Sociotechnical Code-making in the United States:

The Political Content of Successful Technology Policy

STEVEN A. MOORE[1], BARBARA B. WILSON[1]

[1]The University of Texas, Austin, USA

ABSTRACT: Architects, engineers, law-makers and the general public tend to think that technological codes, ordinances, and laws are matters of regulating conditions related only to health, safety and energy efficiency in the built environment. These are, after all, the commonly-stated goals of sustainable development. In this paper we demonstrate that such technological codes have not only environmental consequences, but significant social ones that are generally ignored or suppressed in the code-making process developed in the United States. All codes are, we argue, not purely technical, but sociotechnical.

We make this claim based on the evidence produced in two empirical case studies: on the national scale, the Americans with Disabilities Act; and on the regional or neighbourhood scale, S.M.A.R.T. Housing in Austin, Texas. Using qualitative research methods derived from Science and Technology Studies (STS) we have found a consistent pattern in which social groups that are influential in the code-making process interpret conditions through similar "frames of interpretation." Whether code-makers recognize it or not, they influence the production of artefacts and spaces so as to benefit the interests of particular social groups.

Our historical analysis documents that code-making in the United States is a unique political process--unlike that of almost any other country. This recognition requires that we consider the degree to which our findings are generalizable. We conclude by arguing that the making of any technological code, in any culture, is also the making of social policy. If that finding holds up to scrutiny it suggests that the political content of sustainable technology development must be considered in the design and assessment process if sustainable technologies are to be successful.
Keywords: policy, politics, social equity, sustainability, technology

INTRODUCTION

This brief paper summarizes the findings of a five-year study of technological regulation, or code-making, in the United States related to sustainable development. [1] In what follows we first present a general argument for the existence of what we call eco-socio-technological codes; Second, we review an empirical method for the study of code-making that demonstrates how the "technological frames" of "relevant social groups" influences code-making; Third, we make the method concrete by reviewing a single case; And fourth, we discuss the problem of generalizing from case study analysis.

ECOSOCIOTECHNICAL CODE-MAKING

The making of codes to limit greenhouse gas (ghg) emissions can be understood as one example of ecological code-making that is catalysed by the recognition that some technological practices have negative ecological consequences. Phrased a bit differently, we can describe this practice as the making of eco-technological codes—codes designed to alter existing technological practices so as to better manage elements of the ecological system of which we are a part.

We naturally assume that such codes are founded on "good science." By this term we mean use of objective, or scientific measures to understand dynamic processes and subsequently manage them to improve system "efficiency." Advocates of "ecological modernization"[2] argue that it is only the inefficiency of existing technological processes that generates negative ecological consequences by generating waste in the form of pollution.[3] In other words, if we were 100% efficient, they argue, we would have no ecological problem. There are, however, two problems with this line of reasoning that are generally ignored by scientists and regulators: The first is that the concept of "efficiency" has no inherent philosophical "ground." The second problem is that the interpretive "framing" of the concept of efficiency by different social groups--scientists, regulators, architects, engineers and citizens--may be very different and thus lead to confused and unsuccessful regulation. We will consider these two problems in turn.

Engineers generally mean by "efficiency" that designers should minimize the input into a system and simultaneously maximize its output. The problem with this simple equation is, however, that it fails to ask, "output toward what end?" Philosophers can imagine situations in which efficiency may not be a desirable attribute—an efficient disease or an efficient murderer, for example. In return, engineers might answer our rhetorical question by stating, “output toward ecological sustainability, of course.” There are however, confounding social variables within any system produced, not in the laboratory, but in the real world, that render this seemingly correct answer to be problematic. The example of sizing a simple beam can serve to make the point clear.

