

TECHNOSCIENCE

Society for social Studies of Science

Newsletter of the Society for Social Studies of Science

Fall 2004: Volume 20, Number 3

Editors' Note

Hello and thanks for reading the Fall issue of Technoscience. During this year's 4s Conference in Paris the Publications Committee came to the following decisions regarding Technoscience:

“(1) Council charged the Secretary (Wesley Shrum) with implementing the transition to a fully web-based membership system within one year. A Members Only section of the web page will include access to the Membership directory.

(2) Council approves the elimination of the Technoscience newsletter and, as soon as feasible, the implementation of a monthly broadcast email with headlines and links to the full announcements.

(3) The Publications Committee is charged with the oversight of web publications and will be enlarged. One matter to be considered by the next Publications Committee is the enrichment of the Members Only site. The Publication and Web Society would like to ensure that the prize award and acceptance speeches, Author-Meets-Critics sessions, and Presidential Plenary sessions be published. Also to be examined are thesis and dissertation abstracts, (b) lists of recently-published STS books, (c) a scaled-up book review effort, (d) tables of contents from STS journals, (e) short articles contributed by members. Publications committee will formulate a plan, together with the new Contributing Editors, for the enhancement of context.

(4) Council determined to use current newsletter funds to support three students. The title of each will be “Contributing Editor, 4S Web Publications.” The three individuals will work together and share information, though they need not be located at the same institution. Each will have a salary of \$3000 annually. The Chair of the Publications Committee has oversight of the work of these three Contributing Editors. The Publications Committee will solicit nominations from the 4S student section and the Council. Two of these will be responsible for managing information on the main page of the site. The third will be responsible for managing information on the Student site, who will be appointed by the Student section. Each of the three general categories for information (Events, Papers & Proposals, Positions).”

As per the committee's decisions this will be the last print version of Technoscience. The editors will continue on as contributing editors to the website where we will join graduate student representative David Conz, a PhD student in Arizona State University's Sociology Department.

We've enjoyed bringing you the print edition of Technoscience over the years and look forward to keeping you informed and involved through our website and the new electronic edition of Technoscience.

Please visit us on the web at <http://www.4sonline.org>

We continue soliciting photos of STS related activities or subjects to be included on the website and contributors for reviews and articles for the new content sections. Please make submissions to any of the editors of the newsletter at their respective email addresses.

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Technoscience- Newsletter of the Society for Social Studies of Science

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ARTICLES

SHIFTING BOUNDARIES BETWEEN SCIENCE AND POLITICS: NEW INSIGHTS INTO THE PARTICIPATORY QUESTION IN SCIENCE STUDIES

By Martin Lengwiler

Most studies on the current state of science policy in Western countries converge on a similar historical picture. Denominations for the periods change and the exact chronology differs from author to author, but authors usually distinguish between two periods in the history of science policy since the Second World War. The first period is usually set between 1945 and the early 1970s. In this era, science policy was based upon a "social contract for science", under which the relations between science and politics were guided by the principle of "blind delegation" granting science wide autonomies of self-regulation (Guston 2000). Since the 1970s or 1980s, as most scholars would argue, this social contract has been replaced by new forms of governance in science policy. As part of this process, the seemingly clear-cut boundary between science and politics was redefined and science in particular was held more accountable to political authorities and to the public. The current literature offers different interpretations for this process: some understand it as the contemporary answer to the "delegation problem of principal-agent-relations" (Braun/Guston 2003); others see the process as the emergence of complex, heterogeneous "government arrangements" (Rip 2002) or as a new regime of "collaborative assurance" in science aiming at increasing the integrity and productivity of research (Guston 2000: 144f.); again others highlight the changing models of innovation, distinguishing the traditional linear from a new co-evolutionary model of innovation as illustrated, for example, in the "triple-helix" model (Etzkowitz/Leydesdorff 1997). Finally, there is a wide literature on the changing research practices, stressing the rising significance of interdisciplinary or transdisciplinary approaches when research is increasingly done in applied contexts with close interactions between theoretical and practical work (Rammert 2003; Nowotny et al. 2003).

This conventional wisdom was the starting point for a conference on the "Shifting Boundaries between Science and Politics". The event took place on June, 25th and 26th, 2004 at the Social Science Research Center Berlin (Wissenschaftszentrum Berlin für Sozialforschung, WZB). The conference aimed at discussing the ways in which boundaries between science and politics blurred and shifted in recent years. In this sense, boundaries were not seen as fixed and a priori given entities, but as continually and controversially redefined distinctions between the fields of science and politics. The question was not only how boundaries get drawn but also how they get surmounted and crossed.

On a theoretical level, the conference brought together two distinct but overlapping approaches: the field of science policy

studies on the one and approaches in STS on the other hand. In recent years, the correspondences between these two approaches have intensified. Science policy studies have started to take constructivist STS and its findings into account, whereas work in STS has increasingly opened up to macro-level analyses in general and to the political context of scientific research in particular (Jasanoff 2004; Guston 2000: 27-30).

One example for this interest of STS in the mechanisms of science policy was the critical reflection of several conference speakers on the question of participation in research and in science policy. This participatory question - namely how to integrate ordinary people or concerned groups into science policy - has become the focus of an extended debate in science studies. Of course, STS has always been interested in the notion of the political ever since the field emerged in the 1970s. The sociology of scientific knowledge has already pointed out the social and political interests involved in the production of scientific knowledge; the social construction of technology programme has revealed the hidden "politics" of artefacts; and more recent work, inspired by a social anthropological perspective, has criticised the historical divide between the realms of nature and of society (including politics), calling for an encompassing "parliamentary of things" (Latour 2004). In recent years, following the critique of technocratic forms of science policy, science studies have stressed the need for more participatory decision processes in research and science policy - a tendency that Sheila Jasanoff has called the "participatory turn" of science studies (Jasanoff 2003). The often normative call for more transparency and for opening up the processes of decision making and knowledge production have recently been amended by a series of empirical studies pointing at real life examples of participatory processes and their experiences, for example in biomedical and climate change research or in science policy in the field of biotechnology and other publicly contested issues (Callon/Rabeharisoa 1999; Kleinman 2000; Wynne et al. 2002; Miller 2001; Epstein 1996; 2003; Pestre 2003).

At the conference, several concepts were brought forward to stress the role of non-scientific groups or "ordinary people" in the research process. In his paper on the "Reflexive Character of Science in Policy", Brian Wynne (University of Lancaster, UK) pointed out what the participatory turn would mean for science. He stressed the need for an "upstream public engagement" (opposed of the traditional downstream engagement) of science. Wynne illustrated the meaning of this upstream engagement with the example of contemporary public risk discourses. He criticised the "deficit" model that was still prevalent in public understanding of science approaches. In risk discourses, science would not acknowledge or even deny the unpredictability of its risk assessments and impose its prescriptive assumptions on the public. Also, science would not apprehend the concerns of a wider public about this state of denial. An upstream engagement of science would instead take into account the human purposes, ends and visions of ordinary people. It would include non-scientific models in expert assumptions.

Based upon a case study of non-expert participation in French biomedical research, Michel Callon (École des Mines, Paris) developed the notion of "emerging concerned groups", a phenomenon he interpreted as heralding a new regime in science policy. His argument was the result of a study of the "Association Française contre les Myopathies", a French patients' organization (see: Callon/Rabeharisoa 1999). Callon defined the concept of "emerging concerned groups" in opposition to the notion of laypersons. Whereas laypersons are usually defined in a clear opposition to experts, the notion of emerging concerned groups transcends the lay-expert-divide. Callon argued that the activities of the AFM are not either political or scientific but both at the same time. By articulating the interests of people with myopathic disorders, the AFM got to influence French biomedical research and simultaneously advanced the social recognition of handicapped people. Both processes were intertwined and resulted in a reconstruction of the patients' identity as well as in the shaping of genetic and clinical research on myopathic disorders. As part of this process, the AFM - itself an emerging concerned group - was also transformed, a change of identity that cannot be expressed with the notion of an engagement of laypersons alone. Contrary to the notion of laypersons, the emerging concerned group is itself being transformed while crossing the boundary between science and the public. Moreover, the phenomenon is an indicator for a wider social change. For Callon the rise of emerging concerned groups is not just limited to the biomedical sphere but a common phenomenon in contemporary societies. The process is in Callon's view at least partly due to changing conditions of economic markets, in particular to the growing significance of networks as a form of market coordination.

A third way of conceptualizing the relation between science and the public was discussed by Christophe Bonneuil (CNRS, France) and Claire Marris (INRA, Ivry-sur-Seine, France). Their contribution took up the concept of an "agora", a concept developed by Nowotny et al. (2001) indicating an open arena for the exchange and negotiation of different interests like scientific, economic or public interests. Bonneuil and Marris looked at the negotiating practices asking whether the agora was rather a flat, transparent or a structured and hierarchised space. In their case study, they compared two debates on genetically modified organisms in France with very different public resonance. The first case, that of GMO impact research, consists of the controversies around the development and testing (by field trials) of transgenic plants as part of the wider debate on genetically modified organisms. In this case the field trials led to acrimonious public controversies, with the effect that the national research institute, the INRA (Institut national de la Recherche Agronomique), changed its policies, retreated from field trials and fostered instead the field of biosafety research - a move that Bonneuil and Marris call the "civic turn" of the INRA. The second case refers to the more recent field of plant genomics, a subfield of plant genetics. Here, the research about genetically modified plants did not cause a public controversy. Bonneuil and Marris explain the differences in the public exposure of the two research fields by the socio-economic context of the research. In plant genomics,

because of changed patent legislation the economic stakes and market interests were comparably high. The oligopolistic interests of the agrochemical industry were directly involved in joint research programs whereas other actors representing the civil society were not included. The comparison shows two completely different "agoras": an open and participatory agora including a diversity of civil interests, and an insular, hierarchical agora dominated by industrial actors and their economic interests.

The paper of Marris and Bonneuil was not the only contribution at the conference pointing out that the notion of 'participation' is often used too naively and that it has to be criticised and made more specific. Their criticism was a reminder that the call for democratizing science may sound good in theory but is difficult to fulfil in practice. First, there is a need to define the context or the arena of participation. Most speakers situated these contexts in some forms of boundary organizations or boundary spaces between science and politics. Boundary organizations were understood as mediators bringing together science and politics more closely in new "governance arrangements" (a concept suggested by Arie Rip, University of Twente, Netherlands). Examples presented at the conference include the consensus conferences in the French GMO-debate (Bonneuil & Marris) or the interaction of biomedical research and concerned groups (Callon). The second criticism of the notion of participation refers to the mechanisms of participatory policies. Sheila Jasanoff (Harvard, Cambridge MA) held that participation was a "necessary but not sufficient condition" for the integration of the public into science, particularly if participation is only granted at the end of a research process. Similarly, Michel Callon warned as mentioned against a romantic view of participatory approaches in science policy. Although science policy needed to open itself for the participation of concerned groups, Callon argued that one should not make the mistake of romanticizing the notion of participation - participatory science policy and research would still take place in the context of an economic market with its own rules. Participatory processes could not substitute commercial activities with non-commercial ones. He called for a new "anthropology of markets" that would insist upon the diversity of market forms of organizations. Dominique Pestre also cautioned against the exploding demands for participative democracy in science policy. In his view, these demands were today becoming cynically instrumentalized by people who would use them as an instrument of government. He pointed out that knowledge promoted by science studies was indeed at the heart of company strategies and government politics for over a decade already.

The critical reflection on the notion of participation seems to be particularly important in areas in which the institutions of the political system are still weak - as for example in global governance. A striking case for this problem was brought up in the paper of Clark Miller (University of Wisconsin, Madison, USA). Miller pointed at the political deficit of global governance: an area of the political system lacking strong political institutions and developed means of democratic control. Thus, on the global level, it was not science learning from the system

of political representation - but, as Miller argued, the other way around. Expert committees in the field of climate change research had already developed participatory organizations based upon a pluralistic notion of knowledge. In this sense, these international expert institutions were able to contribute to the democratization of international governance.

In this sense, several speakers demanded a more radical understanding of the notion of participation in STS. One example was Andy Stirling's (SPRU, University of Sussex, UK) paper on "Opening Up and Closing Down? Justification, precaution and pluralism in science and technology policy". Stirling distinguished between the top-down side of science policy, which he called the "unitary and prescriptive" perspective, and the bottom-up side, the "plural and conditional" perspective. He criticised that in STS both perspectives were still largely unrelated to each other and argued that - even if the tensions between the two poles remained ultimately irreconcilable - both perspectives should be much more integrated. Others expanded the claim for participatory approaches beyond the limits of science policy. Sheila Jasanoff called for a "New Social Contract" between science, the public and the state, in order to meet the democratic challenges to science and technology policy. The contract she outlined would include some basic constitutional principles defining the meaning of a new citizenship in a knowledge society, based for example on the right to cognitive representation of the knowledge-bearing citizens of a knowledge society. Dominique Pestre (EHESS, Paris) demanded a critical broadening of science and technology studies. Just focusing on the narrow question of participation would not be enough, the financial and political context of science needed critical reflection too. Drawing on Luc Boltanski's and Eve Chiapello's "New Spirit of Capitalism" he warned that STS approaches too narrowly focused on participation were at risk of becoming caught up in today's dominant social and political discourses. STS would only be able to escape this risk by thinking more globally and radically broaden the areas of study and forms of action.

It was not a coincidence that the conference was held at the Social Science Research Center (Wissenschaftszentrum Berlin für Sozialforschung, WZB) in Berlin. Currently, the WZB fosters its activities in the fields of science studies and science policy studies. By its mission, the WZB is committed to problem-oriented basic research based on a strong empirical foundation. It investigates developmental trends, problems of adaptation, and possibilities for innovation of modern societies with a strong emphasis on international comparisons, processes of transnationalisation and the historical conditions of these trends. The conference has encouraged the WZB to continue investigating the relations and boundaries between science and politics from a historical and an international comparative perspective. Also, the event has illustrated the need to contextualize the current changes in science policy by reflecting their wider social, cultural and economic conditions.

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Bibliography

- Braun, Dietmar; Guston, David H. (2003). Principal agent theory and research policy: an introduction. In: Science and Public Policy, Vol. 30 (5), S. 302-308.
- Cambrosio, Alberto; Limoges, Camille; Pronovost, Denyse (1990): Representing Biotechnology. An Ethnography of Quebec Science Policy. In: Social Studies of Science, Vol. 20, S. 195-227.
- Epstein, Steven (1996): Impure Science: AIDS, Activism, and the Politics of Knowledge. Berkeley: University of California Press.
- Epstein, Steven (2003): Inclusion, Diversity, and Biomedical Knowledge-Making: The Multiple Politics of Representation. In: Oudshoorn, Nelly; Pinch, Trevor (Eds.): How Users Matter: The Co-Construction of Users and Technology. Cambridge, MA: MIT Press, S. 173-190.
- Etzkowitz, Henry; Leydesdorff, Loet (Eds.) 1997: Universities and the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations. London: Cassell Academic.
- Guston, David H. (2000). Between Politics and Science. Assuring the Integrity and Productivity of Research. Cambridge: Cambridge University Press.
- Jasanoff, Sheila (2003): Technologies of Humility: Citizens Participation in Governing Science. In: Minerva, Vol. 41, S. 223-244.
- Jasanoff, Sheila (ed.) (2004): States of Knowledge. The co-production of science and social order. London: Routledge (International Library of Sociology).
- Kleinman, Daniel Lee (2000): Science, technology, and democracy. Albany: State University of New York (SUNY series in science, technology, and society).
- Latour, Bruno (2004): Politics of Nature. How to Bring the Sciences into Democracy. Cambridge MA: Harvard University Press.
- Miller, Clark (2001): Hybrid Management: Boundary Organizations, Science Policy, and Environmental Governance in the Climate Regime. In: Science, Technology, & Human Values, Vol. 26 (4), S. 478-500.
- Nowotny, Helga; Scott, Peter; Gibbons, Michael (2001): Re-thinking science: knowledge and the public in an age of uncertainty. Cambridge: Polity.
- Nowotny, Helga; Scott, Peter; Gibbons, Michael (2003): "Mode 2" Revisited: The New Production of Knowledge. In: Minerva, Vol. 41, S. 179-194.
- Pestre, Dominique (2003): Regimes of Knowledge Production in Society: Towards a More Political and Social Reading. In: Minerva, Vol. 41, S. 245-261.
- Rammert, Werner (2003) : Zwei Paradoxien einer innovationsorientierten Wissenspolitik : Die Verknüpfung heterogenen und die

Verwertung impliziten Wissens. In: Soziale Welt. Zeitschrift für sozialwissenschaftliche Forschung und Praxis, Vol. 54/4, S. 483-508.

