July 24, 2008

Dear STS Core Workshop Participant,

Welcome! We are much looking forward to working with you 30 July – 1 August.

Attached you will find bios for workshop leaders and guest speakers; a rationale for STS in the Core; our schedule and some readings.

The goal of the readings is to give you a flavor of an STS perspective on science and technology. Though much of this comes directly from the STS academic field, we will *not* be expecting you all to become STS scholars. Rather, we will be working with you to find ways to introduce issues of the complex interrelationship of science, technology and society from within your own disciplinary perspectives and interests. The Winner and Cutcliffe/Mitcham readings are relatively short, but we do ask you if possible to read them before the workshop begins. In preparation for the second day of the workshop, we have enclosed two *Physics World* columns on science and society by our invited speaker, Bob Crease of SUNY Stony Brook (bio attached). His article on 'Inquiry and performance: Analogies and identities between the arts and the sciences' is also provided as background material.

On Wednesday, we will provide targeted readings to clusters within the workshop – these will constitute two or three papers that we feel would be of specific interest to you as you develop your courses. We shall discuss these on Friday.

Each day we will begin with a continental breakfast at 9:30 a.m., with formal proceedings getting underway at 10:00 a.m. We will finish at 5:00 p.m. the first two days, with a cocktail reception on Thursday at 5:00 for those who are able to attend. We expect to end at about 4:00 p.m. on Friday (if the weather is nice ☺).

It is a really interesting collective exercise producing a new core for our students. We are delighted that you are among the pioneers of the STS component – we strongly believe in its importance and much look forward to learning more from you about how we can best assist you in this exciting endeavor.

All best wishes,

Geof Bowker	Shannon Vallor	Katie Vann
CSTS/Communication/ESI	Philosophy	CSTS

READING LIST

Day 1

Langdon Winner, 'Do artifacts have politics?', from *The whale and the reactor: a search for limits in an age of high technology* (University of Chicago Press, 1986)

Cutcliffe and Mitcham (eds.), *Visions of STS: Contextualizing Science, Technology and Society Studies* (SUNY Press, 2001); Chapters 1-4, 6 *photocopies included; books will be delivered to your boxes early next week.

Day 2

Robert P. Crease, 'Why science thrives on criticism' (Physics World, May 2000)

Robert P. Crease, 'A top ten for science and society' (Physics World, Dec 2000)

Robert P. Crease, "Inquiry and performance: Analogies and identities between the arts and the sciences." *Interdisciplinary Science Reviews* 28:4 (2003), 266-272.

Day 3 (To be provided on 1st day of workshop)

Facilitators and Guests
Geof Bowker, CSTS, STS Faculty Core Committee
Shannon Vallor, Philosophy, STS Faculty Core Committee
Katie Vann, CSTS
Carol-Ann Gittens, Education/Liberal Studies, Director of Assessment
Robert Crease, SUNY Stony Brook

Participants
Matt Bell, Psychology
Ruth Davis, Computer Engineering
Janice Edgerly-Rooks, Biology
Marilyn Fernandez, Sociology
Carol Gittens, Liberal Studies/Education
Tim Healy, Electrical Engineering
Phil Kesten, Physics
Shoba Krishnan, Electrical Engineering
Kristin Kusanovich, Theatre and Dance
Margaret McLean, Religious Studies
Larry Nelson, Philosophy
Chuck Powers, Sociology
Don Riccomini, English
Patti Simone, Psychology
Keith Warner, Environmental Studies
Alex Zecevic, Electrical Engineering

Bios of Workshop Facilitators/Guests:

Geoffrey C. Bowker is Executive Director, Regis and Dianne McKenna Professor Center for Science, Technology and Society, Santa Clara University and chair of the Faculty Core Committee for STS. His recent book, entitled Memory Practices in the Sciences was published by MIT Press in 2006. More information, including a number of publications can be found at his website: http://epl.scu.edu/~gbowker.

Shannon Vallor is Assistant Professor of Philosophy at Santa Clara University and a member of the Faculty Core Committee for STS. She received her Ph.D. in Philosophy from Boston College in 2001. Her areas of specialization include the philosophy of technology, with a special concern for ethical issues in information and communication technology, and the philosophy of science, focusing on the role of embodiment in scientific observation and evidence. Her publications include "The Fantasy of Third-Person Science: Phenomenology, Ontology and Evidence" in *Phenomenology and the Cognitive Sciences*, as well as articles in the *Journal of Consciousness Studies* and the edited volume *Intentionality: Past and Future* (2005). Her current research project, supported by a Hackworth Grant and the basis of recent presentations in the Netherlands and at Stanford, is entitled "Social Networking Technology and Human Relationships: A Virtue Ethics Approach".

