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The practice of medical technology

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Abstract In this article, we review 25 years of sociological scholarship published in *Sociology of Health and Illness* on medical technologies. We divide the literature into three theoretical perspectives: technological determinism views medical technology as a political force to shape social relationships, social essentialism emphasizes how medical technologies are neutral tools to be interpreted in social interactions, and technology-in-practice highlights the dialectic relationship between technology and its users in health care. While the technology-in-practice orientation allows social scientists to critique the high hopes and dire warnings embedded in medical technologies, we argue that the logical next step of this paradigm is to move beyond criticism and influence the creation and implementation of medical technologies.

Keywords: technology, actor-network theory, inequality, technological determinism, social essentialism

Introduction

In the first article of the inaugural issue of *Sociology of Health and Illness*, Peter Conrad brought up medical technology; suggesting the centrality of the topic for sociologists interested in health and illness. Contributing to the then fashionable social problems-social deviance literature, Conrad explored the ways medicine increasingly functioned as an institution of social control. According to Conrad, medical technologies provided health care providers with effective tools to coerce others into approved, healthy lifestyles. Psychopharmacologies, for example, aggressively promoted by a highly profitable and powerful drug industry, often become the treatment of choice for deviant behaviour. They are easily administered, under professional medical control, quite potent in their effects (*i.e.* controlling, modifying, and even eliminating behaviour), and are generally less expensive than other treatments and controls (*e.g.* hospitalisation, altering environments, long-term psychotherapy) (Conrad 1979: 3).

Conrad focused on innovative, but controversial, paradigmatic technologies: he included brain surgery, behaviour modification, and – foreshadowing a future research interest of his (see Conrad and Gabe 1999) – human genetics. While the scope of technology was highly symbolic, Conrad's conceptualisation of technology remained limited. He did not explain how technology worked as an instrument of social control; suggesting instead a political logic of domination internal to technology. Conrad insinuated that medical professionals were attracted to technologies that minimised 'patient compliance' issues, and in the struggle between the voice of medicine and the voice of the life world (Mishler 1984) allowed them to impose a medical definition of the situation. There is little agency for patients or physicians, only a medical-industrial complex with dark motives and dependent victims. The mere presence of the technologies and their presumed effects constitutes proof of the conspiracy.

Now, turn to a more recent article dealing with medical technology: Alan Prout's analysis of the metered dose inhaler (MDI) (Prout 1996). With this technology, the issue of compliance and social control is also central. People suffering from asthma had been disillusioned by the lack of successful treatment options. Clinicians were wary of prescribing ephedrine because they regarded the powerful drug as potentially dangerous. Inhalation therapies seemed the solution: the metered dose inhaler allowed the exact dosing to be designed in the plastic of the instrument. Prout notes, 'The MDI, then, can be seen as a device for treating both asthma and criticism of biomedicine. Critical patients could be re-enrolled (and new ones enrolled) into a relationship with biomedicine because the relief they were interested in became available through clinicians' (Prout 1996: 207). The process of enrollment suggests power at work through technology but the relationships are less unidirectional. While the metered dose inhaler rearranges power configurations, health care practitioners are not the puppet masters holding the strings of the patients. Patients need actively to subscribe to the idea that inhalers might work therapeutically for them. The instrument needs to fulfill its expectation of increased drug-delivery accuracy. Otherwise, the technology will have little effect. Indeed, Prout indicates that quite often this simple technology does not work. Studies show that 40–60 per cent of patients do not grasp the instructions – for example, failing to inhale when pushing the top of the inhaler or, strangely, holding the inhaler against the chest instead of in the mouth. The history of the metered dose inhaler continues with further adaptations in the technology, teaching new skills to users, and educating physicians on how to educate patients.

The end result of Prout's account is not one big idea that technology oppresses but a fine-grained analysis of subtle and on-going political and ontological changes in the design and implementation of medical technologies. In this review article of 25 years of scholarship in *Sociology of Health and Illness*, we will explore the analytical momentum generated when technologies are taken seriously. Medicine forms an archaeology of layer upon layer of technologies from the most mundane band-aids and pencils to

sophisticated machines such as MRIs and artificial hearts, from virtually neutral infusion pumps to highly symbolic procedures and devices such as the drug Viagra or genetic tests. The Office of Technology Assessment provides an often-cited definition of technologies: medical technologies include 'the drugs, devices, and medical and surgical procedures used in medical care, and the organizational and supportive systems within which such care is provided' (Behney 1989: 759).

