1. The Symmetry of Historical Fatality

It is one of the great ironies of our day that just as economists, politicians, and business persons celebrate the ineluctable progress of efficiency in the rise of the free market amidst the ruins of the plan economies (Blanchard and others 1990; Lipton 1990), equally thoughtful colleagues, looking to home, are discovering that core institutions of the economy such as the firm or financial system have been shaped as much by historical contingency as by the guidance of market competition. Indeed, the more they look the stronger grows the paradoxical conviction that historical accidents, whatever their precise form, are a pervasive and indeed inevitable result of the rationally self-regarding activity that defines economic life (David 1992). History gains, perhaps, in
symmetry what it loses in cunning: On the one side of the tumbled wall those impressed into the service of universal efficiency as revealed to reason; on the other, those doomed to serve the caprices of contingency for reasons no less universal.

As progress is already overtaking its apostles in the East, and they too are coming to see that the ruins of a past that could not withstand the present nonetheless may shape the future (Dittus and Prowse 1994), my concern will be with the awareness at home of historical contingency as an influence, perhaps even a decisive one, on economic development. This awareness fuses two beliefs. The first is that there is no invisible hand joining the cumulative, long-run effects of the maximizing behavior of individuals to guide economic activity up a single ladder of more and more efficient forms of organization. Doing the best we can, we might be overlooking a way of doing better, and never have sufficiently comprehensive information of our potential to know it. Nothing said here is in denigration of this view, although I will neither develop nor explore its implications directly.

The second belief is that the same mechanisms that disable the invisible hand turn economic choice into a nightmare of unintended consequences, at best unforeseeable, and at worst incorrigible. In this nightmare economic actors periodically trap themselves by modest and apparently innocuous response to local circumstance in vast structures from which they can scarcely escape, not least because building the structure they have chanced to build blinds them to the very possibility of constructing anything else. Both beliefs combine in the familiar idea of path dependency; but it is the predominance of the second which makes of that notion at once a shorthand expression for certain methodological convictions and the expression of a deep pessimism about the possibility of effective, deliberate action in the world.

But so understood path dependence flies in the face of the historical record, by which I intend not only the broad experience of industrialization but also, and particularly, the facts of the very cases usually introduced as evidence of the grip of historical fatality. In the large and the small that record reveals the actors as making strategic choices in awareness of alternatives, and more fundamentally, aware that alternatives, far from being mutually unintelligible wholes, can often be decomposed into mutually complimentary parts. The view flies as well in the face of the most competitive current economic practice: The core innovation of what are loosely called "Japanese" production methods consists precisely in the discovery of institutions of collaborative deliberation that allow actors constantly to compare their current and prospective choices to
other possibilities so as to lessen the dangers of self-entrapment through path dependency. Thus, perhaps, the greatest of the current historical ironies of economic experience is this: Just as the theorists have convinced themselves that agents, responding unreflectively to environmental information as they have conventionally been supposed to do, will ensnare themselves in accidental choices, the agents are finding ways of formally institutionalizing and so extending the effective reach of forms of self-reflective comparison of alternatives that have always, if imperceptibly, guided their strategic choices. Or so, at least, I will argue in this essay.

To fix ideas I begin by briefly invoking the developments that have led to the currency of path dependency in economic discussion, and present a first accounting of the arguments contained in that discussion regarding the hold of history on economic decision making. The argument then turns the tables by showing that, on close reading, familiar examples of path dependency such as the persistence of the QWERTY keyboard and the late nineteenth-century battle of the systems between alternating and direct-current generation are counter-examples to the claims they allegedly support. On this reading "path-dependent" choices are less binding in their effects on investment decisions based simply on calculations of returns, and much less constrictive of cognitive development, than the lessons drawn from these canonical cases suggest. The next section introduces certain ideas from pragmatism to generalize the counter-reading into the counterclaim that strategic choice entails understanding of alternatives rather than obstructing it. Thus generalized, the argument is applied to a reinterpretation of work done earlier by myself and colleagues on one of the turning points of nineteenth-century economic history. Then the argument rejoins the present by indicating how actors organize collaboration so as to detect effective alternatives to current arrangements and to adopt them piecemeal as circumstances suggest. The conclusion contrasts the image of the actor as strategically self-reflective that emerges from these re-readings and interpretations with the image of the actor as calculating engine or creature of routine presented in neo-classical and path-dependent accounts of economic activity.

2. History Erupts

One of the deep connections between the natural and social sciences is that large new ideas in both result from a mysteriously coincidental joinder of theoretical innovations and shocks to experience. So it has been with the eruptive discovery of history as a shaping force in economic life; and I will therefore limit myself here to indicating the conspicuous and coincident
empirical and theoretical dislocations that played a role in changing the consensus and have a part in our later story, without pretending that the indications amount to an explanation of the new sense of contingency.

Of the empirical dislocations the most consequential was surely the surprising vulnerability of U.S. firms to new, highly flexible competitors in the form of German, Japanese, and Italian firms from the mid-1970s on, and then the discovery that these apparently superior forms of organization, different as they are amongst themselves, were all in turn vulnerable to the vicissitudes of highly volatile markets. It was a stylized fact of the 1960s and 1970s that the divisionalized, vertically integrated U.S. manufacturing firm represented an optimum compromise between centralization and decentralization in economic organization (Chandler 1977; Williamson 1985). It was a shock to discover that networks of small Italian artisan firms, diversified German corporations using craft skill and monitored by large banks, as well as Japanese *keiretsu* groupings, could all outperform these paladins of history (Piore and Sabel 1984; Porter 1990). It has been a double shock to see the *keiretsu* quickly squander their free cash flow on poor investments, the German banks despair of helping firms in their portfolio restructure in the face of Japanese and (renewed) U.S. competition (Edwards and Fischer 1991), and the halting response of the Italian artisans to the same threat. It is one thing to assume the existence of efficiency frontiers when the institutions embodying them are plain for all to see, quite something else when the frontier shifts before the signage marking its current location is posted.

