Gender and Technology

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Abstract

The praxis-oriented interdisciplinary field of feminist technology studies (FTS) has done most among the social sciences to build a vibrant and coherent school of gender and technology studies. Given their shared commitment to exploring emergent forms of power in the contemporary world, there is surprisingly little dialogue between FTS and mainstream cultural anthropology. This review begins by outlining FTS and its concepts and methods. I then turn to the anthropology of technology, which also offers useful conceptual frameworks and methods for exploring gender regimes. Then, to highlight the ideological and methodological contrasts between social and cultural analyses of technology and the implications for gender analysis, I discuss the treatment of technology in two leading theoretical fields in the cultural anthropology of modernity and globalization: the anthropology of technoscience, and material culture studies. I conclude by asking which forms of engagement might be envisaged between the fields.

INTRODUCTION

FTS: feminist technology studies

coproduction of gender and technology: their mutually constitutive relationship (emphasizing the performative, processual character of both)

One fundamental way in which gender is expressed in any society is through technology. Technical skills and domains of expertise are divided between and within the sexes, shaping masculinities and femininities: Maybe the iconic womanly skill is basket-making, whereas men should excel at hunting (MacKenzie 1991); or boys must learn to clean their fathers' tools to get a feel for grease before they are taught to use them (Mellström 2004); or poor women raise silkworms and sell the cocoons to rich households where the mistress organizes the tasks of reeling, spinning, and weaving among her servants (Bray 1997); or boys huddle around the computer screen practicing hacking skills, while girls develop new communication codes using emoticons (Lægran 2003b, Miller 2004). In the contemporary world, or at any rate in the Western nations which pioneered industrialization and have thus been able for so long to dominate worldwide production of material and intellectual goods, services, and desires, technology is firmly coded male. Men are viewed as having a natural affinity with technology, whereas women supposedly fear or dislike it. Men actively engage with machines, making, using, tinkering with, and loving them. Women may have to use machines, in the workplace or in the home, but they neither love nor seek to understand them: They are considered passive beneficiaries of the inventive flame. The modernist association of technology with masculinity translates into everyday experiences of gender, historical narratives, employment practices, education, the design of new technologies, and the distribution of power across a global society in which technology is seen as the driving force of progress.

"Since technology and gender are both socially constructed and socially pervasive, we can never fully understand one without also understanding the other" (Lohan & Faulkner 2004, p. 319). A dense web of debate within the field of gender and technology studies, or feminist technology studies (FTS), catalyzes continual advances in studying what FTS terms the coproduction of gender and technology. Explorations of "constructive" tensions in FTS (Lohan 2000) aim to develop innovative analyses of the material worlds we are creating through technology, and of technology's role in shaping local and global configurations of power, forms of identity, and ways of living. Although expressed in different terms, this debate shadows current anthropological concerns with the transformative role and destabilizing potential of technology in emergent configurations of *oikos* (what are the forms of human community?) and *anthropos* (what is a human being?) (Collier & Ong 2005). Yet curiously the two debates are not in dialogue but remain largely unconnected.

Theoretical debates around the gender-and-technology pair principally engage feminist sociologists and historians working in critical technology studies. Nordic social anthropologists and one or two representatives of the Anglophone and French school of the anthropology of technology also contribute to the debates. These scholars argue with each other, collaborate, and contribute to the same collections. FTS scholars draw on feminist philosophers of science and technology such as Harding (1986) and Haraway (1991), and gender theorists such as Butler (1993), who are also regular sources of theoretical inspiration to anthropologists. Yet the absence of overlap between FTS and cultural anthropology is striking. The latter is conspicuous by its absence from FTS state-of-the-field essays (Lerman et al. 1997, Wajcman 2002, Lohan & Faulkner 2004) and important FTS anthologies (MacKenzie & Wajcman 1999, Lerman et al. 2003). Conversely, most cultural anthropologists grappling with flows and subjectivities in the contemporary world, even when they put "technology" at the heart of their research, ignore FTS scholarship and define, delineate, and articulate their key questions and objects of inquiry in subtly different terms.

