

Interdisciplinary studies in science, technology, and society: “New Directions: Science, Humanities, Policy”

Robert Frodeman^{a,*}, Julie Thompson Klein^b, Carl Mitcham^c, Nancy Tuana^d

^a*Department of Philosophy and Religion Studies, University of North Texas, 225 EESAT, Box 310920, Denton, TX 76203, USA*

^b*Interdisciplinary Studies Program, College of Lifelong Learning, Wayne State University, Detroit, MI 48202, USA*

^c*Division of Liberal Arts and International Studies, Colorado School of Mines, 1005 14th St., Stratton Hall 301, Golden, CO 80401, USA*

^d*Pennsylvania State University, 201 Willard Building, University Park, PA 16802, USA*

Abstract

This introductory paper reviews the origin and context of the articles assembled in the following special issue of *Technology in Society*. In March 2006 a workshop on the Hurricane Katrina disaster of August 2005 in New Orleans and the Gulf Coast attempted to promote interdisciplinary deliberations that would identify contributions that the humanities might make to an understanding of the many interactions between technology and society—interactions that were at the heart of this catastrophe and thus critical to an effective, long-term response. The workshop was itself another activity in an ongoing interdisciplinary effort known as “New Directions: Science, Humanities, Policy.” This paper thus summarizes previous workshops in this project before briefly commenting on the twelve papers and their themes.

© 2007 Elsevier Ltd. All rights reserved.

Keywords: Hurricane Katrina; New Orleans; Humanities; Science policy; Science; Technology and society

1. Introduction

When Hurricane Katrina made landfall just east of New Orleans on August 29, 2005, it precipitated the worst “natural” disaster in United States history. “Natural” is in quotation marks because, although the hurricane may have been a “natural” event, it was human factors that turned it into a catastrophe. The size and character of the disaster were set in motion not simply by the storm and its aftermath but, more importantly, by technological, economic, political, and cultural forces and conditions. New Orleans is particularly vulnerable to floods and hurricanes because of its long history of risky choices during centuries of radical environmental and social changes predicated on what now appears to have been a complex and in some ways excessive reliance on science and technology.

In March 2006, a multidisciplinary group of scholars comprising the New Directions initiative gathered in New Orleans to explore the connections among different forms of knowledge, and between knowledge and decision making, within the context of New Orleans and Hurricane Katrina [1]. Sponsored by the National

*Corresponding author. Tel.: +1 940 565 2134; fax: +1 940 565 4448.

E-mail address: frodeman@unt.edu (R. Frodeman).

Science Foundation, the organizing question of this meeting was: How did one of the greatest knowledge societies in history do such a poor job of planning for (and responding to) a long-anticipated event? The meeting's working hypothesis was that scientific and technical knowledge are able to have a more beneficial societal influence when placed in an interdisciplinary context where ethics and values are made explicit. The essays in this special issue of *Technology in Society* are selected products of that workshop.

At approximately the same time as the 2006 workshop, *Technology in Society* published a special issue [2] on “sustainable cities.” New Orleans might well have been used as a counter example. Borrowing the definition of sustainability from the journal's preface, New Orleans was not able to provide “the principal resources to maintain desired environmental standards and quality of life for all over a reasonable planning horizon” [2, p. 2]. Indeed, in the case of New Orleans, its location demanded a planning horizon that would take in what might be called the “near geological.”

In the aftermath of Hurricane Katrina a “Talk of the Town” piece in the *New Yorker* reprinted part of an article by John McPhee published 19 years previously [3]. In it, the author described how members of the US Army Corps of Engineers viewed their own politically mandated efforts to halt the geological migration of the Mississippi River away from New Orleans as ultimately unsustainable. But when, following Katrina, questions were raised about the wisdom of rebuilding New Orleans on the basis of previous assumptions, many commentators—and especially residents—claimed that not to rebuild was unthinkable given the city's rich historical and cultural heritage and the rights of all its current residents.

Sustainable cities are defined not only by their infrastructures but also by their cultures. Infrastructures are in part constructed in concord with the cultures of inhabitants, and cities have been the homes of cultures since their appearance in history about 4000 BCE. Some people still go to Jerusalem to pray at the Temple Mount, others to pray at Golgotha or at the Dome of the Rock, others to Athens to think in the shadow of the Acropolis. It is to protect such cultural legacies and their influence that we expend more than we might otherwise on new technological infrastructures by re-routing roads and controlling development. From this perspective, New Orleans is a city that for more than two centuries has sustained, and in turn been sustained by, a distinctive culture of unique customs, cuisine, and *joie de vivre*. Most notably, New Orleans gave birth to that special American musical idiom known as jazz. Additionally, like only a few other US cities—such as Boston, Chicago, and San Francisco—New Orleans has a distinguished literary tradition epitomized by the stories of George Washington Cable and Grace King, the drama of Tennessee Williams, and the novels of Walker Percy, John Kennedy Toole, and Anne Rice. Coloring the threads of this diverse tapestry is its unique mix of French, African-American, and Anglo traditions.