Of the two relevant theoretical dislocations, the first concerns feedback mechanisms and the second the formation of expectations. Economics is famously a theory of self-equilibration through negative feedback mechanisms, of which diminishing marginal returns are a crucial instance. Decreasing marginal returns to successive increments of factors, of course, makes success self-limiting. Once firm expands to the point where marginal returns sink so low that they just cover costs, investment in that line of activity stops and the space is clear for other firms to grow to the same, efficient size, or new entrants to outperform incumbents if the efficient size should increase or decrease. Similarly, when rich countries or regions run down their stock of high-return investments, they should invest in areas with better opportunities, assuring that the poor benefit from the progress of the rich. But modeling innovations (prompted, of course, by discordant observations) made clear how, and with precisely what effect, returns could be increasing rather than decreasing. One mechanism is economies of scale, in which costs decrease with the volume of output; another is positive externalities or agglomeration effects, in which the
presence of firms of a certain type lowers the cost of business to firms, in complimentary activities, whose resettlement to the low-cost area further increases its attractiveness to the next cohort of migrants, and so on (Krugman 1990; Krugman 1991; Piore and Sabel 1984; Porter 1990). Yet a third is investment in non-rivalrous goods, such as blueprints for a chip factory, which can be reproduced costlessly and used simultaneously at different locations. Insofar as investments embody such informational goods, they, too, will exhibit increasing returns: The second chip plant produces the same output as the first but costs less to build because the costly original plan is available free (Romer 1986; Romer 1989). All these mechanisms produce winner-take-all outcomes in which the successful first mover, be it firm, region, or country, increases its advantage over latecomers by exploiting the increasing returns of, respectively, economies of scale, positive externalities, and investment in non-rivalrous, research intensive goods; and success is theoretically never so satiating as to drive the successful to partnership with the poor.

Innovations in the treatment of expectations have been equally unsettling. In standard theory, all actors are presumed to have the model for calculations and the same ability to calculate expectations about the world. If this is so, each will be able to deduce both the strategies of the others and an appropriate response to them from the common information; and if all act accordingly, their expectations will be validated. This is called a rational expectations equilibrium. Once the assumption is relaxed, and agents are presumed to have different models of forming expectations, the problem becomes complexly self-recursive: My expectations of your expectations depend on your expectations of my expectations of you, and vice versa. In some situations expectations formed this way can never be validated by events. In Arthur's Bar Problem, for example, a hundred people make independent decisions to go to a certain bar only if they expect few others to attend that night as well. Then the bar will always be crowded when the attendees expected it to be empty, and vice versa. Perhaps worse yet, there are decision algorithms that will give disproportionate weight to early as against cumulative experience: for instance, the Polya urn model in which the probability of adding a blue rather than a red ball to a vessel depends on the ratio of balls in the vessel, and hence crucially on their distribution during early draws, when each addition has a pronounced effect on the ratio (Arthur 1994). If follow-the-leader strategic choices then transit the leaders' accidentally formed expectations to the behavior of a whole group, the group is at the mercy of the accidental expectations.

A world in which there are no self-evidently workable models of efficiency to emulate, in which the strategic choices that are therefore necessary may well be
blind because based on accidentally formed expectations, and in which those choices are likely to be immensely consequential because winners can take all, is a terrifying place where reason is always at the mercy of invisible fists. It is, as you know, the world of path dependency; and the rapid diffusion of this set of ideas among economists in particular may be an indication that they have more in common with the moods of the average Joe than they themselves may suppose.

In any case, the theorists of path dependency, such as Paul Krugman, are openly alarmed by the practical implications of their theory. In a winner-take-all world, they know, everyone will desperately seek the information needed to win. Markets do not necessarily provide that information; still less do the only alternative to markets under consideration in public discussion: bureaucratic surveillance and guidance. Only political charlatans who can benefit personally from such false advertisements about the capacity of the state would say otherwise (Krugman 1994). The best theory can do, therefore, is tell us to buckle our seatbelts and hold on for the ride; and so the dismal science finds a new way to be dismal.

3. The Reasons History is Gripping

But theoretical ingenuity and resonance with the popular mood do not by themselves make the path-dependent view of blind choices and invisible fists a plausible stylization of economic history and current practice. We see the limitations of this characterization as soon as we reverse perspective and, examining the path-dependency argument from the vantage point of its conclusions rather than its origins, ask, How extensive is the grip of path dependence on economic life, and how, precisely, does it obtain its hold?