In sizing a concrete beam in a building the designer first calculates the live load (people and equipment for a particular kind of dynamic activity), then the dead load (the structure itself), combines them, and then multiplies the sum by 2.0 before translating the calculated total load into the most efficient dimensions of concrete and reinforcing steel required to support the total load. But, why multiply the anticipated loads by a factor of 2.0? This is a typical multiplier used as a “factor of safety” that is required by governments or insuring institutions to guarantee the health, safety and welfare of citizens in the face of uncertainty. For example, was the reinforcing steel tied correctly? Was the “design-mix” correctly combined? Was the form-work left in place the required length of time? Etc. The degree of uncertainty is determined by asking ethical rather than technological questions. Regulators necessarily ask, what is the worth of a human life? How much uncertainty should citizens be willing to accept when entering a building? The point here is that, in practice, the actual size of the beam is determined as much by difficult-to-quantify ethical concerns as it is by the easier-to-quantify physical ones. The “ends” of efficient calculation are, then, not only ecological and technical, they are also always social in character. This is the case whether calculating the size of a beam or the strength of an airplane wing. We propose, then, that scholars and practitioners should refer to code-making related to sustainability as an eco-socio-technical activity. Our observation is that, whether we intend it or not, all technological codes have social inputs and outputs as well as environmental ones. This line of reasoning leads us to hold that all technological codes are both an index of changing social values (how much risk is acceptable to particular social groups) and a method to enforce those values (what is the penalty for non-compliance). Like the protests by German citizens after the Fukijama nuclear incident in Japan, they are not purely technical.

The second problem posed above is that even when we attempt to include the social dimension of uncertainty in our code-making activities, different “relevant social groups” are likely to interpret, or “frame” uncertainty from their own perspective.[4] The two key terms introduced here require definition. By “relevant social group” we refer to those who “influence the creation, the demand for, the production, the diffusion, the acceptance, or the opposition to new technologies.”[5] Such groups are not made up only of scientists in their laboratories, but include corporate CEOs, marketing directors, manufacturers, unions, NGOs, and consumers, just to name a few.

And by “framing” uncertain conditions, we mean that every-day activities are interpreted, not through a universal human frame of interpretation which exists in everyone's head (orthodox science), but that activities are experienced and cognitively organized inside of a primary frame or "schematta of interpretation" in which one lives and inhabits with a particular social group—middle-class North American high school teachers; Bavarian athletes; or Brazilian Engineers. "A primary framework is one that is seen as rendering what would otherwise be a meaningless aspect of the scene into something that is meaningful."[6] Our frames, then, not only help us to make sense of "what is going on," but also to "guide our doings," our actions and involvement within the frame. Frames are used by social groups to judge the activities of individuals according to certain norms or "'standards', to social appraisal of actions." But primary frames are not singular. Goffman holds that social groups have a "cosmology" or "framework of frameworks" that we should understand as a cultural "belief system" in which experience is perceived and ordered.[7]

In the field of Science and Technology Studies, or STS, scholars have adopted the concept of “frame analysis” first developed by Goffman and others in the 1970s. Bijker and his colleagues have applied this analytic tool to our understanding of technological change. By developing empirical methods for understanding how relevant social groups frame a particular technology, we might better understand how technologies serve the sometimes competing interests of various groups. For the purposes of this paper, one group is particularly important—those with a “high inclusion rate.” In Bijker’s analysis, a person who has a high inclusion rate in one of the competing frames of interpretation—a famous scientist or architect, for example—is unlikely to interpret conditions in a manner inconsistent with the social group that supports her social status as an expert. She becomes “trapped” within a single frame and becomes incapable of imagining truly radical change that might also change her status within the group. By insisting on a single interpretation of reality (as in orthodox science), opportunities for collaborative action may be lost.[8] And without collaborative action, success cannot be achieved.

Our point is not to argue that the orthodox “frames” of interpreting reality held by scientists and engineers are incorrect. We generally accept and employ the descriptions of reality put forth by “good science.”

However, those partial truths that describe atoms and natural processes do not inhibit other social groups from constructing other partial truths about the artefacts and risks in question—how it effects their interests, how it fits within their history and ethical traditions. If our goal is to catalyse "successful" action—meaning action that actually reduces climate change and mitigates its consequences—then we should be concerned, not only with determining the "right" or scientifically correct frame through which to interpret conditions, but how to integrate, transform, or align competing frames and partial truths through collective action. Our finding is that in the highly social and political process of aligning frames, new kinds of useful knowledge are produced. This claim is supported by our case studies.

METHODS OF EMPIRICAL ANALYSIS

In reconstructing the making of ecosociotechnical codes intended to catalyse sustainable development, we used a comparative mixed-method case study approach with some variation between the two cases as conditions required. We selected two cases: one at the national scale—The Americans with Disabilities Act, or ADA-- and one at the regional scale—the case of S.M.A.R.T. Housing in Austin, TX. Both cases have come to be understood as contributing to the aspirations of sustainable development, even if they were not initially intended as such by progenitors.