Within such a broad definition, what qualifies as a medical technology for sociological inquiry reflects the theoretical orientation and focus of the social analyst. The sociological literature can be divided into three different strands: technological determinism, social essentialism, and technology-in-practice. We focus particularly on the latter approach that applies central ideas from the interdisciplinary field of science studies to medical technologies. Here, we will sketch some of the main strengths and limitations of these approaches to account for the multiple layers of medical technologies in the health care field, and lay out a research agenda for the future[1].

Technological determinism

With the hindsight of 25 years of additional scholarship, Conrad's view that technology enforces medical social control constitutes a prime example of *technological deterministic thinking*: the notion that technology is a driving political force in late modern societies. This perspectives attributes great explanatory power to technology by isolating it and assuming that technology's overall effect has been harmful. Technological determinism, which goes back to Karl Marx's writings and which has been incorporated in several Luddite social movements, comes in different strengths (Smith and Marx 1994, Winner 1980). Strong technological determinists argue that technology develops as the result of an internal dynamic; moulding society to fit its logical patterns. In an analysis of new reproductive technologies, Elaine Denny (1994) explores a radical feminist perspective that subscribes to strong technological determinism; in this case technology propels medical patriarchal control:

> One of the main themes of radical feminism is that of power and control. In Vitro Fertilization (IVF) is part of a male attempt to control female sexuality and fertility, and needs to be placed within this wider context. Although IVF is promoted as a treatment for infertility, the emphasis on technology is about control of reproductive capacity. (. . .) In radical feminist ideology women's desire for children is fueled by pro-natalist ideology and exploited by men eager to master nature (Denny 1994: 70).

In a weaker version, medical technology is viewed as a political tool in itself. Technology-as-politics occurs when the introduction of a particular

technological device or system becomes a way of settling an issue in a community, or when technologies require particular kinds of political relationships. Dorothy Nelkin and Lori Andrews (1999), for example, discuss the expansion of DNA technologies in terms of 'surveillance creep'. While DNA technologies are mostly instituted for identification purposes, the genetic databases almost inevitably raise the likelihood of genetic discrimination, genetic stigmatisation, and ultimately eugenics. According to these authors, DNA technologies are thus politically compatible with discriminatory practices.

Technological determinism as it presents itself in medical sociology is usually not about analysing technology; it is ultimately about constructing a symbolic case against medical hegemony. Technological determinists, therefore, pay exclusive attention to controversial, innovative technologies threatening to disturb the social order. Dignified death advocates, for example, have singled out life-saving medical technologies, such as resuscitation techniques, as symbols of medical hubris. These technologies signify the far-reaching medicalisation of the dying process. The implementation of these techniques on terminally-ill patients not only cruelly prolongs their dying process, but also robs them of the opportunity consciously to experience their last living moments and their autonomy. The evil technological forces are here anaesthesia and intubations, required for artificial ventilation (see Moller 2000). For technological determinists, technology is directly to blame: 'Technology prolongs the dying process in sterile, alien environments. It requires the presence of paid, impersonal professionals, instead of family and friends, to conduct the modern death watch' (Kearl 1989: 428). Often, the case against technology is made with an unfavourable comparison to a past characterised by Durkheimian organic solidarity or with romanticised 'natural' deaths-births-healing in developing countries (Ariès 1977, Walker 1991).