2. Background: New Directions in Science, Humanities, and Policy

New Orleans is a vivid example of a distinctive environmental challenge for technology and culture in society. Not surprisingly, environmental and societal challenges are not defined by academic disciplines. According to John Dewey's analysis [4], for instance, the challenge begins with recognition of a problematic situation, defined as one in which habitual responses to an environment are experienced as inadequate for continuing some activity that aimed to fulfill needs and desires. Within such a problematic situation arise cognitive efforts to identify and isolate relevant information. Inquiry thus calls on and is informed by a diversity of disciplines and initiates a process of knowledge production that must be continually reassessed in order to complete the cycle leading to understanding and transformation. There is something inherently cross-disciplinary and even transdisciplinary about all environmental and societal challenges. Questions of global climate change, health, environment, or restoration of ecosystems all depend on integration of scientific information with ethical, historical, and cultural perspectives that are aspects of any problematic situation. At the same time, the amount of technical knowledge available to inform intelligent decision making is sometimes overwhelming. Questions arise concerning how rich scientific knowledge and technological expertise can best be combined with diverse values for effective decision making.

In the Spring of 2001, these concerns brought together a small group of scholars from the environmental sciences and the humanities, and stimulated them to launch an interdisciplinary research group called “New Directions in the Earth Sciences and the Humanities.” The purpose was to seek better ways to complete the cycle of knowledge production by bringing the humanities to bear on issues often addressed by science and

technology alone. Although interdisciplinarity in the form of collaborations among different kinds of science, between science and engineering, and between the physical and the social sciences have become increasingly (if still insufficiently) common, the humanities have often remained too marginal. The working hypothesis of New Directions has been that the humanities and humanities-oriented social sciences can make significant contributions to public policy discussions that heretofore have relied heavily on the sciences and engineering.

During its development, what is now known as “New Directions: Science, Humanities, Policy” [5] has explored this hypothesis by means of case studies and a series of workshops. The initial workshop, held at Biosphere 2 near Tucson, Arizona, in March 2002, formed several case study teams each of which focused on some aspect of society–water interaction. The workshop also considered the looming failure of Biosphere 2—a particularly ambitious effort to model biocomplexity, which arguably failed because of what might be described as weaknesses in its humanities interface.

Moving from west to east across North America and then jumping to Europe, the initial six case studies focused on:

- The Georgia Basin (in British Columbia, Canada) futures project.
- Salmon restoration in the lower Columbia River.
- Environmental decision making and hydrological modeling in the Utah Department of Transportation.
- Humanizing environmental research on the South Carolina coast.
- Visualizing a Gulf of Maine digital library.
- Ecology and cultural history of the Neva River, St. Petersburg, Russia.

A second workshop, held at the Colorado School of Mines in September 2002, shared initial case study results. It also explored as its own case study the cleanup then in progress at the Department of Energy Rocky Flats Plant, the former manufacturing site for the plutonium “pits”, or triggers for thermonuclear weapons, located just outside Denver. At cleanup completion in September 2006, Rocky Flats became the most successful remediation of any major nuclear waste contamination site in the United States. A key contributor to this success was the independent Citizens Advisory Board, which was able to interact effectively with the corporate contractor as well as federal, state, and local agencies. This effectiveness, in turn, rested at least in part on the humanities-based skills of its staff and membership, and pointed up communication studies as an interdisciplinary field of the humanities.

Selected proceedings from these two workshops were prepared by Robert Frodeman [6]. The initial proceedings volume emphasized the contributions of the humanities, actual or potential, to the interdisciplinary dimensions of environmental science and engineering projects. Examples included case studies of salmon restoration, which tried to bridge scientific studies of and religious respect for nature; relations between science and culture in the management of the Neva River in St. Petersburg, Russia; interdisciplinary collaboration between philosophers and ecologists on the South Carolina coast; and the construction of a geospatial information system for the Gulf of Maine drawing on hermeneutic principles adapted from art and literature.

