To Curb the Car Culture?

The Future of Auto Use in the Urban Environment

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1.0 Introduction and Background

The open road. The cloverleaf. The commute. The two-car garage. Eight lanes of pavement cutting across the landscape. Tracks of look-alike suburban housing. Empty buses. Abandoned buildings downtown. Smog. All of these images have been influenced by the rise in use of the private automobile, a phenomenon which invaded the North American urban system in the decades following the Second World War (Newman & Kenworthy, 1996; Vance, 1991) . The car's influence exemplifies the bi-directional relationship of transportation technology, use, and demand with land use patterns in the urban environment (Southworth, 2001; and others). Historically, transportation technologies have always influenced the form which the urban environment has taken; the resultant form has then further influenced the use of transportation modes. In the post-1945 period, the rise of the automobile as the mobility and accessibility device of choice for the masses impacted the urban environment in new and still evolving ways. It has been argued that the car has even managed to "break" this land use-transport connection (Newman & Kenworthy, 1996) which has evolved with urban growth and development for the entire history of the modern city system (Vance, 1991). The problems and benefits of the private automobile and their resultant impacts on the style of urban form are examined here. While, ideally, the goal of some might be to eliminate the car's role to reverse its perceived negative externalities, the private automobile has come to symbolize in an abstract and practical way true freedom of mobility (Banister, 1999; Dunn, 1998; Friedman, 1989). The car dependent shift has also led to a tremendous capital investment in the built environment of North American cities; there is an inertia in the infrastructure which is auto-dependent and cannot be easily modified to use without the car's flexibility. The car must, therefore, be included as a part of the solution to the transportation concerns of contemporary urban form. The challenge becomes how to best bring this about while managing its externalities and deciding what role the car should have in future urban growth and development.

1.1 The Land Use-Transport Connection: A Bi-directional Feedback Loop

The connection between the land use in a particular built-up region and the transportation of that region is an intimate one. Historically, since the beginnings of urbanization in 1800, these transportation-settlement relationships have existed (Vance, 1991). Throughout history, the concept of "technological relativity" has been important in determining human movement. The form of the urban entity has evolved relative to the prevailing technology of the period. The journey to work has historically been a key trip in the city and it has been established that, regardless of technology, this travel is never more than about 30 minutes of time (Newman & Kenworthy, 1996). The transportation technology-urban form relationships are discussed chronologically in the section which follows.

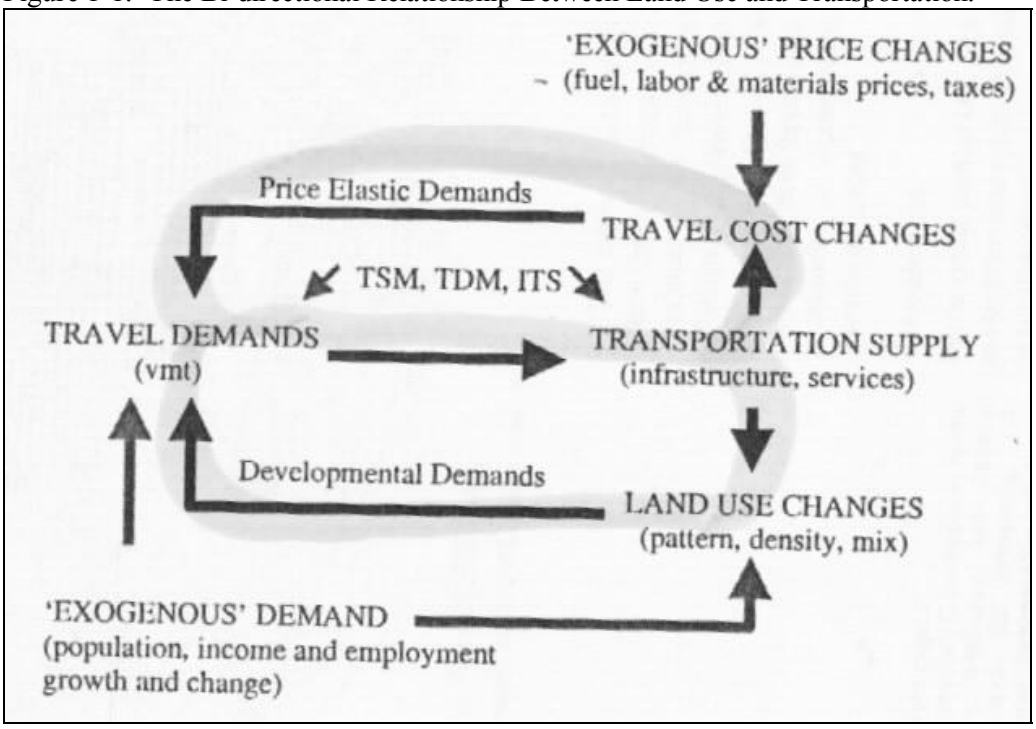
The land use-transport relationship is very much a bi-directional one. It might also be described as a 'chicken-and-egg' problem. While the characteristic urban form directly influences transportation types, choice, demand and service, that transportation then influences future decisions on urban form. Transport determines the most connected and accessible locations, which determine the value of land as it relates to the access to transportation. This land value, in turn, influences the spatial pattern of land uses in the city. Density itself has the function of reducing transport costs (Glaeser, 2000). Of course, beyond the pure bi-directional feedback system, there are also external influences to the relationship. Among these include changes determined due to demographic influences and those determined by market forces and governments (prices of fuels, taxes, planning policy, etc.). Southworth (2001) describes this relationship in terms of the factors which influence the growth of vehicle travel; Figure 1-1 shows the land use-transportation connection and some of its external influences.

