Societal Contexts of Transportation and Communication

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Economic geographers and urban historians have known all along that the histories of cities have mirrored the histories of their transportation and communication systems. We all learned something about those causal relations in grade school. Most literate people have at least a vague notion why so many great cities occupy seaside or riverside sites, why Chicago happened where it did, why the suburbs are spreading in their current fashion, why the southwestern metropolitan areas are expanding today, and indeed why cities happened in the first place. Most laymen dimly remember those lessons about the roles of transportation and communication systems from Geography 1.

But, paradoxically, those of us who work as transportation professionals have become much too knowledgeable about the workings of transport subsystems to pay much attention to such large-system effects. Some of us have become sophisticated model builders who can simulate a network's loading with remarkable precision; others are superb geometric designers; others are becoming skilled at forecasting traffic; and some are now becoming sensitive analysts of environmental neighborhood effects of transport facilities. But where are the transportation planners who are concerned with the larger societal roles of transportation-communication systems? Where are the persons who worry about those outcomes of transport systems that really matter? Where is the effort to formulate national or state transportation policy—that is, policy for transportation services and for their consequences? As I shall try to argue, a plan that merely locates new transportation routes and facilities—whether roads, rail lines, airports, or similar public works—won't do it. Without a predecessor policy for the types, qualities, and distributions of services that are desired, such a physical construction scheme might be counterproductive; i.e., it might do more damage than good.

I say that because transport systems are powerfully influential in shaping social history—just as the geographers and the historians have been contending. And if they are right, we must then ask whether we might exploit them, instrumentally, as levers for deliberately reshaping social conditions. Can we use transport as one among the available means for redirecting city-development processes, for fostering economic development, for improving the life opportunities of the city's residents, for raising levels of the various publics' welfares? With all our newfound sophistication in the transport planning professions, can we now elect those of the potential external consequences of transport developments that we prefer?

That may strike some as a rather old-fashioned idea. At an earlier time, suburban

developers used streetcar lines as sales devices, and trams thus became media for guiding urban expansion. Earlier still the Congress subsidized the construction of a national railway system with the aims of opening the western territories and promoting economic growth. The initial federal road program was directed to getting the farmers out of the mud and getting their crops to market. More recently the BART system was designed as an instrument for inducing growth of high-density business districts at several points around the San Francisco metropolitan area. There are surely other examples in which transport investments were directed to nontransport payoffs, but the surprising thing is how few contemporary examples we can find.

Transportation planning in America seems, inadvertently, to have pursued an adaptive strategy rather than an instrumentally purposive one. Moreover, the adaptations have been responsive, almost exclusively, to transport-specific demands rather than to the external societal ones. It is as though transportation planners forgot their original mission and grew to believe their business was to build transport facilities instead.

This propensity is most visible in the highway planning activities of recent times, although the tendencies are as firmly established in air transport, in seaport developments, and of course in passenger rail systems. In each of these modal spheres the responsible agency undertakes to forecast probable future levels of travel demand between pairs of places and then to design a physical facility with capacity sufficient to handle the predicted loadings. The transport planners' task is to accommodate those loads.

To be sure, some other criteria are imposed. Capital costs of the new equipment must be tolerable. Certain accepted standards for travel speeds and safety must be met, and of course structural design standards must be met as well. These criteria are all internal to the transportation facility itself.

Nowadays some additional criteria are being insisted on that are external to the facility per se. These include considerations of the neighborhood effects of noise, smell, vibration, and the like and consideration of the lost buildings that rights-of-way consume. Much of the recent citizen protest against freeways and airports has been directed against these sorts of first-round external social costs that fall out on adjacent properties and their inhabitants. In turn, these protests have compelled a revised perception of transportation systems, whose boundaries have now been stretched to include the neighborhood effects they immediately generate.

That strikes me as a salutary development in the right direction, but it is at best a modest step. However important those first-round, short-distance, short-run effects, they appear as trivial when compared with the large historic consequences we learned about in Geography 1.

