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Cultural Studies

Theorizing Politics, Politicizing Theory

VOLUME 12 NUMBER 3 JULY 1998

Special issue:

Cultural Studies of Science and Technology

Edited by

Ann Balsamo

Editorial Statement

Cultural Studies continues to expand and flourish, in large part because the field keeps changing. Cultural studies scholars are addressing new questions and discourses, continuing to debate long-standing issues, and reinventing critical traditions. More and more universities have some formal cultural studies presence; the number of books and journals in the field is rapidly increasing. *Cultural Studies* welcomes these developments. We understand the expansion, reflexivity and internal critique of cultural studies to be both signs of its vitality and signature components of its status as a field. At the same time, cultural studies has been – and will no doubt continue to be – the subject of numerous attacks, launched from various perspectives and sites. These have to be taken seriously and answered, intellectually, institutionally and publicly. *Cultural Studies* hopes to provide a forum for response and strategic discussion.

Cultural Studies assumes that the knowledge formations that make up the field are as historically and geographically contingent as are the determinations of any cultural practice or configuration and that the work produced within or at its permeable boundaries will be diverse. We hope not only to represent but to enhance this diversity. Consequently, we encourage submissions from various disciplinary, theoretical and geographical perspectives, and hope to reflect the wide-ranging articulations, both global and local, among historical, political, economic, cultural and everyday discourses. At the heart of these articulations are questions of community, identity, agency and change.

We expect to publish work that is politically and strategically driven, empirically grounded, theoretically sophisticated, contextually defined and reflexive about its status, however critical, within the range of cultural studies. *Cultural Studies* is about theorizing politics and politicizing theory. How this is to be accomplished in any context remains, however, open to rigorous enquiry. As we look towards the future of the field and the journal, it is this enquiry that we especially hope to support.

Lawrence Grossberg
Della Pollock

January 1998

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Anne Balsamo

INTRODUCTION

THE TOPIC FOR THIS SPECIAL ISSUE grew out of discussions I have been involved in the past few years about the structure of interdisciplinary programmes and in particular the role that cultural studies can play in rethinking humanities education for the twenty-first century. I bring to these discussions both a research interest in feminist cultural studies and a pedagogical interest in developing courses and classroom materials in the study of science, technology and culture. Since 1985, the date that marked the initial publication of Donna Haraway's essay, 'A manifesto for cyborgs', these two areas of interest have become increasingly intertwined for many cultural studies scholars as we have turned our collective attention to the critical analysis of science, technology and medicine as the dominant institutional sites for the production and circulation of contemporary global culture.

It is certainly true that this recent interest can be traced back to the clarion call that Haraway issued to socialists and other feminists in the mid-1980s. More than Haraway probably ever anticipated, the 'Manifesto' fulfilled its rhetorical objective: it served as the catalyst for an impressive range of new critical work that takes as its focus the cultural implications of new developments in science and technology. Noteworthy anthologies include *Technoculture* (1991), edited by Constance Penley and Andrew Ross, *Technoscience and Cyberculture* (1996), edited by Stanley Aronowitz, Barbara Martinson and Michael Manser, and the work collected in *The Cyborg Handbook* (1996), edited by Chris Hables Gray. This is not to say that the works collected in these anthologies all follow in Haraway's footsteps. In fact, Manser and Aronowitz take pains to assert that it is 'Haraway's position — but not her approach — on technology, science, and culture' that they largely share (p. 10). Their project represents what they characterize as a 'frontal assault' on the categories and concepts marked by the terms 'technology', 'science' and 'culture'. In contrast to Haraway's 'backdoor assault' (which they don't elaborate fully), Manser and Aronowitz argue for the development of a theory of complexity to describe and account for the shape of contemporary technoculture. This mild critique of Haraway notwithstanding, her work remains an important source of inspiration for cultural critics — and especially for an

entire cohort of feminist graduate students – who seek to understand not only the current technological landscape, but also the shape of things to come as we project ourselves, theoretically and politically, into the next millennium.

