STREAM READINGS

SCIENCE AND TECHNOLOGY STUDIES

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Science and Technology Studies

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Description
This stream will focus on the relationships among science, technology, and political power in contemporary policy making. The modern state's capacity to produce and use scientific knowledge is significant both in the production and maintenance of political order and in shaping or justifying the choices faced by policy elites. We will focus on the role of scientific knowledge in policy-making oriented to environmental "sustainability."

TABLE OF CONTENTS

Science and Technology Studies

CHAPTER 40

TECHNOLOGY AS A SITE AND OBJECT OF POLITICS

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Technology. A composite of Greek *technē* (skill) and *logos* (study of), the term as normally defined exudes utility and resists abstraction. It is, as most dictionaries tell us, simply the use of established scientific principles to solve practical problems. It is no more than the extension of our normal capabilities to achieve what most of us desire anyway: to alleviate pain and misery; ease work; increase wealth; overcome physical and temporal barriers to action; and open up previously inaccessible worlds to human insight and exploration. Technology allows our species to acquire the bodies and minds, the environments and the entertainments, that we collectively aspire to; through it, we fashion the lives that our imaginations have rendered desirable. Technology, so viewed, is instrumental and mechanistic. It realizes visions, but seems itself to remain value-free. It is an extension of the self, a productive force, the ultimate enabler, but for all that a tool, subject to ideas and ideals that originate elsewhere, outside the sphere of the technological. Where, then, in technology's ambit do we find the spaces of the political?

Myths offer instructive points of departure. As dreams have their obverse in nightmares, so the narrative of technology as a liberating and empowering force has its jarring counterpoint in stories of error, failure and loss of control. Technology, in these darker accounts, not only enables but it also constrains. It produces

unforeseen harms, sets up obstinate hierarchies, channels and manages possible forms of life, and subordinates human capabilities to its own impersonal, destructive logics of rationality and domination. Unmanaged technology, we are constantly reminded, can give rise to disorder and misrule. Four powerful myths have crystallized around these not unconnected fears. They represent technology, in turn, as *unavoidable risk*, as *immutable design*, as *dehumanizing standard*, and as *ethical constraint*. Through these four lenses, and the events and reflections that each opens onto, we can map the politics of technology as it is enacted and experienced in the contemporary world.

Icarus, son of Greece's legendary artisan Daedalus, embodies the age-old figure of technology as risk. Icarus inherited his father's daring but neither his foresight nor his wisdom. Daedalus escaped from captivity in Crete with wings ingeniously crafted of feathers and wax, but Icarus fell to his death when he flew too near the sun, whose heat melted the wax and destroyed his wings. In a tragic modern inversion of the myth, the US space shuttle Challenger exploded in 1986, killing all seven crewmembers aboard, when its stiff rubber O-rings failed to seal in the streaming hot gases during a launch in the unexpected cold of a late January morning in Florida (Vaughan 1996). Molten wax, nonresilient O-rings: both testify to the dangers of reaching for superhuman heights with less than perfect understanding of the instruments at the explorer's disposal.

For technology as design, we may turn again to Daedalus, father of Icarus, the master builder who conceived the Cretan labyrinth, a maze so difficult to penetrate that it safely held the half-human, half-bull Minotaur, although it also prevented the escape of the youthful victims ritually led in to satisfy the monster's inhuman appetites. It took a woman's ingenuity and a man's hardihood, Ariadne's ball of string unwound by Theseus, to end the Minotaur's dominion and bring the victor back out alive. But escape is not nearly so easy from the construct that, following Jeremy Bentham (1995 [1787]), Michel Foucault (1995) conceived as modernity's most characteristic architectural achievement: the Panopticon, the circular, transparent building from whose central watchtower a single guard could hold a community of prisoners within a web of permanent surveillance.

Fast forward to the twentieth century, where Aldous Huxley's 1932 novel *Brave New World* provides the canonical myth of technology as an instrument of standardization. Here we find humanity's craving for safety and order driven to pathological extremes. Huxley's world is one from which suffering in its grosser forms has been banished. But in exchange for freedom from hunger and illness, fear and pain, lost too are the powers of creativity, empathy, and self-fulfillment that liberal societies see as the cornerstones of lives worth living. In this controlled society, people themselves are graded and sorted into classes whose capacities are carefully tailored to the functions they perform. Reason crowds out emotion; the system's logic overrides its members' desire for self-expression. Many have deplored this transformation of the human from godlike inventor to cog in the machine as one of modern technology's worst unintended consequences (Bauman 1991; Habermas 1984; Ellul 1964).

Finally, for technology as ethical transgression, the story that has haunted the western imagination like none other for nearly two centuries is Mary Shelley's *Frankenstein*. Written in 1816 by a girl of nineteen, the tale of the Swiss scientist who built from inanimate matter a being he could not control has become the quintessential fable of technological over-reaching. The Frankenstein myth was infused with new life when, in 1997, Ian Wilmut's research group at Scotland's Roslin Institute announced the birth of Dolly, a sheep created from a mammary gland cell of a six-year-old ewe, and hence genetically identical with her "mother." The announcement refuted biologists' long-held belief that cells in adult bodies, human or animal, were fixed into specialized roles that could not be altered. Real life appeared once again to reprise the elements of myth, as technology reversed the expected course of nature, created a hitherto unknown kind of living thing, and, by foreshadowing similar manipulation of human beings, seemed to outstrip the moral intuitions and rulemaking capacity of elected lawmakers.

These four framing narratives are not, of course, wholly independent of one another. Fear of technology's harmful consequences is intimately linked, for instance, to concerns about ethical violations. The charge of "playing God" applies as much to acts that are perceived to contradict the natural order of things (e.g., cloning humans) as to acts of managerial ambition which, through lack of adequate foreknowledge, misfire and expose society to disproportionate harms.[1] Similarly, to the extent that technology orders or designs the physical and psychological parameters of human existence, it does so through sometimes forcible processes of standardization that demarcate normal social identities and behaviors from those regarded as deviant or abnormal (Hacking 1999; Foucault 1978).

Each of the four narratives provides a rationale for a lively politics of technology, although as we shall see each has also given rise to its own distinctive conceptual dialectic, articulated through specific constellations of political actors, controversies, discourses and forms of action. Common to all four as well is that disputes in each center on the ambiguous figure of the technical expert. Appearing in force on the political scene since the late eighteenth century (Golan 2004), experts are primarily charged with providing assurances that it is safe to live with the powers unleashed by technology. But experts also operate as lightning rods for controversy in every area of contested application: weaponry, surveillance, polling, medical intervention, transportation, energy use, and communication, to name some of the most significant. All of these politically charged technologies raise questions about the competence, foresight, interests, and wisdom of experts (Jasanoff 1995; Nelkin 1992). They also cast doubt on the possibility of democratic rule in

[1] E.g., Carson (1962) on the disastrous environmental impacts of persistent organic pesticides.

societies where technically trained elites perform so much of the everyday work of governance (Price 1965).

1 The Politics of Risk

On any day in 2005 at any major airport in the United States, an anthropologically inclined onlooker would have observed a strange ritual. Lines of slow-moving, ticketed passengers, loaded down with bags and packages of varying colors and contours, walk up to a conveyor belt and start divesting themselves of assorted items under the watchful eyes of uniformed guards: laptop computers are removed from their cases, pockets emptied of anything metallic, belts removed, coats and scarves piled into plastic trays, bags and packages put on the belt, and, most bizarre of all, shoes and boots taken off in preparation for the owners' awkward passage through the rectangular arch of a metal detector. On the other side of the barrier, the process reverses itself, as pocket and briefcase contents are returned to their places, jackets and coats donned again, and shoes put back on stockinged feet. Speeded up, the anthropologist might think, it would make a hilarious cartoon sequence of people going through apparently meaningless motions—and so it would if only the stakes were not so grave.

The increased intensity of airport security screening around the world is, of course, a response to the terrorist attacks of September 11, 2001, in New York and Washington, in which nineteen young Islamic militants destroyed the twin towers of the World Trade Center and parts of the Pentagon, killing themselves and some 3000 others in the process. But why must all those shoes come off, and why especially in the United States? One man's actions at the turn of the twenty-first century changed the conditions of travel for 688 million passengers a year on US domestic airlines. Richard Reid, a Briton with ties to the Al Qaeda organization held responsible for the 9/11 attacks, boarded an American Airlines flight in Paris on December 22, 2001, with enough explosives to destroy the plane packed into his shoes. His attempt to light the fuse that would have converted his shoes into bombs was foiled in time, but the episode turned every shoe worn by every airline passenger into a suspected weapon, and hence (unless exonerated as containing no metal) a target of special screening, regardless of the costs in time, inconvenience, and embarrassment for passengers or in added demands on overworked security personnel.