Rabeharisoa, Vololona; Callon, Michel (1999): Le Pouvoir des Malades. L'Association française contre les Myopathies et la Recherche. Paris.

Rip, Arie (2002): Co-Evolution of Science, Technology and Society, Expert Review for the BMBF. Enschede (<http://www.sciencepolicy-studies.de/>).

Wynne, Brian (2002): Risk and Environment as Legitimatory Discourses of Technology: Reflexivity Inside Out? In: Current Sociology, Vol. 50 (3), S. 459-477.

PROFESSIONAL ADVICE FOR THE INTERDISCIPLINARY STUDENT by Torin Monahan

When the graduate director in my department requested that I speak to graduate students about "professionalization," my mind started racing through all the things I wish somebody would have told me. Having just landed a tenure-track job in an interdisciplinary department, I realized that I had a lot to say. I felt the conflicted duty of having to demystify the professionalization process without taking the magic out of it; meanwhile, to be honest, much of the process remains opaque to me still. The more pressing concern was what to tell graduate students getting interdisciplinary degrees when most of the job market is organized around traditional disciplines?

Networking, I began by telling them, is the key to making the academic system work for you. If academia is a complex social world and scholars are trained to make sense of such worlds elsewhere, when it is considered "research," then why not use those analytical skills to understand our profession? Networking is one conceptual tool that can be used for this purpose, and it can also be put into practice even when one is unaware of it. For instance, I related how someone I did not know previously saw one of my conference presentations and invited me to give a lecture at his university, and then how this lecture evolved into a publication. Or how I was short-listed for a job, in part, because several faculty members in the department knew one of my committee members. In this second case, I was embedded in networks that I didn't even know about.

Once one begins to see networks not just as serendipitous occurrences but as ubiquitous operations, one can intentionally cultivate them. Networking in this sense should not be perceived as instrumental or base, because it is, in fact, what drives intellectual endeavors and research programs. After all, we want to talk to and learn from people who are working in our fields; we want to contribute to ongoing conversations about what is important to us. Even job interviewing can be - and I think should be - seen as a chance to meet new colleagues and have new conversations, regardless of whether or not a job is the immediate outcome of that experience.

What are some strategies for networking wisely? First, read widely and generously to forge connections across literatures and fields. This is especially true for interdisciplinary scholars, because it is what they'll be good at and what they'll be valued for. Disciplinary traditions generally inculcate biases that can be side-stepped by making connections across literatures and making colleagues across disciplines. It is an asset for all of us to be able to think outside of our specialty areas, because this enables us to talk well with others who don't do what we do and to see where our work fits into the larger intellectual terrain.

Second, write often and publish what you write. As a graduate student, I frequently marveled that almost every improvised theoretical insight made by my advisor during our conversations would somehow find its way into print. But isn't this what the profession is about: being an active part of an intellectual community and contributing to it? From this perspective, every seminar paper should be viewed as a publication opportunity, an invitation to write for a wider audience, to submit articles for publication, to improve upon them with reviews, and to use them as occasions to get to know others.

For instance, one of my qualifying exams was a review of literature on Los Angeles. I then published that piece as a book review essay, sent it to several of the authors I reviewed, and they have since contacted me about conference panels and other publications. I see this as good networking, and this conclusion is supported by the fact that several of the authors I reviewed have since sent me some of their works-in-progress for commentary (or just for my general awareness about what they're up to). Because we can help those around us to do better work too, and they can help us, the relationship becomes a reciprocal one, an almost karmic loop, returning back to us with good things.

Third, develop an Internet presence. In order to be a resource for others, our ideas must be easily accessible and we should be receptive to unsolicited contact from strangers. Maintaining a web site with articles, works-in-progress, research interests, and contact information is one excellent way to achieve this. Because of my web site, I've had many people contact me wanting advice about graduate programs, about reading suggestions for their research, about student projects, and even about non-scholarly needs such as which educational technologies I thought their children should use. While this may sound like a lot of extra labor, it's really not, when you consider that I've also had people contact me with invitations for publications, for conference panels, for technical consulting, and so on. Making yourself and your work available for others is good scholarly practice with great rewards.

Fourth, and last for now, participate in conferences, workshops, and colloquia. Too often I hear graduate students say that they have nothing to contribute yet, and so they'd rather not involve themselves in these professional events. This perception is only accurate when scholarship is viewed through the myopic lens of formal information dissemination. As networking events, however, conferences and the like are opportunities to meet people, to listen to academic discourses, to observe how people ask and answer questions, to see what others find interesting or important, and to begin to figure out where we can contribute to ongoing

ing conversations that interest us rather than pretending that we must invent something from scratch.

One should begin networking while still in graduate school, and the earlier the better - afterwards, it will likely be too late. Lest this narrative sound too pollyannaish, let me say that not only is networking a lot of work, but it won't always get you what you want either. Some of my colleagues from graduate school who are much better networkers than I am haven't secured academic positions, so chance, fashion, and power play roles in success. What is clear to me, nonetheless, is that one's chances can be improved by networking well. It's not just about who you know, although - as far as I can tell - old boys' and elite university networks do persist, but more about actively building and/or contributing to research programs.

These suggestions may seem entirely self-evident, and they may be! That said, I hope that this articulation alone has helped. As with research methods, topics, and theories, it's important to be selective about what works best for you and to be selective about which conversations you want to be a part of. As interdisciplinary scholars, the communities that we involve ourselves with have disparate compositions and orientations, and our strength rests in our ability to link people and ideas, regardless of (and sometimes in spite of) disciplinary boundaries and conventions.

Acknowledgments: Much of what I've said here was gleaned not just through experience, but through conversations with others and through the incredibly helpful writings of Philip E. Agre and David J. Hess.

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TECHNOLOGY STUDIES AND NORMATIVE CHANGE: BETWEEN THE UMBRELLA AND ECO-SANITATION?

**By
Govind Gopakumar**

Informal settlements (also referred to as squatter, slum or shack settlements) are an inseparable ingredient of the complex urban reality in India and other developing nations. One sees them everywhere (especially in teeming metropolises like Mumbai, Delhi and Bangalore in India) - on pavements, beside railway tracks, beside highways, on vacant land and even in parks. These inhabitants of the cities live their exposed lives almost entirely in the public gaze. It is another matter that most of the more fortunate denizens of the city either never notice their existence or if at all they do, turn their heads away as if that would erase their presence. But how these inhabitants manage to eke out their public existences is a thought that seldom occurs to us more fortunate residents in an urbanizing world. The operative words that give an understanding of their condition being manage and eke. These words imply the ability of these 'informal' inhabitants to employ their accumulated life experiences,

meager resources and culturally rooted notions in crafting their life support systems. These practices are especially significant in matters that concern the provision of essential services like water supply, sanitation, transport, health and energy. Of particular interest are the interventions on the issue of sanitation. How can technology studies present not just an understanding of these efforts in the crucial arena of urban sanitation but also prescribe 'reconstructivist' (Woodhouse et al, 2002) interventions based on a normative position, this has been a thought that has occupied my mind.

A conversation that I had with two young 'sanitation' activists, working in informal settlements in Mumbai, India drove the relevance and importance of that point home very forcefully. My description of the discipline of technology studies and of my interest in water and sanitation efforts in squatter settlements were met with a question that required me to make clear my normative position on the issue - 'Are your interests with the Umbrella or with Eco-sanitation?' While I was at pains at trying to suggest that I support neither option but a more culturally and politically preferred option, I am not sure I convinced the activists. The umbrella in this context refers to its use, largely by women, as a device to shield their act of defecation in public spaces in slums from the unwanted gazes of voyeurs. The umbrella becomes an artifact in aiding the cultural act of defecation. There are facets about the use of the umbrella in defecation that no doubt would be of interest to many from a technology studies perspective. For example, its use in ablutions suggests a radical re-interpretation of the artifact from its explicit design aims of providing shelter to the bearer from the elements. Any design alterations in the umbrella that better accomplish this new aim disinter an interpretative flexibility in a device that achieved closure many years ago. The study of the umbrella and defecation could be framed as a sociological study of how relevant social groups (mostly women) modify the cloth or the spokes of the umbrella in an effort to provide better coverage for the private act of excretion in a public space.

Eco-sanitation refers to various 'high-tech' toilets (many vacuum operated) that separate urine from the feces in order that the composting of the feces can proceed. The logic behind these composting toilets is to eliminate the use of water (a major source of the drain of scarce water resources available to cities) to flush human wastes. The primary motivation behind the composting toilet is to close the circle of nutrients that contemporary flush toilets interrupt. By returning human wastes as nutrients to the soil, a major resource imbalance could be corrected if environmental advocates are to be believed. Doing so, the average ecological footprint (Wackernagel and Rees, 1996) of the human on the earth's land and water resources could be reduced considerably. The need to reduce the ecological footprint of the inhabitant or resource throughput through the economy is seen as one of the major determinants of achieving the green agenda of environmental sustainability. This is of particular concern for affluent countries whose average footprints far exceed the available per-capita footprints in these nations. Unfortunately many of these technically advanced toilets attach little importance to cultural notions of cleanliness that are associated with the act of defecation and the use of water. For example, for many Indians

(even affluent ones) the thought of using toilet paper for defecation is outright revolting. The argument for the composting toilet rests on the technical fix it provides to the aim of minimizing natural resource throughput. The question - 'Do you support the Umbrella or Eco-san?' thus seems to very comprehensively summarize the predominant positions within the spectrum of sociotechnical science on technical change not only on sanitation but also generally. Should the scholar merely observe society dispassionately (as in the case of the umbrella) or should she suggest new changes based solely on her technical expertise (as in the case of eco-sanitation)? Is there another position between these extremes that we as scholars, who wish to see a positive change in the world, need to aspire for?

Technology has predominantly been conceptualized and researched in North America and Europe, its engagement with non-Western contexts has been limited. Shrum and Shenhav in the Handbook of Science and Technology Studies state that research on technology in less developed countries has been informed by the need of these countries to industrially develop and for their economies to grow. Thus research studies are mostly concerned with the dynamics of international organizational technology transfer, the process of generation and adaptation of technology largely within the industrial environment in developing countries, and the social effects of technological change (Shrum and Shenhav, 1995). In short the interest in technology in the developing country context was largely restricted to an understanding of technology as a productive force in the macro-economy or as an external force that could exert a beneficent effect on a tradition-bound society. But such studies rarely if at all locate the societal responses to technologies from within the cultural realm. A reason for this could be because of the differing cultural relationships to technology. Sarukkai has suggested that in the West, technological developments have happened in a cultural ethos where they were accepted and tolerated because of the close association of scientific technics with Western modernist culture. However, Sarukkai goes on to suggest that the relationship between modern Western technology and Indian (or non-Western) cultures has been ambivalent even uneasy. Thus in these cultures one witnesses such practices as worship and rituals offered to scientific artifacts not only with the hope of divine mediation in their successful use, but also as a means to introduce a cultural familiarity into the 'alien' technical construction (Sarukkai, 2003).

Recent studies located within the confines of postcolonial theory have attempted to understand the relationship between culturally-situated societal spaces to 'Western' technologies and the structures of Western technical disciplines from a different perspective. As Young points out "postcolonial theory involves a conceptual reorientation towards the perspectives of knowledges as well as needs, developed outside the west.... postcolonialism seeks to intervene, to force its alternative knowledges into the power structures of the west as well as the non-west....Its radical agenda is to demand equality and well being for all human beings on this earth" (Young, 2003). Kusno focuses on the postcolonial urban space in Indonesia as a site of official (both colonial and postcolonial) intervention and local contestations against these external impositions. Kusno notes that

the Indonesian kampung attains a visibility not seen earlier in the efforts of the imported urban design paradigm to improve the kampung and to introduce a sense of order into the perceived chaotic conditions within it. The underlying aim of this technical intervention was "to provoke a sensibility of "modern" living and a sense of order in the kampung" (Kusno, 2000: 129). Nalbantoglu in her study of the architecture of squatter settlements of Ankara has noted that "carved dwellings of the squatters never came to the architect's attention" since "they produced new and hybrid articulations" that "defy conventional architectural analysis" (Nalbantoglu, 1997: 99). This is because squatter settlements defy being hermetically categorized as 'modern' or 'primitive' given that they are created in a pre-modern mold but are populated by products of the modern city. By transcending fixed disciplinary polarities of traditional/modern, these sites "reveal the partial, precarious and limited nature of architectural truths" (Nalbantoglu, 1997: 98) - disciplinary truths that are reinforced by the obsession of the discipline with formal studies to the "exclusion of the notion of "lived spatiality"" (Nalbantoglu and Thai, 1997: 11). A similar assertion can be made about the exclusion of the "lived technics" of the inhabitants of squatter settlements from within the purview of the formalized engineering discipline.

But the 'subaltern' does not just receive the attentions (or lack there of) passively. The subaltern is active in subverting the process of technical deployment in society and redefining the notion that the expert is the sole producer of technologies. The accepted view is that technologies are deployed in society according to the specifications of designer/engineers while the rest of society passively accepts and consumes technologies. The concept of appropriating technologies questions the existence of the neat polar dichotomy between the producer and the consumer and in its place suggests a consumer who actively reshapes the deployed technology not only in its associated semantics but also in its structure and use as well (Eglash, 2004). Eglash notes that while appropriations of technologies "do not have an inherent ethical advantage" they retain the potential to make "contributions to a stronger democracy" (Eglash, 2004). Returning to the use of the umbrella, the claim can be made that the semantics if not the structure of the umbrella have been altered in order to facilitate the culturally sensitive act of defecation. But can we view this as a politically positive, reconstructivist intervention that contains the possibility for a democratic empowerment or for a sustainable urban experience. I am not so sure. Before we proceed any further in describing the schema for possible reconstructivist directions with regards to sanitation technologies, it would be instructive if we make a detour to understanding the concept of sustainable cities in the South.