To begin with, these questions are so closely related as to be effectively one. If there were an independent standard of economic efficiency, we might calculate the difference between the actual performance of any economy and its potential according to the standard and attribute the divergence to path dependence. But by (path-dependency) hypothesis, there is no such universal standard. It is only in a path-independent or invisible-hand world that current activity or some extrapolation from it does correspond to a theoretical optimism. In depriving us of this referent, path dependency robs us of the means of assessing its own effects. So our evaluation of the extent or significance of path dependency depends solely on the possibility of arguments to the effect that efficiency considerations -- roughly, the willingness to adopt current, best-practice methods of production -- count for little and historically contingent but
entrenched choices count for much in shaping economic life. If the reasons for this view are scant, society may still indulge in "path dependent" choices in many ways: for example, in the national cuisine, or the shape of the cutlery, or in architectural styles, or even in a national language capable of expressing all thoughts of other natural languages, but in fashion especially dear to its native speakers. But in this case the advantages of historical continuity would come, as it were, cheap at the price, as they would have little consequence for the efficiency rating of the economy; and economists, with a sigh of relief, could return to their comfortable certitudes about the disciplinary force of competition. If, on the other hand, the reasons for a view of economic activity as historically determined and efficiency disregarding were many and powerful, at the limit so powerful that history counted for everything and efficiency for nothing, we have to accept the nightmarish life of path dependency[1]. Four such reasons are frequently invoked, although, as I will indicate, only the last seems to carry great weight.

The first concerns sunk costs in the narrow sense of physical capital dedicated to some -- large -- endeavor. Once a harbor is built, the argument goes, it stays a harbor, even if changes in shipping patterns or technology suggest another location, simply because the costs of rebuilding are prohibitive. This argument gets short shrift because it simply miscasts investment decisions. Such decisions look forward, to the rate of return on new resources dedicated to the project, not back to sunk costs[2]. If the rate of return on a new venture is high enough, investors should fund it (with borrowed money), no matter what the absolute costs. We will see an example of just such forward-regarding behavior in a moment; and, by the way, if you do live near a traditional harbor, at least in the U.S., you will likely discover that the cargo port with which it was associated has indeed moved in recent years.

The second argument concerns the winner-take-all character of current competition. Notice the knife-edge, miss-is-as-good-as-a-mile feature of this claim. Even if all competitors know (almost) exactly what is necessary to succeed in a particular market, there is, because of increasing returns, place for only one. That place will go to the firm that is, accidentally, doing the best on the day that the industry as a whole begins to experience returns. Seen this way, the claim is less an argument about fateful choices than about the extraordinary importance of sheer good luck. But this distinction aside, the argument misleadingly confuses a theoretical possibility as revealed by (ingenious) models with an empirical generalization. Recall that the first of the dislocations I mentioned as prompting the articulation and acceptance of path dependency was the unpredictable but frequent emergence of superior competitive forms
and their displacement by new ones. A world in which one winner appears to take all, then another one and another one after that apparently do the same, is not a winner-take-all world. More precisely, the positive returns argument by assumption blends out the possibility, demonstrated by much recent experience and alluded to in the cognitive considerations at which we will arrive in a moment, that winners can be so blinded by success that they overlook developmental possibilities uncovered by their winning ways, thus opening the way for this round's losers to catch up.

The third argument for the pervasiveness of efficiency disregarding or overriding features of decision making is political. Current arrangements will often have the support of current beneficiaries; and current beneficiaries may see change as a threat to their benefits and therefore oppose it. There is evidently great force in this argument, as demonstrated most sharply, perhaps, in the repeated conflicts between traditionalists and modernizations in developing countries over the modernization. The traditionalists' view is that the modernists are right in advertising the possibility of efficiency increases, but that the price of realizing them is the destruction of all forms of life that they, the traditionalists, think worth living. The conflict can result in victory of the one side or the other, stalemate, or a complex compromise that redefines for that people, and perhaps for all of us, the very notion of modernity. Analogous conflicts with an analogous range of outcomes are surely detectable with the advanced societies. All this cautions against neglecting politics or taking a superficial modernity; but it says nothing one way or the other about the relative weight of efficiency-regarding as against efficiency-disregarding motives. In particular it seems an implausibly long stretch from the idea that politics matters to the idea that path dependency matters because politics always entrenches current arrangements. Adam Smith's wonderful arguments about the fall of feudalism showed how the self-interested pursuit of efficiency by merchants, artisans and small holders could find and exploit to its advantage divisions in the alliance between nobility and crown against it; and whatever the defects of universal claims drawn from such arguments they are no more defective than universal claims about the impossibility of efficiency-improving alliances (Smith [1776] 1976).

This brings us to the fourth and most consequential argument, regarding cognition. This claim runs together many themes reflecting diverse current understandings of the cognitive models upon which agents rely in formulating economic action. At one extreme of the spectrum of epistemological complexity these themes assert only that habits are hard to break, but that busy people must rely on them to get through the day; and from this it follows that
decisions, once taken, will root as habits, and be accordingly difficult to extirpate. At the opposite extreme would be the claim that technological paradigms are like scientific paradigms as depicted by Kuhn: incommensurate in that the terms of one theory or set of engineering practices cannot be rendered intelligible in terms of the others' categories, and therefore the choice of a (technological) paradigm is fateful in that, once chosen, it renders incomprehensible the rejected alternatives. A third, intermediate position is that much practical knowledge is tacit in the sense of being so dependent on application in particular circumstances by particular people that it cannot be captured by general theoretical propositions. Rather it is, at most, ordered and orchestrated in the routines and operating procedures of firms and other economic institutions. Competitive markets select among routines, but only crudely, because there are many ways of doing approximately the same thing, many different things worth doing, and constant changes in the set of worthy things (Dosi 1988; Hodgson 1993; Hodgson 1994; Nelson 1982; Nelson 1994). Economic life is not, therefore, about strategic foresight by fully informed and adaptive agents, but rather about good or bad historical luck in stumbling onto the right routines: path dependency as the aggregate result of progress through application of tacit knowledge. Given the limitations in the first three claims, this is the one upon which, in some form or another, general claims of the importance of path dependency have to rest if they are to carry substantial weight at all.