The instant transformation of that most mundane of civilian artifacts, the shoe, into an object of military interest—a potential weapon—underlined the sociologist

Ulrich Beck's (1992) argument that the global spread of science and technology has spawned a "risk society," in which everyone, regardless of social class or standing, is exposed to incalculable, possibly catastrophic, threats that do not lend themselves to rational control. Technologies earlier seen as safeguards against risk (shoes to prevent injury or infection, for example) can suddenly reveal themselves as sources of unexpected danger. The sweeping in of so many million shoes into the purview of airport surveillance systems also points to a fact about risk that social psychologists have noted for some time: that people are particularly concerned about risks that arouse dread—through their unfamiliarity, scope or uncontrollability (especially of new technologies)—and they will in consequence spend more to control low-probability, high-consequence events than they will to regulate more ordinary hazards, like bicycling accidents, that may in the aggregate cause greater damage to lives or property (Slovic et al. 1980, 1985).

Politically, these observations have played into two quite different responses to the governance, or management, of risk; these may be labeled the *technocratic* and the *democratic*. Grounded in a positivistic commitment to the view that risks are determinate probabilities of harm, and a corresponding faith in the power of experts to calculate these probabilities correctly, the technocratic approach seeks to insulate the process of risk analysis as far as possible from the distorting influence of plebeian politics (Breyer 1993; NRC 1983). The calculation of probabilities, termed risk assessment, is deemed a matter for experts; the choice of acceptable risk levels and control policies is relegated to a later stage of risk management, in which public values are permitted to come into play. Key to implementing this strategy is a commitment to formal assessment methods and rigorous review by experts, followed by a quantitative comparison of the costs and benefits of risk reduction, so as to arrive at the most rational (understood as most economically efficient) regulatory outcomes. This normative preference for efficiency entails additional prescriptions that bear on the relations between experts and the public in risk decisions: that experts should be considered more trustworthy than laypersons when disagreements arise about the severity of risk (Sunstein 2002, 2005); that benefits from reducing one risk should be offset against the costs of others that might thereby be increased (Graham and Wiener 1995); and that more should be done to communicate risks properly to the public, so as to bring their perceptions in line with those of experts.

Western governments throughout the last third of the twentieth century took pains to ensure that their citizens would not, on the basis of uninformed opinions and unfounded fears, reject technological innovations that the state's own experts had deemed safe or bearable. To this end, governments made considerable investments in the public understanding of science and technology. Democratic states were particularly committed to this policy, because technology for them was not merely an engine of wealth creation but also, as in grand nation-building projects like the atomic bomb or the Apollo mission, a potent instrument of

self-legitimation (Ezrahi 1990). To the skeptical citizens of modern democracies, such technological successes offer compelling demonstration that the state is acting effectively on their behalf. But to appreciate the successes as successes, states recognized, citizens must be taught to perceive the risks and benefits of technology in the same way as experts. Programs to enhance the public's scientific understanding aimed to fulfill this pedagogical mission, but these efforts encountered both political and conceptual difficulties (Wynne 1995).

If the technocratic approach to risk management recommends sealed-off spaces for expert deliberation, the democratic response seeks rather to enlarge the role of public participation in decision-making about risk.[2] Opponents decry this trend as misguided populism: an overreaction to singular, self-contained cases of mismanagement, like the transmission of "mad cow" disease to humans through poor agricultural practices in Britain in the 1980s; or a working out of the erroneous principle that the people's preferences should prevail in democracies regardless of the facts found by experts (Sunstein 2002); or the application of an extreme relativizing tendency in the sociology of knowledge that places lay experience on a par with specialized expert knowledge (Collins and Evans 2002). At stake in the move to democratize risk management, however, is not a new form of class warfare between experts and laypeople, the epistemic haves and have-nots of modern knowledge societies, but rather a struggle over who should assess the purposes of technology and, with it, the meaning of lives worth living.

Supporting this analysis are numerous studies that reveal risk to be a deeply constructed phenomenon, a function in part of long historical and cultural legacies that predispose societies to regard some harms as worth enduring and others not.[3] European welfare states, for example, have judged the threats to social solidarity flowing from grossly inequitable distributions of risks, as well as the potential public costs of compensation for faulty predictions, to be less tolerable than has the neo-liberal United States (Rosanvallon 2000). To this disparity may be attributed the European Union's embrace of the precautionary principle as a normative basis for health, safety, and environmental regulation in the 1990s (Tickner 2003), a stance that US politicians and analysts committed to the expert discourse of risk assessment dismissed as unscientific, protectionist, or a sign of weakness and insecurity (Sunstein 2005; Kagan 2003). Embedded in well-entrenched regulatory institutions and practices, these disparate orientations to risk may be taken for granted by those within the system, and indeed be accepted as part of the natural order of things, until comparative analysis reveals the cultural specificity of some of the underlying premises.[4]

[2] CEC 2002: UK House of Lords 2000; NRC 1996.
[3] Jasanoff 1986, 2005; Douglas and Wildavsky 1982; Douglas 1966.
[4] Jasanoff 2005; Vogel 1986; Brickman, Jasanoff, and Ilgen 1985.

Advocates of the democratic approach also point out that, when experts and laypersons disagree about risk governance, they are not necessarily focusing on the same object of inquiry. While experts are chiefly concerned with the probability of deterministic failures in technological systems, publics may care more about issues of purpose and responsibility (Irwin and Wynne 1996). Put differently, experts and publics (and even different expert communities[5]) frame risks differently, with consequent differences in the questions asked and the explanations deemed satisfactory. Mathematical formulations, the preferred discourse of expert risk analysis, fail to address lay concerns for metaphysics and morality. What new ontologies are technologies bringing into the world (e.g., robots, anti-depressants, genetically modified crops), and how desirable are they (Haraway 1991)? Who benefits from technologies that might malfunction and cause catastrophic harm? What mechanisms are in place to compensate those who may suffer from technological breakdowns? A costly mistake like "mad cow" disease operates in this context to reinforce legitimate public concerns about the reliability of expertise, as well as about institutional irresponsibility at the highest levels of governmental or corporate power. Far from operating according to what the sociologist Brian Wynne has termed the "deficit model"—which represents the lay citizen as a technically illiterate, emotionally undisciplined actor—the public emerges in the light of this analysis as capable of sophisticated and reflective institutional analysis, and possibly better able than acknowledged experts to evaluate the implications of technological design for democratic governance (Irwin and Wynne 1996; Wynne 1995).

The dismissive label "populist" also denigrates the experiential knowledge, or lay expertise (Collins and Evans 2002; NRC 1996), that various publics bring to the assessment of risks. Such knowledge stems in part from people's close personal acquaintance with actual, rather than ideally imagined, uses of technology; exclusion of this kind of knowledge cannot be considered innocent from the standpoint of decisionmaking, since it not infrequently leads to disaster (Jasanoff 1994; Wynne 1988). Experiential knowledge, too, is often buried within organizational frameworks that impede its free flow or effective use and uptake by those in power.[6] Expert risk analyses may fail to take account of such stickiness until after bad events have occurred. Nation states can be seen in the light of these observations as particularly complex organizations that command distinctive means of framing technological risks and producing and testing public facts. These "civic epistemologies" (Jasanoff 2005), or patterned ways of generating politically relevant knowledge, provide a further argument for broadening expert risk deliberations so as to accommodate a polity's preferences for culturally specific forms of reasoning, proof, and argument.[7]

[5] Cf. Eden (2004) and Jasanoff (2005, 1986).
[6] Power and Hutter 2005; Eden 2004; Vaughan 1996; Short and Clarke 1992; Clarke 1989; Perrow 1984.
[7] See also Antony, Ch. 3 in this volume.

2 The Politics of Design

The labyrinth and the panopticon—the one dark and inward-leading, the other transparent and outward-gazing, but both equally confining—appropriately capture the power of technology to design the conditions of life. Both imaginings, moreover, make clear how intimately technological design is bound up with projects of governance writ large. Daedalus was not a free agent; he served King Minos of Crete, so well in fact that the king eventually imprisoned him to keep him from seeking another master. Bentham, the quintessential utilitarian, conceived the Panopticon as an efficient means for the state to control disorderly prison populations with the least investment of resources. Indeed, incorporating normative principles into the design of buildings and other material objects has proved to be an efficacious means of regulation at every scale of social organization, from global to smallest local.