This essay begins by looking at FTS, its origins and goals, and the concepts and

methods it has developed for relating gender and technology. I then turn to the anthropology of technology, which does not highlight gender to the same degree but nevertheless offers useful conceptual frameworks and methods for exploring gender regimes. Gender-technology relations also feature in the anthropology of work, labor, and development, but unfortunately space precludes discussing them here (see Freeman 2001, Ortiz 2002, Mills 2003). Rather, to highlight the ideological and methodological contrasts between social and cultural analyses of technology and the implications for gender analysis, I discuss the treatment of technology in two leading theoretical fields in the cultural anthropology of modernity and globalization: the anthropology of technoscience, and material culture studies. I conclude by asking what forms of engagement might be envisaged between the fields.

FEMINIST TECHNOLOGY STUDIES: THE COPRODUCTION OF TECHNOLOGY AND GENDER

Feminist technology studies has developed in dialogue with the history and sociology of technology, disciplines in which feminist critiques have played a central part in overturning grand narratives and developing new analytical models (Lerman et al. 1997, Faulkner 2001, Wajcman 2004). Feminist sociologists and historians based in the Netherlands, the United Kingdom, and Australia, and a network of Norwegian scholars that includes social anthropologists, have played a prominent role in developing the field.

Arguing that in the modern world an effective engagement with technology is essential to feminist praxis, FTS strives to develop the theoretical and methodological tools to analyze technology and gender simultaneously in equal depth (Lohan 2000, Faulkner 2001). Unlike much other feminist research on technology, which tends to treat technological artifacts as ready-mades, FTS looks to the production of technology as a point of political leverage.

One influential narrative of modernity, a "standard view" (Pfaffenberger 1992) still in common currency today, designates science as the purest and most powerful form of knowledge, the driving force of modernity; technology is essentially the application of science to practical problems. Technology studies long ago rejected this model, insisting that technology must be studied in its own right as a distinctive practice; in the 1980s science studies also came to acknowledge the critical role of technology and its epistemologies in shaping the production of scientific knowledge. Despite exploring the political, cultural, and even cosmological dimensions of technical projects, technology studies long remained gender-blind, focusing on modern industrial and military technologies and reflecting the social realities of the engineering and business worlds in foregrounding Man the Machine-Maker (Staudenmaier 1985).

In the 1970s radical feminists and ecofeminists initiated a critique of the inherently patriarchal nature of technology, and of technoscience more generally. Here the perils of essentialization surfaced: Some feminists condemned all technology as intrinsically oppressive of women; others perpetuated stereotypes of women as inherently nurturing. Socialist feminists generally tried to be more contextual in their work, pushing Marxist analysis beyond class to ask why and how modern Western technology had become a male domain; to address the gendering impact of modern divisions of labor and of the assignation of women to the domestic sphere; to expand the spectrum of significant technologies to include refrigerators as well as space probes and suspension bridges; and to explore the reproductive and ethical as well as the productive effects of labor organization or of technological design (Oakley 1974, Cockburn 1983, Corea et al. 1985, Kramarae et al. 1988, Wajcman 1991). Cowan's landmark study of household technologies (1983) undermined

sociotechnical system: the distinctive technological activity that stems from the linkage of techniques and material culture to the social coordination of labor

script: material/sociotechnical effects built into the design of technological artifacts

consumption junction: the place and time at which the consumer makes choices between competing technologies

interpretive flexibility: divergent interpretations of form, use, or meaning of an object or of its users

the common belief that technology makes our lives easier, showing how mechanization served to raise cultural standards of cleanliness rather than freeing women from domestic drudgery. Through interrogating concepts such as technological efficiency and significance (Stanley 1993), FTS has broadened the scope of technology studies to include such assemblages as the brassiere, the closet, and the white collar (McGaw 1996). Feminist studies of the engineering profession charted the institutional, social, and cultural barriers against women (Arnold & Faulkner 1985, Cockburn 1985, Bucciarelli 1994). The FTS agenda was both intellectual and political: While undermining gender stereotypes and masculinist accounts of modernity, the ultimate goal of feminist technology studies was, and remains, the translation of scholarship into feminist praxis (Faulkner 2001, Wajcman 2004). FTS follows the technology studies agenda in studying technology as a distinctive domain, but like feminist science studies (Harding 1986) it interrogates its gendering at every level (Cockburn & Ormrod 1993).