In fact, and understandably enough, claims about the historical significance of path dependence combine elements of all four arguments: The only way to show that path dependency is better at accounting for historical developments than other types of theory is to give an account of some episode in which path dependency does better at explaining than the others. But since any historical episode is complex in the sense of entwining political considerations, judgments about the costs and benefits of change, brute luck in the competitive race, and subtle matters of cognition in a way that makes it difficult to distinguish the independent contribution of each form of hysteresis to the global result of path dependency. There is thus nothing surprising in the use of historical re-descriptions to illustrate and explain the argument, nor is it surprising that two particularly detailed and well-crafted descriptions -- one of the persistence of a certain arrangement of letters on the typewriter keyboard, the other of the battle between ac and dc in the US -- should come to stand for the rest. The surprise, to which we turn next, is that neither story supports the view of path dependency associate with it, and that the second, in particular, opens the way to a direct challenge to the fourth and apparently weightiest item on the list of possible causes of path dependence: cognitive self entrapment.
4. Examples as Counter-Examples: Re-Reading the Stories of Path Dependency

The stories are quickly told. The keyboard defined by the QWERTY sequence of letters on the second-top-row was designed in the late nineteenth century to be awkward enough to slow down fast typists, who could otherwise jam the sluggish mechanism by typing faster than it could respond. Once fixed in physical capital, the habits of those who designed it, and above all, the habits of generations of typing teachers and typists, the arrangement became impervious to change. In the story, the prototype of a superior keyboard, one that does allow fast typists to make full use of their powers, was designed by a certain Dworak; but the innovation could not surmount the barrier of habit; and that is why we still use the QWERTY keyboard when word processing with computers today (David 1985).

The story about the battle of the electric-power generating systems in the U.S. is about the significance of individuals in great technological decisions, and hence about how easily that latter can become the playthings of history. In the late nineteenth century, the story goes, the respective advantages and disadvantages of ac and dc generation were so complexly distributed that it was impossible to decide which was on balance the better: dc was costly to transmit long distances, but well-suited to driving electric motors in elevators, industrial equipment, and trams, whereas ac could be moved long distance but was harder to apply at the destination. Edison bet on dc. But as various devices were introduced for converting ac to dc at the destination, he began to fear for his investment, and being by nature a system builder, once he saw that the power grid was unlikely to look like the system he had envisaged, he sold his interests to a consortium that backed the solution to the hilt. And that is how the U.S. came to have an ac-dominated grid whereas Great Britain persevered with a hybrid, but largely dc system of the sort Edison might eventually have built. The useful point of both stories, of course, is to make us wonder just how often we confuse accident, even deliberate inefficiency, for the workings of an invisible but efficient hand (David 1992).

On inspection, and assuming the facts of the matter to be as the stories present them, the tales are not telling in this way at all. Let us therefore ignore the controversy about whether the Dworak keyboard is truly more efficient than the QWERTY arrangement; simply suppose that it is, and ask, skeptically, whether the QWERTY story makes the point about the pervasive long-term effects of sunk costs broadly understood.
Normally, of course, it is extremely difficult to answer such questions because there is no way of calibrating the extent of efficiency losses: Recall the earlier remark about the absence of an absolute measuring rod in a world where economic activity is viewed as the experimental exploration of possible arrangements, not progress up a ladder of efficient solutions. Indeed, this general problem casts its shadow on the QWERTY case too; insofar as the efficiency gains of the Dworak keyboard cannot be measured: Owing to the very path dependency whose effects we want to assess, that solution was never widely tried.

Exceptionally, however, and happily for our purposes, the QWERTY story is part of a larger one whose features allow us to put a -- low -- upper bound on the significance of path dependency in this case. The larger story, hinted at a moment ago, is the replacement of the typewriter by the word processor and computers in general. Any way you slice it, this change required larger write-offs of physical and human capital than would have been necessary to shift from QWERTY to Dworak. Yet the sunk costs were written off in the one instance and not the other. The most straightforward explanation of the difference is simply that the returns to the big change were substantially higher than returns to the smaller one. There could still be all sorts of path-dependent reasons for the survival of QWERTY; but for the vast changes amidst which this continuity was set, the reasons appear to be at the efficiency-respecting, cheap-at-the-price end of the spectrum sketched earlier. Whatever else it may be, the QWERTY story is not a metaphor for the idea that efficiency-seeking behavior goes on within a frame shaped importantly by historical contingency. The only way to sustain such a claim is to make an argument directly about the origins of the frame itself; and I will give an example of such a claim later, but only after reformulating the idea of path dependency along lines suggested by a re-reading of the second story.

The deeper message of that story, too, is contained in its self-contradiction. The ostensible point, to repeat, is that the choice among incommensurate technological systems is determined by historical accident, for reasons directly connected to their incommensurability. If I am choosing between apples and oranges, and these are so different that there is no way of expressing even the traits, and still less the value of the one in terms of the other, my choice will depend on something purely incidental to the (nonexistent) relation between them: for instance, my preference for apples over oranges.