That "artifacts have politics" (Winner 1986) is widely acknowledged. Langdon Winner offered as an example the famously low underpasses designed by Robert Moses for New York's suburban highways, supposedly in order to keep busloads of black day-trippers away from white residential enclaves. Social exclusion was in this way built into the design of urban infrastructure. Feminist theoreticians and historians have pointed to the gendered implications of technological design, whether to exclude women from some lines of work or to insert them more deeply into traditionally female gender roles (Wajcman 1991; Cowan 1983). More generally, the French philosopher of technology, Bruno Latour, calls attention to the regulative capacity of all sorts of mundane artifacts, such as the speed bump, or "sleeping policeman," which serves in lieu of a human traffic controller (Latour 1992). Through their very materiality, technologies exert power; once in place, they cannot easily be redesigned or removed. The question of paramount concern for democratic politics, then, is whose design choices matter. Who, in fact, designs technologies?

In the most optimistic accounts, it is the users of technology who have the final say. Technologies, according to this view, are socially constructed by various stakeholder groups: thus, consumer preferences ultimately control whether bicycles will have ten speeds or cars come equipped with anti-lock brakes (Bijker, Hughes, and Pinch 1987). Objecting that this account unduly privileges the social at the expense of the material, proponents of actor-network theory have argued that nonhuman actants also participate in the making of design, offering resistances that human actors must overcome in order to make a technology function (Callon 1986). Others, however, dismiss both streams of constructivist analysis as perpetuating the myth of market liberalism while ignoring the complex macro-political economy of global manufacturing. Aided by compliant experts, sovereign states and their official subunits have historically invested huge resources in promoting specific technological designs, especially in the areas of military technologies and their offshoots in the fields of computers and information technology (Edwards

1996; MacKenzie 1990), and latterly also in biomedicine. Under totalitarian rule, this partnership of science and technology with the state can lead to such practical and ethical disasters as Soviet agriculture and Nazi medicine (Bauman 1991; Proctor 1988); but even in liberal democratic nations non-transparent alliances between experts and their political masters can produce "closed worlds" of discourse (Eden 2004; Edwards 1996; Gusterson 1996), underwriting virtually invisible, publicly inaccessible, and, from the standpoint of human welfare, highly questionable choices in the development of technology.

Corporations emerged in the nineteenth century as equally important players in the politics of design, with their own stables of experts, whose capacity for inventiveness the law turned into economically useful "intellectual property." By the end of the twentieth century, the power of corporations to disseminate their techno-normative design choices around the globe surpassed that of many nation-states (Noble 1976, 1977). In a world so dominated by the military-industrial complexes of developed nations, and by the monopoly power of companies like Microsoft or MacDonald's, end-users have little latitude to criticize, let alone shape, basic design choices. Even the Internet, once hailed as the architectural framework for a genuinely free exchange of ideas and information, a quintessential "technology of freedom" (de Sola Poole 1983), seemed to be turning under corporate dominance into a space for controlled communication and closely held ownership of thought (Lessig 2001).

Against this backdrop, the politics of technological design has taken shape between the theoretical ideal of *participation* and the practical possibilities of *resistance*. Despite calls for greater democratization of design choices (Sclove 1995; Winner 1986), dethroning experts in the pay of capital has not proved easy, and resistance remains the more readily available means of political expression. In one celebrated, late twentieth-century example, Monsanto, the leading US producer of agricultural biotechnology, announced its intention to develop a technique of gene modification that would render the seeds of staple crops sterile by design, and hence unusable from year to year. If carried through, this project might have affected millions of poor farmers who, having planted their fields with Monsanto's seeds, would have had to return to the company for new seeds each year. In this case, a development activist organization, the Rural Advancement Foundation International, later known as the ETC Group, launched an extremely effective campaign against Monsanto's so-called "terminator technology," forcing the company to back down. The result, in effect, was the abandonment of a trajectory of product development that would, by novel technological means, have shifted control of seed fertility from farmers to a corporate patent holder. For the most part, however, corporate design choices remain shielded from early public review under a tacit social contract that grants confidentiality to the innovation process and leaves it to the market to determine the acceptability of already realized technologies.

Multinational institutions created in the aftermath of World War II have become another rallying point for the politics of resistance, especially as reflected in worldwide contestation over the goals, methods and processes of development (Stiglitz 2002). The rise of an anti-globalization movement, represented in force at the World Trade Organization's third ministerial conference in Seattle in November 1999, put questions of public and corporate accountability at the head of the international political agenda, with a specific focus on issues of technological design. Protest centered in part on large-scale projects of environmental and social engineering, such as the construction of high dams to meet power and irrigation needs in many parts of the developing world. Planned and carried out on a wave of enthusiasm for modernization, these dams became by the later decades of the twentieth century symbols of ill-conceived technological design in many newly independent nations. Not only had the expert designers failed to take account of the dams' long-term environmental consequences, but as protest movements dramatically demonstrated, they had also ignored the impacts on the lives of people made landless and homeless through these massive relocation projects (Khagram 2004; Hall 1990). As the armies of the dispossessed gained voice and visibility (Roy 1999), even impersonal global institutions like the World Bank were forced to reconsider their development policies and become more open to inputs from below (Goldman 2005).

Given that slightly more than half the developing world's labor force still consisted of farm workers around the turn of the century, it is perhaps not surprising that improving agricultural technologies surfaced as a prime objective for development experts. The Green Revolution of the 1960s showed that scientific techniques could be applied to producing significantly higher-yielding grain varieties, with the possibility of reducing hunger worldwide. But success in raising yields did little to alter underlying problems of poverty and inequality, and political discourse fifty years later remained stubbornly divided over whether the revolution had succeeded in its normative, as opposed to its technical, goals. In local contexts, where the lines between rich and poor often solidified, the Green Revolution spawned numerous acts of resistance, employing what the political scientist James Scott (1976; 1985) evocatively termed "weapons of the weak."

On the larger canvas of globalization, the failure to eradicate poverty, guarantee food security and prevent environmental harms led many critics to challenge the Green Revolution and its successor, the Gene Revolution promised by modern agricultural biotechnology, as continuing impositions of hegemonic western power and violence on the developing world.[8] Pulling up genetically modified plants from research plots around the world became the modern analogue of an earlier era's smashing of mechanized looms. The instinctive response from governments and their expert advisers, then and now, was to decry these demonstrations as senseless,

[8] Shiva 1997; Visvanathan 1997; Mies and Shiva 1993; Nandy 1988.

backward-looking acts of vandalism. Critics blamed public ignorance of science, radical environmentalism, and media hype—in short anything but a shortfall in democratic institutions—for these demonstrations. Mechanisms for proactively involving an emerging global public in design decisions affecting the majority of the world's population, as in the case of agricultural biotechnology, eluded the imagination of ruling elites.

3 The Politics of Standardization

Certain design features are favored more by those in power than others. Chief among these is the strategy of simplification, through which the complex jumble of human identities and behaviors can be rendered, in James Scott's term, "legible," and therefore manageable (Scott 1998). The instruments most commonly used for this purpose are classification and standardization (Bowker and Star 1999; Desrosières 1998). The former sorts things into categories that produce legibility and meaning; the latter ensures that the categories so created are filled with similar entities, permitting valid comparisons and the treatment of like as like. It would be difficult to navigate the social structures of modernity without relying on standard categories defined by technical experts. For anything to circulate productively in the world—persons, goods, currency, services, scientific claims, technological artifacts—people and institutions need to know the exact parameters of what is being exchanged. Equally, standards provide the foundation for building safety and trust, without which one could not effectively operate elaborate, spatially dispersed technological systems. And yet classification and standard-setting inevitably entail costs: the creation of senseless or meaningless categories, the reduction of complexity, the elimination of ambiguity, and the sometimes forcible pigeonholing of persons and things into categories in which they do not belong (Bauman 1991).

The relationship between technology and standards has been variously conceived, but whatever the conception the implications are always profoundly political. In technological worlds, humans may become both cognitively and physically the extensions of impersonal machines, with consequent loss of autonomy, individual personality, and freedom of thought and expression.[9] Technologies of mass communication, in particular, not only vastly expand the sphere of public deliberation, but through their power of reproduction they actually construct the masses,

[9] Habermas 1984; Noble 1976; Ellul 1964.

pressing people into shared and reductive ways of thought (Lessig 2001; Benjamin 1968). At the same time, film and more particularly television have privatized the domain of visual expression and communication, disrupting ancient social bonds and promoting the phenomenon that the political scientist Robert Putnam (2000) dubbed "bowling alone." Yet, for all its alienation and atomization, a public whose members have learned to read and think alike can still be led to destructive ideologies and fundamentalisms. The marriage of state power with print capitalism underpinned, in Benedict Anderson's view, the rise of nationhood as a specific form of "imagined community," with all its potential for destructive mass mobilization (Anderson 1991).

