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Agency and Citizenship in a Technological Society

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Abstract:
Citizenship implies agency, but what is agency and how is agency possible in a technologically advanced society where so much of life is organized around technical systems commanded by experts? This paper addresses these questions from the standpoint of philosophy of technology and constructivist technology studies. The paper first establishes the conditions of agency, which are knowledge, power, and an appropriate occasion. It then considers the role of bias in the construction of technological systems and the importance of participant interests in modifying that bias. Finally, the paper addresses the wider issue of the prospects for civilizational change required by the environmental crisis in a globalizing technological regime.

This is a lecture about citizenship in a technological society, or more precisely, technical citizenship. The lecture is divided into three main parts: a first part on agency, a second on my own critical theory of technology, and a third on what I call democratic rationalization.

Technical citizenship

Citizens have rights, for example, the right to speak their mind. But this is not the whole content of our notion of citizenship. Unless it matters when they speak their mind, we do not consider them fully endowed with citizenship. For it to matter they must also have something we call political agency. What do we mean by this concept of agency?

Interestingly, there is no word for agency in French. We ran into this problem when my book *Questioning Technology* was translated into French. We decided to translate the word agency by the phrase “capacity to act.” This is a good start on a definition. More precisely, capacity to act implies three conditions: knowledge and power, and an appropriate occasion.

Power without knowledge is as likely to be self-destructive as fulfilling. This is not what we mean by agency. We do not talk about agency in cases where the subject is too ignorant to make informed decisions. For example, children are not generally consulted about the treatment of their medical problems.

The role of power in agency is complicated by the fact that we exercise a sort of power in many circumstances that have no agential character. This is the case where a universal consensus prevails, as when the subject’s actions conform to a culturally accepted practice. We would not normally describe using a knife and fork at table as agency, although an exception could perhaps be made for disability. Nor is agency relevant where rationality dictates uncontested solutions to problems, as in the case of arithmetic. Using the multiplication table is not an example of agency.

Agency is reserved for domains in which action is both personal and informed, and in which it is appropriately so. Politics is the prime example and we call agency in

this domain citizenship. Citizen agency is the legitimate right and power to influence political events.

This leads to the specific question that I want to address today: is there something we could call technical agency? Technology shapes everyday life. In a sense it is like laws which also shape the framework of our existence. So, it seems there is a prima facie case for demanding agency in the technical domain. But technocratic ideology claims that agency is impossible where specialized technical disciplines such as engineering exist. Even if subjects have the power to intervene, the knowledge component of agency is lacking.

What is the basis of this belief? We generally think of technical questions as similar to mathematical or scientific questions. In all three cases we believe there is a truth independent of personal beliefs established by incontrovertible evidence and reasoning. In the case of technology, that truth concerns the most efficient way to solve problems with devices of one sort or another. Technical citizenship seems incompatible with efficiency since only the technologists know the one best way to do things in their domain.

Philosophically considered, the question concerns the nature of rationality. Most political theorists imagine people disagreeing about values and ideologies, not facts. They take it for granted that some sort of rational process allows convergence around a similar description of the contentious issues, but what to do depends also on personal commitments. Those commitments are not irrational—there are always arguments—it's just that rational individuals often end up agreeing to disagree. This is why citizenship is so important: since no rational procedure can eliminate disagreement, we must have the right to our beliefs regardless of what others think, even if they are many and we are few. But this right does not extend to challenging technical knowledge where it exists with mere ideology or personal preferences.

The technocratic theory is at least partially correct. No one wants decisions about the bridges we drive over to be made by referendum. But this is a straw man. There other ways of thinking about political agency that make sense of the extension of agency into the technical domain. I will be focusing on this latter point here.

Behind the technocratic argument lies a hidden assumption, namely, that technical experts know everything relevant and rational in their domain. Thus the real question is, do the users and victims of technology know anything worth knowing that is not known by technical experts? This formulation reveals the problem with technocracy. There are obviously blind spots in technical disciplines just as there are in every other type of knowledge. There are interests at stake, there are traditions, and there are of course errors.