The notion of sustainable cities has been derived from the globally accepted discourse of sustainable development whose defining concepts are invariably traced to the World Commission on Environment and Development's (WCED) report entitled Our Common Future - 'meeting the needs of the present without compromising the needs of future generations to meet their own needs' (WCED, 1987). The concept of sustainable development has evolved into a 'weak' techno-manage-

rial alternative and a 'strong' behavioral change alternative. The Sustainable cities discourse in the affluent nations has drawn upon these two alternatives to suggest means such as reduction of resource consumption, local waste absorption, use of renewable resources, and compact land-usages to an ecological city. Mahadevia suggests that transferring this discourse to the urban situation in the South ignores the critical issue of meeting basic human needs which still remains largely unmet. Consequently the 'move towards a sustainable city in the South has to be an inclusive approach based on four pillars - environmental sustainability, social equity, economic growth with redistribution and political empowerment of the disempowered (Mahadevia, 2002). So a sustainable city in the South with its slums and squatter settlements demands not just environmental sustainability but a political empowerment of the people living in informal settlements. A reconstructivist agenda for technological interventions in the sanitation realm needs to be framed as contributing to these goals. Seen in this light it is quite clear that the Umbrella as a sanitation technology does not contribute to environmental sustainability, and neither does it seem to hold the potential for the empowerment of women who hold the umbrella while squatting.

In the contemporary philosophy of technology, there exist two noteworthy reconstructivist schema that allow for technological deployment in politically preferred directions. Sclove suggests a strong technical democracy as the preferred direction while Feenberg argues for a representative technical democracy. According to Sclove, "The overall objective ought to be a technological order that structurally manifests a [strong] democratic design style" (Sclove, 1995). The essence of this strong democratic technological order manifests in a procedural concern with extensive citizen participation in technological decisions, but also a substantive concern where the basic technological structure and technological design needs to be in keeping with strong democracy. The Sclovian notion hinges on the presence of a commitment to a strong democracy in the political realm which would then permeate social structures including the technological order. But in the Sclovian schema how could one regard the large technical system providing water supply and sanitation services and the use of the umbrella by those without any access. Would the use of the umbrella be equivalent to "seek relative self-reliance, avoid technologies that promote dependence and loss of autonomy" (Sclove, 1995). It is my impression that Sclove would disagree with this statement but it is not clear how local self-reliance in sanitation can be achieved without communication with the large technical network. Feenberg on the other hand provides a more productive schema for framing the dialog between the marginalized users of sanitation services and the large technical system. Feenberg's notion of a representative technical democracy centers around exerting a democratic influence on technical representatives - engineers, experts etc. The objective is to alter, by the mediation of participant interests, technical codes that socialize the representative in socially preferred directions (Feenberg, 1999). The process by which public inputs are introduced into the technological apparatus, according to Feenberg, is through democratic rationalization which he understands as the actualization of technological ambivalences that are suppressed by the prevailing technologi-

cal rationality. Feenberg sees technical micropolitics as a means to actualize these latent potentialities within technical systems. But he is clear that the non-ideological resistances that constitute technical micropolitics are those that are directed at the "structure of communicative practices" in the technical networks. According to this schema the use of the umbrella in sanitation would not constitute a technical micropolitics since the resistance they represent is not constituted around the technical network. As Feenberg mentions - "Neither ideologies or clientelles hold them [technical micropolitical resistances] together but the very technical networks they challenge (Feenberg, 1999: 120).

In order to conclude and answer the question posed, I do not support either the umbrella or Eco-sanitation but a politically and culturally preferred option. I would not like to propose a solution without an examination, but I will say that some recent efforts at community managed sanitation services do seem to incorporate dimensions which closely parallel the Feenbergian reconstructivist schema outlined here.

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References

- Eglash, Ron. 2004. *Appropriating Technologies: An Introduction*. in R. Eglash, J.L. Croissant, and G. di Chiro (Eds.), *Appropriating Technology: Vernacular Science and Social Power*. Minneapolis: University of Minnesota Press.
- Feenberg, Andrew. 1999. *Questioning Technology*. London: Routledge.
- Kusno, Abidin. 2000. *Behind the Postcolonial - Architecture, urban space and political cultures in Indonesia*. London: Routledge.
- Mahadevia, Darshini (2002), "Sustainable Urban Development in India: an inclusive perspective", in D. Westendorff and D. Eade (Eds.), *Development and Cities - Essays from Development in Practice*, Oxford: Oxfam GB.
- Nalbantoglu, Gulsum B. 1997. "Limits of (in)Tolerance: The Carved Dwelling in the Architectural and Urban Discourse of Modern Turkey", in G. B. Nalbantoglu and W. C. Thai (Eds.), *Postcolonial Space(s)*. New York: Princeton Architectural Press.
- Nalbantoglu, Gulsum B. and Wong C. Thai (1997), "Introduction" in G. B. Nalbantoglu and W. C. Thai (Eds.), *Postcolonial Space(s)*. New York: Princeton Architectural Press.
- Sarukkai, Sundar. 2003. *Praying to Machines*. In *Leonardo Electronic Almanac*, Vol. 11, Issue 8.
- Sclove, Richard. 1995. *Democracy and Technology*, New York: Guilford Press.
- Shrum, Wesley and Yehouda Shenhav. 2001. *Science and Technology in Less Developed Countries*. In S. Jasanoff, G. Markle, J. Petersen and T. Pinch (eds.) *Handbook of Science and Technology Studies*.

Thousand Oaks: Sage Publications Ltd.

Wackernagel, Mathis and William Rees. 1996. *Our Ecological Footprint - Reducing Human Impact on the Earth*. Gabriola Island, BC: New Society Publishers.

Woodhouse, Edward, David Hess, Steve Breyman, and Brian Martin. 2002. *Science Studies and Activism: Possibilities and Problems for Reconstructivist Agendas*, *Social Studies of Science*, 32:297-319.

World Commission on Environment and Development (WCED). 1987. *Our Common Future*. New York: Oxford University Press.

Young, Robert C. 2003. *Postcolonialism: A very short introduction*. New York: Oxford University Press.

VIRTUAL MIND CONTROL: NONVIOLENCE AS THE PINNACLE OF EXCELLENCE FOR INFORMATION-AGE CONFLICT

By Sean Lawson

In general, the method for employing the military is this: Preserving the [enemy's] state capital is best, destroying their state capital second-best. Preserving their army is best, destroying their army second-best... For this reason attaining one hundred victories in one hundred battles is not the pinnacle of excellence. Subjugating the enemy's army without fighting is the true pinnacle of excellence.

Thus the highest realization of warfare is to attack the enemy's plans...
--Sun-tzu

There is no more precious asset for a general than a knowledge of his opponent's guiding principles and character... In the same way the commander must train his eye upon the weak spots in his opponent's defense, not in his body but in his mind.
--Polybius

There is required for the composition of a great commander... an element of legerdemain, an original and sinister touch which leaves the enemy puzzled as well as beaten.
--Winston Churchill

Introduction

The idea of winning without fighting is not new. To convince one's opponent to lay down his weapons without the recourse to force is seen as a special kind of victory, a victory born not of physical power but of mental power, an almost mystical ability to reach into an opponent's head and alter his thoughts, the ability virtually to control his mind and manipulate his will.

The idea has not been lost on contemporary American strategists. In the post-Vietnam period, a growing number within the U.S. defense establishment have argued that the fundamental nature of warfare is changing and, as a result, have proposed changes to the U.S. military of one form or another.

Common to these proposals is an increased emphasis on the nonphysical forms of conflict which betrays the Western tradition of seeking victory through the direct clash of arms in decisive battle. As such, information and decision-making play an increasingly important role in U.S. military strategy, with the greatest revolution in U.S. military affairs taking place in the areas of command, control, communications, computers (C4); intelligence, surveillance, reconnaissance (ISR); and precision guided munitions (PGMs). In the area of C4ISR, the U.S. seeks to achieve "information dominance," the ultimate goal of which is to allow it to alter the enemy's perceptions, decisions, and will to resist. In the use of PGMs, it seeks to realize its goals by expending minimal effort and incurring minimal destruction.

This paper outlines the arguments that U.S. strategists have made in an attempt to articulate a strategy of (what I call) virtual mind control (VMC). First, it places VMC in the context of the Western tradition of warfare. Second, it argues that VMC is pursued on two levels, the tactical and the strategic. Third, it argues that the quest for VMC, combined with increasing reliance on PGMs and effects-based operations, leads to force becoming a display meant more for psychological rather than physical effect. Finally, the paper ends by highlighting some objections that have been raised to a reliance on an information-based strategy of VMC.
Western Military Tradition

It is commonly held among military historians that there are important overarching differences between the Eastern and Western military traditions. Most often represented by Sun-tzu's classic, *The Art of War*, the Eastern tradition is said to place more value on maneuver and deception, while the Western tradition is said to place more value on the direct clash of arms in decisive battle. Illustrating the longevity and entrenchment of the West's military traditions, Hanson (1989) traces what he calls "the Western way of war" to Greece in the classical period. He has argued that "The Greeks' stark way of battle left us with what is now a burdensome legacy in the West: a presumption that battle under any guise other than a no-nonsense, head-to-head confrontation between sober enemies is or should be unpalatable." He continues, "It is taken for granted in our culture...that the only way to defeat an enemy is to find and engage him in order to end the entire business as quickly and directly as possible; and so they have entered upon that crowning absurdity of warfare, the pitched battle." The Western desire for pitched battle also includes a "desire to deliver heavy blows and then steadfastly to endure, without retreat, any counterresponse," as well as a "desire for a single, magnificent collision of infantry." In these "desires" we see the roots of attrition warfare, the doctrine of overwhelming force, and the search for the decisive battle.

Latimer (2001) argues that deception, while it has played an important part in Western warfare, "is often seen as immoral," or as a tool of the weak. Hanson (1989) concurs when he notes the West's historical "distaste for what we call the terrorist, guerrilla, or irregular who chooses to wage war different-

ly." "Differently" in this case usually involves "uncanny success at ambush and evasion of direct assault: they seek not to engage in but rather to avoid infantry battle." Thus, our modern notion of a "fair fight" has its origins in the Greek way of warfare-Hanson reports that Alexander the Great, when urged to attack the Persians at night, rejected the idea as a policy of "bandits and thieves, the only purpose of which is deception."

The United States has not been an exceptional case; American military thinking has fit well within the Western tradition. It is often said that Americans should be adept at fighting guerrillas and terrorists because, after all, the Americans fought as guerrillas in the Revolutionary War. However, Weigley (1986) has pointed out that there has been a "tendency to exaggerate the impact of the forest warfare of the Indians upon the soldiers" of the American Revolution. Instead, he argues that "American ways of war were offshoots of European ways of war, and American strategic thought was therefore a branch of European strategic thought." It was, he argues, George Washington who was the chief advocate for adopting European modes of war. Far from being a revolutionary or guerrilla leader, as some have argued, "Washington eschewed the way of the guerrilla" and thus "conducted the Revolution as a conventional war, in terms of both tactics and adherence to the international law of war."

The tradition continued into the twentieth century. Latimer (2001) explains that "for a long time deception did indeed run counter to the American concept of military honour. There was a strange reluctance among some Americans during the twentieth century to accept it as part of modern warfare." This reluctance would extend to U.S. involvement in World War II, as well as Vietnam. Americans have instead sought the direct clash of arms in decisive battle that is their Western heritage. Hanson (1989) writes, "American thinkers have given more importance to the immediate application of power against the enemy than to the arts of maneuver and envelopment." He argues that, in Vietnam, the U.S. "failure to lure the North Vietnamese army into a Western-style shootout is what finally paralyzed the huge land army of the United States and forced it to abandon the entire theater."

The Mind at War

The United States' shocking defeat in Vietnam led many within the defense community to question U.S. strategy. While that debate manifested itself publicly as a debate over the proper relationship between technology and strategy, over military budgets and acquisition programs, at a deeper level it was a debate over the merits of the Western way of war and the United States' employment of it. Thus, in the last thirty years it has become common within the U.S. defense community to hear the argument that "We have put ourselves out of business, so to speak: for any potential adversary has now discovered the futility of an open, deliberate struggle on a Western-style battlefield against the firepower and discipline of a Western infantry" (Hanson 1989). In addition to its ineffectiveness against guerrillas, insurgents, and terrorists in the twentieth century, Barnett (2004) argues that "globalization, with an assist from the spectre of nuclear weapons, has effectively killed the idea of great-power war-all-out conventional (non-

nuclear) war among the world's most powerful states that concludes only when one side is completely defeated." As such, in the post-Vietnam period there has been increasing emphasis on the nonphysical aspects of conflict, especially command and control, information-gathering of all types, and deception. Where force has been used, it has grown ever more precise, with increasing attention paid to its nonphysical rather than physical effects-both "shock" and "awe" are states of mind.

The U.S. defense community has been influenced to a great degree by the ideas of the late USAF Colonel John Boyd. A fighter pilot, engineer, and self-taught military theorist, Boyd was the intellectual core of the Military Reform Movement, which spanned a period roughly from 1976 to 1986. A critic of American strategy, he advocated the adoption of maneuver warfare principles and more attention to the nonphysical aspects of conflict. His thinking resulted in the development of a decision-cycle model that is widely used within the U.S. military to this day: the OODA loop, or observation-orientation-decision-action loop.

In its final formulation, Boyd's theory looks like a schematic of a cybernetic feedback system. In the process of interacting with their environments, humans construct mental models of that environment that are shaped by immediate observation as well as orientation (based on previous experience, culture, history, genetics, etc.). The mental model is then used to decide on/carry out a course of action. The results of the action feed back into the system through observation. Yet, there is always a necessary tension between the mental model and reality, a problem of representation. Thus, the process, according to Boyd, is always one of "destruction and creation," destroying old models and creating new ones in a never-ending process. The goal of this behavior is to be flexible enough to adapt to an ever-changing environment so as to promote individual survival by increasing the individual's capacity for independent action.

Boyd admits that we both shape and are shaped by our environment. More importantly, he admits that orientation (pre-understanding) shapes our perceptions of what we think we are seeing. Thus, as time passes, he argues that there will always develop a mismatch between our mental models and reality. If we become internally focused, sticking to out-dated orientations, then a breakdown occurs in our understanding, leading to disorder, chaos, confusion, and panic.

In applying these ideas to command and control, Boyd emphasizes the importance of shared orientation, what is commonly referred to these days as "shared awareness." This shared orientation, according to Boyd, fosters the growth of implicit bonds of trust between soldier and commander which allow for command-by-intent rather than command-by-direction. He emphasizes themes such as commonality, connectedness, harmony, and holism, where the military force is seen as a "collective entity," an "organic whole," a "system." This allows one to "Operate inside [an] adversary's [OODA] loop to enmesh [the] adversary in a world of uncertainty, doubt, mistrust, confusion, disorder, fear, panic, chaos...and/or fold [the]

adversary back inside himself so that he cannot cope with events/efforts as they unfold" (Boyd 1987). The ultimate goal is rapid adaptability for the U.S. military and a failure to adapt for the adversary. By causing the adversary to be internally focused, the mismatch between his mental model and reality grows over time. He becomes utterly confused and disoriented. In Boyd's thinking, this has an effect on time. Reaction time for the U.S. military becomes compressed, while reaction time for the adversary is stretched. Conversely, observed time becomes stretched for the U.S. and compressed for the adversary. The ultimate goal is to control the perceptions and decision-making of an adversary.

Originally formulated purely within the context of air-to-air combat strategies, Boyd's ideas have migrated upwards, being applied to ever higher levels of conflict. The application of OODA loop thinking could be seen at the operational level in Operation Iraqi Freedom. Murray and Scales (2003) write that, whereas the 1991 Gulf War relied on overwhelming force in the form of mass, the Iraq war of 2003 focused on "overmatching power"-attacking the enemy across such a broad spectrum of capabilities that his military would suffer systemic collapse." They describe the elements of "overmatching power" in terms associated with Boyd's OODA loop. The U.S. advantage in shared situational awareness over the Iraqis, combined with the "simultaneity, speed, and unpredictability" of the U.S. attack, gave the U.S. the ability to react to Iraqi threats while at the same time actively denying that same capability to the Iraqis. As such, they contend that adaptation to the unexpected and continuous improvisation were critical elements of the U.S. strategy.