Naming this work

What has become evident by the mid-1990s is that the mere act of ‘naming’ of an area of study as ‘cultural studies of science and technology’ often generates controversy among those who subscribe to its intellectual objectives and theoretical commitments. As noted above, Aronowitz and Menser depart from Haraway’s approach to the issue, while they steadfastly assert that cultural studies is best situated to provide a theory of complexity adequate to make sense of the contemporary organization of technoscience. Working a different section of this intellectual territory, Peter Dear takes issue with Joseph Rouse over his confusion about the influence of cultural and social history on contemporary cultural studies of scientific knowledge. Rouse’s article, ‘What are cultural studies of scientific knowledge?’ was the lead article in the first issue of *Configurations* (the journal of the Society for Literature and Science). Here Rouse itemizes the issues that ‘mark the movement beyond the terms of the disputes between internalists and social constructivists’. As he goes on to admit, it is ‘for convenience’ that he adopts the phrase ‘cultural studies of scientific knowledge’ to refer to this quite heterogeneous body of scholarship in history, philosophy, sociology, anthropology, feminist theory and literary criticism’ (p. 2). Rouse’s objective in this piece was to introduce the readers of *Configurations* – many of whom come from a literary studies background – to a distinctive project built on the work of scholars from many fields, all of whom take a cultural approach to the study of science. Because he is concerned to elaborate the key differences between cultural studies of scientific knowledge and a social constructivist (SSK) tradition, the commitments he attributes to cultural studies are defined more in terms that belong to the discourse of SSK than to that of cultural studies. The six themes he attributes to cultural studies include:

- (1) antiessentialism about science; (2) a nonexplanatory engagement with scientific practices; (3) an emphasis upon the materiality of scientific knowledge; (4) an even greater emphasis on the openness of scientific practice; (5) subversion of, rather than opposition to, scientific realism or conceptions of science as ‘value-neutral’; and (6) a commitment to epistemic and political criticism from within the culture of science.

To elaborate these themes he invokes the work of several noteworthy ‘cultural practitioners’ – Paula Treichler, Sharon Traweek, Donna Haraway, Evelyn Fox Keller, Bruno Latour, Leigh Star, among others. As he admits, the people he cites

do not comprise a singular school nor do they represent a common scholarly framework. Again, his point in listing the names of these diverse scholars is to draw attention to the heterogeneity of cultural studies projects that engage issues of the construction of scientific knowledge. In this, Rouse is successful; and yet his invocation of the name ‘cultural studies’ to identify this selection of scholars seems both familiar and odd at the same time. His choice of names works well to illustrate the claims he wants to make about the contribution that cultural studies can offer to the epistemological analysis of scientific knowledge. But the specific cultural theory that marks this work as an example of ‘cultural studies’ is less well elaborated. To be fair, Rouse’s project (as he asserts several times in his article) is true to one of the abiding characteristics of cultural studies – that of its heterogeneity and cross-disciplinary influences. And yet there is a field of scholarship that has been *historically* identified as cultural studies that has during its history included work on issues pertaining to science and technology.

In fact, when reviewing that history, it becomes evident that the move made by Rouse – to gather a heterogeneous group of people under the umbrella term ‘cultural studies’ and to assemble insights from their work in the name of cultural studies – is one that has happened with some frequency during the past two decades. In the process, the identity paradox of cultural studies comes to the fore. How does one ‘name’ a field that is so deeply marked by heterogeneous and cross-disciplinary influences? Furthermore, in the face of this heterogeneity, upon what grounds can one assert the coherence of cultural studies? It is clear, as Richard Johnson illustrated, that cultural studies has a history and a sense of continuity and tradition in terms of the questions it addresses and the methods it employs. As I argued in a different context,¹ perhaps the best approach to take when attempting to stake out a territory for cultural studies is to do so historically: to revisit the work done over time to determine the ongoing commitments that mark the work as ‘cultural studies’. To this end, the next section of this introduction attempts to recall some of those earlier attempts to apply the insights of cultural studies to questions pertaining to science and technology.

One set of influences

In that cultural studies itself builds on the work of an entire tradition of critical scholarship, especially the work of those associated with the Frankfurt School, this engagement has a long history. From Marx through Marcuse, not to mention Habermas and Polanyi, several scholars whose work is central to the development of critical theory had themselves been involved in the project of investigating the specifically cultural dimensions of science and technology. Key theoretical terms such as ‘ideology’, the ‘public sphere’, and ‘capitalism’ were debated and clarified in the work of these critical thinkers specifically in reference to the practices of technologists and the expropriation of a scientific worldview

in the development of both industrial and postindustrial societies. In making reference to this history, I am not suggesting that we need to return to the work of some 'mythic' fraternity of founding fathers in lieu of the inspiration of cyborgian feminism in order to continue our work on these issues. Rather I suggest that a review of some of the work done in the name of cultural studies in the 1970s and early 1980s on issues pertaining to science, technology and culture would not only ground this work historically — an important endeavour especially in the face of criticism that contests our 'right' to address such issues — but it will also illuminate nuances of the questions that continue to compel contemporary work. Although a fuller elaboration of this historical reclamation project is beyond the scope of this introduction, I'd like to begin with a consideration of two books and an educational curriculum that show the early influence of cultural studies on such questions.