In the late 1980s constructivist approaches emerged in technology studies that shifted theoretical and empirical attention from engineers' decisions to the complex social negotiations and contestations, the heterogeneity of expertise, of interest groups, and of material or institutional networks involved in technological innovation and in the stabilization or redesigning of artifacts (Bijker et al. 1987). The concept of "sociotechnical systems" reflected the principle that the social and the technological are inseparable, a "seamless web" (Hughes 1986). Marxist scholars unmasked the politics embodied or encoded in the design of technological artifacts (Winner 1986, Feenberg 1999). Actor network theorists proposed treating artifacts as having agency: These nonhuman actors may resist enrollment into our technological projects; furthermore we may delegate to nonhuman actors moral as well as material roles, inscripted into their design (Akrich 1992, Latour 1992).

A core interest of constructivist studies of technology is how artifacts (mass-produced bicycles, electrical supply systems) come to be as they are (Hughes 1983, Pinch & Bijker 1987). This approach initially tended to keep the focus of analysis upstream, looking at the processes of conceptualization and the marshalling of resources that go into design, production, and marketing. As feminist critics noted, in modern industrial societies an upstream focus may exclude women. However, the artifact itself, or its representation through instruction manuals, advertisements, marketing, or the media, can often be shown to incorporate "configurations of the user," including "gender scripts," for instance, shaver models that inscript male desires to tinker versus female preferences for simplicity (van Oost 2003) or cars marketed to men as powerful, to women as reliable (Hubak 1996).

FTS scholar Cowan first brought attention to the importance of the consumer in determining the success or failure of technologies. She defined the "consumption junction" as "the place and time at which the consumer makes choices between competing technologies" (1987, p. 263). Once consumers (or rather users), like producers, were treated as rational actors embedded in complex sociotechnical and cultural systems, it became easier to explain their decisions to adopt or to refuse a technology, as well as the degrees of "interpretive flexibility" to which they might subject it (Parr 1999, Lægran 2003a).

This shift of attention downstream, to consumers, mirrored a broader trend in social and cultural analysis toward studying consumption as the principle site for the production of meaning and the reproduction of power relations in modern societies. In technology studies, however, the role of consumer is more complex, interesting, and powerful than is usually the case in cultural studies. In technology studies consumers are users (or refusers), engaging actively—sometimes positively, sometimes negatively—with the physical as well as the symbolic dimensions of the artifact (Oudshoorn & Pinch 2003).

New technologies are often threatening and unfamiliar. To be incorporated into our lives they must be successfully "domesticated" (Sørensen & Berg 1991, Silverstone & Hirsch 1992, Lie & Sørensen 1996). At one level we learn to adapt to the technologies, acquiring and communicating technical skills and developing uses and meanings—including gendered subjectivities—within "communities of practice" (Wenger 1998, Mellström 2004, Paechter 2006). Equally important is the feedback upstream of intended and unintended uses. So-called "user-centered design" is now routine in many industries (Oudshoorn et al. 2004), and the choices and subjectivities of nonusers are becoming just as important to industry (and to social scientists) as those of users (Kline 2003, Wyatt 2003).

In the introduction to the second edition of their influential collection on the social shaping of technology, Mackenzie & Wajcman urge researchers to continue to examine "the specific ways in which this shaping takes place. . .[for] if the idea of the social shaping of technology has intellectual or political merit, this lies in the details" (1999, p. xvi). But how might case studies best be connected to cast light on broader political configurations? FTS does not share the current obsession of anglophone anthropology with theorizing globalization. Rather, it proposes the concept of integration as an approach to processes of interpenetration and patterns of homogenization or heterogeneity within a community, nation, region, or global network. On one level, technological integration hinges on the effective interconnection of technical hardware and expertise; on another level, it is a political, social, and cultural process (Arnold 2005, Misa & Schot 2005). Although "users" remain a key focus in FTS, one recent integrative approach, the "mediation junction" (Oldenziel et al. 2005), locates stakeholder interactions, coalitions, and contestations within overarching contexts of regulation or policy, and of state, market, and civil society (see also Oudshoorn & Pinch 2003, pp. 101–90). Oldenziel et al. highlight the importance of consumer organizations in the postwar incorporation of American-style kitchens into European homes, consumption styles, and social values—and also into safety regulations, systems of energy supply, and brand rankings. Other studies compare patient activism around cancer testing in the United States and the United Kingdom (Parthasarathy 2003) or the impact on regulatory policy of global coalitions supporting or contesting genetically modified crops (Bray 2003).