The social sciences and associated technologies of the modern era are at once a response to and an instrument of state power. Techniques such as cost-benefit analysis and risk assessment permit states to justify actions taken on behalf of their citizens, just as they allow citizens, reciprocally, to hold the state accountable for arbitrary actions (Porter 1995; Jasanoff 1986). Through bottom-up action, citizens may even be able to use social science methods to make their problems visible to otherwise uncaring states (Skocpol 1992). The objectivity that these methods claim can guard against egregious abuses of authority, and yet, as shown through comparative analysis, such objectivity itself is a cultural construct that can clothe exercises of power in a spurious rationality unless its intellectual foundations are available for democratic reexamination and critique (Jasanoff 2005). Like the mass media, the social sciences, too, have the power to *make* populations, by specifying how to group people into standard categories for the diagnosis and treatment of social ills. As Foucault's writings preeminently demonstrate, the social sciences and technologies serve in this way as the instruments of a new biopower, through which the organization and control of life begin to feature as the stuff of politics (Foucault 1978). Wielded not only by governments but by other expert statelike institutions, such as hospitals, schools, and prisons, these bio-sciences and bio-technologies transform people's subjective ways of understanding themselves, producing what the philosopher Ian Hacking has called new "social kinds" (Hacking 1999;1995). The eye of external power converges in these institutions with the inner eye of psychological self-perception to produce, in effect, disciplined and self-regulating societies.

It is no surprise, then, that in a period of multiple and overlapping standardizations politics frequently takes the form of individuals asserting themselves against political forces that would rather treat them as members of manageable populations. Briefly put, the conflict so posed is between an *epidemiological* and a *clinical* gaze: the former operating through statistics, numerical aggregation, formal models, and general patterns of cause and effect; the latter wishing to restore to view the individual, the particular, the non-repeatable, and the unique (Desrosières 1998; Epstein, 1996). The locus for such confrontations is often the courts, the only institutions of modernity that routinely hold their doors open for the airing of individual grievances against the objectifying and standardizing impulses of the regulatory state. Yet even here, through disputes about the qualifications of experts representing the two standpoints, the imperial, population-focused, epidemiological gaze has to some degree successfully appropriated the discourse of science as its own, and so has extended its reach at the expense of the humbly clinical (Jasanoff 1995).

4 The Politics of Ethical Constraint

Mary Shelley's *Frankenstein* won a new etymological lease on life in the final years of the twentieth century, when British advocacy groups attached the label "frankenfoods" to the products of the new agricultural biotechnologies, thereby implicitly characterizing them as monstrous hybrids, unfit for human consumption. Behind the catchy media rhetoric and sometimes lurid imagery, there lurked a growing set of concerns about the ontological implications of the new technologies, particularly those based on the mid-century revolutions in genetics and molecular biology. Could technology populate the earth with entities we would rather not see proliferate, or even come into being? Could developments against nature still be counted as progress? Almost overnight in the 1990s, especially after the birth of the cloned sheep Dolly, the distinction between the *natural* and the *unnatural* became a matter for high politics. Governments of most industrial nations recognized that the legitimacy of their bio-technology policies would depend on navigating that boundary with at least as much circumspection as had previously been invested in decisions about physical safety and risk.

If the politics of risk contains at its core an effort by the state to convert lay citizens to the viewpoint of experts, then the politics of ethical constraint has sought, by contrast, to turn lay intuitions into matters of expert judgment. In pursuit of this goal, industrial democracies from the 1980s onward began experimenting with institutions and procedures that would convey formal ethical advice to decisionmakers. The appearance of public ethics commissions as a new institutional form provided one salient marker of this development (Jasanoff 2005). Another was the diversity of procedural formats through which national governments sought to extract ethical intuitions from citizens and translate them into principled bases for formulating law and policy. These experiments with citizen juries, consensus conferences, inquiry commissions, referenda, and ethics councils reached a kind of apogee in 2003 with the UK government's nationwide debate on public attitudes to the commercialization of genetically modified crops. Entitled

GM Nation?, the event entailed the most comprehensive mobilization of an entire polity ever undertaken around a bioethical question. Differently composed and possessing different formal powers, the varied responses to the problem of bioethics nonetheless had one object in common: they all sought to remove ethical judgment from the domain of the private and the subjective and to transmute ethics itself into a new kind of expertise that states could muster in promoting innovative technologies.

As interesting as the spread of the new expert discourse of bioethics was the exclusion of some topics from the domain of ethical deliberation. Under US law, for example, intellectual property decisions remained firmly black-boxed within the technical framework of legal interpretation, resisting attempts to recast decisions about the ownership of biological organisms or materials into the language of ethics. Famously, in its 1980 decision in *Diamond v. Chakrabarty*, the US Supreme Court ruled that living organisms were patentable under law and that ethical concerns had no place to play in this determination. Manipulation of the human genome and of stem cells taken from embryos aroused enormous passion and generated intense ethical debate in many countries; the manipulation of plant and animal genomes, however, provoked little discussion, with rare exceptions, as when the Chicago-based artist Eduardo Kac inserted a jellyfish gene into a rabbit embryo to make an animal that glowed green under ultra-violet light. Interesting, too, was the boundary silently drawn between decisions that were felt to be about risk and those that were seen to involve an ethical component. The national bioethics commission appointed by US President Bill Clinton, for instance, could not reach an ethical consensus on the rights and wrongs of human cloning, but it did conclude that cloning "to create a child would be a premature experiment that would expose the fetus and the developing child to unacceptable risks" (NBAC 1997).

5 Conclusions

Surveying the landscape of democratic politics since the second half of the twentieth century, one must conclude that the genie has definitively escaped from the bottle: technology, once seen as the preserve of dispassionate engineers committed to the unambiguous betterment of life, now has become a feverishly contested space, in which human societies are waging bitter political battles over competing visions of the good and the authority to define it. In the process, the virtually automatic coupling of technology with progress, a legacy of the Enlightenment, has come undone. Uncertainty prevails, both about who governs technology and for whose benefit. No matter which way one looks, the frontiers of technology are seen to be, at one and the same time, frontiers of politics. Settling these regions—making them at once technically tractable and socially habitable—requires the simultaneous activation of society's cognitive, instrumental and normative capacities, in a complex dynamic of co-production (Jasanoff 2004).

Technology as a site and object of politics displays itself clearly in four linked yet separate aspects: as risk; as design; as standard; and as ethical constraint. On each front, as we have seen, politics has played out as a dialectic between competing propositions. In the case of risk, debate has centered on the degree to which technocratic faith in expert assessments or guarantees of safety should take precedence over democratic concerns for institutional accountability and the equitable distribution of technology's burdens and benefits. Controversies over technological design have crystallized around the appropriate timing of public involvement—whether it should be meaningfully participatory, far upstream in the manufacturing process, or rather expressed through resistance, after a product or system is already on the market or in the theater of war. Opposition to technology's standardizing logic has pitted the statistician's epidemiological gaze against the clinician's sensitivity to inter-individual variability and predilection for case-centered explanations. And the search for new ethical constraints in the wake of the biological revolution has activated debates about the right way to draw the boundary between the natural and the unnatural in a period when the stuff of life increasingly also serves as the stuff of politics.

Weaving through all four sites of political engagement is the figure of the technical expert, that invisible yet ubiquitous ordering agent of modernity. In ever expanding areas of governance, it is the expert more than the legislator or the corporate executive who determines how lives should be lived, individually and collectively. The very meaning of democracy, therefore, increasingly hinges on negotiating the limits of the expert's power in relation to that of the publics served by technology. Are experts accountable, to whom, on what authority, and what provision is there for the injection of non-expert values on matters that fall in the gray zones between conjecture and certainty? By addressing these questions, the politics of technology has tacitly taken up a central challenge of contemporary representative democracy, one left too long untouched by classical political theory.

Two hundred years ago, documents were written that still underpin the legitimacy of modern states. These national constitutions allocated responsibility among the branches of government and specified the protected rights and liberties of individual citizens. They checked untrammeled power and made space for creative fashionings of the self. Today, it is not so much these written texts as the architecture of complex technological systems that performs the constitutional functions of enabling and constraining civilized forms of life—especially on a global scale. By examining the resulting dispensations of artifacts, nature and society, we come

closer to understanding how technologies can be scaled to enhance, rather than oppress, the human faculties that dreamed them. The politics of technology is the play and the ploy through which today's citizens can assert control over potentially dangerous extensions of their ambitiously inventive selves.

