Chapter 28

Transportation: Hooked on Speed, Eyeing Sustainability

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Travel figures centrally in Charles Frazier's *Cold Mountain* (1997), a novel set during the American Civil War. With the warrior hero, Inman, slowly making his way back to Ada, who is busy creating the home that is his destination, the story, like the *Odyssey*'s, is built around the contrast between movement (Inman's travel adventures) and domestic stability (the home place that Ada is making). In the exchange recounted here, Ada, now subsistence farming with another woman, Ruby, in the mountains of North Carolina, has just put together a garden scarecrow from remnants of clothing left from her earlier, cosmopolitan life in Charleston, S.C. Ruby, who has never been outside her mountain community of birth, begins with a comment on the scarecrow's hat:

> "That hat in particular's a fine touch," she said.
> "It came from France," Ada said.
> "France?" Ruby said. "We've got hats here. A man up East Fork weaves straw hats and will swap them for butter and eggs. Hatter in town makes beaver and wool but generally wants money."
>
> This business of carrying hats halfway around the world to sell made no sense to her. It marked a lack of seriousness in a person that they could think about such matters. There was not one thing in a place like France or New York or Charleston that Ruby wanted. And little she even needed that she couldn't make or grow or find on Cold Mountain. She held a deep distrust of travel, whether to Europe or anywhere else. Her view was that a world properly put together would yield inhabitants so suited to their lives in their assigned place that they would have neither need nor wish to travel. No stagecoach or railway or steamship would be required; all such vehicles would sit idle. Folks would, out of utter contentment, choose to stay home since the failure to do so was patently the root of many ills, current or historic. In such a stable world as she envisioned, some might live many happy years hearing the bay of a distant neighbor's dog and yet never venture out far enough from their own fields to see whether the yawp was from hound or setter, plain or pied (p. 192).

These musings of an Appalachian woman more than a century ago capture several enduring themes of transportation geography. First, there is the double-edged power

of transportation (or movement) to create economic benefit for some people and places (Parisian hatmakers, in this case), to the possible detriment of others (local hatters). A second and related point is that travel – the ability to traverse distance – often breeds specialization, as in the production of stylish headgear in Paris. Third, at the core of Ruby's reflections is the idea that travel, though clearly held in disdain by herself, has value to some; to put this idea in economic terms, travel has utility for some people at some times, but disutility for Ruby (at all times). A related point, illustrated precisely by Ruby's travel preferences, is that differential levels of mobility lead to distinct cultures of consumption. Fourth is the association of travel with vehicles, which is related to a fifth theme, that of geographic scale: Ruby's "deep distrust of travel" is aimed at movement beyond the bounds of her local community; she travels extensively on foot around her farm, the surrounding forests, and into the village. Finally, Ruby is so accustomed to her everyday space-traversing activities that she doesn't even think of them as travel.

A life truly without travel – lived within a circumference of, say, five feet – is unthinkable and is, of course, unsustainable, especially if everyone else in the world is also living a transportation-free existence. Even Ruby depended on movement, on mobility, on transportation – however local – for access to water, food, wood for fuel, herbs for health. But mobility is more than simply the means to survival; it can also be, as it was for Inman, the means to encounter different landscapes and cultures, in short, more dimensions of diversity than those that exist within one's immediate surroundings. When walking was the only available means of transportation, people like Ruby could, and often did, live their whole lives interacting only with a small circle of well-known others, people who shared many of the same life experiences as oneself. Mobility broadens the scope of experience and opportunity within one's geographic reach, often with disastrous consequences for individuals and society, as Ruby implies.

How much mobility we need – how far we need to travel to find food, water, friends, books, diversity – depends, of course, on where these items are located relative to where we happen to be. Like Ruby, one can have access to people, goods, and services without having a great deal of mobility. Today, we so take for granted the ability to move, to traverse distance, to have access to places other than where we happen to be that we have become numb to the notion that mobility – indeed, transportation – is at the heart of contemporary economic, social, political, and cultural life. How many Americans realize that transportation accounts for about one-fifth of their household expenditures, more than any other single item except housing and as much as is spent for food and health care combined (http://stats.bls.gov)? People concerned about the unsustainability of contemporary settlement systems argue that less mobility might actually be desirable.