Two edited collections, both published in 1980, grew out of the work of scholars who were associated with the Center for Twentieth Century Studies at the University of Wisconsin-Milwaukee (UWM) during the 1970s. These two books include some of the earliest work done in the name of cultural studies on issues pertaining to technology, art, and scientific rationality.² The first volume, *The Myths of Information: Technology and Postindustrial Culture*, edited by Kathleen Woodward, included contributions from Baudrillard, Huyssen, Wildon and Ellul among others, and included sections on 'technology, mass culture, and the public sphere', 'art and technology', and 'cybernetics, constraints and self-control'. The influence of the Frankfurt School's critical theory is explicit: Oskar Negt's article, titled 'Mass media: tools of domination or instruments of emancipation? Aspects of the Frankfurt School's communication analysis', elaborates the sometimes contradictory work on communications and the mass media by scholars such as Horkheimer, Adorno, Brecht and Benjamin. But others pushed beyond the insights of this group to analyse in greater detail the relationship between culture and technology. For example, in his article 'The hidden dialectic: the avant garde — technology — mass culture', Andreas Huyssen writes:

I would go further: no other single factor ha[d] influenced the emergence of the new avant garde art as much as technology, which not only fueled the artists' imagination (dynamisim, machine cult, beauty of technics, constructivist and productivist attitudes), but penetrated to the core of the work itself. The invasion of the very fabric of the art object by technology and what one may loosely call the technological imagination can best be grasped in artistic practices such as collage, assemblage, montage, and photomontage. . . . It may actually have been a new experience of technology that sparked the avant garde rather than [as Benjamin argued] just the immanent development of the artistic forces of production.

(p. 158)

Here Huyssen begins to address an issue that has become more pressing for cultural studies during the past decade — the relationship between the experience of technology and the production of culture. He goes on to offer a historical view on the meaning of the technologically saturated art created by various groups of Dadaists, not because their methods should be resurrected or imitated in the service of producing a critique of contemporary mass culture, but rather because their historically specific engagement with technology and art illuminates a critical project that persists for us today: how to make sense of the relationship between changes in the means of technological production and the contours of the realm of everyday life, especially as these technological developments are 'taken up' more broadly in art, literature and culture. Huyssen also points to a related difficulty for cultural criticism, both then and now: how to apprehend the contradictory effects of technology as it is implicated in the simultaneous creation of new possibilities and the reproduction of traditional, and often oppressive, social relations.

Several people associated with the first volume contributed to the second book as well, which takes its title from a phrase used by Huyssen in the above quotation: *The Technological Imagination: Theories and Fictions*. It is probably not surprising then to see the persistence of key questions from one volume to the next. One difference between the two books is that the second book includes several essays that focus specifically on the relationship between science, technology and literature. One section, titled 'Science fictions', includes work by Darko Suvin and Samuel Delaney, as well as by Teresa deLauretis, who writes:

In every historical period, certain art forms (or certain literary forms . . .) have become central to the episteme or historical vision of a given society. . . . If we compare it with traditional or postmodern fiction, we see that SF might, just might, be crucial from now on. . . . The science fictional construction of a possible world . . . entails a conceptual reorganization of semantic space and therefore of material and social relations, and makes for an expanded cognitive horizon, and epic version of our present social reality.

(p. 170)

Thus we see again the elaboration of a topic that has become familiar to those working in cultural studies of science and technology in the 1990s: a focus on science fiction, as a popular literary form, as a semantic field that narrativizes — and thus makes available for analysis and criticism — the arrangement of contemporary social realities.

In the 'Introduction' to the first book, Woodward describes the range of perspectives represented by the various authors in the anthology:

Although the contributors represent many different disciplines – communications and cultural analysis, literary criticism, intellectual history, philosophy, aesthetics, art history, cybernetics, and economics – their work is best described as cultural studies. . . . Broadly speaking, the concern is with cultural politics. . . . Technology is not considered apart from culture, but rather a part of it, and one part only.