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The New York Times

Self-Driving Uber Car Kills Pedestrian in Arizona, Where Robots Roam

By Daisuke Wakabayashi

March 19, 2018

SAN FRANCISCO — Arizona officials saw opportunity when Uber and other companies began testing driverless cars a few years ago. Promising to keep oversight light, they invited the companies to test their robotic vehicles on the state's roads.

Then on Sunday night, an autonomous car operated by Uber — and with an emergency backup driver behind the wheel — struck and killed a woman on a street in Tempe, Ariz. It was believed to be the first pedestrian death associated with self-driving technology. The company quickly suspended testing in Tempe as well as in Pittsburgh, San Francisco and Toronto.

The accident was a reminder that self-driving technology is still in the experimental stage, and governments are still trying to figure out how to regulate it.

Uber, Waymo and a long list of tech companies and automakers have begun to expand testing of their self-driving vehicles in cities around the country. The companies say the cars will be safer than regular cars simply because they take easily distracted humans out of the driving equation. But the technology is still only about a decade old, and just now starting to experience the unpredictable situations that drivers can face.

It was not yet clear if the crash in Arizona will lead other companies or state regulators to slow the rollout of self-driving vehicles on public roads.

Much of the testing of autonomous cars has taken place in a piecemeal regulatory environment. Some states, like Arizona, have taken a lenient approach to regulation. Arizona officials wanted to lure companies working on self-driving technology out of neighboring California, where regulators had been less receptive.

[Read more on how Arizona became a destination for self-driving car tests.]

But regulators in California and elsewhere have become more accommodating lately. In April, California is expected to follow Arizona's lead and allow companies to test cars without a person in the driver's seat.

Federal policymakers have also considered a lighter touch. A Senate bill, if passed, would free autonomous-car makers from some existing safety standards and pre-empt states from creating their own vehicle safety laws. Similar legislation has been passed in the House. The Senate version has passed a committee vote but hasn't reached a full floor vote.

"This tragic incident makes clear that autonomous vehicle technology has a long way to go before it is truly safe for the passengers, pedestrians, and drivers who share America's roads," said Senator Richard Blumenthal, Democrat of Connecticut.

The Uber car, a Volvo XC90 sport utility vehicle outfitted with the company's sensing system, was in autonomous mode with a human safety driver at the wheel but carrying no passengers when it struck Elaine Herzberg, a 49-year-old woman, on Sunday around 10 p.m.

Sgt. Ronald Elcock, a Tempe police spokesman, said during a news conference that a preliminary investigation showed that the vehicle was moving around 40 miles per hour when it struck Ms. Herzberg, who was walking with her bicycle on the street. He said it did not appear as though the car had slowed down before impact and that the Uber safety driver had shown no signs of impairment. The weather was clear and dry.

Uber said it would work with the police.

“Our hearts go out to the victim’s family,” an Uber spokeswoman, Sarah Abboud, said in a statement. “We are fully cooperating with local authorities in their investigation of this incident.”

Tempe, with its dry weather and wide roads, was considered an ideal place to test autonomous vehicles. In 2015, Arizona officials declared the state a regulation-free zone in order to attract testing operations from companies like Uber, Waymo and Lyft.

“We needed our message to Uber, Lyft and other entrepreneurs in Silicon Valley to be that Arizona was open to new ideas,” Doug Ducey, Arizona’s governor, said in an interview in June 2017.

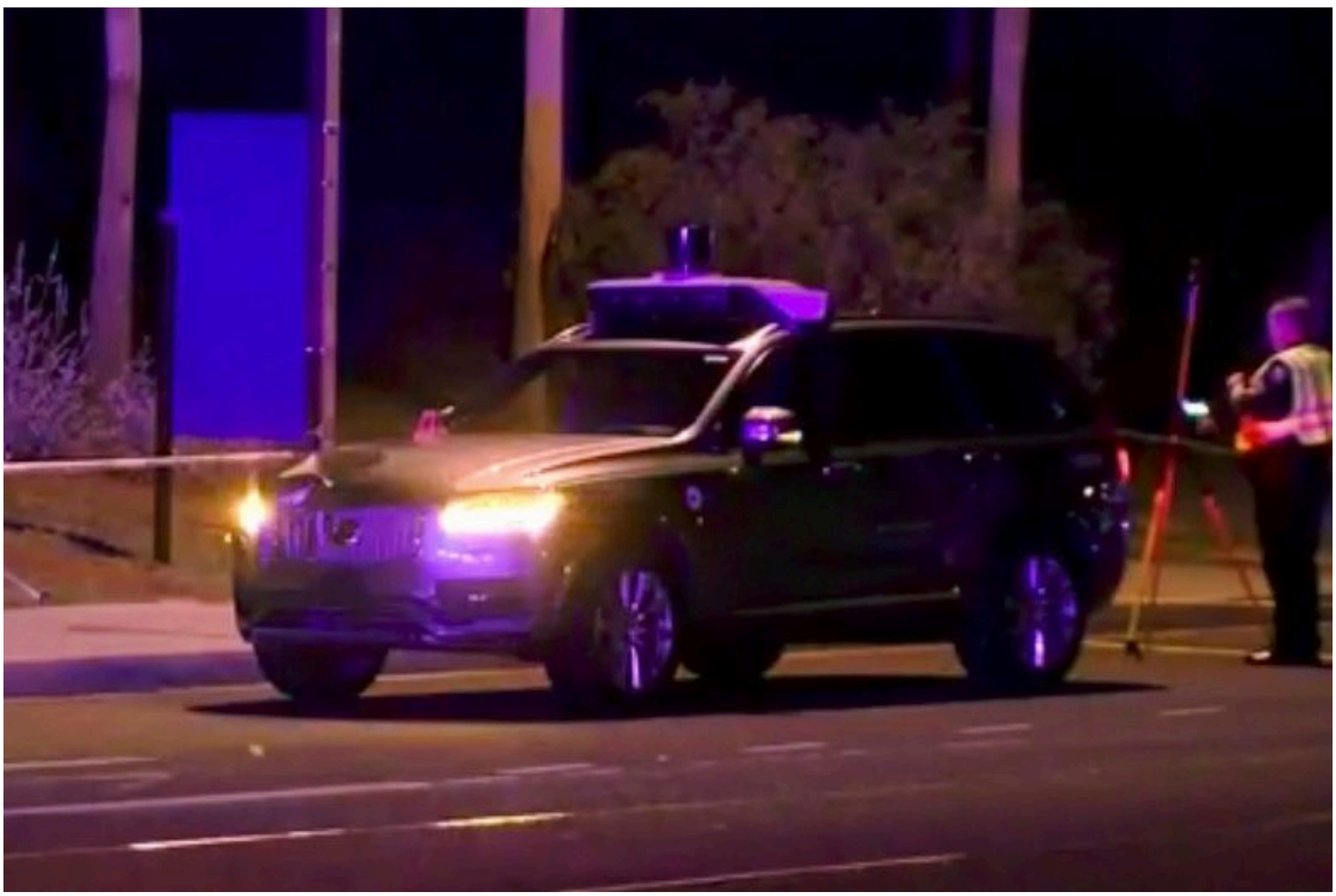
Using an executive order, Mr. Ducey opened the state to testing of autonomous vehicles that had safety drivers at the wheel, ready to take over in an emergency. He updated that mandate earlier this month to allow testing of unmanned self-driving cars, noting that a “business-friendly and low regulatory environment” had helped the state’s economy.

Even when an Uber self-driving car and another vehicle collided in Tempe in March 2017, city police and Mr. Ducey said that extra safety regulations weren’t necessary; the other driver was at fault, not the self-driving vehicle.

But on Monday, Mark Mitchell, Tempe’s mayor, called Uber’s decision to suspend autonomous vehicle testing a “responsible step” and cautioned people from drawing conclusions prematurely. Daniel Scarpinato, a spokesman for Mr. Ducey, said the updated order from the governor “provides enhanced enforcement measures and clarity on responsibility in these accidents.”

In California, where testing without a backup driver was just weeks away from being permitted, Jessica Gonzalez, a spokeswoman for the state Department of Motor Vehicles, said officials were in the process of gathering more information about the Tempe crash. Waymo, Lyft and Cruise, an autonomous vehicle company owned by General Motors, did not respond to requests for comment.

In a news release, the National Transportation Safety Board said it was sending a team of four investigators to examine “the vehicle’s interaction with the environment, other vehicles and vulnerable road users such as pedestrians and bicyclists.”