The main theoretical problem with technological determinism is its reductionism: scholars ascribe 'super technological' powers to tools and practices; powers that do not hold up in empirical analysis. Looking at the practice of resuscitating in emergency departments, the technological determinist 'dehumanisation' argument in death and dying could also be reversed. In emergency departments, dying might fulfil the criterion of 'dignified' dying, not in spite of, but because of the presence of resuscitation technologies (Timmermans 1998). The resuscitation protocols offer a short respite in the sudden dying process that allows the staff to inform and prepare relatives and friends for the possibility of impending death[2]. Terminal care in general depends on the extensive use of less-controversial technologies such as pain medication and special mattresses that reduce the likelihood of bedsores – technologies often ignored in determinist thinking. Also, when Elaine Denny interviewed women who underwent IVF treatment she was compelled to revise the radical feminist premise that medical technologies perpetrate oppressive male patriarchal power over women. Her interviewees argued that the technologies offered them control over their infertility (see also Cussins 1998). She concluded: 'In its similarities to patriarchy I would

contend that radical feminism, far from liberating women provides for them an alternative form of oppression, which exploits the vulnerability of the infertile in the same way that it accuses the medical profession of exploiting them' (Denny 1994: 78).

Because technological determinism paints with broad, impressionistic rhetorical strokes, it remains a seductive way to represent big, difficult-to-grasp new technologies, promising to disturb life as we know it. Genetics and the Internet are often primed with a coat of dire technological deterministic colours (Hardey 1999, Richards 1993)[3]. Unfortunately the, often appropriate, critical reflections lose all convincing power because a closer empirical look at the medical technologies indicates that technological determinism is fuelled by a suspicious blend of case selection and conspiracy theories. Medical technologies, for example, are seen to extend the apparently clearcut interests of some groups. How exactly these interests enter into the technology, and how their operation then linearly exerts these effects, is more often than not left out of the discussion. Ultimately, such analyses result in a big roar and much black smoke but little analytical movement. At this time of stock taking, it would be good to retire technological determinism once and for all.

Social essentialism

It is somewhat surprising that we could find several examples of technological determinism in 25 years of *Sociology of Health and Illness* because this orientation is also profoundly anti-sociological. It presumes that technology is the dominant moving force in society and that the political agency of culture, interests groups, and individuals is to a large extent curtailed by technological momentum. Sociologists occasionally tend to fall in the other extreme, adopting a particular form of *social essentialism* where medical technologies are viewed as blank slates to be interpreted and rendered meaningful by culture. While such empirical analyses purport to be about medical technology, they are not. They are about patient compliance, illness narratives, caring and curing, sick roles, ideologies of disability, illness experiences, gender and race, inequality, etc. All the topics traditionally of interest to sociologists are projected on to medical technology but what is typical of the technology is left unexplored. For social essentialists observing technology infused interactions, the technologies function as sociological *catalysts*: they are tools that generate interactions or social meanings but do not act, affect, or evolve in themselves. This orientation leads to a more inclusive definition of medical technologies. While generally not focusing on the more mundane artefacts, the sociologist discusses the use of a wide variety of technological devices affecting patient care.

Anselm Strauss and collaborators conducted an ethnography of technology use in six hospitals. Yet, their study contains surprisingly little about the

technologies themselves. While they discuss in one page how the 'biography' of fetal monitoring went through research, development, refinement, to controversy (Wiener *et al.* 1979: 264–265), the bulk of their analysis is on how technologies lift patients' spirits and courage, help staff maintain professional composure, allow correction of 'interactional errors,' or contribute to the broad category of 'sentimental work' (Strauss *et al.* 1982, Wiener *et al.* 1979). Similarly, David Locker and Joseph Kaufert (1988) discuss different medical technologies such as the iron lung, rocking bed and positive pressure ventilators in light of the disease 'trajectory' (Wiener *et al.* 1979) of post-respiratory poliomyelitis patients. They focus on how different technologies affect the patients' feelings of vulnerability and their autonomy, in short the social impact of the technologies on disability. While the effects of the different technologies vary based on the phase of polio disability, the technologies simply represent choices between sets of freedoms and constraints. Jeanne Daly's research on echocardiography shows how the cardiac tests function as a technical accomplishment to reassure patients of their 'normality' (but rarely succeed in reassuring), to mediate social relationships between cardiologists and referring colleagues, and to reinforce social control over patients (Daly 1989). In all those articles[4], something important is missing: with regard to the Strauss study, Prout diagnoses, 'medical work is constructed as done *on* and *through* machines but not *by* them' (Prout 1996: 203, our emphasis). The key characteristic of a social essentialist perspective is that the technology is a passive, non-communicable device requiring social interpretations to be rendered meaningful.