Katie Vann is a social theorist and organizational ethnographer working with the Virtual Knowledge Studio in Amsterdam and with the Center for Science, Technology and Society at Santa Clara University. She received a Ph.D. in Communication Studies from UCSD, as well as degrees in Interdisciplinary Social Science (M.A.) and Continental Philosophy (B.A.). Katie researches the cultural and institutional technologies of neoliberal sociality and political-economic order. Current research focuses on the organization of transnational water governance, with an emphasis on the cultural construction of policy formation, water management procedures, and accountability regimes. She has published in a range of social science and humanities journals, including Ephemera: theory and politics in organization; Social Epistemology; Psychologie & Gesellschaftskritik; Mind, Culture, and Activity; First Monday; and The Journal of the American Society of Information Science and Technology.

Dr. Carol Ann Gittens is the Director of Assessment at Santa Clara University and is an Associate Professor in the Education department and the undergraduate Liberal Studies program. Dr. Gittens received her Ph.D. in social / personality psychology in 1996, from the University of California at Riverside. The central focus of Dr. Gittens' research is on the interface of critical thinking, motivation, and academic achievement of adolescents and young adults from diverse cultural and ethnic backgrounds. Dr. Gittens is first-author of the *California Measure of Mental Motivation* (CM3), a critical thinking disposition assessment instrument for children, adolescents and adults, and the *California Critical Thinking Skills Test for Adolescents* (CCTST_M20). Dr. Gittens' consulting activities include working with college administrators, faculty and staff, K-12 educators, as well as business executives, managers and employees. Dr. Gittens' areas of expertise include educational assessment in curricular and co-curricular programs, critical thinking pedagogy and assessment, survey and test development, and assessment design for individuals and institutions.

Bio of Invited Speaker:

Robert P. Crease is Professor of Philosophy and serves as Chair of the Philosophy Department at SUNY Stony Brook as well as historian at Brookhaven National Laboratory. He also heads the interdisciplinary Trust Institute at Stony Brook, which focuses on issues of trust in science and religion. He received his Ph.D. in Philosophy from Columbia University, and is both highly distinguished and widely published as a philosopher and historian of science. In addition to numerous scholarly articles, he writes a monthly column, 'Critical Point', on issues in science and society for *Physics World*. Among his published books are *The Prism and the Pendulum: The Ten Most Beautiful Experiments in Science* (2003), *Making Science: A Biography of Brookhaven National Laboratory* (1999), *The Play of Nature: Experimentation as Performance* (1993) and *The Second Creation: Makers of the Revolution in 20th Century Physics* (with Charles C. Mann, 1986), along with his forthcoming book, *Ten Great Equations that Shape the World*.

Having organized Stony Brook's interdisciplinary Science Studies Forum for several years, Dr. Crease is well-acquainted with the challenges and opportunities of the interdisciplinary model of STS education. As an example of how this model is integrated within his own department, Stony Brook's philosophy program includes the following among its undergraduate courses: 'The Nature and Practice of Science'; 'Philosophy of the Social Sciences', 'Philosophy of Science, 'Philosophy of Technology', 'Philosophy of Mathematics', 'Philosophical Psychology, 'Philosophy and Medicine', 'Philosophy and the Environment', 'Philosophy in Relation to Other Disciplines', and a 'Readings and Research course in the Philosophical Investigation of Other Disciplines'. He has also developed and co-taught an interdisciplinary "Trust Seminar" with Professor Everett Waters of SUNY's Psychology Department.

STS Workshop Schedule

Wednesday, July 30 – LOCATION: CASA ITALIANA 8

9:30-10:00	Continental breakfast served
10:00-10:15	Welcome and Introductions
10:15-11:00	Opening presentation by Geof Bowker: STS as an Interdisciplinary Model
11:00-11:45	Opening presentation by Shannon Vallor: STS in the Core Curriculum
11:45-12:45	Round Table Discussion/Q&A
12:45-1:45	Lunch
1:45-2:30	STS Course Objectives and Navigating the Syllabus Approval Process
2:30-3:30	Assessment Best Practices in STS Education (Carol-Ann Gittens)
3:30-3:45	Break
3:45-5:00*	Round Table Discussion of Winner and Cutcliffe/Mitcham Readings; Challenges and Opportunities for STS Education at SCU

*Readings enclosed in Welcome Packet; the Cutcliffe/Mitcham book will arrive in your department mailboxes on Monday, but copies of Chapters 1-4 and 6 are in your packet.