Yet, at both the tactical and operation levels, the ability to influence an adversary's perceptions and decisions have so far served mainly as an aid to the application of force, allowing the U.S. to apply force more precisely and effectively, while denying that same capability to the adversary. But the ultimate goal is to influence an adversary at the strategic level, to win without fighting. That is where VMC comes in.

Virtual Mind Control is based on the tenet that to influence the will of one's opponent is the basic goal of conflict and that, therefore, all means capable of influencing the will, including inducement, cooptation, coercion, deterrence, and even force should be employed. Szafranski's (1997) notion of "neocortical warfare" expresses an important aspect of the drive towards VMC; Neocortical warfare is warfare that strives to control or shape the behavior of enemy organisms, but without destroying the organisms. It does this by influencing, even to the point of regulating, the consciousness, perceptions and will of the adversary's leadership: the enemy's neocortical system. In simple ways, neocortical warfare attempts to penetrate adversaries' recurring and simultaneous cycles of 'observation, orientation, decision and action'.

Szafranski explains that neocortical warfare has several characteristics. "First, it recognizes that competition, conflict and conflict resolutions are permanent features of the human condition... [N]eocortical warfare rejects the notion that warfare

is an aberration." "Second, a theory would accept that adversaries will wage-war even as you read this-neocortical warfare against us." Thus, he concludes that "we should devote the weight of effort and more resources to the deliberate and continual pursuit of nonviolent influence over the adversary. The object is to understand the enemy well enough to condition or determine the choices the adversary makes." Boyd biographer and military theorist, Grant T. Hammond (1994), agrees with this position and argues that "This means that intelligence, deception, diplomacy, and other measures assume a much higher priority. Knowing an adversary's culture, religion, and perceptions is as important as training, organizing, and equipping forces." In his view, this is the case because "Causes, allegiances, and affinities are major determinants of human action. Values are the motivation for initiating, sustaining, or rallying men and women to make extraordinary sacrifices for their beliefs." He therefore concludes that "The game is chess, not checkers: it involves maneuver, positioning, timing, and consequences several moves ahead. One wins by convincing an adversary to concede, not by destroying him through taking his pieces from the board." When force is to be used, Szafranski (1997) argues that "lean, fast-reacting, violent, almost 'limbic' forces-the stiletto held in readiness to coerce with force of arms-must be created or preserved." As such, physical force is used in a precise manner to achieve nonphysical effects. Thus, "shock and awe" in Operation Iraqi Freedom saw the dropping of many precision weapons on buildings that the U.S. knew to be abandoned from the beginning of the war. It was, nevertheless, hoped that the psychological impacts of the violent display would lead to the intended effects, the collapse of the enemy's system. In terms of airpower, "complexity-based targeting" has been offered as a means to achieving the goals of such effects-based operations. This targeting method is based on seeing the enemy as a complex adaptive system. One group of airpower theorists writes, Whereas industrial-age Newtonian analysis focuses on classifying targets according to their physical nature, complexity theory allows targeteers to focus on how targets interrelate, particularly in nonphysical ways. Complexity-based targeting emphasizes and exploits the characteristics of complex adaptive systems...By focusing on complex system characteristics, planners can induce cascading, chaotic behavior that achieves campaign objectives more dramatically and effectively (Freniere, Dickmann, and Cares 2003).

The goal is greater efficiency in targeting defined by the ability to achieve desired effects with less input (i.e. fewer bombs, greater precision, less emphasis on physical destruction).

Of course, to understand the values and the will of a potential adversary, one must first have the capability to "see" them. To influence them, one must have the capability to respond. This is where the Army's Information Dominance Center (IDC) at its Information and Security Command (INSCOM) comes in. Heath and Woodcock (1999) explain that in Information Operations (IO), "the key operational challenges are identifying Information Centers of Gravity, developing either non-kinetic or kinetic courses of action and defining the associated measures of effectiveness." They explain that "IO is really

about affecting how an opponent thinks, and plans in relation to one's perception about a particular set of issues." As such, "traditional military maps and symbology are often inadequate for accurately portraying the situation." The IDC is therefore developing "new approaches and techniques for determining and displaying Information Centers of Gravity." The IDC has created what it calls both 2-dimensional and 3-dimensional "knowledge landscapes" to map "information spaces." Essentially, these are technologies for visually representing change in vast competing narratives over time. Within the IDC, a Star Trek-like command center set at Ft. Belvoir, Virginian, individuals will be able to freely enter, navigate, plan, and execute operations within Perceptual and Knowledge Landscapes. This capability begins the transition from Information Dominance to Knowledge Dominance. The IDC is instantiating such entities as smart rooms, avatars, square pixel displays, polymorphic views, and other technologies for directly interacting with virtual domains. This will take us to the next paradigm of human-machine interaction within the multi-dimensional spaces required for Information Operations.

"Information operations" have moved from the cockpit of Boyd's fighter jet to the level of grand strategy. Heath and Woodcock explain that "Information Operations in support of civil-military interactions [are] becoming increasingly more important as non-kinetic [read: nonviolent] courses-of-action are required." Arquilla and Ronfeldt (1999) explain this phenomenon by arguing that "The world is turning anew into a highly charged battleground of ideas; it is not just a world in which material resources are the objects of protracted, often violent competition. In this emerging world, the key to success will likely lie in managing informational capabilities and resources skillfully-i.e., strategically." Therefore, they assert that "soft power" is taking precedence over traditional, material 'hard power'." The information-based, soft power paradigm that they advocate "emphasizes the primacy of ideas, values, norms, laws, and ethics." "[R]ather than being state-centric, its strength may likely stem from enabling state and nonstate actors to work conjointly. The driving motivation of *noopolitik* cannot be national interests defined in statist terms." Instead, the paradigm seeks to "empower networks of state and nonstate actors," to "encourage states to cooperate in coalitions and other mutual frameworks." While they argue that the U.S. has yet to develop this paradigm for pursuing national strategy and that a paradigm shift is necessary to deal with the challenges of the Information Age, it seems clear that at least some of the physical and conceptual infrastructure is already in place at the IDC and in the minds of many other theorists. The questions that remain are in regard to the potential benefits and perils of such a grand attempt at VMC. VMC: Less Effective and More Insidious?

Though the idea that information should be the lynchpin of the new American way of war is the new conventional wisdom, not everyone is convinced. In a recent book of case studies which examines the value of intelligence in war, military historian John Keegan (2003) provides plenty of exam-

ples in which knowledge of an adversary did not lead to victory. In the case of the Battle of Crete in World War II, for example, the British knew when, where, why, and how the Germans would descend upon the island. The British were still defeated. At the Battle of Midway, often portrayed as the classic intelligence victory, he demonstrates that pure chance played at least, if not more, of a role in the U.S. victory than did good intelligence. Thus, he cautions that "Foreknowledge is no protection against disaster. Even real-time intelligence is never real enough. Only force finally counts." In stronger terms still, he addresses the purveyors of the new conventional wisdom: It has become part of the conventional wisdom that intelligence is the necessary key to success in military operations. A wise opinion would be that intelligence, while generally necessary, is not a sufficient means to victory. Decision in war is always the result of a fight, and in combat willpower always counts for more than foreknowledge. Let those who disagree show otherwise.

Others have also noted that the will to fight and to keep fighting is still key to victory and worry that the United States' open desire for nonviolent, non-lethal, precise, information technology-driven wars will be viewed not as a new form of power, but as weakness. In Dunlap's (1996) fictional piece, "How We Lost the High-Tech War of 2007," the commander of the rag-tag, guerrilla force that defeated the U.S. explains that ...it became part of our strategy to capitalize on television's power to influence decisionmakers by aiming to wage war in the most brutish-and public-way... [W]e used ruthless tactics openly to intimidate the American people and break their resolve... The 'revolution in military affairs' did not, therefore, make warfare less murderous; war never developed into the almost genteel electronic exchange that some foresaw... Such hideous experiences destroyed predictions of 'non-lethal' conflicts made by over-enthusiastic cyberprophets... We expected that the U.S. would try to wage this supposedly 'bloodless' war by assaulting us from afar with cyberarms. Only the soft, convenience-loving West would think that the loss of electrical power or phone service would stop us.

Could it really be that the quest for nonviolent, non-lethal, precision "cyberarms" could lead to more rather than less brutality? If the drop in public support for U.S. operations in Iraq-after six months of televised kidnappings and brutal decapitations-is any indication, then Dunlap may not be too far off.

Next, the wisdom of even attempting to achieve "information dominance" has come under fire. Gregory Witol (1998) cautions that "attacking the decision maker's ability to perform rational calculations may cause more problems than it hopes to resolve... Removing the capacity for rational action may result in completely unforeseen consequences, including longer and bloodier battles than may otherwise have been." The dream of bloodless information war ignores Clausewitz's principles of fog and friction in war: perfect knowledge is unattainable, and war is always unpredictable. This is especially so when attempting virtually to control the minds of others.

Yet, it should be clear at this point that VMC does not just encompass denying information to an adversary. It involves the use of deception on a massive scale. Much information must be denied to an adversary, but one cannot leave an information hole. One must replace that missing information with other information meant to deceive, to condition a response in the adversary that is beneficial to one's own side. This is where VMC begins to sound more insidious than old-fashioned warfare. Latimer (2001) explains that, historically, "By the virtue of the serious nature of war, it may sometimes be justifiable and even necessary to deceive one's own side."

We must, therefore, be sensitive to the historical and cultural influences which are driving our military leaders in the direction of VMC. When the U.S. pulls out of Somalia because of images of a dead U.S. soldier being dragged through the streets, the U.S. military moves closer to a VMC strategy. When the U.S., fearing casualties, is only willing to use air strikes from above 10,000 feet against Serbia, it moves closer to a VMC strategy. When each enemy civilian death is a media event, when we bemoan and televise the loss of each U.S. soldier in combat, the military moves closer to a VMC strategy, while potential adversaries grow more brutal. But we must ask ourselves: Are we ready for global "information dominance" by the U.S. military? Are we ready for "knowledge dominance"? We should be careful what we wish for; we may long for the good old days of mere physical destruction.

Conclusion

In a round-about way, this essay is a call for more study of the military by STS scholars. In the last thirty years, the U.S. military has undergone profoundly important technological and intellectual changes. But, studying the development of the most obvious weapons systems, like ballistic missiles, nuclear weapons, or anti-missile systems, does not capture these profound changes. The technological changes enabling the shift towards a VMC strategy are embodied in less obvious IT systems like the IDC, JSTARS, Global Hawk, the Global Information Grid, Blue Force Tracking system, and many others. The intellectual shifts are occurring in obscure service journals, where military theorists and practitioners debate the nature of the world and reinterpret Clausewitz, Jomini, and Sun-tzu through the lenses of cutting edge science like chaos and complexity theories. Looking at the headlines and calling for more nonviolent options is not enough. The U.S. military has been listening. They have been attempting to become a more nonviolent, non-lethal force, but in a way that many of us may ultimately regret, both in terms of its potential to be less effective at subduing adversaries and more effective at eroding civil liberties here at home. If "virtual mind control" and "knowledge dominance" are worrisome terms to us, then STS must expand its study of the military if it is to make critical but effective interventions into the realm of defense policy.

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Bibliography

- Arquilla, John and David Ronfeldt. 1999. *The Emergence of Noopolitik: Toward and American Information Strategy*. Santa Monica: RAND.
- Barnett, Thomas P.M. 2004. *The Pentagon's New Map: War and Peace in the Twenty-First Century*. New York: G.P. Putnam's Sons.
- Boyd, John R. 1976. "Destruction and Creation." unpublished essay.
- _____. 1987. "Organic Design for Command and Control." unpublished briefing.
- _____. 1996. "The Essence of Winning and Losing," unpublished briefing.
- Coram, Robert. 2002. *Boyd: The Fighter Pilot Who Changed the Art of War*. Boston: Little, Brown and Company.
- Dunlap Jr., Charles J. 1996. "How We Lost the High-Tech War of 2007." *The Weekly Standard*: <http://www.weeklystandard.com/Content/Public/Articles/000/000/001/569nzbrd.asp>.
- Hammond, Grant T. 1994. "The Paradoxes of War." *Joint Forces Quarterly*: 7-16.
- _____. 2001. *The Mind of War: John Boyd and American Security*. Washington, D.C.: Smithsonian Institution Press.
- Hanson, Victor Davis. 1989. *The Western Way of War: Infantry Battle in Classical Greece*. New York: Alfred A. Knopf.
- Heath, James E. and Alexander E.R. Woodcock. 1999. "The Challenge of Emerging Information Operations." paper delivered at Command and Control Research and Technology Symposium. Newport, RI: U.S. Naval War College.
- Keegan, John. 2003. *Intelligence in War: Knowledge of the Enemy from Napoleon to Al-Qaeda*. New York: Alfred A. Knopf.
- Latimer, Jon. 2001. *Deception in War*. New York: Overlook Press.
- Murray, Williamson and Major General Robert H. Scales, Jr. 2003. *The Iraq War: A Military History*. Cambridge, MA: Harvard University Press.
- Sawyer, Ralph D., Trans. 1994. *Sun-tzu, The Art of War*. Boulder: Westview Press.
- Szafranski, Richard. 1997. "Neocortical Warfare? The Acme of Skill." Pp. 395-416 in *In Athena's Camp: Preparing for Conflict in the Information Age* edited by John Arquilla and David Ronfeldt. Santa Monica: RAND.
- Weigley, Russell F. 1986. "American Strategy from its Beginnings through the First World War." Pp. 408-443 in *Makers of Modern Strategy: From Machiavelli to the Nuclear Age* edited by Peter Paret. Princeton: Princeton University Press.
- Witol, Gregory. 1998. "International Relations in a Digital World." Pp. 65-76 in *Cyberwar 2.0: Myths, Mysteries, and Reality*, edited by Alan D. Campen and Douglas H. Dearth. Fairfax, VA: AFCEA International Press.

TECHNOLOGY AND INTERNAL SECURITY By William Shields

Approaching the city of Rome from the countryside, you will encounter in most places a gigantic, continuous wall of ancient construction. This fortification is known as the Aurelian wall, after the Roman emperor Aurelian (270 - 275 AD) who initiated its construction. Later emperors strengthened it, raised its height, and narrowed the gates. In total length it exceeds 12 miles.

Why did Aurelian devote the resources of a hard-pressed Roman treasury to this huge engineering project? The city of Rome had not been entered by force since 390 BC, 661 years before the reign of Aurelian. During that immense span of time, the Roman legions had defended the Republic and later the Empire in the provinces and beyond. Roman technology had been employed to build a road system throughout the empire to permit quick deployment of troops wherever needed on the frontiers. But by the time of Aurelian, a series of economic, political and military crises had made it again conceivable that Rome itself could be assaulted.

Why do I begin with this bit of history? The parallel is suggested by the events of the new millennium when, for the first time since the opening of World War II, the citizens of the United States have reason to feel threatened on their own soil. In the history of our republic, this has occurred very infrequently. In the war of 1812, the British managed to enter Washington and burn the White House and the Capitol. Two generations later, the capitol city was for a time in danger of attack by a Confederate army. A century later, the attack on Pearl Harbor led to the internment of Japanese citizens, blackouts, and air raid drills. The Cuban Missile crisis of 1962 struck fear into Americans as the great powers edged to the brink of nuclear war. But with the ending of the Cold War in the early 1990s, Americans had reason to believe that they were again safe on home soil. This belief was terminated, of course, on September 11, 2001.