But as even the sketchiest retelling suggests, the "accident' that pushed the battle of the systems in one direction rather than another was Edison's
discovery that the two were not in fact incommensurate. It was precisely the
discovery of a whole array of bridging technologies -- ac electric motors,
rectifiers, alternators, and so on -- that so blurred the distinction between the
two that the very notion of a system as a whole in which all the parts and the
relations among them are the expression of the same principle lost its meaning.
Once that idea was compromised, Edison the system-builder lost interest in the
project and sold out. From this vantage point, however, his decision calls into
question the empirical foundation of the fourth, and we argued, potentially
most persuasive of the potential sources of path dependency: cognitive
constraints, and most particularly those connected to the -- alleged --
incommensurability of technological paradigms. If it is not necessary to choose
between the two systems because activities in one can be rendered through
translation compatible with the activities in the other, or, beyond that, because a
part of one system can be substituted for part of the other, then there need be no
fateful choice between "systems" and no worry that that choice will be made in
the blindness of path dependency (McGuire and others forthcoming).

Nor is the battle of the systems a singular case of underlying commensurability
between what appears to be mutually exclusive alternatives. The battle between
MS DOS and the Apple operating system reveals the same connective
commonality in the world of micro computing. One sign of this compatibility is
the proliferation of programs that translate files formatted for one system into
the format required by the other. A second, deeper indication is the ability of
MS DOS to mimic essential features of the Apple system, especially the
graphic user interface. Apple sued Microsoft for breach of its intellectual
property rights in a failed effort to stop this mimicry. A still deeper indication is
that crucial components designed for one system such as microprocessors and
the bus that links input and output devices to the processor can increasingly be
used as components in the other system as well. Indeed it is becoming common
to observe that just as operating systems allowed computers to use a full range
of peripherals by many vendors, so network-operating systems turn computers
into peripherals that can be connected and deployed irrespective of the origin of
their operating systems. Where is the fateful choice in all that?

"For counter-example," of course is no more a proof than "for example." To
make a case for the proposition that choices can be commensurate but still in
some important sense path dependent I have to show systematically how
differences that matter can still be mutually intelligible, illustrate what such
mutual intelligibility could mean in economic history, and show how the effort
to make intelligible differences the motor of collaboration is at the heart of
current innovation in economic organization. These are the next steps.
5. The Peculiar Intelligibility of Differences

The inverse of the incommensurability assumption that underlies much of the cognitive variant of path dependency is the idea that competing solutions to any (technological) problem are by their very nature mutually intelligible. This apparently extravagant argument is the one necessary to turn the counterexamples into illustrations of a general counter-interpretation of the cognitive underpinnings and consequences of strategic choice in the economy. It is convenient for present purposes that outside of economics -- institutional as well as neo-classical -- this claim is not regarded as outlandish at all.

The mutual-intelligibility claim is rooted in the assertion, most clearly formulated by the American pragmatist Charles S. Peirce, that doubt is not a primitive state of mind. The mind at rest, Peirce argued, is not given to Cartesian skepticism, nor incapable of apprehending anything until doubts about the possibility of apprehension have been allayed. On the contrary, Peirce argued, thought always presumes a skein of beliefs about the world; and the beliefs are held to be true without reflection on the conditions under which their truth might be possible. These beliefs are the expectations that emerge as we habitually rely on ideas in practical affairs and continuously indicate to one another the results of this reliance. The ensemble of these beliefs constitute the world that we suppose in formulating our thoughts (Christensen 1994). So great is its grip that we cannot relax it by indulging a fit of Cartesianism and arbitrarily disbelieving something we have held true. Try to evoke primordial skepticism by doubting a current belief, Peirce challenged his readers. You discover that you cannot.

Yet we do have many doubts about the world. Their origin, Peirce maintained, is not a return to first principles but rather a shock to our expectations: the experience of a surprising violation of our beliefs. The response to such shocks is an urgent inquiry into the possibilities of re-elaborating the beliefs that have become dubious so that they can take account of aberrant experience in a way that attaches the new ideas to the skein of persistent beliefs about the world.

From this and further elaborations of this pragmatic understanding, it follows that explanations, and in the plural that means competing explanations, of new possibilities are not simply hurled into a void, shouted incomprehensibly past each other, or simply tested until the "right" one can be forged as a link in the chain of indubitably true arguments connecting fact to first principles. They are addressed, rather, to the community of troubled belief; and in addressing that community, advocates of novel interpretations are at pains to urge the superior
persuasiveness of their own views both as against troubled orthodoxy and competing heterodoxy. But to make such claims they must suppose and help create by the distinctions they introduce a universe of discourse in which all contending views are rendered mutually intelligible, if only to demonstrate the inadequacy of the disfavored one.[3]

Views of this sort are well accredited, perhaps even dominant, in current discussion of the philosophy and history of science, although not in the versions of those discussions that have currency among such economists as are attentive to these matters. As indicated in earlier discussion of institutional economics, the view current among economists is associated with the work of Kuhn, and it is made to the measure of a view of path dependency as founded in the agents' cognitive disposition. In Kuhn's view scientific activity consists chiefly of the routine problem solving required to sort through the implications of the paradigm of theoretical ideas, embodied in characteristic terms, instruments and procedures, that guides research in any particular discipline most of the time (Kuhn 1970). These long periods of "normal" science are punctuated by brief but ferocious scientific revolutions in which philosophizing heretics seize control from the problem solvers and contend amongst themselves until a new orthodoxy is installed as paradigmatic. Inexplicable in origin, accidental but enduring in outcome, these scientific revolutions turn the advance of science into the succession of mutually unintelligible understandings supposed in many views of the accidentality of technological choice in a path-dependent world.