Furthermore, specializations don't always correspond to a concrete reality. In the real world everything is connected but specializations tend to isolate and separate out a particular cross-section of reality for analytical treatment. This can lead to unanticipated problems. For example, it may turn out that a brilliant engineering idea is not so brilliant from the standpoint of the medical consequences for the workers who have to use the device the engineers have conceived. Once deployed medical complications ensue and another specialization must be called in to deal with non-engineering aspects of the concrete system formed by the device and the physiology of the workers who use it. Who is likely to first notice the limitations of the engineers' useful but narrow conception

of reality? There is no meta-discipline able to predict the need for multiple forms of disciplinary knowledge. The answer is therefore obvious.

There is room for another source of knowledge. I call this knowledge from below. It is based on experience and is frequently occasioned by harms of technology that have been ignored, or unexploited potentials of technology that have not been identified by the technologists themselves but which users can imagine and even in some cases implement. The chief examples of these two categories are the medical harms of industrial pollution, and the communicative potentials of the Internet.

It may be true in these cases that eventually everyone agrees on the facts and that technical solutions will be found on which everyone also agrees. But the operative word here is “eventually.” How long does it take to get to the moment of rational consensus? In some cases corporations, government agencies, even scientists resist acknowledging problems for many years, even decades. David Hess describes what he calls the “object conflicts” that arise over the design of the implicated technologies. These disputes can go on and on as powerful organizations at first ignore the lessons of experience and then attempt to incorporate them. During that long interregnum questions of fact are in dispute and the disputes look very much like political ones in that reason does not dictate a single answer. In this context rationality consists in arguing for one’s point of view and tolerating disagreement. But this is just what we expect of citizens.

These considerations on technical knowledge suggest that there may be a kind of citizenship in the technical domain. Recall the conditions of agency: knowledge, power, and an occasion. I have already suggested that ordinary people may have a useful kind of knowledge relevant to an appropriate occasion of some sort, but what about the power to make changes? In the last 50 years this third element of agency has fallen into place.

Technocratic over-reaching sets the stage for the exercise technical agency. Technocracy not only excludes citizens from the technological sphere but it extends the exclusion to politics on the grounds that political controversies are best resolved when they are treated as technical problems. The idea here, associated with the popular understanding of technology, is that there is always a correct answer to every technical question and every question can be formulated as a technical one.

Political theorists generally assume that there are two types of rationality: scientific-technical rationality which commands universal assent, and what is called normative rationality which does not. Technocratic ideology operates within this framework, disagreeing only on the range of technical problems. If most of what one normally thinks of as political beliefs can be reduced to factual disagreements, then there is no need for citizenship at all. The concept of normative rationality lacks a referent. Those who persist in disagreeing with the correct technical solutions are not exercising agency; they are simply irrational and can be ignored.

Technocratic ideology had its origin in the paradigm of large technical systems such as the railroads and the electrical system. These giant macro-systems were efficiently regulated by small cadres of engineers and bureaucrats. They encompassed the total society and transformed its daily life. Ordinary people simply accepted the systems and worked within them without questioning their nature or boundaries. They did not expect to have agency in the railroad and the electrical systems and by

extension, the technocrats argued, should not have agency in society at large where wise technicians can make better decisions than citizens.

These systems were taken to represent technology in general and to point the way to a new form of rational society. But the influence of technocracy was rather limited until the 1950s and 1960s. The spread of technical mediation to every sector of society and the development of new programming and economic tools after World War II gave it real plausibility. The early 1960s was the highpoint of technocratic ambition. The defeat of this ambition occurred in three stages.