Thursday, July 31 – LOCATION: WEIGAND ROOM, ARTS AND SCIENCES

9:30-10:00	Continental breakfast served
10:00-11:30	Presentation by Invited Speaker Robert P. Crease, chair of the Philosophy Department at SUNY Stony Brook, historian at Brookhaven National Laboratory and monthly columnist for *Physics World* (See extended bio in welcome packet)
11:30-12:45	Round Table Discussion/Q&A
12:45-1:45	Lunch
1:45-3:45*	Breakout Sessions for Syllabus Development/Discussion (with assistance from Geof Bowker, Shannon Vallor, Katie Vann, Carol-Ann Gittens and Bob Crease)
3:45-4:00	Break
4:00-5:00	Round Table Discussion of Syllabus Development and Proposed Courses
5:00-7:00	Reception

* Faculty are asked to bring working materials to this session, appropriate for their stage of course development (course descriptions/proposals, draft or previous syllabi, potential texts/readings, etc.)

Friday, August 1 - LOCATION: WEIGAND ROOM, ARTS AND SCIENCES

9:30-10:00	Continental breakfast served
10:00-11:15*	Breakout Discussions of STS Case Studies/Syllabus Development
11:15-12:45	Participant Presentations: The First 5 Minutes of Your Course
12:45-1:45	Lunch
1:45-2:30	Group Feedback on Presentations and Course Proposals
2:30-4:00	Integrative Exercise

*Readings for this session will be provided on the first day of the workshop.

The Rationale for STS Education in the Core

1. A Santa Clara education ought to prepare every student to function as a well-informed and responsible citizen in their community and the world as a whole. This involves the capacity to make thoughtful and competent decisions about matters impacting their own lives as well as the wider human community and environment. In the 21st century the diffusion of scientific and technological culture into virtually every aspect of life *requires* that such citizens have a basic understanding of the scientific and technological dimensions of society and its institutions, as well as the complex relations between them.

2. Such 'technological citizenship', as it has been called, also demands refined skills in critical evaluation and problem solving, as well as the capacity to reflect from multiple perspectives on the many scientific and technological dilemmas confronting society.(Winston 15) In order to become full 'technological citizens' of the world, then, Santa Clara students will need more than just scientific and technological *knowledge*, they will also need the 'habits of mind and heart' needed to apply that knowledge intelligently and responsibly.

3. The traditional model of liberal education in the U.S. and elsewhere has historically underserved students in these respects, by means of promoting (either implicitly or explicitly) some or all of these faulty or inadequate assumptions:
   a. The assumption that science, technology and society can and should be treated within the various academic disciplines as separate domains of study.
   b. The assumption that science is best understood as an autonomous discipline immune from the influence of other social and cultural norms, values, and interests, with the countless counterexamples ignored or presented as 'aberrations' from 'real' science.
   c. The assumption that technology is simply 'applied science', rather than a social force that also shapes scientific theory and research in myriad ways.
   d. The assumption that technologies are 'value-neutral', and that social problems or opportunities created by their integration into society can simply be regarded as the result of user choices.
   e. The assumption that particular scientific and technological advancements are either unequivocally good or bad for society, rather than a more complex perspective that investigates how such developments affect individuals, groups and institutions differentially and along multiple dimensions of value, understanding that 'progress' almost always involves complex trade-offs.

4. The STS component of the Core is a powerful opportunity to encourage our students to question and reevaluate the assumptions above, and by facilitating their critical, reflective and active engagement with these questions, we can help them to become full citizens of a scientific and technological culture.

Winston, M. (2006) "Children of Invention", in *Society, Ethics and Technology*, 3rd ed., Winston & Edelbach (eds.), Belmont: Thomson Wadworth

STS CORE COURSE OBJECTIVES

1. Students will be able to comprehend and articulate the complexity of the relationship between science and/or technology and society.

2. Students will be able to distinguish the methods and processes of scientific inquiry and explain how science and technology advance through such processes.

3. Students will be able to analyze and evaluate the social impact of science and technology and how science and technology are themselves impacted by the needs and demands of society.

NARRATIVE EXPOSITION OF STS COURSE OBJECTIVES

For the benefit of Santa Clara faculty who are developing, or thinking about developing *Science, Technology and Society* courses for the new core, this document defines each of the three course objectives for STS and describes general pedagogical approaches to meeting these objectives, along with examples of such approaches in various disciplines.