SOCIETAL CONTEXT OF TRANSPORT TECHNOLOGY

The revolution in transportation and communication of the current century has been a key ingredient of the societal revolution that is transforming social organization, political behavior, structure of the national economy, religious practices, and family relations and furthermore transformed the traits of small-scale, early industrial society to those of large-scale, early postindustrial society. No aspect of the national society has been immune to the consequences of that quiet revolution.

Virtually all the technological developments in transportation and communications have had the effect of reducing costs of overcoming geographic space, hence of reducing the barriers to interaction that space has traditionally imposed. Improved ships, canals, railroads, automobiles and trucks with their associated roadways, the telegraph, the telephone, the radio, data-transmission systems, television, communication satellites—all constitute a family of progressively more effective erasers of distance. Each in turn has brought geographically distant partners into closer association, thus opening up the local urban systems to interaction with each other. By now, the entire nation operates as a single open system, indeed as though it were a single city. Business firms located on the 3 coasts interact with the ease of their nineteenth century

counterparts located within the same town. Goods, information, and services are easily traded across thousands of miles, with the result that America has become a single, national urban system of tremendous scale. The progressive modification in the economic geometry of space has abetted a long-term shift toward greater social differentiation, increased complexity in the structure of the political economy, and new levels of social integration. By now, a degree of national integration has emerged, which is unprecedented in its spatial and temporal dimensions.

Of course it would be absurd to attribute the motive force behind the twentieth century nationalization of America to the transportation-communication systems that emerged then. That drama has been the resultant of the interplay among powerful arrays of influences, of which these systems have been but contributing aspects. Even though the revolution in transportation and communication has not been a sufficient cause, it has surely been a necessary contributor to the revolutions in societal patterns that have evolved during these past 70-odd years.

The new transportation and communication processes have been so thoroughly enmeshed within the processes of social change and the processes of economic development that it is probably impossible to distill out their specific roles. That is in part because all these processes are mutually interactive ones such that modifications in the technologies generate modifications in social relations that in turn generate further technological modifications. That sort of positive feedback amplification is a familiar one to development economists and to electronics engineers, of course, and is probably endemic to the workings of most open systems. The sheer complexity of interactions within such a causal network in the national urban system, however, has so far defied description, much less explanation.

The difficulty of explaining causal roles is then further confounded because the variables themselves become implicit functions of each other. When 2 mirrors face each other, is it possible to say which one generated the original image or which reflection belongs to which mirror?

The structures and functions that characterize contemporary Western societies, economies, polities, and geographies have been so thoroughly influenced by current transportation and communication technologies that both the societal and the technological phenomena must be seen as aspects of each other. This country's development has been so intimately involved with the automobile and the telephone that it is now impossible even to conceive of either except as an attribute of the contemporary culture. The automobile, for example, is now a functioning part of social systems, not a separable thing.

Of course, in the trivial sense the automobile remains a physically identifiable machine, complete with wheels, engine, and the rest. So too does the telephone with wires, switches, and so on. But, operationally, each is a working attribute of a high-scale society whose members interact frequently and speedily over large distances and for whom random access is a highly valued capability. Modern society might as accurately be named "automobile-telephone society" as "industrial-commercial society." Each of these names is descriptive. (Or perhaps "monetized society" is a more telling illustration of my point. The invention of money occurred so long ago that we no longer think of either currency or monetary institutions as technological developments. Each has been so thoroughly woven into the societal fabric as to have become a definitive attribute of that fabric and to have taken on the coloration pattern of its context. Can you imagine a modern society without money in some form?) I am suggesting that the automobile, the telephone, the television, the airplane, and the rest ought properly also to be viewed as an integral pattern within that same contextual fabric. Neither pattern nor fabric can exist without the other.

Seen within such a contextual frame of reference, it becomes impossible to discuss the impact of the automobile or the telephone on society. Such a formulation would presume linear, one-to-one, unidirectional causation. Instead, and at best, we might seek to expose the interplay among these mutually interactive influences. I have been trying to learn how to think about these phenomena in this way, and I must say that I find it difficult to do so. It is so easy to fall into the old conceptual trap of the mechanistic cause-effect link through which A impacts B to yield C. I am guessing

that, in the complex world of social systems, A is defined by its interactive relations with both B and C—that A is a function of its environment and of the environment's future history.