(p. xviii)

Woodward's identification of the space of intellectual overlap as 'work best described as cultural studies' marks the scope of work not only in the two books described above, but also in the institutional setting that gave rise to the work collected in these two volumes. Beginning in the mid-1970s, several faculty from the Center had been teaching in an interdisciplinary programme in 'Cultural and Technological Studies' (CTS) started at UWM in 1969 as a curricular programme aimed at the University's engineering undergraduate students. The programme booklet (published at UWM in 1977) that describes the CTS curriculum states that one of the reasons for the development of the CTS programme was that 'Technology . . . is too important to be left to the technologists'. As the statement continues, it becomes clear that the faculty were beginning to stake out a new territory of intellectual inquiry:

The basic aim [of the CTS programme] is to provide students a 'context', historical and cultural. Rather than attempt either to survey the vast and rich themes of Western culture or endeavor to provide students with a topical introduction to God, man, nature and society, our curriculum concentrates on the meaning of life and work in a technological society. Students have the opportunity to evaluate the basic value systems, to examine the limitations and opportunities which this context provides, and to question the relationship between current issues, power structures, change elements, societal needs, and ethical systems.

(p. 4)

The booklet goes on to list the courses and syllabi that constitute the curriculum of the programme. Here we find courses from a wide range of disciplines: anthropology ('Cultural Systems, Energy and Technology'), zoology ('Bioethics and the Future of Man'), urban affairs ('Technology and Urban-industrial Development'), communications ('Human Communication and Technology'), comparative literature ('Literature and Ecology'), history ('Social History of American Technology to the Civil War'), philosophy ('Ethical and Legal Problems in Technology'), and political science ('Technology and Public Policy in the Courts'). Whereas the title of the UWM programme explicitly referred to the study of technology and culture, science was also considered to be an important part of

the critical purview of the programme in that several syllabi required students to read basic scientific research, as well as historical essays on the development of scientific rationality as a particular philosophical worldview.

The point in revisiting the details of the structure of the interdisciplinary programme developed throughout the 1970s at Milwaukee is to illustrate the fact that the interest in technoscience is not a new area of critical concern for cultural studies. Moreover, this interest (as represented in the Milwaukee curriculum) takes shape institutionally during the same time frame as did many science studies and STS programmes in the US. Among the differences between the UWM programme and other science studies efforts were both its focus on technology and culture and its inclusion of courses from a wide range of disciplines into its curriculum. While the decision to include faculty and courses from across the UWM campus may have been a thoroughly pragmatic one – apparently one of the original aims of the programme was to provide a more coherently organized liberal arts education for UWM engineering majors – it enacts a commitment that has by now become an abiding strength of cultural studies projects: the reliance and utilization of interdisciplinary frameworks of analysis for the study of the complex interactions among science, technology, medicine and other domains of cultural knowledge and practice. We see also the resonance with Rouse's invocation of heterogeneity and intellectual diversity in the name 'cultural studies'.

Similar to programmes in science and technology studies, the foundation for this early programme in the cultural studies of science and technology included reference to the work of Jacques Ellul, Paul Goodman, Louis Mumford and Thomas Kuhn. But it also drew on studies of literature, popular culture, science fiction and art criticism as a way of shifting the terms of analysis from a focus on the social characteristics of scientific practice (a typical concern of STS programmes) to a consideration of the cultural embeddedness and the cultural circulation of scientific and technological knowledge. Several of the people associated with the UWM programme in the 1970s continued to offer important insights into the dynamic relationships among various technologies and cultural practices explicitly in the name of 'cultural studies'. These scholars were themselves influenced by the work of earlier critics, many of whom, as mentioned above, also belong to a history of cultural studies. Thus it is possible to read in the various syllabi the trace of the influence of Marxist theory, the social theory of the Frankfurt School, and the aesthetic theory of Lukacs, Brecht and Benjamin.

The influence of communication and media studies

Although not as present in the work of the people at UWM, the other early influences for this focus of cultural studies rests to different degrees with Marshall McLuhan and Raymond Williams. While both fixed their critical gaze on the

dominant media technologies of postindustrial society, they each employed dramatically different methodologies in their work. Where McLuhan contributed his 'tetra-arch' as a methodological template for the analysis of a particular technology's influence and impact, Williams' focused on the study of technological forms and the complex ways in which technologies are both determining conditions and determined effects of specific cultural practices. While it is not the place here to rehearse the limitations of McLuhan's formalism, suffice it to say that his influence can still be seen in current cultural studies work, due no doubt to the resurgence of interest in him popularized by the editorial staff of magazines such as *Wired* and *Mondo 2000*, as well as the continued interest in Baudrillard's writing.³

Less well cited than McLuhan, but arguably more thoroughgoing, was Raymond Williams' studies of broadcasting technology, most notably his book, *Television and Cultural Form*, published in 1974. Williams, like McLuhan and Walter Ong, appreciated the centrality of communication technologies for the social and cultural integration of postindustrial life. Williams refused McLuhan's technological determinism based on what he judged to be grand abstractions on McLuhan's part in favour of a more grounded analysis of the relations among specific communication institutions. Instead, he promotes a theory of complexity (his term) to describe and explain the determining influence of various media technologies.