A self-driving Uber car at the scene of a fatal accident in Tempe, Ariz.
ABC-15, via Associated Press

Since late last year, Waymo, the self-driving car unit of Google's parent company Alphabet, has been using cars without a human in the driver's seat to pick up and drop off passengers in Arizona.

Most testing of driverless cars occurs with a safety driver in the front seat who is available to take over if something goes wrong. It can be challenging, however, to take control of a fast-moving vehicle.

California requires companies to report the number of instances when human drivers are forced to take over for the autonomous vehicle, called "disengagements."

Between December 2016 and November 2017, Waymo's self-driving cars drove about 350,000 miles and human drivers retook the wheel 63 times — an average of about 5,600 miles between every disengagement. Uber has not been testing its self-driving cars long enough in California to be required to release its disengagement numbers.

Researchers working on autonomous technology have struggled with how to teach the systems to adjust for unpredictable human driving or behavior. Still, most researchers believe self-driving cars will ultimately be more safe than their human counterparts.

In 2016, 37,461 people died in traffic-related accidents in the United States, according to the National Highway Traffic Safety Administration. That amounts to 1.18 fatalities per 100 million vehicle miles traveled in 2016.

Waymo, which has been testing autonomous vehicles on public roads since 2009 when it was Google's self-driving car project, has said its cars have driven more than 5 million miles while Uber's cars have covered 3 million miles.

In 2016, a man driving his Tesla using Autopilot, the car company's self-driving feature, died on a state highway in Florida when his car crashed into a tractor-trailer that was crossing the road. Federal regulators later ruled there were no defects in the system to cause the accident.

But the crash in Tempe will draw attention among the general public to self-driving cars, said Michael Bennett, an associate research professor at Arizona State University who has been looking into how people respond to driverless cars and artificial intelligence.

“We’ve imagined an event like this as a huge inflection point for the technology and the companies advocating for it,” he said. “They’re going to have to do a lot to prove that the technology is safe.”

Follow Daisuke Wakabayashi on Twitter: @daiwaka

Rebekah Zemansky contributed reporting in Tempe, Ariz. Cecilia Kang contributed reporting in Washington D.C. and Cade Metz contributed in San Francisco.

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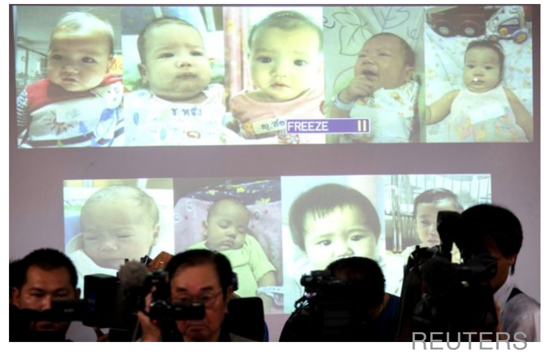
'Baby factory' mystery: Thailand's surrogacy saga reaches uneasy end

By Jonathan Head
BBC South East Asia Correspondent

26 February 2018



REUTERS

The imposing new courthouse for juvenile and family affairs in northern Bangkok w the setting last week for the final ruling in one of the strangest custody cases to emerge from the moral maze of Asia's thriving surrogacy business.

At stake was the future for 13 young children, taken into state care as infants in August 2014, after they were discovered being looked after by nannies in a Bangkok apartment.

At the time the authorities were investigating fertility clinics in Bangkok believed to be offering commercial surrogacy services - paying Thai women to give birth to babies for mainly foreign clients.

This was in response to a Thai surrogate mother complaining that an Australian couple had refused to take one of the twins she had carried for them because he was born with Down's syndrome, a boy she called Gammy.

At least nine clinics were raided. One clinic, which was called All-IVF, was shut down.

The 13 children had been conceived under the supervision of Dr Pisit Tantiwattanakul, who ran All-IVF. It turned out that all of them been fathered by then-24 year-old Mitsutoki Shigeta, a Japanese man who had already left Thailand, and who, from Japan, provided DNA samples to prove his paternity of the remaining 13.

That a young, secretive and single man would want so many babies raised immediate concern over his motives.

The Thai police began investigating Mr Shigeta for possible human trafficking. The surrogacy agent he had first used, the Georgia-based New Life, headed by Mariam Kukunashvili, stopped dealing with him when he told her how many children he planned to father.

"Mr Shigeta first contacted us for surrogacy in 2011", she told the BBC. "Initially he chose two surrogate mothers, and both became pregnant right away. After that he informed us he wanted more than 1,000 babies, and planned 10-20 surrogacies every year, or more.

"He said he had ten passports, and could register the babies through different embassies. We became very worried about the wellbeing of the babies, and we suspected baby trafficking."

Mr Shigeta's lawyer in Thailand explained that his client simply wanted a large family. As the eldest son of a Japanese tech billionaire, he said, there would be no problem looking after the children properly. But his true reasons for wanting so many children, using surrogates, remain a mystery.

The Thai authorities have since identified two children in Cambodia and four in Japan already fathered by Mr Shigeta. Now, after more than three years, the court has awarded him custody of the remaining 13, who have been living in a state children's home. Mr Shigeta has not come back to Thailand to visit them, perhaps fearing either the publicity or possible prosecution, but Thai officials say his mother has visited them every two months.

The court ruled that as Mr Shigeta was the biological father of the children, that there was no evidence of ill-intent or trafficking, nor of a criminal record, and that the surrogate mothers had made no claim to them, it could find no reason not to award him custody. It found that he had established bank accounts specifically for them in Singapore, had paid for helpers to assist in looking after them, and was preparing a home for them in Japan, along with schooling.

He has also bought a property in Thailand in which to look after the children during a planned transition period, where they will get to know the nannies who will care for them in Japan. Thai officials who visited Japan say they were reassured by the evident affection his four children already living there showed for him. They say they will continue to monitor the 13 who are expected to move to Japan in the near future.

The court did not address Mr Shigeta's strange ambition to have hundreds of children, but did say that in considering the interests of the children above everything else, it believed they would be better under the care of a wealthy and apparently conscientious father, than in state care in Thailand.

In 2015, Thailand passed a new law strictly limiting surrogacy to Thai couples, and banning commercial surrogacy altogether - offenders face up to 10 years in prison. The business then moved over the border to Cambodia for a while, but in 2016 that country also outlawed the business. Now it has largely moved to Laos, where there is as yet no specific regulation for surrogacy.

But the lucrative practice has not died in Thailand. As a regional transport hub, with excellent medical skills and facilities, Thailand is still an ideal location for people to seek surrogacy services, even if the impregnation of surrogates cannot be legally done inside the country.

Evidence of cross-border surrogacy appeared last year when a man was detained in April carrying six vials of frozen sperm across the border to Laos. A month later six Thai women were also detained at the border, as the authorities found out they had been contracted to be surrogate mothers in Laos.

Websites offering fertility services state that much of the initial process of obtaining eggs from donors and then fertilising them can be done in Bangkok's experienced clinics, before transporting the embryo to Laos to be implanted in the surrogate.

At some point Laos too will probably tighten its regulations. But the yearning for children in those who cannot conceive naturally, and the globalisation of the "wombs-for-rent" business, makes it inevitable that when that happens it will simply move to another poor country.

And 19 children, all close in age, will now find themselves being brought up by a publicity-shy, 28-year-old Japanese man, with the assistance of his mother and an army of paid helpers. By all accounts they will want for nothing, materially, but Mariam Kukunashvili has concerns over the emotional aspects of such an unconventional family.

"Ethically, we don't understand how one can share love, time and attention among 300 or 1000 babies. Sometimes wealthy people with no parental experience assume that bringing up children just means hiring dozens of nannies, and paying bills.

"You cannot outsource parenthood entirely to nannies, as this can cause psychological problems in the children and adults."

Archive for June, 2015

The US and France invoked different normative standards to admit biologically novel newborns to American and French citizenship, respectively.

"*The problem is that the law hasn't kept up with the advances in reproductive technology*," explained Mrs. Brisman, a New Jersey lawyer, when commenting on Ellie Lavi's protracted attempts to register her daughters as U.S. citizens (1). When the American-Israeli mother gave birth in Tel Aviv, the U.S. State Department refused to recognize the parent-child relationship because the twins were conceived with egg and sperm from anonymous donors and thus were not biologically related to Mrs. Lavi. Born in Israel and lacking a genetic tie to a U.S. national, the twins were initially rejected for U.S. citizenship. This situation changed only with the reinterpretation of a provision in the Immigration and Nationality Act (INA), which now recognizes both genetic and gestational motherhood as a basis for claiming citizenship for a child.