Yet transportation geography as such has become a quiet, some might say moribund, corner of our discipline. How has such an important area of inquiry become so marginalized? It has not always been this way: in the 1950s and 1960s transportation questions were central not just to economic geography but also to human geography. My goals in this chapter are twofold. First, I sketch out the nature of what I refer to as traditional transportation geography as it has developed since the 1950s and 1960s, making clear why transportation analysis once was so central to the discipline of geography. Second, I outline some of the emerging themes and

approaches that an enlarged and more critical transportation geography might more fully embrace. I argue that transportation geography has fallen outside the mainstream of human geography because much transportation work remains within the paradigm of the 1960s. Attention to new questions and openness to new ways of creating knowledge could and should enable transportation geography to contribute vitally to contemporary economic and human geography.

Traditional Transportation Geography

Transportation analysis was in many ways at the core of the dominant paradigm in the human geography of the English-speaking world from the 1950s to the mid-1970s. As the contemporary transportation geography agenda still strongly bears the imprint of that time, it is worth examining the central concerns of this subfield then and considering why they have been so enduring. Because transportation studies tend to be divided along lines of geographic scale, the first part of this section examines such studies at the regional and national scales, with emphasis on transportation's starring role in the economic and human geographies of the 1950s and 1960s; the second part focuses on studies of transportation at the metropolitan scale.

Transportation in economic geography

The reigning paradigm in geography in the 1960s was spatial analysis, whose goal was to identify or discover general spatial patterns and, more importantly, to understand the processes creating these patterns. Within human geography, the search was for generalizable processes governing the spatial organization of human activity, and the friction of distance – along with the ability to overcome it – were seen as central organizing principles. With distance representing a spatial and temporal barrier to be overcome, spatial separation acquired a monetized cost, and space became *commodified* – equated with the cost of moving people or goods over distance.

Models like those of Christaller and Weber, which dominated economic geography at that time, had the friction of distance, and hence transportation costs, at their core. Christaller sought to explain the spatial pattern of different-sized settlements in an agricultural landscape: why do settlements of similar size tend to be equidistant from each other; why are smaller settlements more numerous than larger ones; and what governs the nature of goods and services available in settlements of different sizes? He saw the answer in the distance people are willing to travel to obtain a particular bundle of goods and services. Because, under the model's assumptions, transportation costs are proportionate to distance, another way of stating Christaller's answer is that it lies in the varying transportation costs people are willing to bear in different circumstances. Weber's goal was to explain the spatial pattern of industry: why are certain types of industrial activity located where they are? At the center of Weber's explanation, like Christaller's, are transportation costs; in this case the costs of moving various kinds of raw materials to the site of manufacturing, relative to the cost of moving finished products to market.

Transportation costs were therefore at the heart of the space-economy that human geographers sought to understand. These costs dominated the calculus of the rational economic actors whose decisions fashioned the spatial organization of retail

activity (the geography of consumption), and of industrial activity (the geography of production).

In an industrialized capitalist system, time is money. This is as true for shoppers and workers, who must traverse space to reach stores and jobs, as it is for manufacturers, who need to bring raw materials together at the point of production and then ship a product to market. The commodification of space means that a unit of travel time has a money value. For an individual, travel time is valued at the person's marginal wage rate; it is the cost of foregoing a certain number of extra minutes of wage earning in order to travel. For the manufacturer, the volume of production and hence profits depend, inter alia, on how quickly the transportation system can move raw materials and finished product. In each case, economic prosperity is associated with speed. An economic geographic analysis grounded in the commodification of space – setting a money value on the time it takes to traverse distance – has, therefore, fed the construction of transportation systems dedicated above all else to promoting increasingly rapid mobility. In short, capitalism thrives on speed.

How, pragmatically, can speed be increased? The brief answer is, via networks and technology. Movement is faster and cheaper along corridors designed to promote speed; even walking across an open meadow is easier if there is a footpath. These corridors are linked together into networks, which serve to bring places on those networks closer together in space-time than are places that are not part of those networks. The other important element to consider in speeding up movement is the mode of travel, especially the technology associated with a mode: is it shoe leather, roller skates, a human-powered bicycle, a Model T Ford, a bullet train, a propeller airplane, or a supersonic jet? Because of the value it places on "saving time," the geographic-economic analysis on which transportation decisions are based favors the development of ever-faster travel modes. I believe that the obsession with speed of movement is the main reason that transportation has tended to be thought of in terms of technology and infrastructure – roads, bridges, buses, trains – rather than in more general terms as an enabling and constraining facet of life, a source of pleasure and exasperation, power and control.