Determination is a real social process, but never (as in some theological and some Marxist versions) as a wholly controlling, wholly predicting set of causes. On the contrary, the reality of determination is the setting of limits and the exertion of pressures, within which variable social practices are profoundly affected but never necessarily controlled. We have to think of determination not as a single force, or a single abstraction of forces, but as a process in which real determining factors – the distribution of power or of capital, social and physical inheritance, relations of scale and size between groups – set limits and exert pressures, but neither wholly control nor wholly predict the outcome of complex activity within or at these limits, and under or against these pressures.

(p. 130)

Williams employs this theoretical foundation not only in his study of television and postindustrial culture, but also in his more historically broad-ranging analysis of historical communication systems. His essay on 'Communication technologies and social institutions' is worth rereading for the insights it offers about the so-called epochal transformations between oral, written and print cultures.⁴ 'Between the invention of printing, in the 15th century, and our own day [1981], there has been a long and complex series of institutional changes and conflicts in the uses of this powerful and often decisive technology [writing] (n. 228) His

focus here is on the complex interactions between social institutions and technological conditions whereby literacy becomes a widely adopted cultural objective and cultural battleground.

A fuller explication of Williams' study of the history of communication systems and literacy is (as are many other topics) beyond the scope of this short introduction. Although Williams is better appreciated for his attention to the study of cultural forms, of literature, of drama, and more recently of television, I suggest that his study of literacy is one of his most undervalued contributions to the developing field of cultural studies of science and technology.⁵ Literacy – as an institutionalized set of educational objectives and a mass circulated set of specific knowledges – remains a contested zone of cultural authority. In describing the ways that notions of literacy are ideologically reproduced (and sometimes, though more rarely, contested) through the interactions among technological forms, scientific epistemologies, social institutions and popular cultures, he enacts a critical practice that is attendant both to the historical specificity of particular cultural arrangements and to the theoretical development of cultural studies more broadly. Literacy is a borderland where educational policy meets educational practice, cultural knowledge confronts cultural politics, and the social is reproduced in the individual. Much of the work going on in the name of cultural studies of science and technology implicitly addresses issues of literacy – either through an attention to the informal networks through which science and technology education circulate, networks such as popular science fiction, museums, or popular film, or through attention to the received histories of science and technology that serve as the guiding narratives of science education in the US today.

It is exactly on the topic of scientific and technological literacy that cultural studies faces one of its most pressing political challenges today. Our work is often interventionist in its objectives – the horizon of this interventionist aim is twofold. On the one hand we seek to describe and analyse contemporary arrangements of scientific and technological culture, arrangements that are often 'black boxed' by scientific and technological practitioners, and beyond the supposed expertise of lay critics. It is especially important for cultural studies of science and technology to investigate the way in which certain arrangements get reproduced over time, even as new agents, with new degrees of freedom, transform the landscape of possibilities. Because we live with this landscape we need to keep attentive to the way in which new possibilities are constructed while others are short-circuited and foreclosed.

An equally important horizon is to attend to the education of generations of younger students about the issues that will increasingly come to determine, if not dominate, their social worlds. Cultural studies scholars and critics need to take seriously the challenge and responsibility for transforming the educational system wherein new scientists, technologists and future citizens of the world are educated. Although the possibilities for curriculum revision are scarce, it is not

impossible. In fact, one of the ways in which cultural studies is growing is through new alliances with scientific and technological partners – in technical writing programmes, medical humanities programmes, and scientific ethics and technological policy courses. Forging these new alliances represents an attempt to reap the intellectual terrain, and to stake a claim on a territory that has been previously ‘off-limits’ to the non-scientist. As with other political struggles, this project is not without its risks and dangers.