A third workshop took place at Pennsylvania State University in October 2003, and again undertook an interdisciplinary case study, this time in the form of a field trip exploring the Human–Environmental Regional Observatory (HERO) network. With sites in Arizona, Kansas, Pennsylvania, and Massachusetts, HERO research attempts to develop protocols for studying the long-term implications of human dimensions of global environmental change at regional and local levels. In the Penn State case, the emphasis is on collaboration with the US Geological Survey to create tools for geographic visualization that can draw context- and task-sensitive data from large data warehouses and facilitate multi-site communications. Such a project is strongly interdisciplinary insofar as it incorporates not just scientific but also social science and humanities information.

As Julie Thompson Klein observed, apropos of the initial New Directions activities, “For all the talk about interdisciplinarity, not a lot has been written on how to actually do it and even the abundant reports on research and teaching examples are case-specific” [7, p. 107]. In an effort to advance reflection and practice, she formulated 42 questions divided into five categories (initiation, organization, social learning, collaboration

and integration, and evaluation and dissemination), which any interdisciplinary team might well ask itself as it attempts to advance its work. (It is notable that these started out as guiding questions for cancer research and then were applied to sustainability research in Australia.) As Klein argued:

Building a collaborative identity depends on a willingness to learn from each other, regardless of the disciplinary and social status hierarchies that individuals carry into projects.... Language is crucial. Projects generate a common lingua franca that is typically a hybrid of specialized terms.... Provision for ongoing communication is also important, in order to capture the knowledge production that is occurring and to insure long-term dissemination of results and insights in pertinent fields. [7, p. 108]

Clearly, the humanities have an important role to play in such activities as developing a willingness to learn from one another and appreciating the linguistic basis of knowledge production that is the outcome of social learning. This is especially true if the experience is disseminated beyond the bounds of any particular interdisciplinary experience. Moreover, bringing the humanities into the equation helps deal with what might be called factual fallacy—the belief (still surprisingly common across society) that scientific facts are sufficient for resolving societal problems. Rather, societal progress requires intelligent, context-sensitive discussions where one’s own and others’ values are evaluated by standards of reasonable discourse.

3. Cities and rivers: St. Petersburg, Russia

A second period of New Directions work was initiated by a fourth workshop, this one hosted by Polytechnic University in St. Petersburg, Russia in June 2004. This workshop took one of the original case-study projects—on the Neva River—and gave the water-society theme more concrete form in terms of cities and rivers. Through such specificity it sought greater depth in an intercultural as well as interdisciplinary framework. Participants in the Neva workshop included experts in river ecology, riverfront planning, ecological education, landscape ecology, and environmental activism, as well as environmental philosophy, anthropology, literature, and interdisciplinary studies. A professional photographer joined the group on its field trips to provide images for the website and other documentation.

The group spent its mornings in meetings at the university for formal presentations and discussion. Afternoons were spent touring key locations along the river, including the unfinished dam across Neva Bay, extensive urban embankments, the World of Water Museum, historic sites upriver at the mouth of the Izhora River, the Oreshek Fortress, the ancient city of Ladoga, and the extraordinary water works at Peter the Great’s summer palace. Local historians and urban planners accompanied the group on these tours and provided background and insight into the relationship between the river and human settlements along it.

One product of the St. Petersburg workshop is a 2006 article in *Technology In Society* [8] that analyzed conflicts and convergences between ecology and design in an urban river. Another was a bilingual, interdisciplinary website [9], which is still under construction to include images and essays about the culturally significant sites. All essays are presented in Russian and English, and the website is designed as a “tour” along the river. The aim is to develop this site into a significant teaching and research tool.

4. Cities and rivers: New Orleans and Hurricane Katrina

In response to Hurricane Katrina the New Directions team leaders sought to extend the cities and rivers theme into a workshop on New Orleans and its interdisciplinary science, technology, and society interactions. As exemplified by St. Petersburg, urban rivers offer a particularly useful focus for exploring the complex challenges faced by human societies in an expanding scientific and technological world. Urban rivers often serve the needs of large populations for drinking water and sanitation. When located at river deltas, they handle the concentrated inputs of entire watersheds, which provide transportation routes for people and goods but are also vectors for the movement of invasive species. Urban rivers are complex hydrological systems that are highly sensitive to weather, climate, development, and river management. River contours and bridges determine transportation flows in and around the city which, along with river ecologies, shape urban design and development. Culturally, rivers contribute to the identity of their cities, shaping narratives, aesthetic

expectations, and relationships to the broader world. In the case of New Orleans, scientific, engineering, economic, ethical, political, and cultural perspectives interact in multiple, competing approaches for interpreting the life of a river-based urban cityscape with unique vulnerabilities, engendering debates about how best to respond to the devastation linked to Hurricane Katrina.