Because movement between places reflects and creates their interdependence, economic and transportation geographers have been fascinated by the relationship between transportation infrastructure and the prosperity of places, between network characteristics and what goes on at network nodes. For example, the construction or improvement of transportation networks has long been at the core of regional development strategies, whether in Appalachia or Amazonia. The logic is that transportation networks shape the accessibility of places (how quickly and easily they can be reached), and accessibility shapes economic activity: more-accessible locations have more prosperous economies because lower transportation costs reduce both production and consumption costs there. Accessibility also enables economic specialization, another facet of wealth creation. Changes in transportation technology, such as the move from a footpath to a paved road, from bicycles to automobiles, or from rails to trucks, differentially affect the accessibility of places and thereby alter the space-economy. For example, the advent of paved roads and motorcars, which meant that dispersed rural populations could cover more distance in less time, spelled the demise of the smallest places, which had provided only convenience goods.

Because accessibility is seen as the *sine qua non* of economic prosperity, regional development strategies have sought to improve the accessibility of economically marginal areas like Appalachia by integrating them into broader-scale transportation networks. The problem is that prosperity has not always followed the construction of the transportation infrastructure designed to spark it. Some of the reasons for the failure of this relationship between transportation and economic activity to materialize will be considered in the next section.

Because of the close associations of economic prosperity with accessibility, accessibility with mobility, and mobility with large-scale infrastructure, governments have assumed a central role in the planning, financing, and building of transportation improvements. Clearly, private economic interests benefit differentially from these huge public investments, and some scholars (e.g. Whitt and Yago, 1985) have pointed to corporations as the initiators – and the prime beneficiaries – of transportation policy; arguing that the state has been ineffective in advancing and supporting the public interest. Transportation projects are ultimately about the public distribution of amenities (e.g. access, jobs) and disamenities (e.g. noise and air pollution, marginalization), and therefore such projects centrally involve issues of differential political power (Wachs, 1995). Because huge amounts of public money are at stake, transportation politics are lively. The politics of transportation funding were abundantly clear in the USA during the process preceding the 1998 reauthorization of the federal transportation legislation known as TEA-21 (Transportation Equity Act for the 21st Century, a six-year $215 billion bill).

Within economic geography, scholars have tended to think about transportation in utilitarian, instrumentalist ways; the pragmatic goal has been to move people, goods, or information from origin to destination as efficiently (fast) as possible. From the outset, the field has been heavily influenced by economics, with its premium on parsimonious explanation and its focus on the monetized value of time. Transportation geographers have tended to focus on the analysis of networks and the relationship between location in a network (and associated accessibility) and economic activity. Since its inception in the 1950s, the broader field of transportation analysis has been dominated by civil engineering and to a lesser extent by economists: they have seen their mission as informing policymakers of the best way to solve pressing and very real transportation problems, primarily congestion and the slower speeds that congestion brings. Nowhere has the search for a solution to congestion been more intense than in urbanized areas.

The study of movement in cities

According to those who focus on the economic advantages of agglomeration, the very existence of cities is due to the accessibility edge they provide over non-urban places. The ease of access offered by close spatial proximity yields positive technological and monetary externalities known as economies of agglomeration; that is, with greater density and diversity of economic activity, average production and consumption costs decline and the likelihood of technological innovations grows (Anas et al., 1998; Harrison et al., 1996). Agglomeration economies require high levels of accessibility and hence speed-enhancing networks. Congestion on those networks is the dark side, or the "diseconomy," of agglomeration. As in the

geographic-economic analysis of the broader economy, the urban transportation problem to solve thus becomes how to increase speed, especially during the morning and evening rush hours when transportation networks are clogged with people going to and from work. Transportation analysts have seen this as a technical problem requiring a technical solution, to increase network capacity, and often themselves have had a vested interest in promoting solutions that require the building of additional transportation infrastructure (Wachs, 1995).

The enshrinement of increased speed as the overriding goal of urban transportation planning is evident in one of the earliest US transportation studies, the 1959 Chicago Area Transportation Study: "The dominant objective of a transportation facilities plan . . . is to reduce travel frictions by the construction of new facilities so that people and vehicles . . . can move about within the study area as rapidly as possible." The legacy of this message remains strong, with analysts advocating policies that increase mobility rather than restricting it (e.g. Wachs, 1996; Dunn, 1998). This policy aim of increasing speed has guided the type of analysis conceived, the type of data collected, and the range of options considered.

In a refreshing critique of this view, John Whitelegg (1993) identifies the monetized value of travel time as the main culprit in urban transportation analysis and models of urban travel. These models are used to assess the costs and benefits of proposed transportation projects, including the costs and benefits associated with the "no-build" option. By placing a high monetary value on very small increments (e.g. five minutes) of time "saved," the models overemphasize the benefits accruing from the "time savings" resulting from additional lanes of freeway and have, as a result, promoted massive urban highway building.