The counterview, associated with the work of Lakatos, Feyerabend, and Popper, blurs what Kuhn takes to be the distinction between "normal" and "revolutionary" science. Differences of opinion profound enough to count, from Kuhn's point of view, as "philosophical," are, they argue, pervasive. Research that advances understanding, whether "revolutionary" or not, is necessarily mindful of these controversies, and shapes debate precisely by addressing them. Mere problem solving that proceeds in ignorance of these disputes is the work of drones, and not properly counted as science at all. In this view there is nothing surprising about the large reorientations of thought that count as scientific "revolutions" precisely because debate always anticipated and prefigures them. Indeed, the "revolutionary" idea is precisely the one that recasts and orders the relation among the contending ideas so as to permit the most comprehensive interpretation of the claims they invoke. Victory in the contest of these ideas thus consists in the most telling demonstration of their commensurability (Feyerabend 1970; Lakatos 1970; Popper 1970). Even allowing that last words are a long time in coming in such
controversies, it is nonetheless worth observing that Kuhn has been forced to
concede that scientists operating in competing paradigms can indeed learn one
another’s language, and that he is therefore trying to define or reformulate the
incommensurability of paradigms as the limitations of communication that may
arise in conversations involving non-native speakers.

I come by my convictions regarding commensurability in relation to both
scientific and economic activity the hard way: by having assumed, following
Kuhn, that paradigms are incommensurate, then applying a variant of the ideas
to the interpretation of problems in nineteenth-century industrialization, only to
discover that the contrary view accorded better with findings. Having been
wrong once is not necessarily a powerful advertisement for the reliability of
subsequent claims; but as the path of this inquiry shows that I have never been
viscerally hostile to the ideas that I am here criticizing, and as the refractory
findings illustrate well the fundamental aspects of economic agency that are
shortchanged in accounts of path-dependent choice, I briefly report starting
point and destination of that work here.

The work had its origins in the practical and theoretical tumult referred to at the
outside. In the fall and rise of organizational forms it seemed to Michael Piore,
Jonathan Zeitlin, and myself that we were watching the shift from a system of
mass production based on the use of dedicated or specialized resources --
special purpose machines worked by narrowly skilled workers -- to a system of
flexibly specialized production in which general purpose resources -- flexible
machines such as programmable machines operated by workers with broad,
craft skills -- turned out customized goods to meet the needs of rapidly
changing markets. There seemed to be historical antecedents for this flexible
craft economy in the world of small-scale production that dominated many
Western European economies in the decades before mass production arose in
the U.S. and diffused from there in the late nineteenth and early twentieth
centuries (Piore and Sabel 1984; Sabel and Zeitlin 1985).

The detailed examination of these developments I undertook with Jonathan
Zeitlin had all the features of a path-dependency account. We tried to show
how the two systems arose as natural responses to the particulars of their
respective market environments: Craft production was the form of
mechanization most suited to a world in which artisan skills were widespread
and taste regionally differentiated as a result of the territorial and social
divisions formed in feudalism. Mass production was suited to a vast internal
market, unified by railroads and telegraph, in which craft skills were in short
supply among immigrant workers, but where the standard goods achievable
with the automatic machinery of the day was acceptable to these immigrants because their tastes had been rendered malleable by dislocation and transfer to the New World. The logic of efficiency through economies of scope -- the greater the variety of goods produced, the cheaper the introduction of the marginal variant -- was counterpoised to the usual argument about economies of scale. The central claim was that the dominance of mass production, therefore, had less to do with absolute efficiency advantages than with the historical accidents by which it came to develop and demonstrate the attraction of economies of scale before the world of flexible production could fully demonstrate the vitality of its own characteristic form of efficiency. In both worlds agents responded mostly to the promptings of their environments; and if they developed different forms of economic and even political association, those were reflections of the differing demands placed on them by their surroundings. The choices they exercised consisted in their participation in the myriad struggles over the distribution of property and power insofar as these, cumulatively, reshaped markets and thus changed the background constraints on economic choices narrowly conceived (Sabel and Zeitlin 1985).

So far so path dependent as to be an illustration of path dependency in explanatory action -- indeed, precisely because it was designed to show how political background conditions could shape the very standard of efficiency by which markets selected results -- this was at least a path dependency story that did fall victim to the particular fallacy of composition that vitiates the QWERTY account, and many others like it. So at least the problem was not the failure to think big.

The problem, rather, was that when we joined a team of economic historians and looked at these historical alternatives more closely, we found that the actors were not acting on the information and in the way supposed. Instead of responding exclusively to local promptings, we found in case after case that they scanned the world to uncover the range of potentially viable strategies, and then scrutinized local circumstance to determine which of these, or more often, which hybrid combination of them, was best suited to their needs. Typically, in fact, the actors saw the "pure" strategies as dangerous traps, adapted to highly constrained environments and vulnerable to slight changes in background conditions. For that reason they tried, often with great success, to find hybrids that combined features of both strategies in ways that would allow subsequent adjustment in one direction or another as circumstances required. Frequently, for example, the production of intermediate goods such as forged alloy steel for cutlery or movements for watches was organized on mass-production lines, while the production of final, highly differentiated goods was by means of
flexible specialization. "Pure" types turned out to be, empirically, the exception rather than the rule. In showing, practically, moreover, that strategies we had imagined to be incommensurate were not only mutually intelligible but frequently, even normally decomposable in freely substitutable parts, the actors demonstrated a capacity for theorizing that was certainly not different in type from, and sometimes much better informed than, our own reflections on the connection between environment and strategy. None of this assured survival in every case: Political fights over the distribution of the costs of adjustment sometimes blocked adjustment. Indecision about the correct course to follow could lead to a ruinous dispersion of resources. But these accidents resulted, if anything, from too much, rather than too little knowledge of possibilities and their costs, from too much awareness of contingency rather than too little. The lesson was that even with all the advantages of historical retrospection -- indeed, initially, perhaps precisely because of them -- we had constructed a theory of blind choice that had more to do with the blindness of our theory than the limits of the historical actors' capacities for self-reflection (Sabel and Zeitlin forthcoming, 1995).