Viewed from this perspective, the vernacular conceptions appear to have been far too simplistic, perceiving technological developments and transport facilities as hardware systems somehow tacked onto the body politic when they are really social systems buried deep under the political skin. When sober scholars are able to propose that the automobile or the freeway or some other widely used technological system be banned or otherwise excised from the social scene, apparently expecting the scene to be only moderately altered thereby, it would seem that their models must view technology as outside the social system. The paradigm I am searching for would obviously reject that perception.

To remove either the automobiles or the telephones would so transform geographic and social distances as to effect fundamental shifts in interaction costs and thus in the existing bases of the social order. Further, freedom to move and freedom to exchange information and knowledge would be greatly curtailed in the absence of equivalent technological means for travel and message transmission. Social and economic intercourse would thus decline, which would affect integration among establishments, and in turn affect the operating processes of the economic system, social relations, government, and so on. Technological systems, touching so close to the infrastructural bases of the society, can be excised or greatly modified only with large consequences for the rest of the social system.

You will note that I am not arguing that there are direct one-to-one cause-effect relations, such as the conception of technological impact implies. Nor am I saying that technology is causally neutral. Neither conception is tenable. The structures of society-technology relations more nearly resemble that of a complex, multidimensional web than that of a billiard table. In such a relational matrix some technological systems are so pervasive, so subtle, and yet so powerful in their roles as to comprise key traits of the social order they contribute to. I am suggesting that transportation and communication technologies are among the more pervasive, subtle, and powerful of the contemporary technologies. Moreover, their influences are far more profound than we learned about in Geography 1, for they extend much beyond their roles as shapers of cities and of social relations to include roles as agents in the contest for human welfare and social justice.

SOME ETHICAL ISSUES IN TRANSPORT POLICY

The magnitudes of transportation and communication installations in America have been well documented, and the scales must be generally understood. One out of every 6 jobs is directly related to production and maintenance of the stock of nearly 100 million automobiles, 20 million trucks and buses, and 3.7 million miles of roadway. Those roads carry well over a trillion vehicle-miles of travel each year. The 125 million telephones handle about 150 billion conversations annually, and the postal system handles some 90 billion pieces of mail. The scheduled airlines carry about 170 million passengers, who travel some 130 billion passenger-miles per year. And so on. Clearly transportation and communication are huge-scale activities. They are also very costly, consuming fully a fifth of the gross national product.

The development and installation of their physical facilities alone have of course generated large consequences that have reverberated throughout the political economy, propelling these sectors of the economy to positions of dominance. (Ten of the 12 largest industrial corporations in the United States are primarily engaged in producing automobiles, petroleum, or telephone equipment!)

The geographic consequences generated by the contemporary technology have of course been dramatic. First, all parts of the entire continental land mass were made operationally contiguous, thus permitting spatial dispersion of linked establishments over unprecedented distances. More recently the transition to postindustrialism has accelerated footlooseness; for information and knowledge are superseding bulk raw

materials as the prime inputs into the economy, and these sorts of resources are of course easily shipped from place to place—whether on paper, wires, or embedded in human minds. As the result, factories, laboratories, offices, universities, and business-service establishments are discovering degrees of locational freedom that would have been unimaginable in an earlier stage of technological development. As noted before, the contemporary American political economy has been functionally integrated into a single working network such that nearly every firm in the nation is interlocked with all others in a complex web of mutual interdependencies whose threads connect nearly all persons and organizations in the country.

That scale of economic activity, that newfound locational freedom, that new ease of intercourse, and that nationalization have redounded as unprecedented standards of living for the large majority of Americans. Middle-America has finally attained the 2-car garage and the machines to fill it, the pot complete with 2 chickens, the suburban house, the long weekend, and, now, the growing guilt for having it all. But the guilt aside, few would willingly give it up for the life-style and the simple fare their parents and grandparents knew. Americans are comfortable and terribly wealthy, even the working class.