1.2 Transportation Constraints on Urban Form: An Historical Perspective

The Walking City

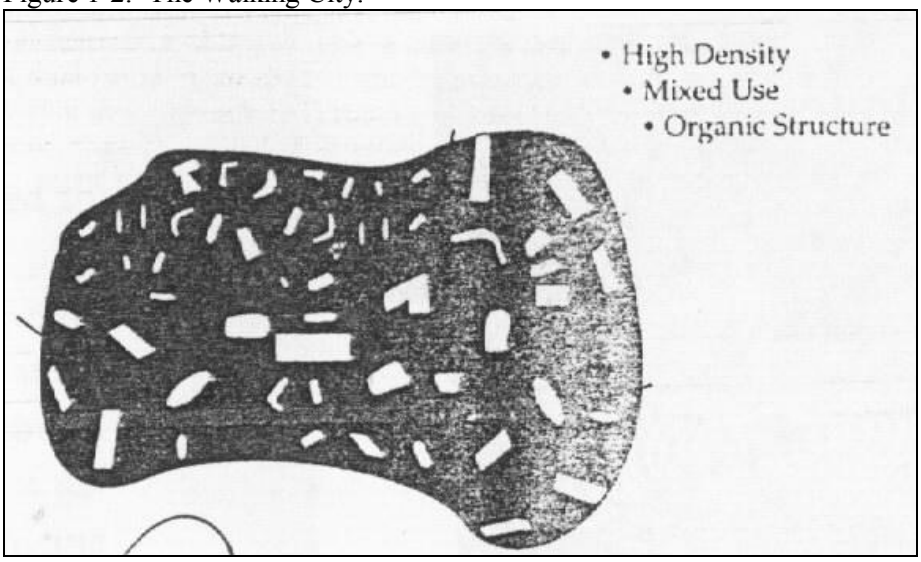
In the "walking city" (Figure 1-2), the urban form is determined by the prevailing transportation technology of early cities, i.e. walking on foot (Graham & Marvin, 1996). Since people's ability to walk is limited in length and distance, the earliest cities took on a very compact form (Vance, 1991). The mix of uses and rather haphazard layout are characteristic of this type of urban form (Newman & Kenworthy, 1996). The early agglomerated businesses drew upon workers living in often poor conditions within a short distance of the work location (often near harbours or other watercourses which served as the basis of the early mercantile city) (Graham & Marvin, 1996). The more well-off also lived close to the centre to be near the heart of cultural and social life in the city (Vance, 1991). In summers, when health conditions became poor due to the crowding and pollution of factories, the well-to-do could escape to country estates (Friedman, 1989), representing the first emergence of a sort of 'rural-urban fringe'.

Figure 1-1. The Bi-directional Relationship Between Land Use and Transportation.



Source: Southworth, 2001, Figure 2.

Figure 1-2. The Walking City.



Source: Newman & Kenworthy, 1996, Figure 1.