In the 1960s movements for political participation challenged the technocrats. The concept of "alienation," hitherto an obscure technical term in Hegelian and Marxist philosophy became a popular slogan. Technocratic claims raised awareness of the extraordinary centralization of power in modern societies despite their democratic political system. Infrequent elections did not alter the fact that in everyday life the citizens were subordinated to management and administration at work, in dealings with medical institutions, government agencies, even unions and political parties. The concept of alienation was widely used in this period to signify the resulting loss of agency.

In this first stage of the reaction against technocracy, the American new left called for participatory democracy by which was meant general consultation rather than hierarchical control. In France in 1968 a much more powerful movement than the American new left demanded self-management in the economic and political institutions of the society.

In a second stage these movements for participation were relayed in the 1970s and 80s by movements with a more specific focus on the environment and medicine. Environmentalists demanded alternative technologies and regulation of the existing technologies. Business and conservative politicians claimed that environmentalism would impoverish society. In reality it is not environmentalists but bankers who have brought the economy low. Most people agree that we are better off for having cleaner air and water and fewer dangerous chemicals in our environment. Environmentalism proved that public participation is neither impotent nor incompetent.

Movements in the medical sphere also changed practices in significant ways. Although there have been recent setbacks, the 1970s saw major changes in childbirth procedures under pressure from women and women's organizations. The most enduring effect of those changes is the routine presence of a partner or friend in the labor and delivery room. Like environmental demands, this demand too was at first resisted by professionals who exaggerated the risks of an unfamiliar arrangement. The fall of this prejudice was the harbinger of a less paternalistic practice of medicine in many domains.

The third stage of the process emerged with the Internet in the 1990s and continues down to the present. The Internet gave the example of technical potentials invisible to the experts but known to users who realized them through hacking and innovation. The users introduced human communication on the Internet. This application was not envisaged by those who originally created it to support time sharing on mainframe computers.

I will discuss several examples related to the Internet later in this talk, but I want to mention an earlier case of agency on a computer network that confirms what we have

learned from the Internet. In the early 1980s the French Minitel system was the only successful large scale computer network. Its original purpose was the distribution of socially and economically useful information to households. The Minitel appears now to be a kind of first draft of the Internet, limited to one nation but, like the Internet later, accessed by millions of users. The Minitel network also resembles the Internet in that it was not designed for human communication. Shortly after it went online, the network was hacked by users who converted an information system into a wildly popular medium for text messaging. One might call this Web Zero point 0.

These movements have led to the decline of expert authority. But there are other causes too. A number of shocks refuted the exaggerated claims of technocratic ideology. The war in Vietnam was presented to the public as a technical problem American ingenuity could solve. It was a disaster. The Challenger accident, viewed by every American school child and many adults, revealed the limits of technical power. And Three Mile Island discredited the claims to prediction and control on which the ideology rested. New social movements around issues such as the environment gained credibility from these failures of the technocracy.

Meanwhile, a new paradigm of the relation of human beings to machines was emerging. The computer replaced the old paradigm of large-scale technical systems in the minds of more and more people. As hackers and amateur innovators worked their magic on the Internet, everyone was shown brilliant examples of a new kind of technical micropolitics that enhanced the established technical systems while subverting their original design. We are still living in the shadow of this change in paradigm.

In any case in recent years we have seen the sphere of public debate and activity expanding to take in technological issues that were formerly considered beyond the bounds of discussion. And with the expansion of the public sphere new forms of technical agency have emerged. Naturally, the exercise of technical citizenship is not an unmixed blessing. The public makes mistakes too. But every advance of democracy incorporates the “unqualified” into the system as citizens. Only after the individuals have the responsibility for participating in decision-making are they in a position to engage the learning processes that qualify them to do so. So far, in any case, the public has not done so badly in technical matters.