The focus on congestion as the problem, and more lanes of highway as the solution, has indeed changed the physical and social infrastructure of metropolitan areas. This conceptualization of "the urban transportation problem" has not only fed decentralization but has led above all else to higher levels of automobile dependence, with attendant increased energy consumption and air pollution. Additional corollaries of abundant highway construction have been reduced use of public transportation, destruction of open space and wildlife habitats, more-dispersed journey-to-work patterns, increased racial and socioeconomic residential segregation, and greater inequities among social groups in access to employment (Cervero, 1995).

These changed patterns of urban form and urban travel also help explain the seeming paradox that despite increasing trips per capita, and growing trip distances, travel times have not changed. Suburbanization, supported with high-speed roads at the urban periphery, together with the shift of trips from transit (a slower mode) to auto (a faster mode) have helped to keep average travel times on the journey to work virtually unchanged from 1983 to 1990 (Gordon and Richardson, 1995). Downs (1992, p. 30) points to the ways that individual auto drivers, faced with recurring peak-hour road congestion, will change their behavior so as to keep their travel times from lengthening: they will shift the timing of their trips from peak to non-peak times, shift the routes they take, or shift from auto to transit during the peak.

Despite Gordon and Richardson's evidence of stable travel times, other researchers find substantial increases in urban highway congestion, and congestion remains a top concern in surveys of urban residents (Transportation Research Board, 1994).

The growth in number of households has outstripped population growth, contributing to increase in personal travel, and the growth of women's waged employment has fueled the demand for mobility. These factors have contributed to the dramatic growth in vehicle miles traveled (VMT) in the USA, up 62 percent from 1975 to 1990 (49 percent for passenger cars only) (Downs 1992, p. 10). Increased VMT together with the dearth of new highways being built are the main ingredients for highway congestion (Downs, 1992; Hodge, 1992).

Road building is no longer accepted as the panacea for congestion, as research has shown that added highway capacity becomes congested by the increased travel demand it stimulates (Sheppard, 1995). A good deal of attention is now directed, therefore, toward the question of how to reduce congestion without building more roads. Economists like Anthony Downs (1992) favor making drivers pay for road use, especially for the marginal cost of driving during times of peak congestion. He suggests using the pricing of roads, fuel, and parking to change people's behavior, especially to increase auto occupancy rates (i.e. more people per auto). Geographer David Hodge (1992) advocates reducing auto dependency through changing land use configurations, so that transit becomes a more attractive alternative. Other ways of reducing congestion that Hodge proposes are Transportation System Management (TSM), which aims to increase travel speeds through managing traffic light timing and ramp signals, and Transportation Demand Management (TDM), which involves reducing the number of autos on the road especially during peak hours via flextime, car pools, telecommuting, road pricing, and more costly parking fees.

Hodge's proposal to reduce congestion by making land-use patterns more supportive of public transportation reflects the fact that transit requires relatively high land-use densities. It also reflects a long-standing bias in favor of transit among urban analysts. During the 1960s and 1970s large public investments were made in public transportation systems, especially light rail systems, because transit was heralded as the solution to a variety of urban problems. It would create higher densities, reduce energy consumption, cut pollution, curb sprawl, eliminate congestion, enhance urban redevelopment, keep downtowns alive, and provide mobility for those without autos (Fielding, 1995). In short, planners wanted to use transit "to reshape the American landscape" (Snow, 1986, p. 45). In part because of this belief in transit as the city's salvation, transportation analysts have devoted substantial effort to studying the conditions under which people choose or might choose public transit over the auto, in order to identify policy changes that might induce a larger share of the traveling public to use public transportation.

Except in extremely dense urban environments, however, the accessibility advantage of the auto has meant that transit's share of riders continues to fall in most US cities. Although transit's share is higher for work trips than for other trip purposes, by 1990 only about 5 percent of US work trips were made on public transportation (US Dept. of Transportation, 1994). In the San Francisco area, for example, despite the construction of BART (Bay Area Rapid Transit), auto travel times to major employment centers have remained about 35 percent shorter than transit times (Giuliano, 1995). The light rail systems built in the 1970s have not succeeded in persuading large numbers of auto drivers to abandon their cars in favor of transit; in fact, most of those attracted to new rail transit facilities had previously ridden the bus (Fielding, 1995). Transit use in New York City, however, has recently increased,

owing in part to immigration and in part to a policy permitting free transfers between subway and bus.