6. The New Institutions of Economic Deliberation

While these debates swirl on, the ideas of the mutual intelligibility and decomposability of strategic alternatives are being put to empirical test, or, more precisely, being proved in practice as just-in-time delivery, simultaneous engineering, benchmarking, and other design and production disciplines that originated in Japanese transformations of U.S. manufacturing practice diffuse through the advanced and developing economies (Helper and Levine 1994; Kaplinsky 1994; Liker and others 1994; Nishiguchi 1994). These methods suppose exactly the features of the choice that path dependency regards as debilitating: that the starting point for any design or process for realizing is historically arbitrary; local efforts at improvement given these starting points must be largely local, but local efforts can result in dead ends; operating procedures can become entrenched in habit; and superior solutions can emerge off the main line of current advance. Taken together the methods create a form of decentralized organization which uses disciplined comparisons -- of current as against best practice, of actual versus target performance, or of the expected features of competing design solutions -- to obligate the collaborators continuously to revise their mutual goals and the organizational means by which they intend to realize them. In effect these discussions of means and ends render at least partially explicit and amenable to joint revision the tacit knowledge of practical activity in the small and the unspoken strategic assumption in the large that in path-dependent views blind economic choice to
its possibilities. They also allow each collaborator to observe the capacity and disposition of the others to perform as expected, and thus to reduce the vulnerability created by mutual dependence to an acceptable level; but these governance properties are incidental to our present concerns, and we will set them aside here.

The basal unit of this form of organization is the independent work group or project team. Regardless of its formal legal status, it has sufficient authority over its internal organization and sufficient choice in the procurement of the goods and services upon which it relies as inputs to be able to determine for itself the best means to pursue its ends. The activities of these teams are coordinated by a system of integrated goal setting: An initial project -- to build, say, a car -- is determined by examination of the best models of the relevant models currently available, and evaluation of likely developmental prospects. General specifications arrived at this way are then repeatedly decomposed, again by reference to best practice and potential developments, into projects suited to single teams. As each team tries to realize its objectives, it suggests modifications in the initial design; cumulatively these revisions in the design of the parts can lead to changes in the characterization of the whole, and vice versa. The continuous re-evaluation and revision of the design, moreover, goes hand-in-hand with continuous re-evaluation and revision of the organization dedicated to realizing it, as difficulties in obtaining particular ends may reveal incorrect disposition of the means as well as shortcomings in the goals themselves. The same interpenetrating evaluation of means and ends, finally, guides production as well as design through the use of disciplines that detect and force immediate correction of the sources of defects either through re-organization or re-design (Sabel 1994).

These activities create a web of continuous comparisons which link and define the units collaborating in production. Benchmarking, for instance, is just the decomposition of competitors' products (or production processes) into their constituent elements and the synthesis of the elements that stand out in comparison into the prototype for a new design or process. Simultaneous or concurrent engineering is the practice of proceeding with the design of all components at once, rather than fixing the features of the most crucial parts, in the order of their assumed importance, and using their definition as a frame for the rest. It uses comparison of the solutions that emerge from each partial elaboration of the original design to suggest and correct solutions to problems arising in connection with treatment of the others (Clark and others 1987; Fujimoto 1989).
And the use of comparisons is, if anything, more prominent in the ordering of production. As design are (provisionally) fixed, for example, suppliers and customers agree on target prices for components. These included annual or semi-annual price decreases to take account of the gains in productivity expected to result from experience, as well as provisions for the division among the parties of gains in excess of the targets. Thus the parties expect to be continuously comparing target and actual performance and adjusting their expectations regarding future projects accordingly (Smitka 1991). Finally, as the last bulwark against the encrustation of habit and the metaphor for the operating logic of the system as a whole, there is just-in-time or zero-inventory production. By removing the inventory buffers between work stations, this method assures that defects are detected and their source eliminated as soon as they are produced: A fault introduced at one work station obstructs operations as it is passed to the next, and discussion of how to fix the immediate problem is inextricably connected to discussion of how to prevent its recurrence by improving the equipment or procedure that produced it. Just-in-time production provides, therefore, a means of comparing the actual performance of a production to the ideal of a system that operates error-free; and once any particular system has been stabilized at a given level of performance it is sufficient to increase the demands on its reliability -- for instance, by speeding up production -- to reveal the currently most unreliable or error-prone operations.