Critical Theory of Technology

These observations call into question many old ideas about technology. We need a new theory to explain technical agency, freed from the influence of technocratic ideology. In what follows I am going to present my attempt to construct such a theory. This theory draws on contemporary Science and Technology Studies (STS) for its critique of technological determinism. This critique is based on two principal ideas that are fruitful for a theory of technical citizenship. The constructivist approach emphasizes the role of interpretation of the meaning of technologies in their development. Actor network theory explores the implications of technical networks. In what follows I develop these contributions of STS in a political context. At a more general philosophical level, the critical theory of technology presents a critique of the notion of context-free rationality in the technological domain. This latter critique is identified with the early Frankfurt School. It provides the background to my concept of the bias of technology.

I call my approach critical theory of technology or critical constructivism. I argue that technology is not universal or neutral with respect to values. Technology is value laden like other institutions that frame our everyday existence. I borrow an account of the bias of technology from constructivism. Constructivists have shown that design is underdetermined by technical considerations. This means that there is choice in design which cannot be decided by simply consulting engineering manuals. Instead design, and even those engineering manuals, is shaped by many actors and not just by pure reason.

Artifacts and systems reflect particular interests, the interests of the actors who have the most influence on design choices, particularly in the early stages. Actors typically disagree over the meaning of a new technology at first. Different social groups may feel that devices that are basically similar from a technical standpoint are really quite different and ought to serve different purposes. Constructivists call this interpretive flexibility.

The famous example developed by Trevor Pinch and Wiebe Bijker is the early history of the bicycle. Two different types of bicycles were in competition in the early days, a fast bicycle with a large front wheel and a small rear wheel, and a safer but slower bicycle with two wheels the same size. Each design appealed to different actors, the high front wheelers to young man who liked to race, and the more stable design to ordinary people using a bicycle for transportation. Most of the parts were similar and both versions looked like a bicycle, but actually they were two different technologies understood in different ways by different social groups. Eventually, through a complicated process of technical development, the safer model came to prevail. It's triumph was not due to some sort of absolute technical superiority but to contingent historical developments.

The bias of technology means that there is no pure form that would be most efficient. Efficiency is not an absolute standard since it cannot be calculated in the abstract but only relative to specific contingent demands. The meaning and purpose of technology thus depends on non-technical factors. This has political implications. Some benefit more than others from the technologies that surround us. The sidewalk ramp is a case in point. The ordinary high curb works fine for pedestrians but is an obstacle to the free circulation of wheel chairs. When the disabled demanded the right to circulate freely, society responded by introducing sidewalk ramps. A suppressed interest was incorporated into the system. This is a model of the exercise of technical citizenship confronting a biased technology. The outcome is not an unbiased technology, but more precisely, a technology that represents a wider range of interests.

The familiar opposition of irrational society and rational technology invoked by technocratic ideology has no place in this context. The biased design that eventually prevails in the development of each technology is the framework within which that technology is rational and efficient. After technologies are well-established their particular bias seems obvious and inevitable. We cease to conceive it as a bias at all and assume that the technology had to be as we find it. This is what gives rise to the illusion that there could be an unbiased form independent of the choices of any particular social group.

The notion of the bias of technology brings interests into focus. Technologies enrol individuals in networks. These networks associate the individuals in various roles,

for example as users of the technology or workers building it, or even as victims of its unanticipated side-effects. Designs represent some of these interests better than others. It sometimes happens that users are well served by a technology that causes pollution. The victims of the pollution are also enrolled unwittingly in the network created by the technology.

We can see in this case that participant interests don't just preside over choices of design, they also emerge from choices. The owners of automobiles discover an interest in better roads they would have had no reason to feel before joining the automotive network. Similarly, the victims of pollution discover an interest in clean air that would never have occurred to them had they not suffered from respiratory complaints caused by the freeway next door.

These interests should not be conceived in a essentialist fashion as permanent features of a particular class or of human nature as such. Rather, involvement with a technology makes certain interests salient that might otherwise have remained dormant or had no occasion to exist at all. I call these “participant interests.”