Overall we used eight methods of gathering and interpreting data. First, because much of the critical work of the disability rights movement is well catalogued in oral histories and archival documents at the University of California at Berkeley's Bancroft Library, archival research served as the main source for primary data for this movement. Second, we conducted semi-structured interviews— two related to disability rights and twenty-nine related to affordable housing in Austin. These interviews were subsequently transcribed and dissected into thematic categories of text through digital means that helped us interpret how our respondents framed and/or participated in code-making. Third, in the Austin case we installed a heuristic exhibition about "alley flats" at City Hall and used that event as an opportunity to hold a public opening and two focus groups with a broad spectrum of community stakeholders. Next, we were "participant observers" at meetings related to both cases. We have also been active through the Austin Community Design and Development Center (ACDDC) in developing housing that is both affordable and accessible. Fifth, we facilitated a discussion between the Real Estate Council of Austin (RECA) and the Austin Community Housing Development Organization (CHDO) Roundtable about building code-oriented impediments to affordability and accessibility in Austin. Sixth, as University of Texas faculty members we also engaged students in the design and building of alley flats—small affordable, sustainable, and accessible infill housing units. And lastly, we conducted archival research and a lengthy secondary literature search related to affordability, sustainability, and accessibility. Each of these methods contributed to our understanding of how relevant social groups framed code-making nationally and in Austin.

In our empirical case studies we have found a consistent and predictable relationship between three primary variables found in the search for sustainable development: First are the "relevant social groups" as defined above. This term derives generally from social identity theory and attempts to explain how individuals perceive their membership in various social groups that may be political, professional, recreational, or social in orientation. Second are the "technological frames," also defined above, through which these social groups interpret the world. And third are the "focal issues" that drive policy-making. Focal issues are defined here as public conflicts that tend to dominate public consciousness and mask other issues that compete for attention because they touch core tensions or identities in the community. In Austin, for example, water quality has dominated public talk for at least four decades. In post- 9/11 New York City, public security has become a focal issue. Although these three variables are certainly influenced by the forces of global economics, we find the relationship between the variables remains pretty much the same from place to place.

In sum, our hypothesis can be stated as four linked and sequential sub-hypotheses:

1) Relevant social groups interpret focal issues from within shared technological frames.
2) Technological frames are said to be generative if they catalyse action intended to improve conditions for a particular social group.
3) Generative frames are said to be re-generative if they transform, realign, and/or expand relevant social groups through action, and
4) Regenerative technological frames are said to be successful if they simultaneously produce codes that materialize built environments that, in turn, enhance the resiliency of the ecosystem and the agency of relevant groups.

These are highly abstract propositions, but ones that we think will be useful to decision-makers elsewhere seeking to develop cities sustainably. To make them more concrete it will be helpful to put them in the context of one of our case studies: S.M.A.R.T Housing in Austin, Texas.

THE CASE OF "S.M.A.R.T. HOUSING

S.M.A.R.T. is the acronym for housing that is Safe, Mixed-income, Accessible, Reasonably-priced, and Transit-oriented. That combination of descriptors derives from public talk in the city of Austin over nearly a century. Our historical and ethnographic analysis of that time-period, these descriptors, and the highly social process of constructing them, adds up to how locals tend to define the concept of sustainable development. To be clear, it is a definition of sustainability that is context-dependent rather than universal, or context-independent.

In our field work we found five social groups who dominated the public talk related to the coding of sustainable/affordable housing: (1) neighbourhood organizations, (2) the environmental community, (3) the development community, (4) the knowledge community, and (5) the professional community. In this short paper we will not attempt to characterize these self-described groups other than to give them names.

We also found three broad technological frames inhabited by these actors: (1) supply-side, (2) demand-side, and (3) affect-side. Advocates of what is routinely referred to as supply-side economics argue that economic growth and technological innovation can best be created by reducing obstacles, in the form of taxes or regulation, to producers. As a result producers will, supply-siders argue, be able to provide consumers with lower cost goods and services. A supply-side technological frame embraces this economic view, which depends, in turn, on defining the system in a simplistic linear and narrow fashion.

In contrast to supply-siders, advocates of demand-side economics argue that the unwanted external costs of production, such as degraded air quality or childhood asthma, can only be avoided by reducing system-wide demand by all consumers. According to one respondent, changing what is going on in Austin through the demand-side frame requires that "you reduce the demand, not just supply electricity [to meet] the demand, but you attack the problem by reducing the demand." But she also recognizes that "the demand-side is viewed by advocates of the supply-side as the one that doesn't generate money." For a business, even a publicly owned one like Austin Energy, the problem of reducing demand while maintaining revenue levels is a paradox, at least to supply-siders.