Analysts have accepted almost without question that transportation technology shapes land use and urban form (Muller, 1995) as well as the broader settlement system (Borchert, 1967). Certainly urban and economic theories that base their explanations on accessibility predict that any change in the transportation system will have an impact on the spatial arrangement of economic activity. Yet studies at varying scales, from the sub-metropolitan to the regional, have had difficulty demonstrating that transportation investments such as the building of a light rail transit system, a highway, or an additional lane on an existing road, actually do transform land use patterns.

Genevieve Giuliano (1995) has carefully reviewed these studies and identified the many reasons why it is so difficult to show that a specific transportation improvement is responsible for a particular land-use change. First, initial investments (like building the first road through an area) produce bigger impacts than do subsequent investments (like adding a highway lane or another link in an already-developed network). The latter often make only marginal changes in accessibility and therefore can be expected to have only a marginal influence on land-use change (see also US Congressional Budget Office, 1998). Second, the availability (or lack) of developable land affects the magnitude of the impact that any transportation change can have: land use controls such as zoning regulations can constrain the land use changes that are possible. Third, the health of the regional economy is an important factor in determining whether a transportation investment will lead to higher-value-added economic activity. The transportation investments in Appalachia over the past several decades, for example, have not led to an economic boom there (Glasmeier and Fuellhart, 1999). Finally, it is often difficult to know whether any resulting changes in land use represent a net gain in wealth-producing activity within a region or simply a relocation of already-existing activity. This difficulty is part of a related problem, namely that of identifying the geographic scale at which any land use changes are likely to occur. Theoretically, a change in any part of a transportation network differentially alters accessibility throughout the entire network, facilitating land use changes in places quite distant from the site of the transportation investment.

Urban transportation studies have always had robust ties to transportation planning, land use, and engineering, which may account for their strongly pragmatic and positivist nature. A large portion of transportation studies has been aimed, quite literally, at telling decisionmakers where to lay the concrete. I do not wish to essentialize men or women, but I think it is not inconsequential that transportation analysis has been almost entirely a male domain. Perhaps this reflects the age-old association of travel with male adventures like those of Odysseus in the *Odyssey* or Inman in *Cold Mountain*; perhaps it reflects the association of transportation with infrastructure and heavy equipment, or maybe it's the mathematical bent of traditional transportation analysis. Nevertheless, as Kingwell (1998, p. 48) has noted, a fascination with speed speaks of desire for control: "Speed, we might admit, is our preeminent trope of control and domination." Traditional economic-geographic analysis has been hooked on speed, a legacy of its origins in the spatial analysis of the 1960s. Some transportation geographers have begun to question the valuing of

speed above all else, to ask who is served by such a goal, to examine the societal costs associated with a focus on increasing speed, and to propose alternative bases for thinking about transportation. In the next section I outline some of these emerging themes and argue for expanding the approaches to knowledge creation in transportation geography.

Emerging Themes and Approaches in Transportation Geography

How analysts define, or frame, a problem affects how they will design their analysis and, in the case of transportation issues, how policy options will be imagined. Although the transportation problem has been defined primarily in terms of the need for increasingly rapid mobility (or the need to conquer congestion), one might also envision a range of other ways of defining the problem. A few possibilities are: unsustainability, fossil fuel dependence, restricted choice, inequity, inflexibility, and poor health. Clearly, values are important: traditional transportation analysis has valued motorized over non-motorized modes, longer travel distances over shorter ones, independence and privacy over more-communal forms of living and traveling, mobility over access, efficiency over inequity. Some of the emerging themes discussed below are grounded in values that differ from that of speed and reflect, in part, the changed societal context within which transportation studies now take place. Before considering some of the emerging and potential research areas and alternative research approaches in transportation geography, I highlight a few of the ways in which the analytical context has changed.

Changed context

The societal context for transportation studies has shifted dramatically in a number of ways since the 1960s. Most important are changes in socio-demographics, attitudes toward the environment, the role of activists, the impact of information technology (IT), and concern about sustainability. Transportation-relevant socio-demographic changes in industrialized countries include aging populations, declining household size, altered household structures, changed gender relations, increased employment instability, and growing income polarization. Each of these shifts has implications for mobility needs and should affect how analysts think about transportation.

Environmental concerns, especially those of air quality and biodiversity, have become far more important in defining the context for transportation and land use modeling than they were in the 1960s. These concerns are reflected in an altered regulatory context, with the national government in the USA, for example, requiring metropolitan areas to meet federal air quality standards. Garrett and Wachs (1996, p. 25) maintain that air quality is now the prime focus: "Congress and the Environmental Protection Agency have concluded that air quality concerns should replace mobility considerations as the overriding factor in highway planning."