Once enrolled in a network individuals are motivated to address its failings and in some cases they also acquire potential power over its development. That power may have no formal outlet. It may even be suppressed but it is a basis from which struggles can emerge. And the power of individuals within a network is quite different from that of individuals who have no connection to it. Because they are on the inside they can identify vulnerabilities and bring pressure to bear. This gives them a platform for changing the design codes that shape of the network.

Consider the famous tuna boycott. The boycott arose when the purchasers of canned tuna became aware that tuna fishing unnecessarily killed many dolphins. An imaginary community of tuna eaters formed around this unhappy news, and this community acted to protect dolphins by refusing to buy tuna caught in nets that also entrapped dolphins. Eventually the nets were changed to protect dolphins. One sees how even the consumers’ rather remote involvement in a technical network gives power.

The video game industry offers another example of the complex power relations that emerge in technical networks. The industry is now larger than Hollywood and engages millions of subscribers in online multiplayer games. The players’ gaming activities are structured by the game code, but online communities organize them in informal relationships that the industry does not control. These communities form within and in reaction to the rationalized structures of game technology. Once activated, the community struggles to reconfigure aspects of the game, mobilizing code and items from the game in new ways and contexts. Markets appear in goods won during play as players auction them off for money. Games are modified by players skilled at hacking. Companies may protest these unauthorized activities but in the end they usually give in and attempt to co-opt what they cannot control. Interaction between game designers and players and among the players themselves creates an opportunity for technical citizenship unlike the mass audiences created by television broadcasting.

I use the phrase technical code to indicate the point of intersection of social choice and technical specification. Technical codes translate the one into the other. So, for example, the choice of the safety bicycle translated a social demand for safety into a technical specification for wheels. Similarly, the social demand for the protection of

dolphins was translated into a different net design. Such codes are Incorporated into both designs and technical disciplines.

I distinguish two types of technical codes, the codes of particular artifacts, and the codes of whole technical domains. For example the refrigerator is subject to an artifact code reflecting the demands of families in specific social environments. The standard size of the refrigerator varies with the size of families and the distance from the store. Refrigerators in Paris tend to be a lot smaller than refrigerators designed for suburban households in the United States. Codes relevant to whole technical domains are involved in the definition of progress. For example, the domain code under which industrial progress was pursued in the 19th century required the replacement of skilled labor by machines. This code is still influential to this day.

This continuing influence is illustrated by the development of online education since its invention in the early 1980s. Only online discussion was possible then and so a pedagogy developed based on dialogue and collaboration. This could be considered a progressive development of traditional distance learning since it added human interaction to the distribution of printed educational materials. But in the late 1990s, university administrations were attracted by the still unfulfilled promise of automated learning. They saw the possibility of replacing professors with Internet based software and videos. This implementation of online education was also understood as progress and it had far more resonance with the public given its conformity to the standard code of industrial development.

The failure of automation has left a confusing situation in which online education means very different things to different people. Which technical code will prevail, a code based on the traditional educational reliance on communicative interaction or an industrial code that privileges mechanization? Online education is at the stage of those early bicycles studied by Pinch and Bijker.

When a technical code is well-established the alternative approaches that it excludes are forgotten. A kind of technological unconsciousness covers over the earlier history and obscures the imagination of future alternatives. Technology takes on an apparent necessity. We don't think much today about a possible future of air travel based on the ever-increasing speed but that was a hot issue at the time the Concorde was developed. That possible branch of commercial airline development is foreclosed.

The history of the computer offers another example. If you asked people in 1960 the question, “What is a computer?” they would probably have answered “A calculating and data storage device.” But today when you ask the same question computer technology is also defined as a medium of communication. We know that this has had a huge impact but the change is so profound that it is difficult to remember how improbable it seemed only a short while ago. Taking the nature of the computer for granted obscures the complicated history in which it became what it is. The democratic interventions that shaped that history are forgotten and it is assumed that the computer serves communicative functions because it is a computer. This is the dangerous tautology of the illusion of technology. I call this the technical illusion. To create a place for agency technical citizenship must struggle to overcome this illusion and to restore contingency to the technical domain. The definition of progress is at stake in this struggle.