As cultural studies scholars actively seek to contribute to debates about the structure of scientific and technological education, they find themselves in the position of having to navigate a highly charged and contested zone of cultural authority. These debates have garnered a fair share of media attention under the banner of the ‘Science Wars’ and have in the past two years included a number of well-publicized skirmishes between scientists and cultural critics. At issue are questions of authority and intellectual territory.⁶ While some scientists contest the right of cultural scholars to critique the practices of technoscience on the basis of a (collective and individual) lack of scientific training and professional socialization, cultural critics counter that science, technology and medicine represent the central institutionalized sites of ideological work in contemporary culture. As such, these technoscientific institutions and practices implicate all of us in global arrangements that we have a right, and in fact a duty, to debate, contest, modify and perhaps even to transform. These institutions and practices are therefore important areas of investigation – even for the supposedly untrained critic. Although scientific training and the related professional socialization clearly bestow upon science ‘producers’ a range of intellectual privileges – including the privilege of speaking the discourse of truth – the lack of such training and socialization does not insulate anyone from the consequences of the deployment of scientific authority or technological rationality, nor does it disqualify a critic from understanding the intricacies of the social matrix within which technoscientific knowledge is produced and disseminated. In fact, one could argue, in the anthropological tradition, that the ‘outsider’ status of the cultural critic engenders an incisive (albeit perspectival) insight into the actions under consideration. While the debates are still ongoing among participants in the Science Wars, these skirmishes represent a significant chapter in the history of cultural studies in that they testify to the increasing influence of cultural studies within the US academy now, not just in the traditional humanities, but also in the sciences and other professional fields.

The work in this special issue

True to the influence of this history I have briefly invoked, the scope of these articles as a collection spans several traditional disciplines and implicitly argues that the study of scientific and technological formations demands a critical facility

to read across discourses and to borrow analytical insight from diverse interpretive frameworks. In contrast to the focus of SSK or STS – studies that emphasize the investigation of the social practices of scientists and technologists or of the development of scientific knowledge – this work focuses instead on how scientific and technological knowledge becomes institutionalized in specific cultural arenas such as medicine, tourism, the leisure industry, and youth culture. In this sense, the emphasis of these articles is more a shared focus on the deployment and circulation of scientific and technological knowledge – both diachronically and synchronically – than on its development and contestation.

In her article ‘English mud’, Kavita Philip investigates the epistemological issues at stake in the circulation of specific British colonialist ‘settlement’ memoirs of the late nineteenth and early twentieth century. She illuminates the concern on the part of indigenous people living in the hill country of Nilgiri – a region in the western mountains of India – about the colonialist transformation and control of the nature of the region. Her investigation of the rhetoric of colonial science shows how scientific and technological rationality, as historically specific forms of subjectivity, aided the British imperialist project in settling the region. One of the attendant consequences was that certain classes of scientists (including anthropologists as well as botanical agriculturists) became engaged in the colonialist transformation of an entire region and social system. As Philip points out, traditional SSK approaches will often investigate issues such as the social construction of nature, but not usually with an understanding of the way in which such constructions are themselves politically contested and embedded in global political economies – in short, how they are constituted in relation to the enterprise of colonialism. By combining the insights of SSK and the sociology of science with cultural studies, Philip shows how social constructions are politically and economically ‘stitched into place’ even as they are contested by other social actors. Thus, she contends that:

historical scholarship in cultural studies of science is faced with a unique opportunity: that of transcending traditional boundaries between disciplines by forging a historiography which fully incorporates the insights of cultural/textual studies, to yield a genuinely integrated approach to engaging in a dialogue with the past – one that combines political engagement and cultural critique without abandoning the rigour of complex and detailed historical analysis.

Working on a similar concern, namely the way that cultural constructions of nature vary historically as well as geographically, Richard Grusin analyses the narratives embedded in a specific conservationist act: that of creating Yosemite as a US national park. His article, ‘Reproducing Yosemite’, discusses the expressive (signifying) practices of landscape architecture as it develops in concert with and against nascent beliefs in environmentalism in the US in the nineteenth century.

In his attention to the historical specificity of the circulation of a discourse about nature and aesthetics, he shares with Philip a concern to keep cultural studies historically grounded. His contribution, in keeping with this focus, is an illumination of the way that scientific and technological practices (specifically of Olmstead's borrowing of certain tropes of neuro-medicine) were implicated in the reproduction and dissemination of certain relations of capitalist production. In the case of Yosemite, he shows how Olmstead's invocation of the therapeutic value of natural scenery refracted the contradictions of late nineteenth-century capitalism. For Olmstead, the therapeutic benefits offered by the 'national' park simultaneously built on and elided the effects of social and psychological exchanges that constituted the capitalist marketplace in the nineteenth century. Grusin's reading of the Yosemite conservation project draws attention to the historical moment when 'environmentalism' became thinkable in America. Thus he illuminates the historical context and epistemological antecedents for the development of a particular cultural logic that persists today.