One immediate consequence has been the creation of Aurelian walls inside the capitol city of Washington. Fortifications have sprung up around government buildings, major thoroughfares have been barricaded, and antiaircraft missile batteries have been installed on rooftops. Americans visiting their capitol city must undergo security checks when entering museums and government buildings, and are warned of tight security for major public gatherings events such as Fourth of July celebrations. The city's sidewalks are covered with huge flower pots designed to block vehicle access.

But beyond all that, there is the vast investment in new technology to deter internal attacks: a technological Aurelian's wall. It is not an exaggeration to say that every facet of modern technoscience is being harnessed to defend against assaults on the infrastructure of the nation. While placing an exact

number on this investment is all but impossible (many of the budgets devoted to internal security are classified), it is surely reaching into many billions of dollars already. What kinds of technology are to be developed in this program? A partial would list would include systems and devices to:

- detect chemical, biological, and radiological weapons and weapons materials;
- track individuals of interest to law enforcement (principally resident aliens);
- monitor access points to transportation and large gatherings; and
- identify persons by means other than falsifiable documents.

For convenience I will refer to these technologies as a group by DTMI drawn from the first words of each line: "detect . . . track . . . monitor . . . identify."

In an earlier time-during World War II, for example-these tasks would have been carried out almost entirely by people and paper: FBI surveillance, identity documents (badges, passes), aided by rudimentary technologies such as wiretaps and film cameras. As it happened, internal security during that war never became a critical task, principally because Germany and Japan were too heavily engaged on the battlefield to devote significant resources to espionage.

In the new millennium, we are confronted with an entirely different threat and a vastly changed technological landscape. The persons and groups most likely to carry out attacks within U.S. borders are (a) nationless, (b) potentially suicidal, and (3) well-funded. They cannot be deterred by pre-emptive or punitive strikes on a foreign battlefield, cannot be expected to act in the interest of self-preservation, and very likely can purchase what they need to carry out attacks of many kinds. Perhaps fortuitously, however, we also live at a time when technologies developed to provide American consumers with sophisticated and miniaturized information processing and storage devices provide a powerful base on which to build an internal security infrastructure. Parallel and equally startling developments in DNA analysis and manipulation are converging rapidly with this electronic technology.

Americans like to consider their homeland an "open society," in which they are free to go where they want, when they want, and (within the limits of the law) do what they want without much interference from government. In the 1950s, my mother would drive my father to the airport, he would pick up his ticket and leave his bags inside the terminal, and minutes later stroll out to the waiting aircraft. Today, his son must arrive at the airport two hours early, park far from the terminal building, wait in long lines, present photo ID, strip off all metal objects, take off his shoes, pass through a detector (while his carry-on bags are scanned), all the while confronted with heavily-armed guards. Meanwhile his luggage is X-rayed and scanned for explosives, and depending on location, he may be scanned for unusual behavior or biometrics. As in World War II, citizens are now urged to watch for "suspicious behavior." And they are doing so. In recent news, individuals taking

video tape of a bridge (in one case) and a natural gas terminal (in the other) were reported by civilians and questioned by police. A private aircraft carrying a state governor to Washington DC was very nearly shot down, and the Capitol was evacuated in a panic, all because the plane had a faulty transponder. These are but a few examples of the gradual conversion of the United States from an open to a guarded, if not closed, society.

As a lawyer, I am fully aware of the protection of individual rights provided by the Constitution. The Fourth Amendment guarantees that "the right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches, shall not be violated, and no warrants shall issue, except upon probable cause." But what does this provision mean in the face of technologies capable of continuous surveillance of email, telephones and radio communications inside U.S. borders? The Constitution was written to be a flexible and living document, and has been amended 27 times in its more than two centuries of existence. It is interpreted according to the tenor of the times. During World War II, federal courts skirted the constitutional issues raised by the forced evacuation of Japanese citizens into detention camps. More recently, there has been a struggle over the right to trial of U.S. citizens held on suspicion of terrorist acts at Guantanamo Bay.

For better or for worse, America is building an Aurelian wall, here and there with stone and concrete but mostly with advanced technology. With every DTMI advance, the technology will become more hidden and more ubiquitous, more of an accepted "commodity" to use Albert's Borgmann's term. The time will probably arrive, perhaps in a decade or so, when we are under some form of surveillance or identification at nearly every moment of the day. At home and at work, our electronic and telephonic messages will be monitored. We will be scanned in public buildings, our automobiles will transmit our whereabouts and speed to monitoring computers, we will be scrutinized when using any form of public transportation, and will be identified using foolproof biological markers recorded in government computer systems. Public buildings, transportation infrastructure, and all large public gatherings will be under intense surveillance by hidden devices and by human beings trained to recognize suspicious activities. The movements of U.S. citizens and visiting aliens may be followed using a combination of remote surveillance, tracking devices attached to the person's vehicle, and data received from security checkpoints. The question, ultimately, is whether the unbounded development of DTMI devices and systems will create a society that may be relatively safe from internal assault yet bear few of the hallmarks of openness that we have prized throughout our history.

In January of 1941, as democracies and peoples around the world fell to the armies of Germany and Japan, Franklin Roosevelt delivered to Congress his "Four Freedoms" address. It is worth recalling his description of the "freedom from fear":

"A good society is able to face schemes of world domination and foreign revolutions alike without fear. Since the beginning

of our American history we have been engaged in change, in a perpetual, peaceful revolution, a revolution which goes on steadily, quietly, adjusting itself to changing conditions without the concentration camp or the quicklime in the ditch. The world order which we seek is the cooperation of free countries, working together in a friendly, civilized society. This nation has placed its destiny in the hands, heads and hearts of its millions of free men and women, and its faith in freedom under the guidance of God. Freedom means the supremacy of human rights everywhere. Our support goes to those who struggle to gain those rights and keep them. Our strength is our unity of purpose."

As we erect a security infrastructure by bringing to bear all the power of modern science and technology, it is important to consider at what point we will lose that which we are seeking to protect. Is our strength in unity of purpose or in the building of walls of internal security? As scholars of science and technology, we should be devoting some time and thought to that question.

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DISEMBODIMENT AND CYBERSPACE: A PHENOMENOLOGICAL APPROACH

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Amidst the incessant encounters with new technologies and the hyperbolic narrativisation of their possibilities, key Enlightenment ideals come into being again, all the while confusing and deranging modernity's notions of self and body, of individual and community. In every utopian encounter, images are conjured of how technology may set us astray from the reality of our own existence, from the limitations of time, distance and space, and most saliently, from the constraints of our own bodies. In this essay, I shall attempt to phenomenologically examine what is believed (Coyle, 1999: 5) to be shared pervasive themes in both, Enlightenment and new technology: the body, subjectivity and identity. As a starting point for this task, I shall highlight some of the dominant Western visions of the self, furthering the analysis with reference to cyberspace.

...digital narratives represent one of two antagonistic stands of the Enlightenment: rationalism and romanticism. Their continual antagonism seems to impel much of the intrigue with information technology, and further support its participation in the myth of unity and multiplicity. Many people eschew rationalism, but in doing so simply move to a romantic orientation, reworking old ground.

Coyle, 1999: 6-7

Be it in terms of romanticism or rationalism, to Coyne, digital narrative is but a reiteration of Enlightenment philosophy and a refurbishment of its epistemology: community building

(cyberspace as a virtual locus for social interaction, constructed through binary codes of bits and bytes), proximity (erosion of time and space boundaries through electronic communications), virtual reality (engineered emulation of reality), artificial intelligence (the basis of knowledge is grounded in numbers, 'pure ideas' and hence positivism), subjectivity (subjective and personal aspirations as the source of the aura and creativity in romanticism), utopia (the quest for a better life through technology) and what is of most interest to us at this instance, conceptual disembodiment (transcendence of body limitations through electronic prosthesis). The point of departure for this cyclical culmination, yet unending venture of Enlightenment was Descartes' (cited in Seidler: 1998: 17 and Springer, 1996: 16) metaphysical axiom 'Cogito, ergo sum' (I think, therefore I am), which extolled the capacity of individual reason as the foundation of awareness and the locus of knowledge. As a rationalist philosopher and mathematician, Descartes forcefully separated between mind and body and thereby articulated a Cartesian dualism that has long provided a pivotal feature for the hegemony of Western culture.

Central to this Cartesian epistemology is a systematic belief in the supremacy of logical reason over the illogical nature, as such; Enlightenment philosophy assumes that the rational self has an 'inner' relationship with the mind and an 'outer' relationship with the body. Therefore, the body is conceived not as part of 'who we are' but part of nature, hence an object to be controlled and mechanised (Seidler, 1998: 17). With the Kantian philosophy of ethics, reason is identified with morality for it provides the priori principles for knowledge, certainty and universal law, whereas the body is identified with feelings and emotions, which are, according to Kant, external 'forms of determination and a lack of freedom... taking us away from the path of pure reason' (Seidler, 1998: 17). Indeed, this very attitude of inflation towards the mind and deflation towards the body has long set the stage for the 'transcendental' ideals in an attempt to articulate the order of 'empirical' world beyond its particularities and peculiarities, or to use phenomenological terms, beyond its 'immanence' (Husserl, 1990: XVII), driving the Western culture to its quest of disembodiment.

From here, the notion of transcendence went on to act as a basis for objective and universal knowledge, reinforcing the Cartesian 'method' of existence and cognition, and ratifying the need of disembodied experience, yet, dialectically espousing a synthesis of mind and body where the latter became the obedient rather than the 'prison' of the former. As such and in the episteme of transcendence, experience is deemed to be 'real' only if deeply entrenched within consciousness and entirely detached from the corporeal. Personal subjectivity is thus regarded as a threat to the credibility and validity of experiential knowledge, and can be transcended only if thawed into the crucible of 'unity', in other words, into the realm of Kant's unified 'transcendental subjectivism' (Husserl, 1990: XX).

With this Western phallogocentric Cartesian dualism and its promises of knowledge and control, it is no surprise that the

question of disembodiment lies at the very heart of technological discourses. However, in order to understand the ontology or epistemology of disembodiment within any given discourse, it is first essential to understand the conditions of embodiment or put crudely, the reality of what constitutes the materiality, spatiality, and experience of the body itself, however, beyond its Cartesian configuration. To do so, let me consider some of the retrievable conceptions regarding the body and precisely vis-à-vis the Merleau-Pontyan phenomenological perception of it.

It is from the soil of Merleau-Ponty's (1962) phenomenological sancta that new attempts emerged, attempts to reconcile the division between the body and self, and recover the embodied subjectivity through a re-evaluation of perception that goes beyond the duality of the Cartesian metaphysics. In so doing, Merleau-Ponty (1962: 90-96) provides a psychological dimension for 'being' a body in the world, making the embodied experiential stand in for the disembodied transcendental. In a way that is contrary to Descartes' abstract cogitatio, perception plays a fundamental role in Merleau-Ponty's work for it challengingly overrides the entire concept of consciousness, a notion that is crucial not only to the Cartesian epistemology but also to the Husserlian phenomenology. Perception in Merleau-Ponty's terms is a 'system' of meanings by which the phenomenological process of recognising and 'sensing' objects takes place, and it is through the medium of the body that we get to 'experience' and 'perceive' the world: 'Our own body is in the world as the heart is in the organism: it keeps the visible spectacle constantly alive, it breathes life into it and sustains it inwardly, and with it forms a system' (Merleau-Ponty, 1962: 203). As such and insofar as we understand and perceive the world via our body, perception can only be embodied, hence, the production of knowledge, whether subjective or objective, can only exist within a corporeal reality that is itself embedded within an implosion of specific contexts and situations. In so believing, Merleau-Ponty extols the body as the 'subject of perception' (1962: 206), demystifying Descartes' maxim 'I think, therefore I am' and almost overriding it by what could be termed as 'I perceive, therefore I am'.

According to Merleau-Ponty (1962: 298), to be a subject of perception is to have a world; in other words, to be a body is to have a space where the materiality of this body can be endowed and where its existential potentiality of movements and hence actions can be exercised. As such, neither experience nor knowledge can be perceived as being 'out there' but rather, as emerging out of the inextricability of the body and its spatiality:

Consciousness is removed from being, and from its own being... The consciousness of the world is not based on self-consciousness: they are strictly contemporary. There is a world for me because I am not un-aware of myself; and I am not concealed from myself because I have a world.

Merleau-Ponty, 1962: 297-298

Indeed, it is this intertwined and inseparable relationship between body and space that brings about the myriad of sensory experiences, which contributes to the significance of body movements and thus the meaningfulness of personal actions. As such, to deny these psychological recourses would be equivalent to not only denying one's body, but also erasing one's awareness of space and hence knowledge, as 'according to Kant himself, knowledge [is] connected with space' (Merleau-Ponty, 1962: 244). Thus, Merleau-Ponty's teleology clearly seeks to restore the fundamental unity between the self and the world, emphasising that this unity is but embodied, and hinting to the notion that identity, by virtue of the latter, is a cognitive accumulation of phenomenological bodily experiences.

Following on from here, one might assert that to have an identity is to be able to existentially putting claim to have a 'presence' in the world albeit when the functionality of the 'sum' of body parts is reduced to nothing as in modernist terms, the 'whole' may still be eligible to claim some kind of presence within the spatiality it -actively or not- occupies, and let me go to the extent to crudely but not essentialistly suggest that to have an identity is to have a body, for whether it is at the level of immanent embodiment or transcendental disembodiment, the body is yet the point of departure from itself, the point of return to itself and most ostensibly, the point of being in itself. Having said that, we may also add that identity is and becomes an oscillation between the initial state, that is the physical, and the ultimate -but not always attained- state, that is the meta-physical, both of which are yet in a consecutive and sometimes concurrent reliance on the body for their realisation. As such, even at the very epic moment of transcendence and the highest level of phenomenological reduction, the body is still the reference, the anchor and the trajectory of any transcendently experiential instance, for denying the body is in itself recursively ratifying its inevitability, especially that empirically, transcendence is but a 'transient' state of being/becoming-in-the-world rather than a 'permanent' state upon which the self can indefinitely settle.

Nonetheless, it might be objected that such assertions are valid only insofar as they are uttered vis-à-vis the physicality of the tangible world where the rule is: one body, one identity, whereas the impalpability of cyberspace may lay claims to a disembodied transcendence where experience is no longer a matter of sensory phenomena à la Merleau-Ponty but rather a diffusion of information that is based on a pure mental capacity to 'live' before even 'perceive' that experience. This, in turn, smashes the links between space and body and foregrounds virtuality instead of materiality. However, even within the virtuality of cyberspace, the construction of identity, subjectivity and self is not entirely devoid of bodily perceptions, but initially takes off at a socio-cultural ontogenesis, travelling through a realm of simulation and eventually lands on a runway of what we could call a pseudo-disembodiment, 'pseudo' because the user's presence in cyberspace first and foremost derives its functionality from a concoction of both, sensory and mental data, and as such, the belief in the possibility of a

Cartesian split through cyberspace is but a naïve delusion or to put it in Baudrillard's (1983: 26) terms, a banal strategy of 'deterrence'.