A great many are actively absorbed in the affairs of those interest-communities they happen to care about—church, professional society, hobby club, or American Legion post. Nearly all are tapped into the national communications channels in real time such that national and international events at least touch their consciousness, and nearly all share in the international recreation-sports-amusements-art-literature-music explosion that has become for many a paramount source of satisfaction and sense of achievement. Insofar as the transportation and communications technologies have contributed to that accessibility and thus to the current explosion in science and art, we must of course score them positively. And there can be no question about the beneficial roles of automobiles, telephones, campers, trailers, airplanes, boats, television, high-speed printing presses, and all the rest in the development of the new suburban life and the new recreational and intellectual opportunities.

But more important here is the parallel fact that these benefits have been unequally distributed among the nation's publics. More than that, because some sectors of the national population have benefited so greatly, other sectors have been positively hurt. Insofar as the new transportation and communications technologies have been major contributors to those inequitable outcomes, they must then be faulted and, I believe, corrective action should be taken.

Automobiles and telephones permitted spatial dispersion at the metropolitan fringe and thus were in some primal sense causal factors in the suburbanization of America. At least 2 further consequences of suburbanization worked positively to hurt those who did not enjoy the advantages of car-plus-phone.

The induced decline of public transit services has meant that those who do not have discretionary use of private cars are worse off because those who do have them are better off. Further, the massive restructuring of the metropolitan spatial patterns has meant a rapid expansion of jobs in suburban locations and the concentration of the poor in the old city center. Those who are constrained to center city residential locations are relatively inaccessible to the expanding suburban jobs. That fact is exacerbated by the geometrical asymmetry of public transit systems, which are ineffective at serving work trips originating in the center city but bound for dispersed suburban locations.

One consequence has been the further relative deprivation of those sectors of the population who are already relatively deprived, most notably persons who are poor, underskilled, underemployed, and underclass. If they happen also to be black, and thus barred from many desirable suburban residential districts, the shifts in spatial structure and the atrophy of public transit services have compounded their handicaps.

Of course, they are not the only ones who have been hurt by the twentieth century revolution in transportation and communication. The young, the old, the infirm, and others who either cannot drive cars or cannot acquire them have been similarly disserved by the shift to the automobile-highway system, however much they have profited from the increased access to information, knowledge, friends, and so on.

The black revolt of the 1960s and the middle-class citizens' revolt of the 1970s have

made us all aware of these inequitable incidences of benefits and costs arising from changes in transport systems. Transport planners are now actively searching for a rationale in equity to replace or, at least, to supplement the engineers' traditional rationale in efficiency for testing alternative transport designs. Most officials in transport agencies by now agree that least cost solutions are not necessarily the right ones, that benefit-cost ratios are too gross a test (in part because they hide the distributional consequences), and that issues of social justice are of at least equal importance to issues of cost accounting.

In the United States, we are of course a long way from finding easy operational procedures that would respect those insightful conclusions. And I am guessing that our received professional paradigms are probably the most difficult obstacles in our way.

Those of us who were trained in the natural sciences and in engineering, and many of us who were trained in positivist social science too, were trained to believe that there are correct answers to problems. The frequency of the phrases "problem solving" and "optimization techniques" and the facility with which some can speak of "solving the urban problem" are dead giveaways. We truly believe there are right answers to be found, that there are optimum solutions to be discovered or invented.

I shall wish to argue that there can be no such answers or solutions to societal problems or to societal systems, including such societal systems as transportation and communication ones. The only tenable answers to questions are those that come out the other end of political processes. Especially where the outcomes are of the zero-sum sort, such that somebody loses because someone else wins, there is no way of knowing what is right. Indeed, there is no right. There are only political bargaining and the outcomes of those open political processes.

That may be the hardest lesson for scientists and engineers to learn. Contemporary and future transportation policy will specifically surround just these kinds of equity issues for which answers can never be found. We are in for a tough period of learning in the transportation professions, where our intellectual habits are mismatched with the contemporary problems of transportation policy.

That is in part why I suggested in my opening comments that we reconsider the idea of national and state policy plans for transportation-communication. It should be clear by now that I do not believe a simple cause-effect program-outcome plan is possible. Technology-society relations are far more complex than that. But transportation-communication policy can be consequential because these systems occupy so central and so powerful a set of roles in the workings of huge-scale societies, and especially in those of huge-scale postindustrial societies.