Working on a dramatically different intersection between science and nature, in her article, 'Interspecies reproduction: xenogenic desire and the feminist implications of hybrids', Susan Squier examines the meaning of the invocation of a specific experimental medical procedure: cross-species fertilization. Even as the procedure is 'outlawed' in various government reports, Squier shows how the concept, once put in circulation, has contradictory ideological effects. Her close reading of an official governmental research panel report yields a glimpse of both an underlying moral anxiety and acute curiosity with the mixing of human and non-human biological material. For Squier, this anxious obsession about hybrid embryos recalls theories of race that circulated in the seventeenth, eighteenth and nineteenth centuries. As she briefly reviews the historical development of the scientific interest in hybridity, she illuminates the trace of a racist ideology at work in contemporary scientific theories of interspecies reproduction. To show further how this ideology circulates in other cultural forms, and in more recent historical moments, Squier turns her attention to the elaboration of narratives of hybridity in more recent literary texts, first of several texts that reveal the nuances of a modernist fear of hybrids and then of those that announce a particular postmodern fascination with the promises of hybridity. Through her close analysis and reading of one through the other, Squier describes how both scientific theories and literary texts reveal broader cultural preoccupations with reproductive boundaries and transgressions. Moreover, she shows how even the most proactive texts on xenogenesis betray our limits to think outside the boundaries of 'class, race, gender, species, as well as propagative methods'. She ends – by invoking Rosi Braidotti's work – with an invitation to feminists to begin to think 'interspecies reproduction within an alternative register of non-sexual reproduction'. Squier's article shows clearly the way in which scientific debates get taken up in specific popular cultural texts. Culture and science, in her view, are not worlds separated by ontological and

epistemological differences, but are rather interlaced sites for the elaboration and circulation of a particular worldview that has material consequences for all participants.

In a way similar to Squier's invocation of the racist implications of theories of hybridity in the biomedical sciences and in the shift from modernist to post-modernist literature, Ron Eglash maps the cultural politics that emerge in the transformation between phases of cybernetic theory as they parallel changes in American youth culture. His article, 'Cybernetics and American youth sub-culture', offers a speculative account of the causal links between cybernetics and popular culture – links that he argues work in both directions – especially as they concern the non-scientific involvements of early cybernetic theorists, including Norbert Weiner, Gregory Bateson, Margaret Mead and others. Eglash notes the way in which political polarization accrued to those dichotomies central to the field of cybernetics. Of particular interest is the way in which 'recursivity' as a characteristic of self-corrective systems becomes identified with a humanistic notion of liberation. In Eglash's work we read echoes of Raymond Williams as he discusses how scientific and technological constructs are complexly, and often contradictorily, implicated in the determination of other cultural phenomena as they are also influenced by broader cultural forces. He then proceeds to trace the ways in which the *meaning* of the analogue-digital dichotomy is differently deployed in various social analyses and scientific accounts of the different phases of the historical development of the informational sciences. By his own admission, his final analysis backs away from offering a grand statement to explain the confluence between the technoscience changes he traces in the field of cybernetics and the ones he isolates in various popular cultural practices. In doing so he reminds us that the power of cultural analysis does not result from the production of grand theoretical formulations about various cultural practices, but rather from the act of making manifest the connections between what seem to be on the surface disparate practices and knowledges.

Greg Wise takes up a topic similar to Eglash's in that he investigates the nature of agency in cybernetic systems. His article, titled 'Intelligent agency', considers the 'nature' of intelligent agents – programmes that navigate information networks as an 'agent' of a computer user. Such IAs serve as mediators between a cybernetic structure – such as the space of networks of information – and the individual user. But the nature of the agency of these programmable intelligent agents is dubious at best. They are, Wise argues, always 'double agents' – working for the user in an immediate sense, but ultimately for a corporate agent in some guise. The nature of the agency possessed by IAs is compared to the nature of agency possible for cyborg citizens. This leads Wise to a discussion of the differences between linguistic agency and technological agency as two forms of agency available to technological users. The point of his analysis is to draw our attention to the way in which technologies not only 'have agency' in a Latourian sense, but are reproducing agents that can function as social actors

and as our proxies in the information landscape of the Digital Age. As Wise argues in the end, this technological multiplication of disembodied social actors *who are empowered to act on our behalf* is not a part of some science fictional future, but a current situation that requires our immediate attention.