The magnitude of the problem is greater than technological, economic, or even political assessments typically measure. Hurricane Katrina, as the intersection of geological and human history, presents a unique teachable moment for the earth sciences, challenging citizens to reflect on their relations to non-human realities. It also calls into question a particular kind of faith in science and technology that draws attention away from social science and humanities questions.

For example, in a provocative study of hurricane damage across the 20th century, Roger Pielke and Daniel Sarewitz [10] show that although monetary damages have increased, this cannot be attributed to increases in the number of hurricanes or their intensity. In consequence, they argue, to focus on producing long-range scientific hurricane predictions may not be a reasonable use of limited resources. In their words, “The primary cause for the growth in impacts is the increasing vulnerability of human and environmental systems to climate variability and change, not changes in climate per se” [10, p. 256]. Initially, this argument may appear to diminish concern for issues such as climate change, which many sought to highlight when interpreting the impact of Hurricane Katrina. At the same time, Pielke and Sarewitz emphasize that “the central role played by the characteristics of population and society” is a factor that increases vulnerability [10, p. 265]. Of course, it should be clear that an interest in climate change does not necessarily detract from concern about increasing vulnerabilities; on the contrary, climate change as projected could exacerbate vulnerabilities that are increasing for societal and other reasons.

One aspect of population and society that Pielke and Sarewitz slight is the way some groups become more vulnerable than others not simply as a result of hurricane intensities or engineering particulars. Often it is complex social and economic forces that contribute to enhancing the vulnerabilities of some while enhancing the securities of others. It is such human-made vulnerabilities and securities that call for social justice analyses of the kind more likely to be emphasized in the humanities. And it is the discussion of such social justice issues that post-Katrina New Orleans has the power to stimulate. Scientific and technological knowledge are incomplete without the inclusion of moral and political knowledge.

It is not just nature but everything from building codes and zoning ordinances to insurance standards and transportation systems—and their willingness to appreciate the existing realities of geology and climate—that are key factors. To quote Pielke and Sarewitz again, “Focusing more attention on the integrated, multidisciplinary aspects of climate impacts will likely show that current research portfolios ... are out of balance with respect to the information needs of decision makers” [10, p. 267]. Social and political factors, including how to integrate scientific and technological understanding into social and cultural orders, as a special concern of the humanities, must be of special interest to all experts. Indeed, the popular faith in scientific knowledge and technological inventiveness as answers to the problems highlighted by Hurricane Katrina, is not directly subject to scientific or technological criticism. It is necessary but not sufficient to point out that some engineered structures, such as levees, may not be adequate for their purpose. It would be a mistake to assume that better engineering alone can solve the problem.

What is called for in addition is a more general criticism of cultural patterns of reliance on science and technology as well as a critical self-examination of human behaviors. Time after time, engineers and others charged with responding to the devastation in New Orleans, found the human and cultural aspects of the city’s plight colliding with their professional judgments about the vulnerability of the city to future floods and the difficulty of rebuilding in a wise and responsible way. For example, to one interviewer’s comment that “It just isn’t a great place for a city,” an engineer and environmental scientist from Louisiana State University responded by saying, “Well, it’s how you look at it. If it’s your city, if you fall in love with this city, it doesn’t matter how the city looks, you still love it” [11]. On another occasion, the president of the American Society of Civil Engineers argued that Katrina challenged engineers to more fully acknowledge their responsibilities to protect public safety, health, and welfare [12]. In effect, such scientists and engineers have found themselves debating the city’s right to remain below sea level with an inadequate public understanding and technological infrastructure. In the aftermath of Hurricane Katrina, scientists, engineers, and humanists—often incomprehensible to one another—have found themselves seeking a common language. Often this is a

language of ethics and aesthetics, of love and beauty, intertwined with issues of levees, wetland buffers, and sedimentation rates. The goal of the New Directions workshop was to create a setting in which scientists, urban planners and designers, engineers, and humanists could explore the implications of this new—or newly obvious—proximity of their interests.