The theoretical underpinnings of social essentialism are specific *weak* forms of social constructivist thinking[5]. In a reprimand to social scientists to shore up their metaphors, philosopher Ian Hacking noted that social constructivism subscribes to the following relationship where X is the subject of social constructivism.

> X need not have existed, or need not be at all as it is. X, or X as it is at present, is not determined by the nature of things; it is not inevitable (Hacking 1999: 6).

Indeed, the social essentialist analysis of technology generally raises doubt about the inevitability of tools to maintain a particular social order. Medical technologies are viewed as influential instruments to be mobilised by social actors and imbued with meanings. In the less critical version of social essentialism, the social analysts evaluate how technologies perpetuate a particular therapeutic ethos; noting that the same issue could and would have been treated differently in a different culture or at another historical juncture. Such an analysis emphasises how technologies facilitate the reduction of a rich illness experience to a more narrow medicalised disease. Health care technologies signify here the symbolic capital of the medical profession in late modern societies.

In the more critical version of this analysis, the point of a social essentialist analysis is 'to show how categories of knowledge are used in power relationships' (Hacking 1999: 58). In contrast to a technological deterministic analysis, where technology propels people to act in an authoritarian way or requires particular political relationships to manage its effects, a critical social essentialist analysis presents interest groups as selecting technologies in order to assure the continued hegemony of the medical-industrial complex. Medical technologies are one more tool to solidify health inequities. Drawing from Mannheim's call to 'unmask' ideologies, the social essentialist analysis is covered in a thin layer of social moralising; the social scientist shows how 'bad' behaviour flows from 'flawed' technologies. In both versions, the technology does not act in an hermeneutic, interpretive sense; it mainly absorbs and reflects social and political meanings. The way in which biologists of different nationalities interpret the social relationships of monkey colonies differently teaches us a lot about the patriarchal and cultural projections of the biologists but little about the simians themselves (Haraway 1989). In the same way, social essentialism teaches us much about sociological preoccupations but glosses over what is technological in medical technologies.

Importantly, the social essentialist perspective used in some studies of medical technologies differs from the stronger social constructivist perspective in science and technology studies (see the contributions in Bijker *et al.* 1989). The latter social analysts focus on the actual content of technology development and implementation to explain the success or failure of technical artefacts. These authors propose an evolutionary-based theoretical model in which differing social groups rally in favour or against the adoption of medical technologies in order to obtain an acceptable measure of technological stabilisation (Pinch and Bijker 1987). The important message of this approach is the dynamic relationship between technology and society: social interests shape technologies throughout their design process and usage and, in turn, technologies shape the activation of different social constituencies. Such a reciprocal dynamic is lacking in the social essentialist perspective.

Technology-in-practice

Traditional medical sociological writings on technology either overestimated the power of technology to change society or underestimated the role of medical technologies, viewing them as mere tools to be socially situated. With some exceptions, however, these representations are largely images from the past. During the 1990s medical sociologists have largely borrowed from the interdisciplinary field of science and technology studies to embrace a more dynamic way of analysing medical technologies. The common thread in these new approaches is that a piece of medical technology is located

ethnographically or historically in the practice of designing or using the technology. To paraphrase Bruno Latour (1987), technology is studied in action. In this perspective, technology might *do* things (quite often the technology fails, see examples in the work of Michel Callon 1986, Latour 1996 and John Law 1987), but what it does and how it accomplishes something remains an open empirical question. Technology is viewed as one actor among many in changing configurations of social and technical elements (Law and Hassard, 1999). Unlike the view of technology in social essentialism, it is not a blank slate to be interpreted because technology itself co-ordinates clinical and organisational aspects of health care. Neither is technology a 'super' actor stifling all other interactions as presented in the strong form of technological determinism; its agency is constituted by others and in turn constitutes the actions of others (Callon and Law 1982). Technology-in-practice leads thus to a broad definition of technologies, including the entire gamut of mundane to sophisticated technologies, drugs, and even managerial instruments such as patient records. Actually, in this approach it is difficult to single out one technology as an isolated device because technologies are embedded in relations of other tools, practices, groups, professionals, and patients and it is through their location in these heterogeneous networks that treatment, or any other action, is possible in health care.