Being no more than a warmed-up Descartes but in a high-tech style, many proponents of computer technology contend that the dream of cyberculture is all about reaching the eventual obsolescence of the body in order to 'leave the 'meat' behind and to become distilled in a clean, pure, uncontaminated relationship with computer technology' (Lupton, 2000: 479), and ultimately open up possibilities for creating new and autonomous identities (Poster, 1997), which are unencumbered by the constraints of physical cues such as sex, gender, race, class, etc (Haraway, 2000). As such, cyberspace is seen as a divine hyper-potency, a utopian Cartesian map sketched on a metaphoric canvas through a suspension of corporality in exchange for virtuality that is made possible through the density of information and communication networks. So no longer does the body occupy the status of the 'container'; instead, a new relation of body to identity is being laid down, that of which reassigns a new state of 'being', set apart from the body as the phenomenological 'catalyst' or the referential 'location'. This intensity of alienation from one's body via technological prostheses is seen by avid cyber-enthusiasts as fleshless exultation beyond bodily corruption (Gibson, cited in Jones, 1997: 48), which by virtue of its ontology plays midwife to the Cartesian dream.

It is precisely within the epistemology of this total corporeal amputation that the notion of cyberspace as virtual reality takes shape, lending itself to infinite imagination and culminating into a matter for the mind and the mind alone. Cyberidentities are thus conceived as a matter of momentary performances, reality as an illusive metaphor, subjectivity as a mere possibility and body as a vital impediment to the meta-physical infinity of virtuality. Cyberspace as a lived experience is therefore extolled not solely as a platform for a distant dream but mostly as a point of take-off towards the 'realisation' of this dream and precisely that of 'we are all Gods' (see Robins, 2000: 78). In such framework, a phenomenological shift occurs: the subject behind the computer screen is reincarnated -or rather disincarnated into a hypercogitatio (Romanyshyn, 2002) that progressively abandons the body to freely float between the inner world and the outer world, and in doing so, reaches a status of 'terminal identity' where any 'felt' sense of selfhood is entirely eliminated from the picture. As such, Bukatman (1996: 208-210) came to deduce that:

Cyberspace is a celebration of spirit, as the disembodied consciousness leaps and dances with unparalleled freedom. It is a realm in which the mind is freed from bodily limitations, a place for the return of the omnipotence of thoughts... the return of the animistic view of the universe within the scientific paradigm.

However, if cyberspace really allows the return of these so-called omnipotent thoughts and animistic view, then it should be a return with a cataclysmic vendetta, that of which subverts and disrupts the overall schema of physical limitations that has

long served as a terrain for legitimising and exercising modes of subordination, coercion and exclusion. Nevertheless, this hyperbolisation of cyberspace only conceals rather than reveals the social problems for which the empirical practices provide the fuel. Even the Internet proponent Mark Poster suggests - and precisely in terms of gender- that 'the disadvantages suffered by women in society carry over into the 'virtual communities' on the Internet: women are underrepresented in these electronic places and they are subject to various forms of harassment and sexual abuse' (Poster, 1997: 222). As such and if contained within realistic proportions, cyberspace can only be seen as what Gibson (cited in Robins, 2000: 77) calls a 'consensual hallucination', which merely offers the delusive impression of transcendence and omnipotence, wrapped up in euphoric utopia and craving desires for a better world, a world where dreams may become reality through new technologies. However, it is this very notion of consensual hallucination that Robins (2000) seeks to problematise, recognising the need for a political discourse in making sense of the fact that while we are voluntarily immersing ourselves within the delirium of virtual reality, we may as well leave the issue of who controls this reality unscrutinised:

I think we should urgently set about dis-illusioning ourselves. There is no alternative and more perfect future world of cyberspace and virtual reality... The institutions developing and promoting the new technologies exist solidly in this world. We should make sense of them in terms of its social and political realities, and it is in this context that we must assess their significance.

Robins, 2000: 78-79

According to Robins, a starting point for this political discourse is to painstakingly examine the question of self-identity and its relation to techno-reality. Indeed, anyone interested in this theme would surely at some point ask if the shift towards virtuality does really offer a great deal of autonomy in deciding upon one's identity. Put simply, are we really disembodied in cyberspace or do we faithfully carry our old baggage with us on our virtual journey? Is this cyberspace a truly egalitarian realm or is it merely shorthand for the American and thus capitalist much-vaunted ideals of freedom and choice? Well, Robins' assessment seems deeply sceptic about these so-called new cyberidentities as well as the totalising belief in autonomy and power, which they uncritically claim:

New identities, mobile identities, exploratory identities -but, it seems, also banal identities. Only the technology is new: in the games and encounters in cyberspace, it seems there is little that is new or surprising.

Robins, 2000: 80

As such, Robins reaffirms that what new technology does, by removing physical cues, is generating possibilities for hallucination that simply creates illusionary visions of heterogeneity vis-à-vis identities and subjectivities. This hallucination in effect, hardly offers a 'concrete' ground for radical and progressive social change, as one is too engrossed within the psychological borderline of waking and dreaming through tech-

nology to such an extent that one can no longer take up any viable political action. This statement brings to mind the words of Baudrillard (1983, 1988), which proffer a valid headline for the abundance of banality and simulacra in cyberspace: with the implosion of the hyperreal and the diffusion of signs, all possibilities are lost into a state of immanency in which 'illusionary' freedom is synonymous to disembodiment, and disembodiment is synonymous to the tele-omnipresence of hermaphroditic and androgynous beings. And alongside this loss of identities' foundational characteristics come a loss of subjectivities and ultimately a loss of 'concrete' freedom:

Forgetting about the body is an old Cartesian trick, one that has unpleasant consequences for those bodies whose speech is silenced by the act of our forgetting; that is to say, those upon whose labour the act of forgetting the body is founded- usually women and minorities.

Stone, 2000: 525

The manifestation of such discourses surely urges for a re-examination of the body as yet a phenomenological experience, but this time not in terms of its relation to the physical space but the virtual one.

Space is not the setting (real or logical) in which things are arranged, but the means whereby the position of things becomes possible. This means that instead of imagining it as a sort of ether in which all things float, or conceiving it abstractedly as a characteristic that they have in common, we must think of it as the universal power enabling them to be connected.

Merleau-Ponty, 1962: 243

If we are to assume the position of Merleau-Ponty and consider cyberspace as a power enabling things to be connected, we should first ask the question: what is exactly being connected or probably disconnected in cyberspace? Of course, without a re-arrangement of things in a manner that would stimulate our perception, cyberspace would be no more than a duplicate, a déjà vu i.e. just as 'real' as the real world it attempts to supersede (Longoni, 2001). Thus, as a prerequisite for the realisation of cyberspace, the things being connected within it should 'appear' to be new, transcendental and unrecognisable in the real world even if they are derived from it, which means an obliteration of all sensory resources. So we might think at this point that what is being connected in cyberspace is the remaining entity, i.e. the mental data. Nevertheless, even the mental data are bound to retain sensorial attributes in order to attain a degree of 'connectivity' with their producer i.e. the mind, hence, the inevitability of the obdurate body.

Inseparably bound up with perceptual virtuality, the phenomenal body becomes imperative to trigger the access to cyberspace and the realisation of the technologically mediated experience. This experience is facilitated through the malleability and extendibility inherent within the nature of the corporeal schema by which the body is able to morph itself and integrate a multitude of external instruments to continuously reconfigure

its state of being-in-the world. This is further elucidated by Merleau-Ponty's (1962: 142-143) belief that the body is not restricted by its tangible boundaries where sensorial phenomena occur i.e. the skin, but may extend itself by rendering external objects as internal and projecting a body-image that is in continuous flux:

A woman may, without any calculation, keep a safe distance between the feather in her hat and things which may break it off. She feels where the feather is just as we feel where our hand is. If I am in the habit of driving a car, I enter a narrow opening and see that I can't 'get through' without comparing the width of the opening with that of the wings, just as I go through a doorway without checking the width of the doorway against that of my body. The hat and the car have ceased to be objects... The blind man's stick has ceased to be an object for him, and is no longer perceived for itself; its point has become an area of sensitivity, extending the scope and active radius of touch, and providing a parallel to sight.

Merleau-Ponty, 1962: 143

This statement is salient especially in bringing the ironic dialectic to the fore: in light of the technological rhetoric, new technology is suggested to be partly the 'instrument' by which we may override our bodily limitations and reach the transcendental moment. Yet, this instrument is but an extension of the body itself and as such, its *raison d'être* can only be realised through an embodied experience. In cyberspace, this embodiment is, in fact, an ad-hoc occurrence i.e. a spontaneous prerequisite for communicating in it and interacting with its interface, which is by no means a pure mental construct but a myriad of sensory dialogues (seeing, hearing, feeling, etc). As such and insofar as the body is the basis for our interactions and perceptions, virtual space can only be seen as a symbiotic synthesis of technology and corporeal phenomena.

Therefore, virtual tools cease to be external objects and become part of our phenomenological corporality, just as the blind man's stick becomes an extension of his sensorial activity. Consequently, the construction of self in cyberspace follows an alternative mode of 'embodiment', a physical virtuality per se, within which a unity of disunity emerges, a synergy so to speak: the mind and body become one in order to pursue a unified goal, and if either is missing, the result is the non-existence of the experience. So however we might say it, in cyberspace one is, in effect, embodied in one's disembodiment. The body in this context is no longer seen as the obsolete object or the inert container of the mind, but an integral entity, which is reassigned with an indispensable role, that of the medium. Furthermore, the body is no longer seen as the basic tool for using technological apparatuses, but the very parameter for constructing cyberidentities and performing instances of gender bending and identity play, discourses of which have saturated cyberculture.

Rosalind:

*Were it not better,
Because that I am more than common tall,
That I did suit me all points like a man?*

*A gallant curtle-axe upon my thigh,
A boar-spear in my hand, and in my heart,
Lie there what hidden woman's fear there will,
We'll have a swashing and a material outside,
As many other mannish cowards have
That do outface it with their semblances.*

Shakespeare, 1975: 28

Just as Shakespeare's character Rosalind uses gender-swapping as a mechanism for self-protection during her journey towards the magical forest of Arden, female users also adopt gender-swapping as an apparatus for protection against sexual harassment and objectification during their virtual journey in cyberspace (see Turkle, 1996: 215-222). In fact, regardless of being male or female, all users of cyberspace are exercising the Benjaminian legitimacy to be 'reproduced' and sometimes inverting but by no means subverting the dichotomies of the real world (gender, sex, sexuality, etc). Although it might seem that virtual reality is providing us with utopian substitutes where free and fluid identities are displayed before us, it is necessary to understand that our deeply rooted socio-cultural attributes have an immense impact upon who and how we may choose to be in cyberspace. And be it in terms of reality or virtuality, it is the body that bears the scars and reveals the marks of our being-in-the-world, it is the body that takes us to places where we may find or lose ourselves, and it is the body that carries our memory and with it our identities. The result: we cannot go farther than the body and parenthetically, this is not a nihilistic negation of reason à la postmoderne but that of the defective model of the Cartesian split. So no longer a matter of supremacy, the mind and body ought to live in harmony! By problematising the notion of embodiment within cyberspace, I hope I have provided a critical answer to the question of disembodiment all the while drawing attention to the necessity of reinstating a corporeal return and reworking the ontological and epistemological premises of the relation of self to technology. Ending up on this tone, I can only see myself straddling again a set of questions still circulating cyberdiscourse: does cyberspace mark the end of space? Does the virtual body mark the end of the real body? Does simulation mark the end of reality? And does information mark the end of imagination?

I would say No!

References

- Baudrillard, J (1983) Simulations. New York: Semiotext(e). PP: 26.
- Baudrillard, J (1988) The Ecstasy of Communication. New York: Semiotext(e).
- Blackman, L (1998) 'Culture, technology and subjectivity' in Wood, J (Ed) The Virtual Embodied. London: Routledge. PP: 133.
- Bukatman, S (1996) Terminal Identity. Durham and London: Duke University Press. PP: 208-210.
- Coyne, R (1999) Technoromanticism: digital narrative, holism, and the romance of the real. Massachusetts: Massachusetts

Institute of Technology. PP: 5-7.

Haraway, D (2000) 'A cyborg manifesto: science, technology and socialist-feminism in the late twentieth century' in Bell, D & Kennedy, B (Eds) *The Cybercultures Reader*. London: Routledge.

Husserl, E (1990) *The Idea of Phenomenology*. Dordrecht: Kluwer Academic Publishers.

Jones, G (1997) 'The neuroscience of cyberspace: new metaphors for the self and its boundaries' in Loader, B (Ed) *The Governance of Cyberspace*. London: Routledge. PP: 48.

Lathan, A (1975) *The Arden Shakespeare: As You Like It*. London: Methuen & Co. Ltd. PP: 28.

Longoni, S (2001) *The Body is Back: Communication in Cyberspace*. Available at:
<http://www.newschool.edu/mediastudies/sam/>

Lupton, D (2000) 'The Embodied Computer/User' in Bell, D & Kennedy, B (Eds) *The Cybercultures Reader*. London: Routledge. PP: 479.

Merleau-Ponty, M (1962) *Phenomenology of Perception*. London: Routledge.

Poster, M (1997) 'Cyberdemocracy: The Internet and the Public Sphere' in Holmes, D (Ed) *Identity and Community in Cyberspace*. London: Sage. PP: 222.

Richardson, I & Harper, C (2002) *Corporeal Virtuality: The Impossibility of a Fleshless Ontology*. Available at:
<http://www.brunel.ac.uk/depts/pfa/bstjournal/2no2/journal2no2.htm>

Robins, K (2000) 'Cyberspace and the world we live in' in Bell, D & Kennedy, B (Eds) *The Cybercultures Reader*. London: Routledge. PP: 77-80.

Romanyshyn, R (2002) *The Dream Body in Cyberspace*. Available at: <http://www.cgjungpage.org/content/view/389/28>

Rumsey, J (1997) 'Revisions of agency in Kant's moral theory' in Schott, R (Ed) *Feminist interpretations of Immanuel Kant*. Pennsylvania: The Pennsylvania State University Press. PP: 130.

Seidler, V (1998) 'Embodied knowledge and virtual space' in Wood, J (Ed) *The Virtual Embodied*. London: Routledge. PP: 17, 20.

Springer, C (1996) *Electronic Eros: Bodies and Desire in the Postindustrial Age*. Austin: University of Texas Press. PP: 16.

Stone, A (2000) 'Will the Real Body Please Stand Up? Boundary Stories about Virtual Cultures' in Bell, D & Kennedy, B (Eds) *The Cybercultures Reader*. London:

Routledge. PP: 525.

Turkle, S (1996) *Life on the Screen: Identity in the Age of the Internet*. London: Weidenfeld & Nicolson. PP: 215-222.

RECENT DISSERTATIONS/THESES IN STS

SCIENCE NARRATIVES

by

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The central focus of this thesis is the role of narratives in the construction, mobilisation and validation of scientific knowledge claims. With an epistemological commitment to constructivism, the regulatory domain of impact assessment is used as a case study to undertake the task of tracing the translations that intervened between assessment process inputs and outputs - contributions deemed 'scientific' and 'independent' by the project's proponents and supporters. Specifically, the knowledge claims tendered by Tasmania's hydro-electricity generator are examined. At issue are the predicted environmental impacts stemming from changes to river flows required to generate and export hydro-electricity across a 350-kilometre sub-sea power cable known as Basslink.

Notwithstanding its designation as a World Heritage Area, with the proposal for Basslink the Gordon River once again became a site of political struggle between Tasmania's hydro-electric power generator and those wanting to conserve the natural environment of the area. Compared to the fight in the early 1980s to save the Gordon's major tributary, the Franklin, from inundation in a hydro-electric power scheme - the Australian environment movement's finest hour - the encounter over Basslink was considerably muted. At a broad level, this thesis seeks to understand how things were different.