hegemonic masculinity: embodies the currently accepted answer to the problem of the legitimacy of patriarchy

Another prominent concern in current FTS is the exploration of femininities and masculinities, their performance through technology, and issues of practice, skill, and embodiment, including emotions, pleasure, sexuality, and eroticism (Law 1998, Law & Singleton 2000). Together with Butler's analysis of gender as performance, Connell's (1995) concept of "hegemonic masculinity," "the configuration of gender practice which embodies the currently accepted answer to the problem of the legitimacy of patriarchy" (p. 77), serves FTS scholars as a tool to explore how particular gendered identities are attributed, achieved, and performed and their place within broader configurations of power.

Wajcman has noted a distinction between two expressive and constitutive forms of masculinity, both connected to the mastery of technology. One is based on toughness and practical skills (e.g., the mechanic), the other on intellectual acuity (e.g., the software designer) (Wajcman 1991). Horowitz's collection *Boys and their Toys?* (2001) examines "manhood in the workplace," "learning to be men" and "manhood at play." Faulkner and her colleagues explore different ways in which men and women talk about their technical aptitude, setting these self-representations against actual practice (Faulkner 2000, Kleif & Faulkner 2003). Mellström (2003) has studied the relation between technologically configured masculinities and state ideologies of modernity in Malaysia; how the embodied "learned dispositions" of mechanics are fostered and transmuted from father to son (2002); and the uses of leisure artifacts such as

motor-bikes in male bonding in Sweden and Malaysia (2004). Although the equation between masculinity and technology in Western societies is durable, there are often huge mismatches between image and practice so that fractured and contradictory constructions of masculinity often coexist (Faulkner 2000). Meanwhile research on non-Western societies challenges these associations. Lagesen's research in Malaysia, for example, shows that young women enter the profession of software engineering in roughly equal numbers to men and believe that their different practices of problem-solving are equally conducive to excellence (Lagesen 2005).

FTS scholars use the term coproduction to designate the dialectical shaping of gender and technology. The concept is intended to highlight the performative, processual character of both gender and technology and to avoid the analytical and political pitfalls of essentializing either (Grint & Gill 1995, Berg 1997, Faulkner 2001). In modern societies gender is constitutive of what is recognized as technology, determining whether skills are categorized as important or trivial (Bowker & Star 1999). An electric iron is not technology when a woman is pressing clothes, but it becomes technology when her husband mends it. A woman engineer who tests microwave ovens is told by her male colleagues that her job is really just cooking (Cockburn & Ormrod 1993). In the 1970s computers were thought of as "information technologies" and coded male; it was widely assumed that women would have problems with them. By the 1990s computers had also become "communication technologies"; now it was presumed that women would engage with them enthusiastically. "New technologies spur processes of boundary work and renegotiations of what is to be considered masculine and feminine" (Lie 2003a, p. 21; Lohan 2001).

In terms of praxis, the overarching goal of FTS is to analyze how technology is implicated in gender inequalities to work toward more democratic forms of technology. Noting the relatively limited potential of consumer intervention for democratizing technologies from the outside in, some FTS scholars suggest that rather than continuing to focus predominantly on consumption, identity, and representation, FTS should return to production and work, or to the gendering of design processes and the gender subjectivities of designers, as research sites (Oudshoorn et al. 2004, Wajcman 2004). An important paper by Suchman (1999), based on an anthropological consultancy for technology design in a large industrial enterprise, draws on Haraway and on labor theory to propose new modes of feminist objectivity, rooted in densely structured and dynamic landscapes of working relations that destabilize the boundaries between producer and user. Documenting the masculinist ideologies of the engineering world and exposing prevalent stereotypes about women and technology may both contribute to democratizing technology from the inside out. Eventually they might inflect prevailing ideologies of technology. More modestly, given that gender systems are more difficult to change than are material technologies, they suggest ways to encourage more women to become engineers or to reshape state or industry policies of training and employment (Kvande 1999, Gansmo 2003).