The final article in this special issue considers a relatively new mass-mediated technology for the circulation of scientific and technological knowledge. In his article, 'IMAX technology and the tourist gaze', Charles Acland offers an analysis of the development of IMAX cinema as it extends the filmic perspective of popular cinema into the tourist industry and museum culture. His project has significance for both cultural studies as well as film studies in that he argues that IMAX is a 'powerful example of the changing role of cinema-going in contemporary post-Fordist culture'. In describing IMAX as a 'multiple articulation of technological system, corporate entity and cinema practice', Acland employs Gramscian social theory to describe the 'meaning' of this emergent media form and shows how specifically it is reconfiguring older cultural forms and practices under new conditions of spectatorship and filmic production. In doing so, Acland comes the closest to Williams' approach to the cultural study of technological forms by focusing simultaneously on the relationships among the social institutions (cinema, tourism) that shape the development of this new technology, and on the impact of the technology on other institutional arrangements (spectatorship, the epistemological structures of museum culture). In the process, he returns to an insight suggested by Raymond Williams several years ago: that culture is taking over the integrative function of social practices. As Acland points out: 'the distinctions between the museum and the amusement park, between institutions of public education and public entertainment, between shopping and tourism, and their associated modes of presentation, are increasingly muddled.' His study – of one site of the collapse of the social into the cultural – serves as an insightful model for the construction of cultural studies of science and technology in that it offers rich details about the organization of media institutions and the development of new technologies while it educates the reader about the significance of these arrangements and the transformations we often fail to notice.

Although there is some disagreement about the most important points to emphasize in studying the cultural dimensions of scientific and technological formations, taken together the contributors to this collection offer accounts of science and technology as cultural accomplishments that are simultaneously influenced by and implicated in reproduction of broader cultural arrangements. This is the promise, following Raymond Williams, of cultural studies of science and technology – to show with historical rigour and analytical precision how science and technology are both determining conditions and determined arrangements. Whereas the broad aim of this issue is to build on the work of science and technology studies (STS) as it has been developed and disseminated in the US during the past three decades, it is specifically concerned to extend this

work into the domain of culture. The articles in this issue demonstrate the particular contribution that cultural studies can make to the exciting and sometimes cranky area of research in technoscience studies. At the very base, authors share an understanding of science and technology as immanently social practices, but they are also concerned to illuminate how such practices are themselves part of broader cultural formations. Taken together, these articles identify the range of scientific and technological issues that will be important across global cultures during the rest of this decade and into the next century.

Notes

- 1 Anne Balsamo, 'Feminism and cultural studies', *Journal of the Midwest Modern Language Association* (Spring, 1991): reprinted in Jeffrey Williams (ed.) *The Institutions of Literature* (SUNY, forthcoming).
- 2 Kathleen Woodward (ed.) *The Myths of Information: Technology and Postindustrial Culture* (Madison, WI: Coda Press, 1980) and Teresa deLauretis, Andreas Huyssen and Kathleen Woodward (eds) *The Technological Imagination: Theories and Fiction* (Madison, WI: Coda Press, 1980).
- 3 *Wired* magazine claims McLuhan as its 'patron saint'. *Mondo 2000* gushes McLuhanesque platitudes in every (sporadically published) issue. Baudrillard is another author who takes McLuhan a bit too literally without considering the implications of his technological determinist position. See especially his essay, 'The implosion of meaning in the media and the implosion of the social in the masses', in Kathleen Woodward (ed.) *The Myths of Information: Technology and Postindustrial Culture*.
- 4 In Raymond Williams (ed.) *Contact: Human Communication and its History* (New York: Thames and Hudson, 1981: 225–38).
- 5 For a compilation of this work, see Alan O'Connor (ed.) *Raymond Williams on Television: Selected Writings* (London: Routledge, 1989).
- 6 For an insightful analysis of the implications (specifically) for cultural studies of one recent skirmish in the 'Science Wars', see Jennifer Daryl Slack and M. Mehdi Semati, 'Intellectual and political hygiene: the "Sokal Affair"', forthcoming, *Critical Studies in Mass Communication* 14:3 (1997). See also the volume edited by Andrew Ross, *Science Wars* (Durham: Duke University Press, 1996).