The general purpose of this approach is to gauge what technologies do; what caring, curing, or alternatives to those goals they help accomplish. What becomes a relevant 'social', 'technological', or other category in the development or usage of technology depends on how it is transformed during technological practice. The focus of this kind of study is on the different worlds techniques contain and imply (Timmermans and Berg forthcoming). X-rays, for example, did not immediately reveal a hidden reality in the shadows of light and darkness. They only became effective after the standardisation of X-ray equipment and photographic material, after the training of technicians, after the construction of boundaries between normal and pathological, and after the stabilisation of links between X-ray images and other diagnostic technologies (see Pasveer 1989).

Science and technology studies draw partly from social constructivism (the so-called 'strong programme' (Bartley 1990) and SCOT (Pinch and Bijker 1987)) but criticise weaker forms of social essentialism from a combination of ethnomethodology, post-structuralism, feminist theories, and actor-network theory[6].

The more innovative analytical strengths of a technology-in-practice approach are best illustrated in an article about the role of duplex technologies in the detection of diseased leg vessels (Mol and Elsman 1996). In an unusual but theoretically consistent collaboration, Annemarie Mol, who identifies herself as an empirical philosopher, and Bernard Elsman, a surgeon, raise the question whether diagnosing in medicine implies that one detects disease or designs a treatment. This might seem a trivial question but the authors explain its sociological relevance:

> If detection and design were separable, then the first phase, detection, might be a matter of finding facts, pure and simple, while pragmatic considerations (social factors, values, culture, you name it) would enter the scene only in the second phase, the design of treatment. It is precisely to undermine this assumption that those who hold detection and design to be inseparable, stress the impact of practicalities (social factors, values, culture) from the moment of the patient's first encounter with medicine (Mol and Elsman 1996: 611).

Mol and Elsman argue here against a variation of the 'sociology of error' argument (Bloor 1991). When a medical device fails to materialise or a consumer agency pulls it off the market, in a sociology of error analysis, social factors explain what went wrong. But if a tool 'works', then social factors are excluded from the analysis: nature simply revealed its patterns. At first sight, Mol and Elsman will thus expand the sociological grounds: social 'practicalities' permeate every aspect of diagnosing. In the process, however, sociology loses its traditionally-privileged variables. 'The image sketched cannot be summarized in a short, all-encompassing statement. Instead, it draws together vessels, surgeons, research designs, hospital organization, patients, apparatus, general practitioners, dye, buttons, interview questions, catheters, gel, blood and many other elements. All of them interrelated. Yet each irreducible to the other' (Mol and Elsman 1996: 628).

The practice of medicine is thus not reducible to sociality. When taken to its fullest extent, this approach to medical technologies poses a profound challenge to conventional sociological thinking. An analysis of medical technologies following the dicta of actor-network theory asks that the researcher suspends *a priori* knowledge of all standard explanans, including standard sociological ones. What counts as science or nature and what counts as society is not a pre-given but the outcome of the configuration of heterogeneous elements (Latour 1987, 1999). In this approach, one can thus not presume a static immutable category such as gender or ethnicity but one should ask what kind of sexes are made and unmade in medicine (Hirschauer and Mol 1995). Taking ethnomethodology and actor-network theory to its logical consequence, this approach thus extends constructivist scepticism to sociological categories itself, turning *sociology* itself into one of the categories whose emergence requires explanation[7].

Focusing on the content of medical discussions and techniques, Mol and Elsman show with fine ethnographic detail of clinical and research practices how the duplex technique operates in a hospital. They find that in some instances detection of disease and design of therapy are intertwined while at other times they are kept separate with different professionals doing either aspect. The duplex technique is not an object to be manipulated by ultrasound technicians but itself performs a calculable reality of vessel disease that in some circumstances might need to be confirmed by other technologies, other professionals, and the vessels in legs. The diagnostic technique

does not simply reflect the meaning of illness in a patient's biography but actively constitutes those existential meanings.