Meanwhile, France's Supreme Court dealt with the question whether twin boys borne by a surrogate mother in India for a French couple should be granted citizenship. Although there was a genetic tie between the intended father and the children, French judges decided to reject the couple as legal parents and denied citizenship. Uncertainties regarding the boys' civil status were ironed out only when the European Court of Human Rights decided that France must recognize the parent-child relationship when citizens conduct gestational surrogacy abroad.

The U.S. lawyer's statement above captures the prevailing sentiment about the law's sluggishness in the American context but it also holds true for French public debates on surrogacy. At its heart is a picture of the law as a viscous body of rules that eternally trails behind the inexorable agenda-setting forces of science and technology. This perception of the relationship between law, science and technology is commonplace in public controversies about novel technologies and has been examined critically by STS scholars (2). Yet, the mere coexistence of the American and French stories on foreign surrogate mothering underlines the limitations of this narrative.

While giving birth was not at first sufficient to establish legal parenthood and citizenship under U.S. law, the situation in France was exactly the reverse. French authorities refused to recognize the lineage between the twins and the genetic father, and to accept the boys as citizens, precisely because the legal definition of parentage was keyed to the act of giving birth. These contrasting rules represent an unexpected nexus of two larger complexes of law that came into play in these situations.

On the one hand, there are nation-specific ways of controlling the degree to which the process of human reproduction can be mechanized and externalized with the help of novel technologies (e.g. in-vitro fertilization, gamete donation, surrogacy). On the other, there are regulations that tie bodies to political spaces, including nation-specific ways of obtaining citizenship and the rights and obligations that attach to citizens. The influence these bodies of law can have on people's decisions to conduct fertility treatments abroad became evident in the case of the French couple that engaged a surrogate mother abroad to bypass France's domestic legal restrictions. Here, we see that regulations already in place preconditioned new social practices that gave rise in turn to novel legal questions.

Comparison between the U.S. and France further illuminates the different choices of law made by the two countries' legal authorities. By extending the legal parenthood and citizenship from proof of a genetic relation to include the acts of gestation and giving birth, U.S. authorities reconfirmed that citizenship should be defined in biological terms. They admitted, however, that the regulations previously in place had defined the biology of motherhood too narrowly and therefore law needed to be brought in line with what technology had enabled. In effect, the U.S. decision affirmed the law lag narrative by conforming the law to a new understanding of reproductive biology.

This tacit delegation of normative authority to biological facts, however, is not universal, as the story of the French couple and their twin boys shows. In fact, French officials did not let their understanding of biology define the children's civil status but rather evoked a set of norms that applied to their citizens whether they were conceiving children at home or abroad. According to French standards, surrogacy impermissibly exploits women and commodifies children. Merely banning the practice at home was not thought sufficient to meet French ethical demands, since citizens could always escape by engaging a surrogate mother in a country with liberal or no regulations on this matter. Hence, refusing to grant citizenship to children born through surrogacy abroad should be understood as France's attempt to hold its citizens to French norms regardless where they happened to be in the world. Put differently, the country's moral stance was thought to travel with its citizens, who were not allowed to break out of French normativity on so basic a matter as reproductive rights just because they were territorially no longer in France. Law in this sense took precedence over technology.

To sum up, each country invoked a different normative standard to admit biologically novel newborns to American and French citizenship, respectively (3). These contrasting solutions point to nation-specific imaginaries attached to different practices of technologically assisted reproduction, contrasting ideas about citizenship, and conflicting visions of how the future can and should be rendered governable in the face of late modernity's rapid and destabilizing sociotechnical changes. STS critical tools that analyze not only technological outcomes but also the discourses that normalize (or fail to normalize) these outcomes help us to investigate further and to achieve a more profound and differentiated critique of biology and law. In this case it takes us beyond the simplistic assertion that the law always lags behind science and technology.

Keywords: law lag; assisted reproduction; parenthood; citizenship

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Limits of Responsibility: *Genome Editing, Asilomar, and the Politics of Deliberation*

BY J. BENJAMIN HURLBUT

On April 3, 2015, a group of prominent biologists and ethicists called for a worldwide moratorium on human genetic engineering in which the genetic modifications would be passed on to future generations. Describing themselves as "interested stakeholders," the group held a retreat in Napa, California, in January to "initiate an informed discussion" of CRISPR/Cas9 genome engineering technology, which could enable high-precision insertion, deletion, and recoding of genes in human eggs, sperm, and embryos.[1] Such modifications could affect every cell in a resulting child, including germ cells, and could therefore be passed down through subsequent generations. The group was responding to rumors, now confirmed, of experimental attempts in China to apply the CRISPR/Cas9 technology to human embryos. Although the Chinese efforts to modify human embryos were inefficient,[2] the Napa group declared that the advent of a technology that makes human germ-line genetic engineering plausible makes a corollary discussion of its ethical implications urgent. Echoing this sentiment, the National Academy of Sciences (NAS) and the National Academy of Medicine have announced plans to convene an international summit in fall 2015 to assess the implications of CRISPR/Cas9.

Yet the notion that the advent of this particular technology is the warrant for initiating a public discussion is remarkable, and so too is the idea that the experts who have brought it into being and are putting it to use are best positioned to define the terms of the debate. Since the prospect of engineering the human germ line has been a matter of debate for at least half a century, the relevant ethical questions are by no means specific, let alone subsidiary, to the CRISPR/Cas9 technology.[3] They are longstanding questions about what features of human life ought not be taken as objects of manipulation and control. They are questions about our responsibilities to our children and our children's children, where the mark of our actions will be inscribed upon their bodies and their lives.

What, then, justifies the notion that this emerging technology has caught us off guard or that it is appropriate for experts to retreat into secluded spaces to define the parameters of public debate?

The Legacy of Asilomar

The answer lies in the history that both the Napa group and the National Academies have invoked as precedent: the recombinant DNA controversy and the famous scientific retreat held at Asilomar, California, in 1975. As new techniques for modifying DNA emerged in the early 1970s, prominent researchers called for a voluntary moratorium on recombinant DNA experiments out of concern that they might unwittingly create dangerous new pathogens. A group of elite biologists convened the Asilomar meeting to assess the risks associated with recombinant DNA technology and to establish guidelines for research that they hoped would simultaneously limit biohazard risks and forestall public regulatory intervention. The meeting was an expression of scientific responsibility but also of control; the scientific community assumed the authority to define science's responsibilities in the present and to declare what promises can be made, what risks warrant worry, and what technological futures are possible, desirable, and good.[4]

Two members of the Napa group, Nobel laureates Paul Berg and David Baltimore, also played key roles in organizing Asilomar and defining its scope. Baltimore opened the 1975 meeting by declaring two topics out of bounds: the biosecurity implications of recombinant DNA and the social and ethical implications of the technology. How these technologies might be used and what those uses might mean for our lives were not on the table. Instead, Asilomar focused narrowly on technical questions about risk assessment. That framing was used to justify both the recommendations that came out of the meeting and the lack of public participation

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in formulating them. If risk could be contained within the laboratory and the manipulated organisms, why should the wider public have any say? At the same time, the Asilomar scientists prided themselves on the transparency and openness of their deliberations. Rather than keep their concerns secret, they put them on public display so that the public could see (and appreciate) the scientific community's self-restraint.

Asilomar is remembered as having defused public anxiety, opening the way to a commercially successful biotechnological future. The moral of the Asilomar story is often repeated, most recently by the Napa group: "[A]t the dawn of the recombinant DNA era, the most important lesson learned was that public trust in science ultimately begins with and requires ongoing transparency and open discussion."[5]

But the public role that the Asilomar story celebrates is one of dependence, with the public passively learning—and deferring to—science's authoritative judgment about what is at stake and when a democratic reaction is warranted. The legacy of Asilomar lies less in its scientific achievements than in its implications for democratic governance of science and technology. In 1975, Senator Ted Kennedy rightly characterized Asilomar as a usurpation of democratic authority: "They were making public policy, and they were making it in private."[6]

Limited Imaginations

The resolution crafted at Asilomar charted a course for molecular biology that would rely heavily on scientific self-regulation and on the notion that scientists are in the best position to make judgments about whether and when a technology is sufficiently developed to warrant public attention to its "impacts" and "consequences." It thereby laid out a path not only for recombinant DNA research but also for an entire way of approaching controversies over emerging technologies. Asilomar has been cited as the model in areas as wide-ranging as human cloning, geoengineering, artificial intelligence, and synthetic biology. In each proceeding, questions about what forms of research are appropriate—what research reflects the values, aspirations, and concerns of the society that supports it—were largely left aside. Yet with the present controversy, Asilomar is once again being held up as a model and precedent. The National Academies have announced their intention to take the lead in constructing standards and guidelines for governing human germ-line gene editing, framing the effort as a replication of the role that the NAS played in convening the 1975 meeting.