For those who inhabit the third frame, affect-side reasoning, technologies are neither good nor bad in essence. Rather their value depends on who is affected by change, how they are affected, and when. In our field work, we found that those who inhabited this affect-side frame tended to share two characteristics: First, they tended to be the most vulnerable to change of any kind in the present because they were often poor. And second, they were not particularly invested in either the supply- or demand-side frame of interpretation. They were, although no individual used the term, practitioners of the Precautionary Principle. This is to say that affect-siders recognized the risks inherent in either allowing conditions to remain as they are or embracing new and, to them, untested technologies. In short, unlike those with a high-inclusion rate in any given frame, affect-siders in our cases were code-switchers—they had the ability to see how the storylines constructed by the advocates of the other two competing frames could be alternately helpful or harmful—the level of risk varies. More important, however, is that affect-siders could see that the storylines constructed by supply- or demand-siders historically failed to include their interests, either in the short- or long-run. Another way to say this is that both supply- and demand-siders tended to interpret technological events ideologically from and overly negative or overly positive perspective. Affect-siders, however, tended to be more prudent and wait for evidence to inform their interpretation of the risk embodied in any particular change.

A very significant finding in our fieldwork is that members of these self-described social groups did not always inhabit a single technological frame of interpretation. Even more surprising was that individuals might employ different interpretive frames at different times of the day depending on the social context—whether they are at work in the morning or at a social event in the evening. And, as conditions evolved, as individuals participated in action related to sustainable /affordable housing, their technological frame was changed. Snow et al. have described this phenomenon as the "transformation, realignment, and/or expansion" of relevant social groups *through action*.[9] In an urban context that is always dynamic, leaders who are skilled at reading the political landscape, and who listen to their constituencies, can attract new constituents by aligning their message with that of related groups, expand their message to include the related concerns of another group, or transform a social movement entirely with a new message.

A second significant finding, suggested above, is that the technological frames of social groups become aligned, not by compromise or competing actors sitting down to define their goals through the skilful parsing of language, but through action toward a common goal, even when that goal is ill-defined. Another way to say this is that common language in the city is produced through action, not through scientific discourse that appears to be disinterested. Once again, our point in making this claim is not to dismiss scientific discourse as unnecessary or irrelevant to public process, but to argue that in itself, science does not change action. If experts are interested in getting things done, in making our cities more sustainable through successful action, then they should be willing to hear the sometimes conflicting knowledge(s) embodied in the technological frames inhabited by other relevant social groups. In concrete terms, we are asking experts in all fields to become "public intellectuals"—expert citizens who inform debate at school meetings, zoning board disputes, and public policy debates of all kinds.[10]

This reasoning is supported by Wittgenstein's critique of "language games" which he describes as the propensity of scientists and philosophers to debate the significance or "essence" of words outside of their immediate social context.[11] In contrast, our finding is that action toward a shared goal not only catalyses the new language required by actors to define it, but that meaning, technologies and social relationships coevolve with the goal. There are numerous case studies by other STS practitioners that make related arguments.[12]

Figures 1 and 2 demonstrate how the technological frames of the five relevant social groups in Austin shifted, or aligned over a period of approximately five years. It was this coevolution that enabled S.M.A.R.T. Housing to be moderately successful. The principal actors in this case became very self-conscious and strategic in their efforts to enlist potential allies and opponents in defining both the goals of the program and specific action to achieve it.

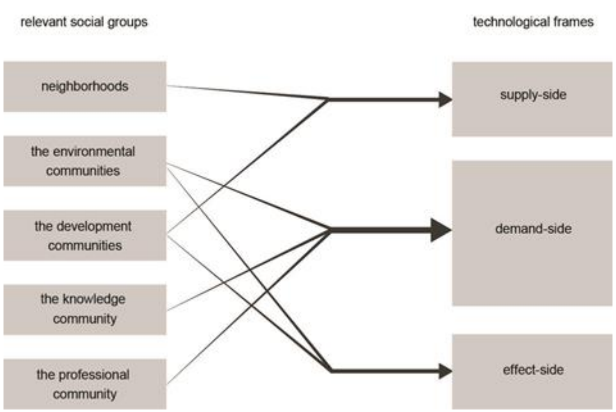

Figure 1: The Initial Frame Structure of Case #2

The direction and weight of the arrows in these two figures approximate the percentage of individuals within the five relevant social groups in Austin who interpreted conditions related to affordable/sustainable housing from within the three technological frames. Although some changes over time were subtle, the shift toward effect-side interpretation was the most significant. We found a very similar shift, or realignment, in the second case, the Americans with Disabilities Act. This similarity begs the question of generalizability.