This latter central point of technology-in-practice studies has further been developed in a project of an overlooked piece of health care technology: the medical record (Berg 1996). Health care professionals tend to complain about the increase in paperwork – it has become a symbol of the misguided thrust of government regulations and managed care – and social scientists have similarly dismissed the repeated practice of taking notes as 'not really medicine' or as an uninteresting representation of medical work. Yet the patient record does not merely represent but actively *mediates* the clinical encounter by directing the clinician's gaze. Note-taking and reading medical records transforms information by assembling it in specified formats. Looking over the shoulder of a physician during a patient in-take exam,

> [The physician] creates an overview, distilling and reconstructing information from different times and places, different relevancies, and different sources into a single frame, in such a way that the bits of information he jots down mutually elaborate each other, and form a clear case. (. . .) Each entry is a transformation of disparate cues into one which strongly directs the line of action to take (Berg 1996: 505).

Such continuous note-taking, amending, repairing, and acting upon the record, however, does not by itself determine the interaction, 'the formal demands of medical records are continually subordinated to the contingent requirements of the actual tasks' (Berg 1996: 501).

A consequence of the fine-grained observations of technology-in-practice is that scholars have been wary of overgeneralisations between different kinds of, for example, medical records, not to mention between entire realms of technologies such as visualisation instruments. Mol, for example, adds the following disclaimer, 'other examples would yield slightly different pictures. For the shapes taken by the relations between the various components of diagnosis can only be understood if we analyze the intricacies of specific diagnostic procedures, as well as the clinical and research practices of which they form a part' (Mol and Elsman 1996: 611). The small differences matter. This seems to limit the critical potential of these studies. Indeed, a regular comment at conferences and in discussions is that while the technology-in-practice approach is analytically attractive it seems to be devoid of political potential. If everyone and everything is implicated in clinical practice, who or what should be held accountable for the injustices in the health care system? What about the big picture of lack of access to health care services, rationing, health inequality, waiting lists, medical hubris?

In our opinion, the technology-in-practice approach is not only profoundly political but it also shows how the 'blame game' is simplistic and misguided. One of the strengths of this approach is to deflate the moralistic

rhetorics of the social essentialist and technological determinist model. At the same time that technology-in-practice shows that technical qualities, such as diagnostic visibility (Pasveer 1989), are achieved in clinical interactions, and differ over different locales, this approach also shows politics in action, locally and on a larger scale. To paraphrase Latour again, medical technology is inevitably politics by other means. This approach allows an observer to see how subtle political shifts in the autonomy of patients, the professionalisation of health care professionals, or the goals of government regulators might be implemented technologically, but also resisted, or simply ignored (Collins *et al.* 1998).

Drawing from actor-network theory, Emilie Gomart (2002) explores the political potential of technology-in-practice in her ethnography of a Methadone drug treatment clinic. Policy makers approach the consumption of illegal drugs sometimes as a medical addiction falling under the purview of health care counsellors, sometimes as a form of criminal behavior requiring 'stiff' prison sentences, and sometimes both. In the 1990s, a group of critics in France charged that the medical and criminal approach rested on the same fallacy: the addict was viewed as a free, autonomous subject who was coerced by the drugs to behave in destructive ways. The problem was, however, that the 'free subjects under influence' avoided treatment centres, therefore undermining the efficacy of drug treatment programmes, and that prison sentences did not result in sustained abstinence. The critics offered an alternative based on Methadone treatment: instead of trying to eradicate drug addiction, the addictive character of Methadone could be used to stabilise drug dependency.

Gomart argues that Methadone substitution constituted a criticism of the liberal definition of human agency. Based on extensive ethnographic observations in a clinic in a Parisian suburb, she details how the experimental clinic went out of its way to find users and tailor its treatment after a sophisticated analysis of the relationship of the user to the drug use. Clinic staff set goals with the users and negotiated doses of different drugs with them, taking the addictive agency of the drug into consideration, in order to induce and seduce the users into substitution. The clinic's approach rested on a programme of 'generous constraints'. Cunningly deploying those constraints offered the staff and users an opportunity to build attachments and new relationships. Gomart's rich political analysis centred on the drug Methadone documents one instance in a process of political crystallisation, dissolving, and recrystallisation; at the end of her article, she notes that the role of Methadone and the success of the clinic to fight drug addiction have come under fire.