Democratic Rationalization

This leads me to raise questions about what we mean by progress in the light of this theory of technological citizenship. Advocates of the democratization of technology often argue that progress must have a moral as well as a material dimension. Most democratic arguments are based on the notion that procedures such as voting or citizen juries can achieve this. But there is a risk in these procedural arguments. They are exposed to the neo-liberal counter-argument that participation is inefficient. There is a trade-off, we are told, between morally virtuous procedures and material wealth. Unfortunately, not many advocates of democratization have been willing to address this argument. An effective response must show the instrumental rationality of democratic change.

It is important to be clear on what this implies and especially on what it does not imply. Instrumental rationality is not necessarily instrumental to the production of the maximum quantity of consumer goods. The concept is much more general and refers to the efficient production of any type of good that is appropriately pursued by efficient means, whether it be a public good such as health care or a private consumer good such as automobiles. Furthermore instrumental rationality is not restricted to what we in our society today define as a good but is relative to any socially accepted notion of what is worth producing efficiently in any society. Of course not every good is subject to this condition. Efficiency is irrelevant to many human interactions and to playful and creative activities. The proportion of such interactions and activities to goods subject to an efficiency criterion may vary, but wherever some goods are so subject, instrumental rationality is a relevant concern. It seems obvious that no modern society can ignore it.

One influential way to think about instrumental rationality is in terms of the increasing role of calculation and control in modern societies. This is called rationalization in the sociological theory that derives from the German sociologist Max Weber. Rationalization in Weber's sense refers exclusively to means. According to Weber and his followers, modernity is a society based on rational means.

It is not difficult to understand Weber's concept of rationalization. The ability to measure is essential to optimizing the use of resources and the innovation of better technology. Control is essential to prevent waste, bribery and theft. A corporation or a government that is good at calculation and control will be more successful. A whole society organized around these virtuous procedures can be called more advanced than one based on traditional means.

But Weber assumed uncritically that better calculation and control imperatively required bureaucratic administration. His model was the very rigid German bureaucracy of his day. As a result his theory of rationalization led to a pessimistic conclusion. He warned that modern societies were headed toward an "iron cage of bureaucracy." We, on the other hand, routinely observe the inefficiency of overly rigid bureaucracy. Successful management can be far more inclusive and participatory than Weber imagined. Innovation, another important feature of modernity, requires more freedom than a Prussian bureaucrat would normally allow.

This is why we need to formulate a "generalized rationalization theory" which affirms with Weber the importance of calculation and control, but drops his insistence on bureaucracy. Rationalization can occur under any system of social control, including

democratic control or various kinds of collegial control or, as we will see now, what I call democratic interventions.

Theories of democratic socialism and participatory capitalism assume some version of this generalized rationalization theory. They offer utopian perspectives on the reform of modern society. But the actual technical politics emerging today is far less ambitious than these theoretical schemes. These democratic interventions are punctual interventions from below, tied to particular cases at particular times and places.

Democratic interventions are observable wherever the public becomes involved in conflicts over technology, for example controversies in the public sphere leading to hearings, lawsuits, and boycotts. Such controversies often lead to changed regulations and practices. A second mode of intervention is public participation in design. This approach especially characterizes the computer industry where there is frequent consultation with users in the creation of new programs. I call a third mode of intervention the creative appropriations of technologies, a kind of reinvention modifying devices to meet new demands. The most impressive such case is the Internet. The basic framework was supplied by the government but reworked by innovative users with technical skills. Their innovations include essentially all the communicative applications of the network. The fact that these innovations were widely adopted by the user community gives them a democratic character.