ANTHROPOLOGY OF TECHNOLOGY, ANTHROPOLOGY OF TECHNIQUES

Within the American tradition of cultural anthropology, technology has generally been viewed "as a context for, rather than a central part of, culture" (Wilson & Peterson 2002, p. 450). Pfaffenberger (1992) lays out a melancholy history of neglect, dating back to Malinowski's declaration that the study of technology alone was scientifically sterile (1935, p. 460) and to Kroeber & Kluckhorn (1952, p. 65), who rejected the term material culture on the grounds that the culture was the idea behind the artifact. Technology continued to be studied by archaeologists,

cultural ecologists [including Geertz at an early point of his career (1963)], and development anthropologists; feminist archaeologists have been particularly productive in rethinking gender-technology relations (Gero & Conkey 1991, Wright 1996). Yet within mainstream cultural anthropology in the United States, technology was not an object of analysis in its own right, and no recognized field of anthropology of technology emerged (Pfaffenberger 1992, Suchman 2001). This antimaterialist aversion was less marked in British social anthropology, but despite some distinguished studies and original theoretical claims (Goody 1971, 1986; Sillitoe 1988; Gell 1992; Ingold 2000), there too anthropological interest in technology as a theorizable category has remained muted.

In 1992 Pfaffenberger published an impassioned call to anthropologists to take technology seriously. Anthropology was uniquely qualified, he argued, to answer important questions about technology as a universal human activity. He proposed translating the concept of "sociotechnical systems," borrowed from technology studies, into a template for anthropological study, laying a basis for comparative analysis of the place of technologies in the generation of meaning, in precapitalist as well as capitalist societies. In 2001 Pfaffenberger once again lamented "the enormous cost of Anglo-American anthropologists' penchant to ignore technological activities" (p. 84). His paper appears in a wide-ranging collection of perceptive and original essays on technology by archaeologists and anthropologists. But theoretically and methodologically they sprawl: a noble attempt by the editor to extract a coherent agenda for an anthropology of technology reads like a list, not a program, and gender is not mentioned (Schiffer 2001b).

Among the few American anthropologists to take technology seriously as technology are Suchman and Downey. Both work among engineers, focusing on the design and production of technologies, the business contexts in which they are developed, and the material incorporation of values and worldviews into artifacts such as bridges or CAD/CAM technology (Downey 1992, 1998; Suchman 2001). In an essay advocating "cyborg anthropology," Downey et al. (1995) propose close anthropological attention not only to representations or consumption of technology, but to the cultures of the technical communities that produce technologies and to the specific material effects of technology on perception, communication, and identity. The authors propose cyborg anthropology as an action-oriented agenda, aligned with FTS, that would engage the general public and unmask the material as well as cultural dimensions of domination by race, class, and gender.

From her uncharacteristic perspective as an anthropologist working with industry, Suchman (2001) distinguishes three aspects of research on contemporary technology: (*a*) ethnographic studies of sites of technology production; (*b*) studies of technologies-in-use; and (*c*) ethnographically based design interventions. Although aspect (*c*), rooted firmly in aspects (*a*) and (*b*), would be the goal of feminist technology studies, anthropological studies of technologies are usually limited to aspect (*b*). In the absence of sustained debate around technology as a distinctive category of material activity, rather than just another source of metaphors, it is not surprising that most anthropologists prefer just to look at the dimensions that are most obviously cultural productions. As Axel (2006) notes, anthropologists writing on emergent technologies, for example, information and communication technologies (Hakken 1993, Escobar 1994, Wilson & Peterson 2002), invariably claim that anthropology as a discipline is particularly well suited to charting their emergence. Yet these are accounts not of technology per se but of specific technologies, and it is not clear that they offer anything distinctive from analyses produced in other branches of cultural studies.