Where to go from here

Taking stock at the 25th year of existence of *Sociology of Health and Illness*, we feel that there are two roads that are particularly exciting and innovating.

First of all, the recent turn to 'technology-in-practice' requires much in-depth investigation and elaboration. Looking at technologies as central *mediators* in the construction and reproduction of novel worlds – including patient-identities (van der Ploeg 1995), professional identities (Tellioglu and Wagner 2001), and the overall organisation of health care work (Blume 1992) – should be high on our research agenda. Several authors have now taken up the challenge to investigate how novel medical technologies co-produce novel *subjects* or *bodies* (Epstein in press, Cussins 1998). They address categories that have been largely ignored by social scientists or have been brought in as the 'givens' that 'grounded' our social experience, for example, how a simple tool like the medical record has helped to shape a particular *subject*: the modern patient (Berg and Harterink in press).

Importantly, in these studies there are no simple morals: While the politics are of vital importance (who gets treated when the 'infertile patient' is a couple, for example; how do 'poor' and 'wealthy' patient records differ), the results have no predictable plots. Also, in these studies the 'material' and the 'social' intertwine in complicated ways. A case in point is the emerging sociology of the body. Here, we need to avoid treating the 'body' in the same way as we have so long treated medical technologies: as either a biological, given entity, or as a (mere) social construction. We should avoid 'lapsing into either an ahistorical essentialism or an insufficiently material consideration of the multiple ways in which [bodies are] constructed' (Jacobus *et al.* 1990: 4). We should prevent the 'erasure of embodiment' that is prevalent in postmodern deconstructions of the body while attempting to keep this 'embodiment' as a culturally and historically specific phenomenon (Hayles 1992, 1997, Duden 1991). These discussions about embodiment and the role of medical technologies are particularly relevant in the field of disability studies where a backlash exists against the social (essentialist) model of disability (see, for example, Morris 2001, Paterson 2001).

As to the medical technologies that await our investigation, we would like to repeat our plea for the seemingly mundane, 'infrastructural' technologies – such as records, information systems, standards, small home-care technologies, clinical research guidelines – that do not have the immediate attraction of reproductive technologies, HIV-AIDS, or genetics. It is often in the seemingly 'technical' matters that deeply relevant, social issues are 'hidden' – such as inclusion/exclusions of certain groups or voices, or the subtle restructuring of patients' or professionals' identities. Similarly, in being ubiquitous, small, home-care technologies such as insulin pens, or asthma peak-meters, might have far-reaching impacts that would otherwise escape the sociologist's eye.

Secondly, the interdisciplinary nature of science and technology studies, from which technology-in-practice draws, confirms the value of a sociological perspective while emphasising a desire to fracture disciplinary boundaries and to become involved in technology design, production, and implementa-

tion. Here is the true challenge for sociologists studying medical technologies: how to conduct research that is relevant to the users and designers of the devices while maintaining a sociological identity.

Social scientists have many relevant insights to offer disciplinary crossovers. A focus on technology-in-practice is theoretically and politically relevant by focusing on how different technologies help produce different worlds (Mol and Lettinga 1992). Different guidelines can embody different notions of what it implies to practice medicine 'objectively', which in turn imply different positions for the patient (Berg *et al.* 2000). Topicalising 'objectivity' as an attempt to reduce the 'subjective' input from both doctors and patients, and to focus maximally on quantitative data such as laboratory tests and so forth – yields a patient different from topicalising 'objectivity' as the balanced and careful weighing of all available patient information in the way prescribed by the physicians' peers (*c.f.* Dodier 1994). Similarly, diagnosing obstructed vessels through a duplex technology defines the core parameter for this disease as a 'percentage of occlusion' while the parameter of focus could also be the question 'how much can this patient walk'. Defining measuring technology, thus, is about defining diagnosis and, simultaneously, about defining *what* is the most relevant parameter in establishing this diagnosis. Since the correlation between 'occlusion' and 'actual complaints' is far from 100 per cent, this choice is at least partly about *whose* perspective counts (Mol 1998).