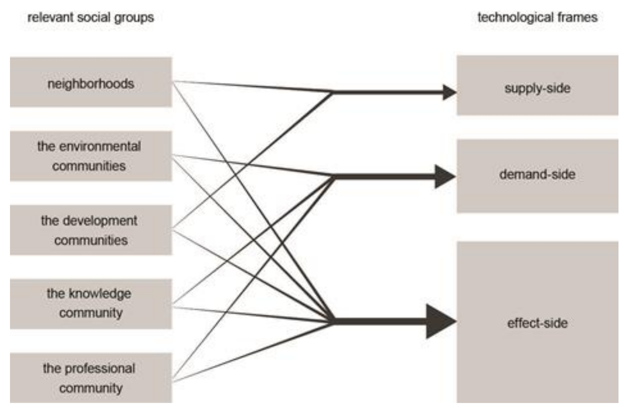

Figure 2: The Altered Frame Structure of Case #2

THE PROBLEM OF GENERALIZATION

A core finding of this investigation has been that the development of successful ecosocialtechnological codes is context-dependent—that local conditions intervene to guide the coevolution of technologies, societies, and ecologies. If that claim stands, is it reasonable to also claim that our hypotheses might be usefully applied elsewhere?

We will argue in favour of a limited yes vote in answer to this rhetorical question—which is to hold that that external validity can be achieved, if, interdisciplinary activists learn how to distinguish the relevant social groups in action, the technological frames that guide their choices, and the focal practices that galvanize action. This claim requires some additional backing.

Another significant finding of our study—one that is potentially confounding--is that technological codes in the United States are produced in a manner that is virtually unique.[13] Although federal legislation (what we call Government, or first-party interests) have influenced some codes, historically the majority have been developed by private, industry-based associations (what we call second-party interests). Second-party interests—in practical terms this means corporate managers and shareholders--have, then, exerted a disproportionate influence on codes, not only in the United States, but wherever US corporations operate globally. This is not a condition that will, we think, lead to sustainable development.

We have, however, also found that it is non-governmental organizations, or NGOs, that are increasingly exerting influence at the global, national, and local levels (we call these third-party interests). Third-party activist groups such as the World Green Building Council,[14] Green Globes,[15] or TUV Reinland[16] have organized local, national, and international groups which have become highly relevant in the making of ecosociotechnological change at a variety of scales. Our second case study, the Americans with Disabilities Act is an example where context-dependent local action expanded over time to become a highly inclusive national movement. The environmental movement might, then, learn from that success.

In this brief paper we cannot articulate a global strategy through which third-party interests like the ADA can come to realign or transform the frames of ecological and social interpretation held by dominant neo-Liberal economic interests. Scholars do, however, recognize, in the structure of corporate branding strategies, vulnerability in the market to consumer demands for more environmentally healthy and socially just consumption practices.[17] In their view "consumers" can be successful in moving toward sustainable development by making demands simultaneously at the local level (to store managers who manage and order consumption) and at the global level (to corporations and governments who manage and order production).[18] To this literature we add our ecosociotechnological hypothesis as a tool for context-dependent action. We recommend, however, that use of this tool at any scale will require expert architects, natural scientists, social scientists and trained activists to engage directly in action, rather than rely only on disengaged analysis. It is only through action, informed by good science, that transformative change happens.[19] For example, what collective action might PLEA take as a consequence of this symposium?

CONCLUSION

This paper has argued, based on historical and empirical evidence derived from a five-year study, that whether experts know it or not, the making of technological codes in the name of efficiency also has, not only environmental consequences, but social ones too. Bringing the ecological and social consequences of technological choices to public awareness requires that code-makers make their ecological and social intentions clear at the onset, rather than present choices as only technological. Without statements of ecological and social intention, how might the efficacy of regulation be judged over time? We propose, then, that technological change and code-making be politicized. It will not be, however, only engineers and politicians who must be engaged in the public talk about how we want to live. Rather, it will require that scientists, engineers, architects, and citizens also be held accountable for coding alternative futures.

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