Over decades of intensive debates in the pages of *Techniques et culture* and other francophone journals, the French school of

operational sequence: the series of material, social, and symbolic operations involved in a specific transformation of matter

anthropology of techniques, which also includes archaeologists, economists, engineers, historians, and sociologists, has developed specific theoretical and methodological repertories for the comparative study of technologies. The convention of defining technique to include bodily practices (*techniques du corps*) as well as the use of tools dates back to Mauss, who saw *techniques du corps* as distinctive cultural practices, and to Leroi-Gourhan, who treated tool and anatomy as inseparable in his analysis of the logic of technical action. The French approach begins with detailed attention to "operational sequences" or *chaînes opératoires*, "the series of operations involved in any transformation of matter (including our own body) by human beings" (Lemonnier 1992, p. 25). From systematic observation of the operational sequences of production or use, analysis proceeds to what Lemonnier calls the "social representation of technologies": This denotes not only the kinds of meaning that usually attract the attention of cultural anthropologists, but also the ideas governing the construction and use of tools and artifacts, an ethnoscience of material nature and action.

Skills (*savoir-faire*), documented through operational sequences, are a key focus in which material, mental, social, and cultural resources converge (d'Onofrio & Joulian 2006). The analysis of technological choices or styles goes beyond, but must account for, the relevant material affordances or constraints and systems of technical skill and understanding (Lemonnier 1993). The core observational and analytical methods may be deployed within a variety of overarching frameworks, including actor network theory (Latour 1993), modes of production (Guille-Escuret 2003), or anthropology of ritual (Lemonnier 2004). The approach spans high tech, low tech, and no tech, from the design of high-speed urban transportation systems (Latour 1996), through the rocky negotiations of technology transfer (Akrich 1993), to gender differences in Indian pottery making (Mahias 1993) or the place of posture in Chinese femininities (Flitsch 2004).

Similar to the American anthropologists of technology, the French school views technology as a universal human activity and emphasizes the need to build strong analytical and empirical bridges between upstream and downstream, artifact production and use. Its conceptual frameworks and methods are designed to apply equally to old or new technologies. Scholars such as Mahias (2002) have deployed them brilliantly to illuminate the interpenetration of "traditional" and industrial, local and "global" technologies and technological cultures. Although gender-technology relations are not as prominent or sustained a theme as in FTS, the methods lend themselves to finely textured studies of gendered identity, some focused on individual technologies or bodily practices (Desrosiers 1997, Darbon et al. 2002, Pardo 2004), others on gendered repertories of technical skills (Mahias 2002). Although Latour's study of Aramis (1996) has been criticized for gender blindness (Wajcman 2004), it offers rich materials for the study of masculinities. In a study of imperial China, Bray (1997) documents the historical dynamics of a "gynotechnics," mutually shaping technologies of dwelling, production, and reproduction central to hegemonic and pragmatic gender identities. Refining the concept of *techniques du corps*, Ingold (2000) proposes treating the skills of craft and of art under the same heading and highlights their ontogenetic nature. Far from being added onto a preformed body, skills grow with the body: "[T]hey are fully part and parcel of the human organism, of its neurology, musculature, even anatomy, and so are as much biological as cultural" (p. 360). This approach suggests bridges to recent FTS researches, inspired by Butler (1993), on the "achievement" of gender (Lie 2003a).

ANTHROPOLOGY AND TECHNOLOGY

Classic anthropological monographs, including Malinowski's, are rich in materials on technical activities and their meanings

(Malinowski 1935, Pfaffenberger 2001). Examining the articulations of work, production, and skills with exchange, ritual, kinship dynamics, and social differentiation, they address, as does FTS but implicitly, sociotechnical systems, "seamless webs" of material, social, and symbolic practices and relations. Although not expressed in these terms, classic anthropology contributed some fine precursors to the study of technology and gender, for instance in studies of sexual divisions of labor (e.g., Richards 1939, Hugh-Jones 1979).

Once the concept of gender became a specific analytical focus, feminist scholars focused on technical practices, old and new, to retheorize core anthropological concepts radically, including kinship (Strathern 1992), exchange (Weiner 1992), or space (Moore 1986). As the anthropology of gender fused with the anthropology of modernity and of globalization, attention turned to the role of technoscience in reshaping gender regimes. And with the broader cultural turn emphasizing the importance of consumption as the constitutive site of subjectivities and power, the new field of material culture studies contrived a radical new antiessentialist perspective on technologies.