5. Twelve contributions

The twelve papers collected here and arranged alphabetically by author, enlarge and deepen the basic theme of the need for more comprehensive interdisciplinary engagement between science, engineering, and the humanities. The first four papers highlight issues of social justice. Each author—Barbara Allen (architect and science and technology studies scholar), Victor Baker (hydrologist), Richard Campanella (geographer), and Craig Colten (geographer)—has a professional history of bringing a humanities perspective to bear within a scientific or technological discipline. Allen is a model example of this interdisciplinary effort; after a professional degree in architecture she returned to graduate school in the interdisciplinary STS field. Baker has for years worked to promote among his scientific colleagues a pragmatist philosophical perspective on the geosciences. Campanella, in the title of his essay, affirms his philosophical interests. Colten is one of the foremost geographer-historians of New Orleans. All but Baker have extensive personal histories of living in or near New Orleans. The themes of these first four authors come together to raise fundamental issues of justice and, as with Campanella, point to the need for further empirical and analytic work.

It is worth noting that few of the scholars came to the workshop from which these essays emerged with as consistent an emphasis on the humanities dimensions of their work as is now manifest here. The fact that the humanities—with their focus on the distinctly human concerns of ethics and interpretations of the meaning of experience—play such a prominent role in these papers is at least in part the outcome of reflections stimulated by discussions that took place in New Orleans in the wake of hurricane Katrina. This point applies in one way or another to most of the papers in this issue.

The second set of four papers—those by Scott Frickel and M. Bess Vincent (sociologists); Fletcher Griffis (civil engineer); Thomas Lapoint (biologist); Lisa Shaffer (political scientist) and Demetri Deheyn (marine biologist)—emphasize more technical issues that need to be taken into account by the humanities and any public discussion of the future of New Orleans. Frickel and Vincent provide empirical evidence to support the existence of a form of institutional blindness that humanists and ethicists often point out by other means, such as textual and rhetorical studies. Griffis (whose paper is the only one not a result of the Katrina workshop) provides an engineer's analysis of what went wrong, using his extensive experience in the US Army Corps of Engineers, and a distinguished academic leader in construction engineering. As an environmentalist and director of an institute of applied science, Lapoint offers a general ecological perspective. Shaffer and Deheyn open up the issue of New Orleans to a comparative assessment from the perspective of scientific studies and engineering design work currently being undertaken to protect Venice, another culturally important and flood-endangered city.

The last four papers are by Wesley Shrum (sociologist), Eugene Turner (ecologist), Anna Wesselink (civil engineer and science and technology studies scholar), and Brent Yarnal (geographer). Here again there is an emphasis on disciplines that involve interdisciplinary constructions and highlight the importance of the humanities. Shrum's approach to sociology manifests a concern for human experience and an interest in utilizing new media technologies to give expression to such experience. Turner's ecology, as presented in a recent issue of *Science* [13] and an associated news focus story [14], draws out the human implications of his research, especially policy discussions about rebuilding New Orleans. Yarnal is a geographer not so much of the physical as of human–environmental interactions, who calls special attention to issues of vulnerability while making rhetorical use of the jazz experience so characteristic of the city with which he is concerned. Wesselink is another technical professional who has returned to the university to do interdisciplinary graduate work in science and technology studies. Her narrative of engineering and the social context of the Delta Werk in the Netherlands offers an international perspective on the efforts of a region to protect itself for the long term from the potential catastrophic effects of storms and floods.

As should be apparent, this is a multidisciplinary group of scientists, engineers, and social scientists all influenced by the humanities, who are also concerned to advance interdisciplinary understanding of complex

science-society issues and to promote more intelligent democratic decision making. The intellectual merit of this set of papers is that it deepens our understanding of the interconnections among disciplines in addressing societal challenges. Obviously, the natural sciences and engineering are extremely good at providing knowledge about the physical world, while the social sciences and humanities strive for knowledge of the social and cultural world. But as Hurricane Katrina's devastation demonstrated, we must also understand the intersection between things and people, between the natural environment, science and engineering, and social and cultural orders. The broader impact of these essays thus lies in their potential for improving the relevance of scientific and engineering knowledge to the social realm, and the relevance of ethics and cultural understanding to the scientific and technological domains.

Acknowledgments

Many sponsors deserve acknowledgment for their multiple contributions to the New Directions project from which this collection of papers has flowed. What follows is only a partial listing reflecting primarily monetary grants. Initial seed money came from the Hennebach Visiting Professorship in the Humanities at the Colorado School of Mines; further extensive funding has been provided by the US National Science Foundation with additional support from the National Aeronautics and Space Administration, the US Geological Survey, the Environmental Protection Agency, the National Center of Atmospheric Research, the National Endowment for the Humanities, and the Environmental Protection Agency. The Penn State Rock Ethics Institute and the University of North Texas Department of Philosophy and Religion Studies are founding institutions of New Directions and have contributed generously to this initiative. The Katrina workshop and production of this selected proceedings was funded by National Science Foundation grant no. EAR-055035.