Proposals for STS core courses should describe how that course will satisfy the three STS objectives for student achievement, and how such achievement will be assessed. With regard to each of the objectives, a course proposal should (a) identify and describe those exercises, units, or themes that the instructor believes will be particularly successful in modeling/encouraging student achievement of the objective, and (b) how someone looking at the course products could tell how well this goal was achieved in the case of any given student.

Finally, in order to ensure that STS courses provide students with substantial exposure to both the scientific/technological and the social dimensions of their subject matter, the STS Faculty Core Committee developed the following rule of thumb: a minimum of 30% of the course content should address the scientific/technological dimension, and a minimum of 30% of the course content should address the social dimension, each taught at a level appropriate for the expected student audience. Ideally, these dimensions will be integrated within the course rather than treated separately, and thus the FCC does not regard precise quantitative assessments of such percentages as feasible; however, the minimums reflect the overarching aim of the STS component: a true intellectual union of these perspectives in the minds of our students.

(continued)

Course Objective #1: *Students will be able to comprehend and articulate the complexity of the relationship between science and/or technology and society.*

Definition: Our first objective is to teach students that science, technology and society are not three separate islands, but that they mutually interpenetrate: social changes precipitate scientific and technological changes and vice versa.

General Approaches: This objective entails that one step towards helping our students become fully engaged citizens is to have them be able to pick up a newspaper or a popular science or technology journal and be aware of social, technical or scientific dimensions that are critical to understanding the development and are not included; and to know where they might go to pick up the whole picture.

Coursework should help students recognize that science, technology and society are, and have always been, fundamentally inter-related dimensions of human existence and help them integrate their understanding of these three regions of human activity.

Example: There are many ways to play this out in different disciplines. We will give just one example covering climate change from different disciplinary angles.

A historian teaching a climate change course might want to look at the history of the relationship between peoples and climate change over the past several thousand years (the desertification of Africa; the little Ice Age in the early 1800s when the Thames froze over) and so forth. So they would learn that climate change is an ongoing phenomenon. They should learn about the evidence for anthropogenic climate change dating from the Industrial Revolution. They should understand enough of the science to be able to follow debates around natural variation (Milankovich cycles; the role of volcanic eruptions and so forth) as opposed to change caused by our activities. They should learn about scientific changes on this issue – in the 1970s the consensus prediction was for an imminent Ice Age. And they should learn about the politicization of climate change science over the past ten to twenty years. A cognate course in an engineering school might look at the various technical fixes that have been proposed: giant mirrors in space, increasing the albedo of the ocean by dispersing reflective sheets, burying carbon dioxide far below the surface and so forth. However, to work in the new core, such a course might also cover an exploration of the trade-off between lifestyle changes (polluting less) and technical solutions. They might look at how 'clean technology' is developing now – and how some countries have embraced this as an economic boon and others continue to push for, say, the use of coal-fired plants. A science class could look at the various modalities for measuring climate change (tree rings, ice cores, the importance of isotope variations and so forth). However, it could also look at the ways in which the rules of scientific evidence have been deployed politically on both sides of the equation by believers and unbelievers.

Course Objective #2: *Students will be able to distinguish the methods and processes of scientific inquiry and explain how science and technology advance through such processes.*

Definition: Expresses the need for students to acquire a greater capacity for understanding how scientific inquiry and/or technology actually progress.

General Approaches: Develop a course containing content that helps students develop a greater capacity for understanding basic scientific/technological methodologies, concepts, principles, standards, and techniques.

Examples: A course offered in philosophy, history or another area of the humanities might meet the objective by presenting students with one or more case studies taken from the history of science in which the evolution of a particular theory or scientific concept is analyzed; this might include examining the theoretical or experimental background used to select and define the specific research problem or question; the specific patterns of scientific reasoning (deductive, inductive or abductive) used to advance the discovery; the specific techniques used for data collection and analysis, the stages by which the scientists arrived at their conclusions, and/or how the validity of those conclusions was ultimately confirmed by the research community. For example, one might teach a course in evolutionary theory that explored the conceptual difficulties in dealing with non-experimental, non-predictive science. In a history class, attention would be paid to the development of the theory in the context of changes in geology early in the twentieth century, the development of statistical tools and their value, and finally the synthesis between evolutionary theory and genetics.