Anthropology of Technoscience

Technology and such derived concepts as "technoscapes" or "techno-nature" figure prominently in recent anthropological theories of the place of technoscience in modernity and/or globalization. Key concerns of anthropological studies of technoscience, as of FTS, are the formation of the modern subject and the distribution of power through emerging global networks. However, Escobar (1994) explicitly distinguishes the agenda of the anthropology of technoscience from that of the sociology of technology: "For anthropologists, inquiry into the nature of modernity as the background for current understanding and practice of technology is of paramount importance. In this anthropology is closer to the philosophy than to the new sociology of technology" (p. 213). The culturalist approach to technoscience, like the "standard view," is interested first and foremost in science, powerful knowledge instrumentalized through technology. Technologies are of anthropological interest as phenomena emerging from particular cultural contexts, contributing to new cultural worlds such as "cyberculture" or "techno-nature" (Escobar 1994, 1999).

domestication: users' appropriation of new technologies and feedback into design

In destabilizing boundaries between the human and the natural or between human and machine, promoting new, troubling relations of intimacy, or facilitating new forms of governmentality, emergent technologies such as in-vitro fertilization, transnational organ transplants, stem-cell research, or data-banks raise new questions of "how to live" (Collier & Lakoff 2005). New technologies may be conceptualized as prostheses, elements of cyborg fusions between human and machine that extend our capacities and permit enhanced modes of being and relating; new forms of interpenetration of zones of space and time; and new possibilities for action at a distance, for connection, coalition, or control (Axel 2006, Rafael 2003, Wright 2001). They may figure as tools for both research and accumulation, concentrating capital or biocapital in certain sites while providing the material procedures and equipment for the domestication of new life forms such as stem cells (Franklin 2005). The term global assemblages has been proposed to address the spatial and political dynamics of these restless flows and concentrations of material and symbolic resources (Ong & Collier 2005).

Most work within the anthropology of technoscience that explicitly attends to gender-technology relations addresses biopower and its new subjects: the new masculinities or femininities achieved through remakings and resexings of the body; or through cross-class, transnational, or interethnic reconfigurations of kinship and reproduction (Kaufman & Morgan 2005). Analysis focuses on the potentialities and interpellations

MCS: material culture studies

inherent in the new science and its representations; on users as "ethical pioneers"; on interactions between experts and technicians and the "lay" users (or refusers) of biomedical services; and on "lay" appropriations or contestations of new disciplinary regimes (Rapp 1998, Greenhalgh 2005). However the technological apparatus itself is usually left as a black box. Despite Downey's cyborg manifesto, there are few anthropological studies of the material production or design of the technologies of biopower, cybercultures, or techno-natures. Rabinow's illuminating biographies of technology, studying the coproduction of technological apparatus, technocracy, research agendas, and scientific imaginaries, are rare anthropological analyses of the power inherent in the nuts and bolts of technology (Rabinow 1996, Rabinow & Dan-Cohen 2005). Traweek's classic upstream study of the mechanical foundations of high-energy physics (1988), which explicitly explores the gendering of technocratic production and practice, is another exemplary rarity.

Material Culture Studies

The anthropology of technoscience engages with heroic technologies, such as DNA sequencing or organ transplantation, that promise to transform what it means to be human. Material culture studies (MCS) currently takes up the challenge of decoding the mundane technologies of everyday life such as kitchen equipment or cars, analyzing the role of material artifacts in producing subjectivities and social relations. As a counterbalance to classical Marxist analyses that treated work and production as the loci where identity and meaning were produced, the cultural Marxism of MSC prioritizes meaning and identity production through the social processes of consumption (Miller 1995). One theoretical concern of MCS is to critique the reification of globalization by demonstrating that the "global" is always manifested and experienced as a "local" phenomenon. Widely viewed as global in nature, yet intrinsically cultural in their use, the new communications technologies offer irresistible test cases.

MSC studies of the Internet in Trinidad (Miller & Slater 2000) or of cell-phones in Jamaica (Horst & Miller 2005) generate richly textured analyses of how technology use intertwines with sociality, including the expression and affirmation of gendered identities and forms of intimacy and relatedness. They also document the gratifying extension of Jamaican or Trinnie styles of communication across transnational spaces, transforming the experiences of migration or diaspora. The point is convincingly made that Caribbean Internet users are not reacting to globalization but creating it. By insisting that the new technologies facilitate but do not determine these cultural extensions, these studies reflect the MCS position on "materiality."