To A. George Schillinger and Anthony J. Wiener of *Technology In Society* who, because of their care for the themes and devotion to quality, contributed extensive editorial guidance to the authors and thereby improved the final product in ways that cannot be numbered but can only be appreciated, we offer deep thanks.

Finally, we would like to dedicate this collection of essays to Michael Mayhew, a program officer at the National Science Foundation, recently retired, whose vision of interdisciplinarity that includes the humanities and the social sciences has been a source of repeated encouragement over many years.

References

- [1] New Directions Initiative website: <<http://newdirections.unt.edu/katrina/index.html>>.
- [2] Technol Soc 2006; 28(1–2):1–2.
- [3] McPhee J. The sunken city. *New Yorker*, Sept. 12, 2005. p. 38–9. Selection reprinted from the control of nature: Atchafalaya. *New Yorker*, February 23, 1987. p. 39–44.
- [4] Dewey J. *Logic: the theory of inquiry*. New York: Henry Holt; 1938.
- [5] See the New Direction website: <<http://www.ndsciencehumanitiespolicy.org>>.
- [6] Frodeman R. The new directions initiative. *Colorado School Mines Quart* 2003;102(1):1–114.
- [7] Klein JT. Thinking about interdisciplinarity: a primer for practice. *Colorado School Mines Quart* 2003;102(1):101–14.
- [8] May R. Connectivity in urban rivers: conflict and convergence between ecology and design. *Technol Soc* 2006;28(4):477–88.
- [9] See: <<http://enspire.syr.edu/nevaworkshop/nevamap9/htm>>.
- [10] Pielke Jr. RA, Sarewitz D. Bringing society back into the climate debate. *Popul Environ* 2005;26(3):255–68.
- [11] National Public Radio, September 16, 2005.
- [12] Martenson DR. Message from the president: lessons learned from Hurricane Katrina. *ASCE News* 2006;31(9):4.
- [13] Turner RE, Baustian JJ, Swenson EM, Spicer JS. Wetland sedimentation from Hurricanes Katrina and Rita. *Science* 2006;314:449–52 First published online *Science Express* 2006 (September 21).
- [14] Stokstad E. Katrina study stirs debate on coastal restoration. *Science* 2006;313:1713.

Robert Frodeman is Associate Professor and Chair of the Department of Philosophy and Religion Studies at the University of North Texas. Frodeman's *Geo-Logic: Breaking Ground between Philosophy and the Earth Sciences* (2003) is complemented by two edited volumes: *Earth Matters: The Earth Sciences, Philosophy, and the Claims of Community* (2000) and *Rethinking Nature: Essays in Environmental Philosophy* (edited with Bruce V. Foltz, 2004).

Julie Thompson Klein is Professor of Humanities at Wayne State University. She is the author of *Interdisciplinarity: History, Theory, and Practice* (1990) and, most recently, *Humanities, Culture, and Interdisciplinarity: The Changing American Academy* (2005). She also does extensive consulting on interdisciplinary skill and knowledge development both in the United States and abroad. Klein is a frequent consultant on interdisciplinarity for the US National Science Foundation, the National Institutes of Health, and the National Endowment for the Humanities.

Carl Mitcham is Professor of Liberal Arts and International Studies at the Colorado School of Mines, where he also directs the Hennebach Program in the Humanities and coordinates a graduate-level Individualized Interdisciplinary Program. A recent publication project was to serve as the editor-in-chief of the four-volume *Encyclopedia of Science, Technology, and Ethics* (2005). (His contribution here includes support from NSF grant no. SES-0620175.)

Nancy Tuana is DuPont/Class of 1949 Professor of Philosophy, Women's Studies, and STS and Director of the Rock Ethics Institute at Pennsylvania State University. She works in the areas of philosophy of science, epistemology, ethics, and feminist science studies. Her forthcoming article, "Viscous Porosity: Witnessing Katrina" (*Material Feminisms*, eds. Susan Hekman and Stacy Alaimo, Duke University Press) examines the centrality of humanities perspectives in examinations of human–environment interactions. She also serves as co-founder and secretariat of the Collaborative Program on the Ethical Dimensions of Climate change, which recently released the *White Paper on the Ethical Dimensions of Climate Change* <<http://rockethics.psu.edu/climate>>.