With these examples we have ventured into the heart of biomedicine, and have started participating in debates about defining diagnosis, constructing guidelines, or building information systems. Theoretically speaking, the fall of disciplinary boundaries allows us to enter adjacent fields and escape the occasionally insular environment of sociologists speaking to each other about how to be politically relevant. Physicians, nurses, information system designers, guideline developers are eager to enter such dialogues about definitions of autonomy, patienthood, professionalism and so forth. There are now, for example, many sociologists and anthropologists working as and with information technology designers, (see, for example, the journal *Computer Supported Cooperative Work* for a meeting place for such border-crossers). Such dialogues, however, would not be about us (the sociologists) telling them (doctors, nurses, patients, technology designers) what sociology has discovered about the worlds they live in. It would, rather, be a dialogue in which we could bring sociological sensitivity to problems that are also felt to be relevant by professionals, patients, and designers: why clinical practice guidelines are not being used, how information technologies could truly support patients, why implementing home care technologies is about more than creating the necessary technical infrastructure. It is about building *bridges* – in language, culture, methods, notions of evidence – across disciplinary chasms that we have left uncrossed far too long.

When we do this, we will discover that (as the ethnomethodologists and actor-network theorists had predicted), these actors' categories are often

much more elaborate, multi-dimensional and complex than our sociological conceptions of them. On the other hand, these actors are often pleasantly surprised by the richness and methodological openness of in-depth qualitative research, for example, or by the way sociologists can articulate and evaluate experiences that for them remained 'tacit' or were overly 'subjective'. We can help build health care information systems that would build upon a sociological understanding of health care work (Bardram 2000) and design patient information that starts from the patient's perspective (Forsythe 1995). There is much to learn, here, for sociologists and practitioners, patients and technology designers: such, after all, is the nature of real dialogue[8].

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Notes

1 For other reviews of this literature, see Elston (1997), Casper and Berg (1995), Timmermans (2000).
2 For a similar critique of technological determinism among genetic activists and the disability movement, see Shakespeare (1999).
3 While technologies have the status of guided nuclear missiles in the medical armatorium, occasionally social scientists subscribing to technological determinism note that the missiles might back fire. Hardey, for example, argues that the wide accessibility of expert medical knowledge on the Internet contributes to the deprofessionalisation of medicine, weakening the professional monopoly over medicine (Hardey 1999).
4 Other articles falling into this perspective are Dent (1990), Calnan and Williams (1992), Strickler (1992), Hughes and Griffiths (1996).
5 Although Calnan and Williams (1992) use their material to critique a central pillar of social constructivism in sociology of health and illness, medicalisation theory.
6 It lies beyond the scope of this article to articulate all the fine points of these different legacies. We will only sketch some general themes relevant to medical sociologists. Also, some scholars have given a dominant social essentialist twist to technology-in-practice studies. In such versions, the sociologist downplays the more radical ontological legacies from actor-network theory (the often misinterpreted extension of 'agency' to non-humans, and the stress upon the unpredictable and emergent nature of any constructed entity), and instead relies on the processes of resource mobilisation, enrolling, and translation to show how one technology came to dominate a clinical field (see, for example, Manning

(2002). The result is a more sophisticated 'social interests' model with social essentialism absorbing a simplistic, Machiavellian take on actor-network theory. Ultimately, this ends up being more of the same social moralising.

7 See the dialogue between Harry Collins and Bruno Latour in Pickering (1992). Some 'conventional' sociologists stated long ago that traditional sociological variables need to 'earn' their way into an analysis and cannot be privileged (see Glaser and Strauss (1967). Yet the radical twist in ethnomethodological and actor-network theory is that the most explanatory power can be derived from a close attention to the 'sociologies' constructed by the members/actors *themselves* (see *e.g.* Lynch 1993, Latour 1999).

8 This dialogue, of course, neither has to lead to some 'consensus' nor does it have to be always about literal communication. It is just as much about struggle, building (alternative) viewpoints into technologies, exploring what it is that users 'want' through designing prototypes, and so forth. It would require a full-length article, however, to develop these points further (see, for example, the special issue on *Sociotechnical Issues of Health Care Information Technology* of *Methods of Information in Medicine*, co-edited by sociologists and medical informatics scholars for many other forms these dialogues can take (forthcoming: 2003).

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