It is reasonable to call these interventions rationalizations where they effectively improve the instrumental rationality of technologies. The effect may not be visible from the standpoint of specific corporations or government agencies, which often pay the price of changing technical designs to conform with public demands. We hear their protests in the name of “efficiency” all the time. But if the efficiency of the technological system is measured from the standpoint of society as a whole, then it is clear that interventions for such things as pollution control or improved opportunities to communicate do constitute technical progress.

Micro-political activism of this sort is the specific form of agency associated with technical citizenship. Micro-politics is distinguished from such large scale interventions as elections and revolutions that aim at state power. It may lack long term organization and is often focused on a single issue and sometimes a single location. Nevertheless, the effects of micro-politics are not trivial. Democratic interventions are translated into new regulations, new designs, even in some cases the abandonment of technologies. They give rise to new technical codes both for particular types of artifacts and for whole technological domains. This is a special and irreplaceable form of activism in a technological society. It limits the autonomy of experts and forces them to redesign the worlds they create to represent a wider range of interests.

I want to conclude now by talking about the wider significance of these considerations on technical citizenship. One of the great questions of our time concerns how far the technological system can evolve toward a more democratic configuration as its bias is challenged from below. The cases I have described are moderately encouraging. They have in common the effectiveness of user agency in the dynamic situation of the introduction or development of new and complex systems.

It is worth asking why there is a need for technological citizenship at this moment in history. It was apparently unnecessary in earlier times. What has changed? To answer this question we must go back into the history of industrial societies such as

ours. These societies were created by capitalism. In the early stages, capitalists were restrained minimally by society. Within the factory the owner was fairly free to act as he wished. This is less true today, but capitalist enterprise still retains a large measure of independence of other social institutions.

The capitalist's extraordinary freedom defines a new type of ownership, quite different from most earlier notions of property. For example, the owners of large estates in premodern times were expected to fulfil religious, political and charitable obligations to their tenants. But the capitalist version of ownership imposes only narrow responsibilities. The owner is granted the right of legitimate indifference to his workers and to the community in which his factory is located. This is what I call "operational autonomy," the owner's right to make decisions without consulting any overriding normative considerations or constituencies. Note that operational autonomy does not require private ownership. The same type of control may be exercised in a state owned or non-profit institution freed from traditional constraints and obligations.

The structure of top-down control that evolved under capitalism has become the imperative requirement of modern organization. The forms of sociability that impose this pattern emerged with capitalist manufacturing which shattered the traditional structures and ethos of artisanal production. It continued with the bureaucratization of the state apparatus in both capitalist and communist countries. It has shaped the culture of the technical disciplines which serve the enterprise and the bureaucracy, and the technical codes in every field reflect these origins.

Operational autonomy dictates the style of technological design characteristic of industrialism. The goal is to inscribe top down control in the machines and especially to perpetuate control over future technological choices. Such strategies prove "efficient" under the conditions that prevail in the capitalist enterprise, closing the circle and giving the illusion of neutral technical rationality. For example, where profit is the measure of success, technologies such as the assembly line easily prove their worth. But were the success of a worker-owned enterprise measured in terms that reflected workers' interests, the detrimental psycho-physical effects of assembly line work might be counted against it and another technology chosen. The formal rationality of the system is adapted to its social bias.

Our standard conception of politics today is inadequate because it does not recognize the political nature of such biases. Politics is about war and peace, laws and taxes, and is based on geographical representation. But today many of the most controversial issues that affect our lives involve technology. The affected "communities" often belong to technical networks that stretch across political jurisdictions. The concept of politics needs to be revised to take account of this new situation.