What was incongruous was that the hydro-generator's presentation of its findings was accompanied by claims about the implausibility of the model outputs from which it derived its conclusions. This begged the question - if the assessment of Basslink was based on empirical 'scientific' evidence, how did hydro-generator fulfil the process requirements and have its regulatory proposals substantially approved?

To answer this question, this work maps the origins, mobility and durability of three stories from their tenuous beginnings, through the assessment process and then into the regulatory outcomes. In particular, it seeks to understand how these narratives were packaged, how they stabilised knowledge claims as well as what influence they had on judgments about

impacts, and the regulatory outcomes of the Basslink impact assessment process. It finds that stories can bridge empirical gaps, explain and obscure inconsistencies, erase unexpected model outputs, contextualise findings and mobilise ontological claims. In essence, this analysis highlights the stabilising effects of narratives and the constructions they can mobilise, and demonstrates the ability of narratives to travel virtually unhindered across domains.

TELEBODIES & TELEVISIONS: CORPOREALITY AND AGENCY IN TECHNOCULTURE

by Ingrid Richardson, PhD
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In this work I aim to trace some of the transformative effects of televisual technologies in contemporary post-industrial culture, and to critically assess their impact on the way we produce knowledge, and experience a sense of embodiment and social agency. I question the relation between humans and tools, and investigate the hybridity of words such as technoculture and biotechnology, arguing that the separation of human and technology, and body and tool, at the level of both existence and knowledge is synthetic rather than essential. Throughout this work I combine and adapt the phenomenology of Maurice Merleau-Ponty, Don Ihde's philosophy of technology, the postmodern materialism of Donna Haraway, and the recent work of corporeal feminists Moira Gatens, Liz Grosz, Vicki Kirby and Gail Weiss. I suggest that every human-technology relation is irreducible, producing certain kinds of being, and particular ways of knowing and making the world. Nothing - including ourselves - can be defined intrinsically; we are all in some sense extrinsic and relational achievements, confluences of body, culture, environment, technology. Thus, every interface can be described as a technosomatic interface. Moreover, the predominance of televisual and imaging technologies in contemporary technoculture has meant that our visual tools become inseparable from what we might discern as our own perceptual and bodily boundaries as 'access' to the world. Specifically, I concentrate on some of the medium specific effects of postclassical visualising technologies, from high-end ensembles such as virtual reality and medical imaging apparatuses, to the mundane apparatus of television and the remote control device. Such ways of seeing and interfacing, I argue, collaborate in producing an emergent tele-body, or a telesomatic mode of perception and knowing which exceeds standard epistemologies of vision in both science and the everyday. This work thus aims to develop a theoretical and conceptual framework for understanding the variable effects of postclassical technovision and televisuality upon our modes of embodiment.

SOFTWARE WORK AND WORKFORCE: AN EMPIRICAL STUDY IN SILICON VALLEY OF INDIA

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Many Third World countries like India are concentrating on software industry, one of the fastest growing industries in the world, as a viable option to strengthen their national economy. Indian software industry has a higher growth rate in the world and software work is one of the most preferred occupations in India. Study focuses on two issues in software industry: (1) Occupational classification of software workers, and (2) Task fragmentation in software work. The existing Indian occupational classification of software workers was framed in 1969 and is outdated. There is a need to evolve a new scheme which will help us understand the nature of software workforce. The nature of software work in India, predominantly export oriented and dominated by low skilled tasks, provides ample grounds for testing whether software work is task fragmented. The study was conducted at Bangalore considered Silicon Valley of India.

The review of literature on software work shows that the existing classification of software workers does not adequately reflect the nature of workforce in the industry. The various known classifications are ambiguous and inadequate. Also, there is no consensus on whether software work is task fragmented or not. One view is that software work like any other industrial work is task fragmented. In the production process of software work, tasks had been divided into conception and execution tasks through structured programming techniques. There is a clear cut division of labor in the work, and the low-level software worker could be seen as an assembly line worker in the conventional factory. The other view proposes that software work cannot be fragmented. It posits that software work is not equivalent to any mass production work, and it has certain characteristics that defy the application of prevailing theory of scientific management.

Software workers were classified using a task inventory. Tasks were identified based on literature, and consultation with experts. Six hypotheses were deduced from the available literature to investigate whether task fragmentation is present in the software work.

Data was collected by triangulation of methods: questionnaires, semi-structured interviews, focus group discussions, observer participant method, mail communications, and content analysis. The data was collected primarily from two software organizations located in Bangalore selected through multistage cluster sampling method. Additional data was collected from workers who are employed outside the sample organizations, based on purposive sampling.

Analysis showed that two sample firms do not differ significantly on task factors, inferring homogeneous nature of work performed in the industry. Factor analysis of listed tasks clearly indicated that software development production process is not segmented into discrete stages of conception and execution. The workers were classified into four categories by performing non-hierarchical cluster analysis on the tasks listed on

the inventory.

The findings show that the categories of Indian software workers do not form a discrete set of components in the occupational pyramid of the industry. They appear to represent the layers of an onion. The workers in the outer layer partly perform activities of the inner layer in addition to their own. The workers were classified into four categories: 1) Writers; (2) Developers; (3) Designers; and (4) Supervisors. The categories of workers differ significantly on the following: (1) Number of years working in software industry; (2) Frequency of the activities of software production process present in their work; (3) Number of projects they are handling; (4) The basic nature of work - technical or managerial; (5) Annual salary; and (6) Age of worker. The categories of workers do not differ on the following characteristics: (1) Basic training - the educational qualifications; the background discipline; and type of educational institutions the workers attended; (2) Training given by the employing organization; (3) Work schedule; and (4) Work place interactions between workers and users.

The study did not find any support for the hypotheses, and concluded that task fragmentation is not present in software work. The findings showed that all the categories of workers perform the activities related to both conception and execution tasks involved in the software production process. All the categories of workers participate in executing the project, without limiting participation in conception part of the software development process to any person or position. Further, all software workers are predominantly from upper socio-economic stratum of the society. There is little differentiation among categories of workers with respect to socio-economic background. The basic training and the training given in the organizations are not different for various categories of workers. All workers go through almost similar career paths. The study observed that workers benefit from the documentation activities prescribed by the quality certification procedures and also that control over work gets distributed among all the workers.

The findings of the study have both theoretical and practical implications. They showed that software work in India illustrates the post modernization process, the process of societal transformation from modernity to post modernity in the area of work and industrial systems. The proposed classification could be used for cross-national comparison of software workforce. Inclusion of the proposed classification scheme in National Classification of Occupations of India could possibly bring about a valid account of the software workforce in the country. The findings about the background characteristics of software workers provide insights for policy formulation regarding the inclusion of middle and lower socio-economic groups as well as women in the workforce. The study shows that software workers in India are indirectly forced to follow a similar career path leading to the managerial side of software work, while the technical career path is not given enough attention. Devising strategies for encouraging some workers to opt for a technical career path would help the organizations in enhancing both their technical and managerial capabilities in the long run.

**ON BEING ON THE SAME PAGE:
ORGANIZATIONAL COMMUNICATION AND THE
USER-CENTRED DEVELOPMENT OF A DIGITAL
LIBRARY COLLECTION.**

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As computer and communication technologies become more ubiquitous, and the warp and weft of technology use and social practice woven ever tighter, the ways in which we understand and talk about technology amongst ourselves as social and institutional actors assume an ever-greater importance.

Technologies open our lives to new social possibilities, and to explore these possibilities and how we may take advantage of them, we have to be able to talk amongst ourselves about technologies. How therefore do we make sense of new technologies? In what ways do we share and exchange our understandings with other people, and use them to make decisions and take actions, particularly where technologies are novel and complex, and diverse groups of stakeholders are involved?

The dissertation examines the character and nature of communication amongst the developers and users of a technical project, an educational digital library, as they engaged in the development and design of the digital library and its collection. This particular digital library followed a 'user-centred' collection development strategy, in which representatives of the future users of the library, principally high school teachers, participated in the development of the library's collection. They did so while living in different parts of the United States, communicating principally using online tools. Understanding the nature of this distributed work and communication between developers and users regarding collection development, and how it could be supported technologically, was a crucial component of the project as a whole.

Research into organizational responses to the development of new technologies has generally described how these responses can be complex, diverse, and unpredictable, and can give rise to conflicts between different organizational groups.

Organizational communicational remedies for such organizational conflicts are often framed broadly within terms of the need to improve the quantity and quality of technological discourse amongst organizational members. How this might be achieved in practice is however often left relatively unelaborated, and I argue that these remedies simplify and elide both the complex nature of how we perceive technology, and also the ways in which our perceptions are mediated amongst each other.

In the dissertation I seek therefore not so much to prove this digital library was socially constructed by its members - this is taken more or less as a given - but rather to inquire into how various social constructions of 'digital library' by different groups in the project played out in the project's organizational communication and processes. In doing so I suggest that the

process of the 'social construction' of an artifact involves ways of knowing - such as 'technological frames' - that are tacit, not readily expressed directly and reflexively in discourse, and, on occasions, incommensurate.

To further address the question of how we talk about amongst ourselves of the things that we socially construct, I draw on Anthony Giddens' theory of structuration and model of practical consciousness, to suggest that our understandings of the world (and in this case of digital libraries) are tacit, ontological, heterogeneous, and often not expressed directly in discourse. With respect to technology design, I refer to Pelle Ehn's theory of work-oriented design to suggest that developers and users often embrace different understandings of the same technology, with developers thinking of a new technology in terms of possibilities for change, and users thinking of a new technology in terms of how it may be integrated with their existing practices. Finally I draw on Wittgenstein's notion of language games and 'forms of life,' and his observations that different groups can appear to share language-games and forms of life and to be in agreement, while at the same time having different and perhaps incommensurate understandings of what those language-games and forms of life entail, to suggest that organizational members can have different understandings of a technology and yet can talk with each other without necessarily realizing that they have differences in understandings. Such a situation can hinder design and development processes; and I suggest that addressing such differences involves organizational members not just talking about technologies, but engaging in reflexive contemplation to remind themselves as to what they think about these technologies, especially in contrast to what other people may think about the same technologies. Once people have reminded themselves as to how they may be thinking about a particular technology, they can then represent those reminders to other organizational members.

My claims are illustrated with an extended case study that draws on three years of ethnographic observations with a digital library project. I describe how the designers and users of the project appeared to be in discursive agreement regarding the issues involved in the design and development of the library collection, while at the same time they embraced different ontological understandings of what they thought a digital library was. The problems that this caused the project, and the development process, are described in detail; and I describe the various forms of data collected, including recordings and transcripts of face-to-face discourse, project e-mails, project documents, transcripts of project telephone conferences, etc. Also described are the range of qualitative and quantitative methods, including ethnographic coding, and computational forms of text analysis (latent semantic analyses) that were applied to these data, in order to understand how designers and users understood the digital library in different ways. Finally, there is detailed description of how these findings were fed back to the project's management and how the project managers performed organizational communication interventions based on these analyses. These interventions were based on developing visual artifacts and representations of their own

understandings of digital libraries, that were then made available to other project members, and which affected the project's work processes and productivity in significantly positive ways.

FACING COMPETITION: THE HISTORY OF INDIGO EXPERIMENTS IN COLONIAL INDIA, 1897-1920

**by Prakash Kumar PhD
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This historical study focuses on scientific research conducted across laboratories in colonial India and England, and in farm stations to improve the yield of indigo - the blue dyestuff extracted from the leaves of *Indigofera tinctoria*. The launch of cheaper and purer synthetic substitute by two German companies in 1897 provided the primary impetus for these endeavors.

The commercial attack by synthetic indigo was predictably resisted by those who were willing and ready to fight on behalf of natural indigo for a slice of the Western markets. The solid resistance of the native indigo growers drove the planters to use science rather than wage cut as a tool for reducing the cost of production of the natural dye. These efforts of chemists, bacteriologists, botanists, and agricultural experts continued till 1920. By studying the efforts of scientists called upon by the European planters living in India and the colonial government this dissertation analyzes the nature of science in a colonial context. At the same time it also reveals the dilemmas faced by the producers of the natural dye as they tried to fight the competition of the synthetic product in the market.

The doctoral dissertation explains: when and how were the laboratories and farm stations organized? Who were the experts and what type of expertise was brought to bear on the problem at hand? What results were obtained? To what extent did the efforts of the experts meet the goal of improving yield and consistency? And finally, under what circumstances were those efforts abandoned at the end of the period in question? Moving beyond the experts and outside the laboratories and farm stations, the dissertation also elucidates the nature of the support for these experiments by the planters and the colonial government.

HYBRID PRACTICES: THE DYNAMICS OF UNIVERSITY RESEARCH AND EMERGENCE OF A BIOTECHNOLOGY COMPANY

**by Juha Tuunainen
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This doctoral thesis focuses on the trajectory of an agricultural plant biotechnology research group and its transformation into a university start-up company under the auspices of a major Finnish university, the University of Helsinki. The data applied

in this study consist of 79 interviews and an extensive body of documentary material including scientific publications, research plans and reports, and correspondences. The qualitative analysis of these materials was informed by conceptual resources drawn from several theoretical approaches that have addressed science and the university organization in terms of work and practice e.g., cultural-historical activity theory, ethnomethodology and symbolic interactionism). On the grounds of the results so achieved, four sociological theories purporting a change of science and the university institution are discussed. The theories considered include the Mode 2 knowledge production thesis, the triple helix of university-industry-government relations, academic capitalism and the enterprise university.

The main body of the thesis is composed of four research articles, each analyzing a distinctive phase in the agricultural plant biotechnology group's trajectory. The first article analyzes the construction of research objects in the laboratory and the transformation of experimental systems used at the early stages of the group's research. The second paper relates to the social world perspective and investigates the complex organizational ecology of disciplines in the university department where the biotechnology group operated. The third paper makes use of the concept of boundary work and deals with the regulation of the emergent spin-off company at the university. Finally, the fourth article unites the empirical results and criticizes two of the above-mentioned theories, namely, Mode 2 knowledge production and the triple helix.

On the grounds of the literary review and empirical analyses accomplished, the thesis demonstrates the deficiencies in the existing sociological theorizing on the transformation of science and the university. By appraising the dissimilar theoretical statuses of the four theories in focus, the thesis also demonstrates the need to see science and universities as complex dynamic entities whose development is locally shaped by multiple historical, political and cultural characteristics, better appreciated by the practice-oriented sociology of science than the four theories considered.

**NEGOTIATING ACCEPTABILITY OF THE IUD:
CONTRACEPTIVE TECHNOLOGY, WOMEN'S
BODIES, AND REPRODUCTIVE POLITICS**

by Chikako Takeshita, Ph.D.

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In this dissertation, I deconstruct the commonly held assumption that the intrauterine device (IUD) is an unsafe and/or obsolete contraceptive method that has been used mostly to impose population control on women in developing countries. Simultaneously, I explore the changing meaning of the device over the last 40 years in varying socio-historical contexts. Capitalizing on the analytical tradition of science and technology studies that regards technology as socially constructed, I

analyze the IUD as a technology that transformed through a series of material and discursive negotiations. I show that negotiations over the IUD took place in multiple layers, most notably in the social and political domains that defined the meaning of the contraceptive technology, but also in the domain of science, in which claims about the device's technical features and its relationship with the biological body were made.