MCS proposes the concept of materiality to transcend the object-subject divide, viewed as an enduring weakness of Western thought. One might have thought this would open up very interesting possibilities for theorizing technology, skills, and subjectivity. However, in repudiating reification of the object, MCS specifically dismisses technology as an analytical category. Although Miller develops methods for charting the extension of technology use that correspond to the specific ways in which the Internet or cell-phones work, he insists that the primary interest is how they are brought into being as cultural artifacts. It is correct, as Miller asserts, that the Internet is in constant flux, its features continually reworked by its users. Yet even the Internet involves a framework of technical design, costing, and regulation (local or transnational) that channels and constrains the forms of communication and sociality it allows (Wilson & Peterson 2002, Wilk 2005). Miller's studies of communications technologies are actually rich in detail on the political-economic context within which they were launched and adopted, and on user skills, technical

as well as social. Generally speaking, however, MCS is open to criticism for excessive culturalism: "while the demolition of the essentialized object was an urgent necessity, the declaration of objects' and images' emptiness has become a proof for an anthropology committed to the victory of the cultural over the material, and of the discursive over the figural" (Pinney 2002, p. 259).

FRUITFUL EXCHANGES?

The interdisciplinary field of feminist studies of technology has done more than any other social science to build a vibrant and coherent school of gender and technology studies. FTS has drawn heavily on ideas and methods developed within anthropology: the integrity of social action and culture; the "micromacro" linkage of everyday skills and techniques and political-economic activities; and detailed empirical observation and broad-ranging comparative analysis. Could we now envisage more explicit and sustained forms of engagement among different branches of anthropology and FTS, to strengthen our understanding of gender-technology relations in a rapidly changing world?

Philosophically, FTS and the anthropology of technology share a strong materialism in their approach to culture-technology dialectics. Exchange between the fields therefore presents few epistemological problems. FTS lacks research on gendered dimensions of technical skills (Faulkner 2001), and here methods developed by the French school for documenting operating sequences and *savoir-faire* might prove helpful. In considering the full spectrum of gender subjectivities achieved or imposed through technology in different contexts, another obvious lack in FTS at present is studies of non-Western societies, past as well as present. The anthropology of technology, by theorizing technology as a universal human activity, offers not only a rich spectrum of non-Western and premodern case studies, but also analytical frameworks for reintepreting historical and ethnographic documents from FTS perspectives.

In its attention to the materialities of everyday life, the French school of anthropology of technology shares common ground with MCS, but fundamental disagreement about whether technology constitutes an analytical category is a serious barrier to dialogue. It is not totally insurmountable, however. Dant (2005) argues for the value of incorporating more attention to technical skills and practices into MCS analysis; some contributors to *Material Culture Studies* focus on technological goods as technologies (Shove & Southerton 2000); and French practitioners of MCS have successfully borrowed from the anthropology of techniques, integrating analysis of production and skills into their studies of consumer culture (Warnier 1999, Faure-Rouesnel 2001). Were anglophone MCS to tread a similar path it might have to abandon some ambitious idealist claims about materiality. Yet valuable new insights into the coproduction of technology and gender might result if the strengths of MCS in charting the coproduction of global and local culture were extended to acknowledge technology. This would also provide a neat way for MCS to incorporate global flows of financial, corporate, and regulatory power more fully into their analyses.

The anthropology of technoscience attends closely to these global flows of power, and despite significant philosophical differences with FTS, there is a strong case to be made for closer dialogue between the fields. Concepts such as sociotechnical systems, stabilization, and integration allow FTS to explore how technologies and the associated politics of gender travel across space and time and how they consolidate into systems that resist change. These approaches, along with FTS methods for studying the design and production of technologies, could enhance technoscience studies of biopower and of global assemblages. Attention to the gendering of technical design

would be particularly valuable in advancing understanding of biopower. Conversely, in focusing so closely on the gender-technology nexus itself FTS sometimes neglects deeper-lying ideogical dimensions within which any regime of truth concerning gender and technology must ultimately be understood, and which the anthropology of technoscience takes as its object, namely emergent configurations of *oikos* and *anthropos*.

DISCLOSURE STATEMENT

The author is not aware of any biases that might be perceived as affecting the objectivity of this review.

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