plan
WTMC works with a "model" Training and Supervision Plan (TSP), which lists information on: the objective of the PhD trajectory; the research plan; the supervision team (our "best practice" is at least one promoter and one co-promoter); the PhD students' tasks, duties and rights in terms of research, training, and teaching; the frequency of supervision; evaluation; assessment after one year; and relationship of trust.

Communication of final attainment aims of the training and PhD thesis to PhD students
WTMC informs its students with an extensive welcome package, which includes the WTMC model Training and Supervision Plan; a list of WTMC core literature, divided into 1. classics: works systematically introduced and discussed in the WTMC curriculum, 2. introductions and 3. works related to one of the three WTMC research clusters; a note of WTMC core research crafts and skills, with a very detailed list of final attainment aims; information on WTMC's use of a website and wiki, including models for short descriptions of PhD research. As to the final attainment level concerning the PhD thesis itself, WTMC allows for two models: the dissertation based on published articles, and the booklength dissertation, which is usually based on at least three case studies. These models are regularly discussed at workshops and schools.

Codes of Good Practice
Once in two years, WTMC organizes a Supervisors' Day to exchange best practices in supervision. In addition, the welcome package (sent to both supervisors and PhD students), including the "model" Training and Supervision Pan functions as code of good practice.

Monitoring of PhD students
At their "local" universities, many PhD students have to write an extended research proposal within six months of starting their PhD trajectory. In addition, there is a formal go-no go decision one year after the start of the PhD trajectory. This decision is taken by the supervision team. Moreover, each PhD student has one formal review meeting (*functioneringsgesprek*) per year, next to the "daily" monitoring by the supervising team.

WTMC monitors the PhD students' progress during the workshops and schools, at which the WTMC training coordinators talk to *all* students individually at *each* event, and advise the PhD students on problem solving. In case of recurrent problems, they inform the WTMC academic director, who then talks with the supervisors. Moreover, WTMC uses a database for monitoring the progress of PhD students in terms of WTMC courses and the phases of their PhD trajectory. In the near future, WTMC aims to make this monitoring more formal by organizing, in addition to the review activities which we already undertake, one contact moment between each PhD student and the WTMC academic director per year after the first two years of the training program (either face-to-face, through video skype or by telephone).

Evaluation of the courses
WTMC evaluates each individual course, workshop and school on the basis of standard evaluation forms. Both the WTMC Program Committee and the WTMC Board itself discuss the evaluations, which are usually available within a few weeks after each event. In addition, the PhD student advisors in the board organize a questionnaire about the WTMC program every two years.