The dissertation is divided into the examination of four major domains - global population policies, American contraceptive market, American antiabortion politics, and scientific research - within which the IUD took shape both materially and discursively. My analyses of the first three, or the socio-political domains, inform my close reading of the scientific work on the IUD. By cross-examining the social backgrounds and the historical development of science, I illustrate the intricate relationship between scientific research of contraceptive technologies and the political implications of fertility control. At the same time, I offer a critique of the scientific discourse that often justified the use of the technology by women of certain race, class, and nationality. An additional chapter addresses the agency of IUD users by introducing the ways in which women in developing countries have manipulated the IUD to achieve reproductive self-determination. This dissertation should be of interest to scholars in cultural studies of science, technology, and medicine as well as to women's studies scholars with a focus on reproductive issues.

FROM THE WEBSITE

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ANNOUNCEMENTS

IEEE Technology and Society invites submissions in the broad areas of social and policy implications of electro-technology, engineering ethics, and history of electro-technology. Topics of particular interest to the editors during the coming year include social, ethical, and policy implications of:

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Writing for the EASST Review

Hi everyone,

Summer is arriving and I'm sure you are all full of sparkling research ideas (and looking forward to holidays; well, not to forget the EASST/4S conference in Paris of course)!

I just wanted to remind you of the possibility to write pieces, short essays, critical remarks about developments within STS, reports of STS events you have visited, etc. for the EASST Review. Unlike journal articles, these pieces do not have to be long and do not have to reflect your research (they can be 500-1000 words), but will give you the opportunity to engage or start debates about STS (or its future); explore ideas you have encountered at an interesting conference, and of course just help your writing skills. The EASST Review is there and can be used as a platform for ideas and exchanges on STS-related topics and it would be great if especially young scholars would like to engage in this. I would especially like to draw your attention to the possibility of writing a piece on your finished PhD research to let a wider audience know what your work is about. I know I would be very interested in reading (short pieces) about other people's PhD's.

For examples of EASST Reviews, see www.easst.net. Send your written pieces and essays to the editor of the EASST Review for consideration for publication. The editor is Chunglin Kwa, C.L.Kwa@uva.nl.

Looking forward to read your ideas and short articles in the EASST Review and hope to see you all in Paris in August! Have a great summer!

NEH 2005 Summer Stipends

Online Applications for NEH 2005 Summer Stipends will be available starting August 1, 2004, and will be accepted for filing between August 1 and October 1st, 2004 (5PM local time). Successful applicants receive \$5000 awards for two consecutive months of full-time research and writing. The stipends are to support advanced research that contributes to scholarly knowledge or to the public's understanding of the humanities. Award recipients usually produce scholarly articles, monographs on specialized subjects, books on broad topics, archaeological site reports, translations, editions, or other scholarly tools. Projects may be completed during the tenure of the award or be part of a long-term endeavor. Among other restrictions, summer stipends cannot be used for works in the creative or performing arts. Please see

EVENTS

Conference
Myth and the New Science
University of Bristol, UK
July 2006

In the eighteenth century Giambattista Vico formulated his theories of history of human civilization as *The New Science*, in a gesture which curiously parallels the proclamation of a new epistemology by the father of history, Herodotus, in the fifth century BC. In the history of history, we continuously see this mode of knowledge re-created and displayed anew, as new, and the discourse from which it repeatedly emerges is most often that of myth. This relationship is not simply one of opposition, as the early historians appropriate myth even while they seem to separate their works from this kind of storytelling. A similarly complex relationship can be seen today between myth and history. Contemporary views of the social significance of myth have clear affinities with histories of *mentalité*, and the importance of history in shaping individual and collective identity. In both oral and written history can be seen mythicizing structures, through which events in time can be made meaningful beyond time. In the twentieth century, the importance of memory, and of the performance of memory, has become pressing for the reaffirmation of humanity. At the same time, we see that history has become one of the most dominant systems of knowledge in the Western World, subsuming almost entirely literary and art criticism, and placing strongholds in the domains of philosophy and the sciences. This conference aims to explore the question of the many relationships between different forms of 'scientific' knowledge and myth, with especial focus on the claims made in different epochs to the instauration of a 'new science', and the mythic status of those very claims.

This conference will take place in the University of Bristol in July 2006. Papers are welcomed on any of the following aspects: myth and the new sciences of antiquity, Renaissance humanism, the Enlightenment, history of science, the new historicism, psychoanalysis, postmodernism, and the role of history in the discourses of mythology. Pre-arranged panels will also be welcome. Proposals for papers should come in the form of abstracts (one side of A4/US letter) to Dr. Ellen O'Gorman, Department of Classics and Ancient History, University of Bristol, Bristol BS8 1TB (tel. +44 117 928 9848; fax. +44 117 928 8678; email. e.c.ogorman@bris.ac.uk), by 30 June 2005

Cultural History of Health and Beyond
A joint venture of the European Association for the History of

Medicine and Health (its VIIIth meeting) and the Society for the Social History of Medicine
Ministère de la Recherche, Paris (France)
7-10 September, 2005

Submission Deadline: 15 Nov

<http://www.eahmh.net/>

Society for Philosophy and Technology 14th Annual Meeting
Theme: Technology & Designing
Delft University of Technology
Delft, The Netherlands
20-22 July, 2005

Submission Deadline: 30 Nov, 2004
<http://www.sptdelft2005.tbm.tudelft.nl/>

Perspectives on 20th-century Pharmaceuticals
Centre for Health, Medicine and Society and Business School
Oxford Brookes University, Oxford, England
14-16 July, 2005

Submission Deadline: 30 Sept, 2004
<http://ah.brookes.ac.uk/conferences/pharmaceuticals/>

CALL FOR PAPERS

Workshop Call for Papers "Imaging NanoSpace - Bildwelten der Nanoforschung" Zentrum für interdisziplinäre Forschung, Universität Bielefeld May 11 - 14, 2005 Images and the power of image-making are defining the field of nanoscience and nanotechnology. This is reflected in the founding myths of the field (which is said to have begun with STM and AFM microscope) and its popular representations that feature dramatic molecular landscapes, visionary devices, or the manipulation of molecules. Much of nanoscale research practice revolves around the creation and interpretation of images. The workshop will focus on the specific characteristics of images as visual representations. It considers the whole range of images ? from microscopy and simulation to popular culture. Scientists from the fields of STS, art theory and history, cultural studies, communication studies, and history and philosophy of science are invited to contribute. The full call for papers takes the form of an internet-exhibition at the following website:

<<http://www.ifs.tu-darmstadt.de/phil/NanoSpace>> This virtual gallery features 14 families of images. These are supposed to serve as a starting point and common referent for the talks and workshop discussions. While contributors are therefore asked to relate their proposals to one or more of these 14 families, they are not restricted to the images in the web gallery but invited to expand the pool. Please send a 200 to 500-word abstract in the form of a word-document by December 1, 2004 to: jochen.hennig@staff.hu-berlin.de (Jochen Hennig, Helmholtz Zentrum für Kulturtechnik, Humboldt University,

Unter den Linden 6, 10099 Berlin, Germany). Please indicate the families of images from the web gallery that your proposal is relating to. The conference language is English, a publication is planned. The workshop organizers are Prof. Horst Bredekamp (History of Art, HU Berlin), Jochen Hennig (History of Science, HU Berlin), and Prof. Alfred Nordmann (Philosophy, TU Darmstadt). The programming committee also includes Andreas Lösch and Joachim Schummer (Sociology, History and Philosophy of Chemistry, TU Darmstadt), Chris Robinson and Davis Baird (Art, Philosophy, University of South Carolina). For further information please contact: jochen.hennig@staff.hu-berlin.de or nordmann@phil.tu-darmstadt.de

The American Association for History and Computing (AAHC) Affiliate Association of the American Historical Association Part of Archives & Artifacts: The 119th Annual Meeting of the American Historical Association -- Seattle, Washington -- January 6-9, 2005
<http://www.theaahc.org/>

REFRESH!
FIRST INTERNATIONAL CONFERENCE ON
THE HISTORIES OF MEDIA ART, SCIENCE AND TECHNOLOGY

September 28 - October 2, 2005 at Banff New Media Institute, Canada
"The technology of the modern media has produced new possibilities of interaction... What is needed is a wider view encompassing the coming rewards in the context of the treasures left us by the past experiences, possessions, and insights." (Rudolf Arnheim, Summer 2000)

Recognizing the increasing significance of media art for our culture, this Conference on the Histories of Media Art will discuss for the first time the history of media art within the interdisciplinary and intercultural contexts of the histories of art. Leonardo/ISAST, the Database for Virtual Art, Banff New Media Institute, and UNESCO DigiArts are collaborating to produce the first international art history conference covering art and new media, art and technology, art-science interaction, and the history of media as pertinent to contemporary art.

CONFERENCE DIRECTOR & ORGANISATION
Oliver GRAU, Director Immersive Art & Database of Virtual Art. Humboldt University Berlin
<http://virtualart.hu-berlin.de>

POSITIONS

SOCIO-CULTURAL ANTHROPOLOGIST

University of Alberta, Department of Anthropology seeks a Socio-Cultural Anthropologist whose research and teaching focus on understanding the cultural and societal dimensions of modern science and/or technology with a strong anthropological perspective. The successful candidate will be expected to teach a large introductory course in the Anthropology of Science, Technology, and the Environment, other courses in his or her area of specialization as well as introductory anthropology. She or he will be expected to contribute to both the undergraduate and graduate programmes in Anthropology and to participate in the Interdisciplinary programme in Science, Technology and Society which is housed in the Faculty of Arts. This is a tenure track position at the rank of Assistant Professor commencing on July 1, 2005. PhD required at time of appointment.

We seek a colleague whose research interests complement those of other faculty in the Department (such as medical anthropology, linguistic anthropology, anthropology of religion, the Circumpolar north, and past human biology and behaviour), and who will be able to contribute to our continuing development of the four-field approach to anthropology. Deadline for application is December 10, 2004. Applications must include a letter describing areas of teaching and research interest, a curriculum vitae, and samples of publications and evaluations of teaching performance, if available. Letters of recommendation should be submitted by three referees. All materials should be sent to Dr. Raymond LeBlanc, Acting Chair, Department of Anthropology, 13-15 Tory Building, University of Alberta, Edmonton, Alberta, T6G 2H4, Canada. Applications to our confidential fax (780) 492-1526 or by email to gail.mathew@ualberta.ca are acceptable if followed by hard copy. Information about the Department can be obtained at www.arts.ualberta.ca/anthropology/.

All qualified candidates are encouraged to apply; however, Canadian and permanent residents will be given priority. If suitable Canadian citizens or permanent residents cannot be found, other individuals will be considered.

The University of Alberta hires on the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and Aboriginal persons.

Applications are invited for the post of Research Assistant attached to a newly funded project exploring the social and clinical dimensions associated with the implementation of pharmacogenetics (PGx). The research is part of a collaborative initiative funded by the Department of Health.

The post, which is located in the Department of Sociology's Science and Technology Studies Unit <http://www.york.ac.uk/org/satsu> is part-time (0.5 fte) and available for 30 months commencing 1 January 2005. The person appointed will work closely with Professor Andrew Webster and Dr Graham Lewis

See full details and further particulars under the Vacancies listed under "Research" at the following site:

<http://www.york.ac.uk/admin/persnl/cfm/vaculist.cfm>

Senior Analyst and Associate Positions

Center for Science and Technology Policy

Abt Associates Inc.

We are looking for one or more science and technology policy analysts for our Cambridge or Washington DC offices. The ideal candidate has a doctoral degree in science, engineering, or S&T policy, and S&T evaluation and/or policy experience (e.g., as part of OMB).

Much of the work will involve providing scientific support to the White House Office of Science and Technology Policy (OSTP) and other clients in the Federal government, where tasks may include developing research designs for projects involving the collection and analysis of both quantitative and qualitative data, developing data collection instruments and plans, conducting case studies, designing and implementing the analysis and synthesis of data, managing the work of more junior researchers, preparing technical memoranda and reports, preparing research reports intended for a wider audience, and communicating research results to clients and other external parties.

Competitive salary offered.

Abt Associates is an employee owned policy research organization with annual revenues of over \$180 million, providing services to governments and businesses worldwide. It is built on the concept that sound information and empirical analysis are the best foundations for decision making. Abt's Center for Science and Technology Policy is the division that has led our science and technology (S&T) studies for almost twenty five years. Current and past clients include NSF, NSB, NIH, NIST, DOE, NASA, NTIA, and others.

Interested candidates should send resume and cover letter by email to:

Bhavya Lal, Senior Associate
Director, Center for Science and Technology Policy Studies
Abt Associates Inc.
email: blal@abtassoc.com

Adjunct Faculty in Technology, Society, and Values (New York Institute of Technology)

Put your academic expertise to work as an Ellis College Adjunct Faculty Instructor.

Ellis College Adjunct Faculty is responsible for creating a

challenging, relevant, and engaging course experience for Ellis students. Ellis College requires thorough online training of all Adjunct Instructors to enable them to perform effectively in the unique Ellis College instructional environment. Instruction at Ellis College involves not only supportive interaction with individual students but community-building as well. The faculty mission is to create the very best conditions for the academic success of students. Adjunct Faculty are responsible for teaching Ellis College courses as designed, facilitating online discussion, evaluating student work, keeping students on track to completing the courses, and responding to individual student requests and concerns. Ellis Adjunct Faculty are educators and practitioners in their fields of expertise, and many teach at other institutions. They are required to hold a Ph.D. or Master's degree in their subject area, and most have related work experience.

Further Information: <http://ellis.nyit.edu>

Haverford College invites applications for a tenure-track appointment in the History Department at the rank of assistant professor with a specialization in the History of Science. We are especially interested in scholars who focus on the medieval and/or early modern eras and whose research emphasizes comparative scientific traditions and/or interactions between Western and non-Western knowledge cultures, including Islam. Candidates should send a detailed letter of application including a statement of teaching and research interests, c.v., at least three current letters of recommendation, and a sample of scholarship by December 1, 2004 to: Sharon Nangle, Administrative Assistant to the History of Science Search Committee, Haverford College, 370 Lancaster Avenue, Haverford PA 19041-1392. Questions about the position can be directed to Professor Lisa Jane Graham [lgraham@haverford.edu]. Haverford College is an Equal Opportunity/Affirmative Action employer. As part of its ongoing efforts to diversify its faculty and the life of the college, Haverford especially encourages women and minority candidates to apply. For information concerning Haverford College, please visit our web site (<http://www.haverford.edu>).

Contact Info:
Sharon Nangle
Administrative Assistant to History of
Science Search Committee
Haverford College
370 Lancaster Avenue
Haverford, PA 19041-1392

Website: <http://www.haverford.edu>

The University of California at Davis seeks to appoint a Director of the Science and Technology Studies Program, with a joint appointment in Anthropology, Economics, History, Philosophy, Political Science, Sociology or Psychology. Tenured associate or full professor, beginning Fall 2005. Duties include directing the interdisciplinary program in Science and Technology Studies, including program development and guiding the transition from an existing program in History and Philosophy of Science to an STS program with undergraduate major. Other duties include research, teaching, and service in STS Program and department. Teaching is based on a standard faculty load of four one-quarter courses per year, which will be reduced for administrative service as STS Director. The appointee must have Ph.D. and have a record of strong scholarly and teaching accomplishments in some field of social, historical or philosophical studies of the natural or social sciences, medicine, technology or engineering.

The STS Program at the University of California at Davis has involved participation by members of the Philosophy, History, Sociology, Anthropology and other departments in the social sciences and humanities, as well as faculty and students in the natural sciences.

Contact Info:
Professor Joan Cadden
Search Committee Chair
Science and Technology Studies Program
University of California
One Shields Avenue
Davis, CA 95616
Phone: 530-752-2224
FAX: 530-752-3156
Email: jcadden@ucdavis.edu