The national and state policy-planning style I dimly perceive would not be a scheme for the installation of facilities of various kinds. That kind of master planning may have its place somewhere later in the developmental process, but not here. Rather we need a set of synoptic policies that would seek to exploit potential new technological and institutional developments in transportation and communication for explicated social purposes. Likely candidate policies would be concerned with the further expansion of accessibilities to opportunities, including geographic accessibility and access through other routes such as improvements in cognitive, social, occupational, and artistic skills. (That is to say, transportation is only one of many means at our disposal for opening social systems and for expanding access to opportunity. It may not even be among the most effective ones.)

Clearly at the top of a policy agenda concerned with transportation and communications is the demand, among deprived groups, to redress the grievances that the rise of automobiles, telephones, suburbs, and the decline of public transit have generated. Something like half the national population does not have discretionary use of an automobile, and that condition obviously must be confronted.

The response is obviously not to "remember the answers" from the last century's approaches. Neither rail transit nor present bus systems are likely to satisfy latent demands for service. Instead, I suggest, the response should be a set of policy positions—a set of preferred functioning conditions—that might then guide large-scale research and development efforts to develop successors to the automobile. Such a new system would, in effect, be a better "automobile," but usable by those who are now

excluded. I mean to say, it would probably have to mimic the present car's operational capabilities by furnishing random-access, door-to-door private service; and it would need to be safe, comfortable, and within the economic means of its intended users.

National and state transportation-communication policies of the sorts I am suggesting would initially be directed to the development of the nation and the regions—including their economic development, their revised geographic patterns, and the preferred pace and patterns of human development for the several publics. Those goals would need to be interpreted into levels and qualities of services to be provided, not hardware systems. The hardware systems ought then to follow in turn insofar as we have the capacity to design hardware systems to order.

Among the key demands we should impose on such a policy formulation is the demand that careful efforts be made to trace out and expose likely future consequences of each alternative explored, especially the distributional consequences that would allocate benefits and costs among the many publics that constitute the society.

We would wish then to generate political debate over these proposals and consequences, searching for the politically viable policy-program package. In a field such as this where there is no consensus on national goals and no consensus on the distributional equities, only political bargaining can yield acceptable decisions. The task of transportation and communication planners is to fuel that debate by supplying better repercussion analysis, better forecasts of likely outcomes, and sharper questions that will engage more publics in defense of their preferred positions.

Of course, those sorts of analyses and informational contributions cannot be politically neutral. Inevitably, whenever the analyst must select data or interpretations, he or she adds to the debate, affects the outcome of the debate, and aids one group at the expense of others. However dispassionate the analyst is and however disinterested in the outcome, by informing the debate he or she fosters one set of distributional consequences over potential others. This is to say that every technical analysis is inherently political in character.

And so, however distasteful the analyst-planner-designer-engineer may find the role, he or she cannot avoid being cast as a political actor and partisan. I mean that in 2 senses. Because the technical contributions of the analysis may help one group accomplish its purposes and deter another's from its, the analyst inadvertently becomes allied with one of the rivals. But, moreover, insofar as his or her contributions lead to the exploitation of some technological systems over others, the analyst also thereby becomes party to the social history that will follow, including the future history of equity or inequity. There can be no neutrality in such public affairs, and especially not in affairs that matter as much as these do.

I am suggesting that transportation systems are far more important to the processes of social change, to the workings of politics, and to the distribution of social justice than the transportation planning enterprise seems to recognize. If the large-system perspectives of Geography 1 were to inform a future national transportation-communication policy, perhaps the grossest latent inequities could be avoided. Perhaps we might even be able deliberately to open access routes to improved life opportunities. Or, if you happen to prefer different social purposes, perhaps the large consequences triggered by new transport and communication developments could be directed to accomplishing your ends instead.

It is in the nature of these systems that those consequential outcomes will be generated anyway, whether we like them or not. As agents in their design, transport planners will be causal agents of those consequences, whether they intend them or not. It strikes me that those conditions pose a problem in professional ethics from which there can be no escape.

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