A third dimension of the changed analytical context is in the level and nature of activism around transportation issues. Grassroots citizen organizing and lobbying are far more sophisticated now than they were 30 or 40 years ago. The shift in US transportation priorities evident in the 1990s federal transportation bills (e.g. the

1998 TEA-21) is due in no small part to citizen activism. Although the bulk of federal moneys still go for highways, very little of that (less than 5 percent in TEA-21) goes for new roads, and the proportions for bicycle, pedestrian, and transit facilities are rising.

New information technologies describe a fourth dimension of the changed context. The growth of personal computers and the advent of the Worldwide Web have the potential to alter mobility needs and the demand for travel. The geographic and social unevenness of access to these technologies raises serious questions for transportation geography. In addition, GIS technologies, particularly their graphic capabilities, may change the nature of transportation research and the relationship between planners and citizens (Elwood and Leitner, 1998).

A final element of the changed context within which transportation analysis now takes place is that the sustainability of current transportation practices is now a subject of debate. In particular, the many dimensions of extreme auto dependence and the increased scale of movements are increasingly questioned. Taken together, these aspects of the changed context open up new possibilities for transportation geography. In particular, they point to the importance of cultural discourses in shaping transportation-related behaviors, decisions, and policies.

Emerging themes

The changed transportation context makes clear how little we know about some very pressing transportation-related questions and how great is the need for a reinvigorated, critical, transportation geography. In this and the next section I outline a few of the themes and the approaches to knowledge creation that might form the basis of such investigations. The themes can be broadly grouped into issues of sustainability and IT impacts. Crosscutting these is the need for research on transportation issues in the so-called developing world and on the crucial role of mobility in constructions of class and gender.

What are the full costs and benefits of a society predicated on the auto, and who bears these costs? In traditional planning calculations of the expected costs and benefits of a proposed transportation investment, social costs or externalities (such as air, noise, and water pollution; death or injury from accidents; the loss of open space) do not appear on the cost side. In recent years scholars have tried to assess the social costs of the automobile by putting a monetary value on these externalities (see Murphy and Delucchi, 1998, for a review and evaluation of these studies). Delucchi (1997) has estimated that the social cost of the auto in the USA in 1991 ranged between $8,791 and $17,352 per registered vehicle. These figures include costs not borne by drivers, such as those associated with congestion, air pollution, accidents, noise, police, and climate change. Although many drivers believe that their gasoline taxes fully pay for highway construction and maintenance, in the USA gas (fuel) taxes and other user fees cover only about 60 percent of federal, state, and local spending on highways and roads; the remainder comes from general funds, property taxes, and the like. In other words, non-drivers (who are more likely to have very low incomes) subsidize drivers. When social costs are included in the calculations, drivers bear only about 25 percent of the total cost of their transportation; the rest is borne by employers (especially for parking at the workplace), tax payers,

and unborn generations. These studies and figures pose a host of research questions not only about the equity of the current system but also about its long-term sustainability (see Transportation Research Board, 1997; Vasconcellos, 1997a, 1997b).

What are the prospects for sustainable transportation? Which elements of the current system are more or less sustainable, and why? Despite their importance, these questions have received relatively little research attention. Whitelegg (1993) sees sustainability as essentially an issue of scale, requiring slower, smaller-scale movements and the consumption of locally produced products. He would consider Ruby's community-contained world sustainable! Arguing that the dominant transportation paradigm amounts to the "conquest of distance by the destruction of time," Whitelegg (1993, p. 77) also decries the "time pollution" of a speed-craving, and in some ways speed-dependent, society. That is, the more we try to save time via faster movement, the less time we have and the more harassed we feel. In addition, the more we emphasize time savings, the more the transportation system becomes skewed toward meeting the needs of the wealthy (car owners) at the expense of those who rely on more-sustainable, non-motorized means of travel. Vasconcellos (1997a) stresses that equity, especially for non-motorized modes, is a necessary component of any truly sustainable transportation system. Activists, too, have resisted the dominant philosophy of speed and promoted the benefits of slow mobility through "traffic calming" (infrastructure changes like road bumps and narrowed streets that enforce slower vehicular speeds) and through bicycle- and pedestrian-oriented settlements (see the newsletter of the Surface Transportation Policy Project, a US lobbying organization, at www.transact.org).