Thus by assuming the arbitrariness of starting points, the shortsightedness of local improvements and the dangers of routine, these disciplines create the possibility of a piecemeal re-examination of means and ends that can produce a wholesale redefinition of both precisely because nothing is taken for granted beyond the folly of relying on what is assumed. Another way to put the point is to say that the new methods make tacit knowledge the subject of discussion -- not everywhere and all at once within an organization, but bit by bit, and all potentially in time, as experience directed by comparison reveals the opportunity and creates the categories for doing so. In doing all this the actors neither restrict themselves to selecting a production set-up from a list of possibilities given market prices, as neo-classical views of choice suggest; nor bend the knee to habit, routine or accidental expectations, as path-dependent accounts would lead us to suspect. Rather they act with a deliberation and capacity for self-reflection that, together with the re-interpretation of the turn to mass production, invite re-examination of our ideas of economic agency. This topic is broached by way of conclusion.

6. Deliberate Choice
The deep connection between standard and path-dependent views of agency is this: In both, the agents react directly to the promptings of their environment. In the standard view, the agents are supposed to have code books at hand with whose help they can determine the meaning of market signals, once these have been extracted from noise and corrected for the possibility of maliciously introduced errors. These signals guide the way to an ever more efficient organization of production; and the assurance of continuing progress towards efficiency is taken as a sign of deep concord between reason and divine purpose.

In the path-dependent view the actors are in the grip of their explicit decision rules or habits. These They may know that the signals they get provide an incomplete picture of the world; they may have found habitual ways of responding to circumstances that go beyond the direct promptings of the market. But their knowledge of the subtle indications that such adjustment is required, and of the forms it should take, is tacit, buried in routines that allow, even require them to do what is appropriate under the circumstances without explaining -- without imagining they can explain -- why they do what they do, how, and what larger changes might follow from it. For this reason they may well respond mutely and passively to changes in the environment that select against them: knowing better under these restrictions is no help. The light of reason leads nowhere in particular; following it, we can wend our way among hillocks and never catch sight of the mountains against which they nestle.

The protagonists of the nineteenth-century debates about the direction of industrialization and even more the champions of the new disciplines live, in contrast, in a world of ambiguity. They assume that alternatives are incompletely specified, and prove in part complementary rather than mutually exclusive. They do not believe there is a code book in which signals characterizing a particular situation are translated into the uniquely appropriate actions. Still less do they count on their habits as a guide. Instead of relying on either they undertake the active exploration of the ambiguity: through comparison of strategies in the first, historical case, and through the construction of a web of institutions to organize deliberate, comparative evaluation of collaboration in design and production in the second, contemporary one.

In their awareness of contending views and in their dedication to use this very contention as a means of exploring their possibilities they resemble nothing so much as the scientists in the account of Feyerabend, Popper and Lakatos. Differences in views of the world, for both, make deliberation understood as
the constant exchange of reasons for believing what one believes both necessary and possible. These are not, in their view, a sign of our isolation from the truth of the world, but rather the means by which we explore it. The condition, of course, demonstrated in the activity of science that can be at once normal and revolutionary and the self-reflection of firms that take neither themselves nor their projects for granted, is the ability to make these differences mutually intelligible by finding ways to speak of them.

In adopting practices such as benchmarking and simultaneous engineering they do just that: Assuming they do not know what to assume, they decompose current successes, combine their elements with extrapolation of current developments, and so determine which possibilities to explore further through continued experimentation. By these means they in effect create both new possibilities and the instruments to realize them, and so reduce the chance of being caught for long in a locale that seems attractive on condition that nowhere else is known. An increased ability to escape from error is not the same thing as a guarantee of the ability to find the truth; but it may be all the consolation we have.

I said earlier that the wide acceptance of path dependency might be a sign that economists are more in touch with the mood of the average Joe than they imagine. If that is so, then perhaps the deliberate, cautious inventiveness of the new economic actors will soon have an effect on them as well.

Footnotes


[2] For a detailed current proposal to amend accounting rules so that firms are valued fundamentally according to the expected cash flows generated by the projects they undertake rather than assets, tangible or intangible, amassed in the past, see (AICPA 1995). Such forward looking valuations force managers to ask whether proposed projects are likely to be paying propositions given the best efforts of current competitors, not whether they make sense given the prior investments of their own firm.
[3] Another route to the same conclusion follows Davidson's argument about the mutual intelligibility of any articulations that might reasonably be called a language. Suppose we say that linguistic activity or language is either the activity of ordering or categorizing things in the world, or fitting beliefs to experience. If we see a being engaged in categorizing or fitting, we can find a way to exchange views about the differences, if any, between its way of dividing or connecting things and ours. In this sense there could not be incommensurate or mutually unintelligible languages, because any being engaged in linguistic activity would be doing something intelligible to any other being engaged in linguistic activity. It would, after all, be obtuse for me to observe you doing something I recognize as ordering or fitting, yet maintain that your activity is nonetheless utterly incomprehensible. By extension, then, mutual recognition of engagement in the same activity, however particular, creates a common frame which allows subsequent elucidation of differences. Advocates pressing alternative views to the same problem before the same audience are engaged in the same activity, and recognition by all parties of this mutual engagement ensures the mutual intelligibility of the positions under discussion (Davidson 1985).

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[4] The next draft will elaborate this theme by indicating how the tacit character of craft knowledge sets limits to the collaboration based on it. The current adjustment difficulties of the German and Italian economies, both of which did extremely well in competition with US mass producers but less so against firms using the new, Japanese inspired methods, is instructive in this connection. See (Kern and Sabel 1994); and for an extraordinary account of mute, craft skill, the discussion of flute making in (Cook and Yanow 1993).

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