Four decades after Asilomar defined the framework for debate, we find ourselves caught off guard by precisely the issues that were excluded: biosecurity and the social and ethical implications of genetic engineering. We find ourselves in this position in no small part because of the way limits were set on the kinds of questions that could be raised in the 1970s. Two years ago, Americans learned that researchers had used their tax dollars to create strains of H5N1 flu virus that could cause a pandemic and had sought to publish these inventions.[7] What is remarkable is not merely that this work was done out of the public eye, but that multiple stages of scientific review—from grant proposal evaluation, to biosafety assessment, to peer review—raised essentially no questions, and certainly no invitation for collective deliberation about whether the research itself was appropriate. When the flu researchers called for a moratorium, its declared purpose was to allow time to reassure an overly anxious public that the experiments had been conducted with "appropriate regulatory oversight" and "to explain the benefits of this important research."[8] The questions of whether the oversight was adequate or the research itself appropriate, let alone how to approach these questions as a problem of democratic governance, were sidelined. The narrow scope of routine regulatory oversight was a legacy of Asilomar, as was the notion that when the public baulks at worrisome research, the appropriate action is to hit "pause" long enough to allow public views to come into closer alignment with scientific judgments.[9] Today with the Napa recommendations and the first reports of human embryo engineering experiments,[10] we are likewise thrust into an urgent discussion—urgent only because we have been discouraged from engaging in it for decades.[11] The current debate over whether gene-editing technology ought to be applied to human gametes and embryos once again frames public ethical deliberation as a footnote to expert judgments about the benefits of research. Why, given nearly half a century of debate about what commitments to human integrity should guide our technological projects, does this question arise with such apparent novelty and urgency that it seems to catch us unprepared?

Forty years later, the legacy of Asilomar lives on in the notion that society is not in a position to judge the ethical significance of scientific projects until scientists can declare with certainty what is realistic: in effect, until the imagined scenarios are already upon us. It lives on in our tacit commitments to focusing ethical deliberation narrowly on the "impacts" and "consequences" of science and technology, rendering the ambitions that animate the scientific projects that threaten such impacts invisible and immune to democratic scrutiny. We are invited to worry only over the end products of science, not about its processes of judging what forms of research are desirable and good. In short, Asilomar underwrites the notion that those who are in a position to make the technological future are also the most competent to declare what possible futures warrant public attention. This renders society and its institutions inevitably and perpetually reactive.[12]

This approach gets democracy wrong. It is our technologies that should be subject to democratically articulated imaginations of the futures we want, not the opposite.[13] Science and technology often claim to be servants of society;[14] they should take that promise seriously. Imagining what is right and appropriate for our world—and what threatens its moral foundations—is a task for democracy, not for science.

The public role that the Asilomar story celebrates is one of dependence, with the public passively learning—and deferring to—science's authoritative judgment about what is at stake.

Toward Democratic Innovation

Consigning the public to a reactive role renders democracy subordinate to epistemic correctness. It reflects an uncritical political deference to scientifically authorized accounts, effectively shifting democratic responsibilities onto the shoulders of science. We limit ourselves to mere reaction by uncritically deferring to scientific accounts of what scenarios are realistic and what public reactions are warranted. Scientific voices can declare the right and the good for society only insofar as society shirks its own responsibility for imagining the worlds we want to live in. This is a democratic deficit that cannot be rectified merely by cultivating a more informed and engaged public. Progress demands cultivating innovation in democracy no less than in science and technology. I offer three correctives for charting a prudent path forward:

First, prudent restraint ought to extend to scientific research agendas and not merely to eventual applications. In a parallel statement published in *Nature*, some of the researchers who created gene-editing technology called for prohibiting both clinical applications of these technologies and the forms of research that would make such applications possible.[15] By contrast, the Napa group supported increased research to evaluate the safety and efficiency of germ-line applications, in effect asserting that science should proceed even in the face of grave reservations about whether its offshoot technologies could *ever* be legitimately used. But this simplistic distinction between research and application profoundly constrains the opportunities for collective ethical judgment. Judgments that are confined to clinical applications alone are reduced to answering a yes or no question, a choice between prohibition and acquiescence to an already established technological trajectory. Yet responsibility requires that our aspirations and values inform trajectories of innovation themselves, and not merely their eventual applications.

Second, an informed deliberation on genetic engineering research and its applications need not depend on comprehensive public understanding of the science behind CRISPR/Cas9 gene editing. The Napa group imagines that a democratic response is possible only after the public is educated "by experts from the scientific and bioethics communities" about the technological particulars.[16] The NAS initiative reflects a similar sentiment. But this is trading the forest for the trees. Tinkering with the basic stuff of human life is simultaneously tinkering with our sensibilities about what features of human life are inviolate. The never-finished collective work of refining these sensibilities is not a footnote to the biotechnology *du jour*. It is our sensibilities that should decide what aspirations ought to animate scientific ambitions and what goods biology can be asked to deliver.

Third, we need not and should not wait for a scientific declaration that the time for deliberation has come, nor should we leave it to scientific experts to determine when a moratorium is necessary or that society needs to play catch-up. Neither should we silently defer to expert judgments that the state of science in any field makes ethical deliberation premature. Public deliberation on science should transcend the particular technologies that make it so urgent. A truly "prudent path forward"[17] requires recognizing that the technological possibilities we find before us already reflect prior moral commitments about what choices are appropriate, what powers of control we command, and what moral imaginations should regulate and restrain our technological aspirations. Those commitments belong to all human societies; they demand unflagging democratic attention and the cultivation of capacities to sustain it. They ought not be confined to the interval of a moratorium whose parameters are declared by science. The moment for collective deliberation about what scientific trajectories we set upon, and what visions of the good should animate them, is—and has always been—right now.

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The following three essays are part of a series on teaching bioethics, edited in collaboration with the Presidential Commission for the Study of Bioethical Issues.

Why Training in Ecological Research Must Incorporate Ethics Education

BY G.K.D. CROZIER AND ALBRECHT I. SCHULTE-HOSTEDDE

Although we come from different disciplines and faculties—one of us is an evolutionary ecologist; the other, a philosopher of the life sciences—we share an interest in the ethics of biological science. The philosopher, G. K. D. Crozier, has taught bioethics to honors biology students, and the ecologist, Albrecht I. Schulte-Hostedde, integrates ethics sections into his graduate courses and serves on the Board of the Canadian Council for Animal Care, the national organization that oversees the ethical use and care of animals in science. When we met in 2011, we started investigating how ecological researchers contend with the ethical dimensions of their field studies. In 2013, at the Annual Meeting of the Canadian Society for Ecology and Evolution, we conducted a workshop and survey of ecological researchers regarding the ethical dimensions of their work, and since then we have had numerous communications with researchers about their personal experiences. These communications confirmed our expectations: they convinced us that ecology should have ethics integrated into its graduate training curricula.

Historically, biological researchers have held considerable skepticism, if not downright animosity, toward ethics because of the association between ethics and animal rights activists.[1] The only place that any ecologist might formally encounter ethics issues has been when working on vertebrates or cephalopods and in the animal care infrastructure and organizational structure associated with animal welfare and the use of animals in science. As one anonymous respondent to our survey put it, "People studying biology are particularly illiterate in ethics since students with ethical concerns about use of animals are steered to other nonscientific fields. Such concerns are viewed as invalid. In fact, it is often the case that 'we' (ecologists) are ill informed. Discourses of ethical concerns for animals remain largely taboo (but things are improving)." We have been pleasantly surprised, however, by the amount of support for ethics education we have found within the ecological research community.

Ecological Research

Ecology is the branch of biology devoted to the relationships among organisms in the wild and between organisms and their environments. Ecological research scientists work in universities, governments, nonprofit organizations, and industry, and they study a broad range of topics, including, for example, the population dynamics of other-than-human organisms, including endangered species; the impact of industrial pollutants on wild populations; and the evolution and dispersal of wildlife diseases, including diseases that are transmissible to humans (zoonoses).[2] When we use the term "ecologists" in this essay, we refer specifically to scientists in the field of ecological research rather than to forest or wildlife managers, environmental policy-makers, conservationists, environmentalists, and so on (although members of these

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