Activists have been instrumental in placing another sustainability concern – air quality and the air pollution stemming from transportation sources – on the research agenda. Worldwide, the transportation sector contributes about one-quarter to one-third of all carbon dioxide emissions (Transportation Research Board, 1997). Current US laws, requiring metropolitan areas to meet air quality standards, put pressure on transportation agencies to increase auto occupancy rates, raise public transport ridership, boost bicycle and pedestrian travel, and reduce automobile vehicle miles traveled. In a recent San Francisco legal case, brought by the Sierra Club and other citizen groups, the court ruled that local planners must predict the air quality impacts associated with transportation policies (Garrett and Wachs, 1996, provide a full discussion of this fascinating and important case). Current transportation models are not designed to make accurate and reliable air quality predictions, however, and incorporating such predictions into the modeling process will be extremely difficult.

Policy questions also swirl around the air quality issue. Policy analysts see two ways of reducing emissions: change transportation technology (via cleaner fuels, electric cars, lighter vehicles) or change travel behavior (reduce vehicular miles traveled, shift people from single-occupancy to high-occupancy vehicles, increase transit ridership and walk or bike trips). Debate thrives over how best to bring about behavioral change, whether through the market (mainly via the pricing of road use, parking, and fuel) or via regulation (e.g. gas rationing, restricting auto use at certain times or places. See Downs, 1992). Critics like Whitelegg, however, argue that neither regulation nor market-based solutions will yield more sustainable transportation

because they will not create exclusive spaces for cyclists and pedestrians. I would argue, moreover, that the role of discourse in shaping policy options needs more explicit recognition. Radical activist groups like Critical Mass, which aims precisely at improving conditions for cyclists, fully understand the policy relevance of altering the public discourse around transportation, and strategize accordingly (Blickstein and Hanson, 2000).

The energy (fossil fuels) consumed in transportation is another source of both concern about the sustainability of the current system and of important unanswered questions. Because aggregate data show a relationship between land use density and distances traveled, and between density and energy consumed, the creation of higher-density settlements via land use planning is commonly viewed as a way to reduce energy consumption. Breheny (1995) asks how much urban decentralization in the UK increased energy consumption between 1960 and 1990. In one simulation, he estimates that if all 1960–1990 growth had been as evenly distributed over the settlement system as it was in 1960 (i.e. if no urban decentralization had taken place), the transportation energy saved would amount to only 2.5 percent. He concludes that the energy savings associated with urban compaction, a policy widely favored in the UK but difficult to implement, are relatively small. Surprisingly little is known about the relationship between land use configurations and energy consumption, making this an important emerging area of research, especially for those interested in sustainability.

Another vital area of emerging research concerns the intersection of information technology (IT) and grounded social relations (those requiring face-to-face contact): how will these two forms of interaction shape each other (Hanson, 1998)? Questions abound: What is the impact of IT on the need for mobility? Does IT enable access without mobility? Is distance dead? As more interactions take place in virtual (cyber) space, how can we conceptualize and measure accessibility in an information age? It is clear that such measures must take into account access to information technologies (both hardware and software) as well as access to cyberplaces within those technologies (Hodge and Janelle, 2000). An important set of questions surrounds the equity impacts of IT (see also Warf, this volume). How, for example, is IT related to geographic and social marginalization: does it alleviate or reinforce inequities? I have argued that answering this question requires recognizing the embeddedness of physical and cyber interactions in (usually grounded) social relations, and exploring how new technologies intersect with, as well as help to shape, these social relations (Hanson, 1998).

As the Worldwide Web expands exponentially and people increasingly shop, visit, work, and entertain themselves on the Internet, what kind of geographies will these kinds of interactions create? In a world where the friction of distance held sway, speed shaped commerce and commerce, in large part, shaped places. Kingwell (1998, p. 41) suggests that the kind of speed that IT underwrites stands in a different relation to place-creation: "Speed's annihilation of time and place means, finally, speedy annihilation of places – and times. The inner logic of technology is not technical but commercial, and within the logic of commerce, location is an increasingly meaningless concept. We confront, now, a new topology, a world of instant and direct contact between every point on the globe." Who, if not geographers – and especially transportation geographers – will explore these momentous processes?

Sheppard (2001) and the articles in Hodge and Janelle (2000) are excellent points of departure for this exploration.

The final two emerging themes cut across and through the others. The first of these is that of examining access and mobility questions in the so-called developing world (Leinbach, 2000; Vasconcellos, 1997a, 1997b). Such studies are needed for a more truly international understanding of transportation and mobility. The world's population is predicted to grow from the current six billion to nine billion people by 2050, and almost all of this increase is expected to be concentrated in cities outside Europe and North America (United Nations, 1993). All of the sustainability issues raised above are thrown into relief by these stark – and extremely likely – forecasts. As Vasconcellos (1997b) points out, South American cities have suffered from the wholesale adoption of North American approaches to transportation. Leinbach (2000) argues for rethinking the relationship between mobility and development, and suggests several high-priority questions for research. Economic and transportation geographers could contribute enormously to the sustainability transition by helping to increase understanding of alternatives to the US transportation-settlement system. What might US planners and decisionmakers learn from the experiences of the so-called developing countries? Enriching the research base outside of Europe, North America, and Australia could be part of a more self-consciously geographic approach, focused on the importance of context and place-to-place differences.