Political theory has not yet made this adjustment. It has no answers to questions about technical representation. More worrisome still is its inability to grasp the anti-democratic implications of certain technological designs. Philosophical speculation on the nature of totalitarianism often overlooks the role of new techniques of surveillance, information management and communication in making possible the one party police state so disastrously prevalent in the 20th century. Instead the blame is laid at the feet of Plato and Rousseau! And few political theorists worry about the single most undemocratic feature of modern democracies, namely the use of broadcasting to spread lies and propaganda in the interests of established elites and their policies. Is

the ambition of business to control the Internet an issue for democratic theory? It certainly should be although there is not much philosophical literature on this topic. Rather than speculating on the remote intellectual origins of our present problems, research should address the real situation and encourage a major reorientation of democratic theory.

Traditional politics concerns specific laws, but technology frames a whole way of life. Basic changes in a technology such as the industrial revolution or the Internet alter our civilization at its roots. We therefore need a new category of civilizational politics to talk about such changes.

Climate change and globalization today initiate a similarly vast civilizational change. The future of this revolution is ambiguous. We may either stick with the status quo under conditions of gradual decline or innovate a new industrial system. What seems clear is that the Western model of wealth cannot achieve for the entire planet what it has achieved for a small number of advanced countries. In poor countries the imposition of the Western system intensifies climate change and class divisions while enriching a small minority. The problem is the culturally and technologically embedded notion of wealth we are exporting along with our technologies.

In China for example a policy aimed at promoting prosperity as we understand it in the West created the largest market for automobiles in the world while abolishing guaranteed medical care for a billion people. Policies like this are sure to be experienced as intolerable and oppressive by their victims and in fact China is responding to unrest in rural areas by attempting to widen access to care again. But it is doing so without reducing reliance on polluting and inefficient automobiles. Are there enough riches in China to accomplish this double program? We will soon find out.

In the meantime Western style technology spreads around the globe raising many out of poverty but also bringing in its wake increasing criminality, political violence, and even civil war rather than the happy results predicted by theorists of modernization in an earlier period. A superficial critique would say that this is because the income gap is more visible. But this ignores the effects of pollution and the destruction of traditional ways of life that go along with Western style modernization.

There is no easy answer to the questions raised by these pessimistic observations. Two answers are so implausible they can be dismissed without further ado. On the one hand, there are those inspired by radical environmentalism who argue that the only solution is economic regression to a more technically primitive society. But the overwhelming political pressure throughout the earth is in exactly the opposite direction. On the other hand, there are those inspired by an ever more overweening technocratic ideology who promise a technical fix to the problem of climate change through geo-engineering. The absurdity of experimentation on a planetary scale is all too obvious in the light of such recent technological disasters as the failure of the Fukushima nuclear plants.

The only way out appears to be a transformation in the goals pursued with future industrial means we can create on the basis of existing technology. But a conception of wealth cannot be imposed. It must result from the evolution of desire and taste of a whole people. A new system based on a different conception of wealth that is less destructive of the environment and more easily shared can only emerge from citizen participation in determining the direction of progress.

There is no way of manipulating an entire people into changing its desires, but technical arrangements have an influence. In high density urban areas with good public transportation, city dwellers are often uninterested in owning an automobile. They realize that they can save money and avoid unwanted problems and responsibilities by taking the bus or subway. Obviously, no such realization is likely to awaken the dwellers of suburbs in low density urban areas to the virtues of public transportation. Desire is to some degree, if not determined, at least influenced by the structure of the everyday environment and this in turn depends on technology. As costs and environmental problems increase it is possible that technical citizens will pressure the industrial dinosaurs that govern these matters today into adapting to a new situation.

We must hope that such democratic initiatives preserve the essential achievements of modernity such as freedom of thought and speech, freedom of movement, education, and access to the necessities of life. But making these goods universally available in an era of environmental crisis requires a new form of technologically advanced society. The essential goods must be separated from their current technological bearers and delivered in other ways compatible with the environment and with the huge populations that demand admittance to modernity. Only technical citizens can achieve this by identifying new directions of progress. Whether they will do so is very much in question. I cannot therefore conclude on an optimistic note. All theory can hope to do today is to identify open possibilities, not confidently predict the future.