A course taught in the natural sciences or engineering might meet this objective by focusing on a particular scientific discovery, development or sub-discipline and examining: the underlying scientific principles; the ideas that were revised, replaced or removed as understanding grew; and the scientific techniques used and developed that provided the tools for the discoveries. The theoretical and quantitative components of this treatment may be analyzed on a deeper level than would be the case in a humanities STS course, in accordance with the skills and background knowledge of the expected student audience. A canonical case here would be the move from a Newtonian to an Einsteinian world view—one could discuss this through reading Thomas Kuhn on the structure of scientific revolutions and the role of anomalies in science (which could be covered in an exploration of the emergence of quantum theory and general relativity).

Alternately, a natural sciences or engineering STS course might meet this objective by looking at a particular technology and examining: the mechanical or other physical principles presupposed by its design; the constituent physical parts of the technology and the means of their interaction; the nature of the energy sources relied upon; various quantitative methods and empirical techniques used in the design, fabrication and testing phases, and the prior technologies it draws from, improves upon, or replaces. For example, one could look at the development of the transistor, understanding why they are more useful than vacuum tubes, why it was so applicable to different industries, principles of integrated circuit design (especially the role of Boolean logic) and difficulties balancing heat budgets with chip size. The same types of technological content might be treated in a humanities STS course, but again, the theoretical or mechanical principles and quantitative methods may be analyzed on a deeper level in a course in the natural sciences or engineering, in accordance with the skills and background knowledge of the student audience.

Course Objective #3: *Students will be able to analyze and evaluate the social impact of science and technology and how science and technology are themselves impacted by the needs and demands of society.*

Definition: This objective concerns a range of cognitive habits and abilities that foster the ability to move beyond the confines of current conventional thinking and/or one's own background assumptions and prejudices, and to move in directions that are fruitful because they further illuminate the world and/or suggest constructive avenues of response to challenges.

General Approaches: Critical thinking skills extend beyond memorization and other passive learning techniques and involve the ability to *use* information actively and effectively. Although many approaches for STS courses would allow students to practice and enhance the above habits of mind, several can be highlighted as particularly appropriate. A course might lead students to closely follow the science in a case that illustrates the process through which, and consequences with which, a change occurred in accepted scientific thinking. Students could work to identify the initial scientific assumptions; the aims and values that shaped the selection of the problem and methods for attempting its solution; or how social, economic and/or political conditions may have impacted the work. Students might be asked to critically assess the way in which scientists and their peer community assessed their own progress; and/or the resultant consequences for society—both anticipated and unanticipated—of their achievements. Another course might analyze the "before/after" social transformation that occurred as a result of the introduction of a new technology. Students might work to identify the social, economic and engineering considerations that guided the design process; to discern and critically assess the merits of various assumptions about the needs and desires of the society or culture for which the technology was being developed; to compare the actual effects of the introduction of that technology with what was expected and to assess its overall contribution to human flourishing; or in the case of an emerging technology, to identify the various factors and contingencies that will collectively determine its impact on society. Students could also be asked to rigorously explore alternative ways that technology could work to better enhance social/community/organizational life, or ways that particular societies/institutions might be modified in order to constructively adapt to changing technological conditions.

Examples: A course on robotics and society might require that students practice critical and independent thinking by identifying the relevant socioeconomic facts, cultural priorities and presuppositions, human needs and values that created the initial impetus for robotic technology, as well as those currently shaping its development. Demonstrating more advanced critical faculties might involve reflecting upon the relationship between robotic technology and various notions of the 'good life', and determining how the benefits and costs of robotic technology might be distributed among different social and economic groups and institutions. The course might also involve the students anticipating future developments in robotics and assessing the social impact and ethical import of such developments. Finally, reasoned conclusions might be drawn about the social desirability of various possible outcomes, and sound strategies for societies, institutions and individuals to employ in constructively guiding and adapting to future developments in robotic technology could be identified.

A course on biotechnology and society might look at the structuring of the biotech industry and the role of publicly funded research. The stress here would be in identifying how and why certain scientific breakthroughs occur and others don't (for example, biocontrol is languishing at the expense of biotech in part because of different economic models). While exploring specific scientific developments (stem cell research, crop biotechnology, cloning) it could look at the role of public debate about these issues. Material from scientists, public policy makers and activists would be looked at in order to see what use – rhetorical and factual – they were making of scientific findings.

For further information or answers to specific questions about STS core course development, please contact any of the following members of the Faculty Core Committee for Science, Technology and Society:

Geof Bowker, CSTS (Chair)
Phil Kesten, Physics (CCIT Liaison)
Rich Barber, Physics
Jack Gilbert, Chemistry
Shoba Krishnan, Electrical Engineering
Chuck Powers, Sociology
Shannon Vallor, Philosophy