The other cross-cutting theme is the need to comprehend how mobility and transportation issues shape understandings of class and gender. Vasconcellos (1997b), for example, argues that transportation technology is embedded in contemporary patterns of social reproduction, and that consequently, especially in developing countries, the car is essential to the reproduction of the middle class as a class: if middle-class people were to use their legs or transit to conduct their daily activities, they would no longer be middle class. In their study of local labor markets, Hanson and Pratt (1995) show how mobility is implicated in the construction of gender. For example, the many women who had accepted primary responsibility for child rearing in their families chose waged jobs located close to home and schools so that they could be easily accessible to their children in an emergency. Employers reinforced such gendered mobility constructs by preferentially hiring women with shorter commutes and men with longer ones. Are women's lives truly more localized, as the *Odyssey* and *Cold Mountain* imply? How are changes in mobility related to shifting conceptions of gender and class?

Approaches to Creating Knowledge

If transportation geography is to become central again to economic and human geography, it must broaden its methodological and epistemological repertoires. The economic and engineering approaches that have long dominated the analysis of transportation issues need to be supplemented with other ways of understanding, such as those grounded in historical and cultural analyses. For example, the story about transportation and land use changes is often one starring technology (see, for example, Muller, 1995), but where do these technologies come from? Why are certain ones adopted while others are neglected? What determines how a technology will be used? In tracing out the origins of Los Angeles' low-density, freeway-reliant

settlement pattern, Martin Wachs (1996) highlights the role of an ideology that associated modernity with the antithesis of the dense industrial city and equated the modern with a low-rise urban profile – the city in a garden. Also important were historically specific conceptions of what is environmentally sound: in 1920s LA, the auto and the bus were presented as more environmentally benign than railways. Wachs's analysis raises questions about the origins, development, and impact of such ideologies and discourses. That is, being open to new modes of analysis means opening up new areas of inquiry.

As another example, cultural, feminist, and historical analyses have begun to expand understanding of the role of movement and mobility in identity formation (e.g. McDowell, 1999, chapter 8). In the quote from *Cold Mountain* at the outset of this chapter, we saw in Ruby an example of an individual who constructed her identity in terms of [im]mobility. As scholars have shifted their view of the subject from one based in a unitary and stable identity to one assuming multiple and fluid identities, movement has become key. Excavating the values embedded in current transportation practices – and proposing practices based in different values – is another important form of cultural and historical analysis that deviates significantly from the traditional positivistic approaches of transportation geography (Whitelegg, 1993; Vasconcellos, 1997a). The transportation research agenda should include opening up and critically evaluating core concepts like accessibility, mobility, density, and sustainability, as well as understanding the role of cultural and political discourses in shaping transportation alternatives.

These and many of the emerging themes discussed in the previous section are best tackled from a variety of epistemological and methodological perspectives, including qualitative approaches as well as the quantitative ones that have long dominated the field. Opening transportation geography to cultural, historical, and feminist modes of analysis will deepen understanding, and holds out the hope of pointing the way toward more-sustainable transportation practices.

Conclusion

Issues of access and mobility always have been and will continue to be central to understanding space and place. When geography sought universal explanations, built around the friction of distance, transportation geography was at the core of economic and human geography. As the discipline has moved from a concern with universal theories to mid-level theories, and from embracing logical positivism to post-positivist and interpretive epistemologies, transportation geography has lost its disciplinary centrality, largely because it has remained within the analytical framework of the 1960s. Although this may in some small part reflect the lower relative importance of transportation costs now compared to 40 years ago, I think it is mostly due to a reluctance to adopting a critical stance vis à vis the reigning transportation paradigm of ever-increasing speed and embracing a broader spectrum of epistemologies and methodologies.

A changed research context – most notably the need to understand the access- and mobility-related dimensions of sustainability and IT and transportation processes outside of OECD countries – presses new questions upon transportation geography. Recognizing the complexity of transportation-related issues and the importance of

context calls for deploying diverse approaches to creating knowledge. Scholars and activists have begun speaking for values other than those of speed and wealth creation, and for strategies other than road building. By focusing on far more than the friction of distance, geographers have much to contribute to the many important questions that hinge on movement, access, and mobility – in short, on transportation.

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