The Early Transit/Omnibus City

As independent entrepreneurs soon discovered they could make a business of providing transportation, horsecarts began to establish fixed or non-fixed runs along major routes in the early city (Kunstler, 1993). Eventually routes began to expand out from the city along major country roads, sometimes establishing connections to nearby settlements in the surrounding rural regions (Figure 1-3); this is the beginning of the era characterized by linear, radial spread from the centre (Newman & Kenworthy, 1996). With the advent of rail-based streetcars, the lines became more permanent and speeds improved, allowing people to expand further outward along extended lines into commuter villages, while still taking the same time to travel to the inner city (Kay, 1998). At this time, transit could only be afforded by the middle and upper middle classes. The ordinary factory worker still relied on living close to the factories. Thus, the central city remained a major focus of employment and retail, and the residential area for low-wage workers (Vance, 1991). Immigrant groups also entered the city, often establishing themselves in homes vacated by those who had moved up or out of the city in housing (sometimes referred to as 'filtering' and associated with 'incumbent upbringing' of inner city housing).

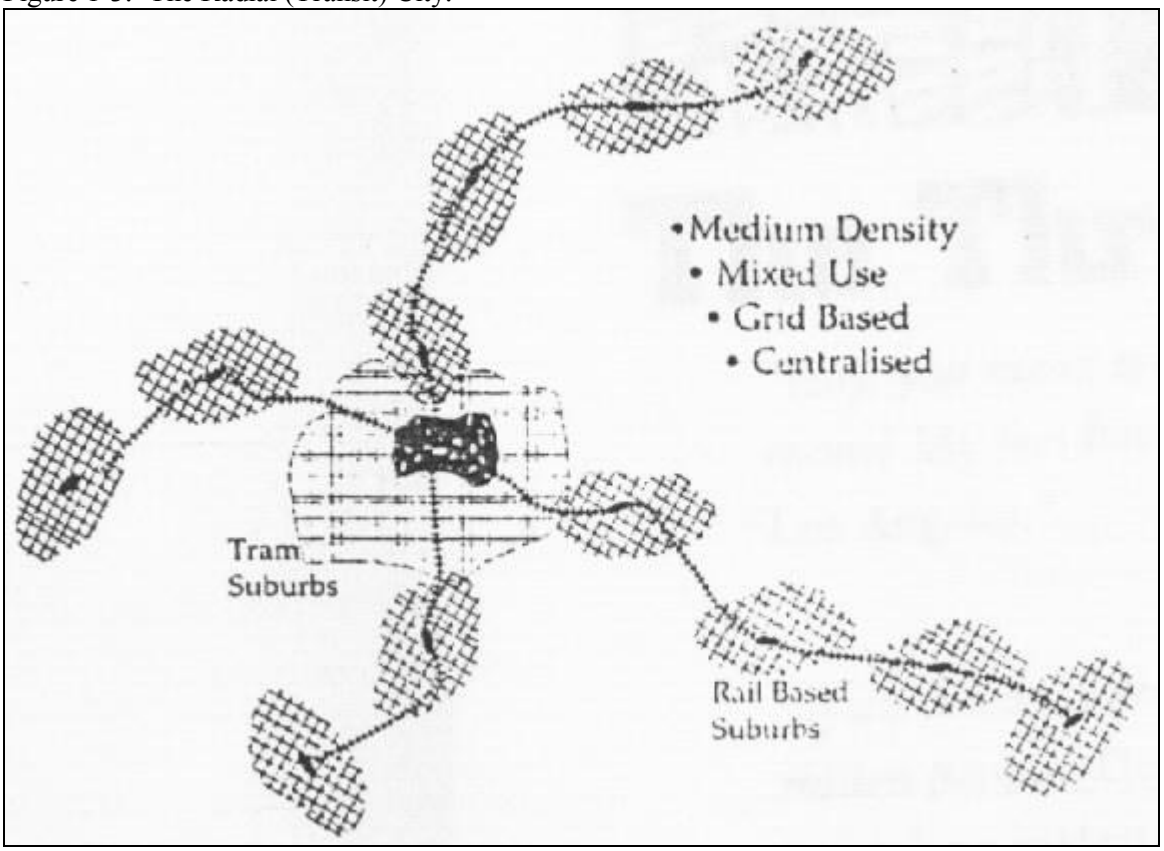
Transit - The Radial City to the First Sprawl

More rapid transit (subways in the largest cities) and the introduction of mechanized transit vehicles (i.e. buses) in the early 20th Century allowed both longer and more flexible routing of transit. This facilitated further outward growth beyond the earlier 'streetcar suburbs' to areas even further from the centre. The flexibility of buses on the existing road networks even allowed transit service to become less radial and more integrated across areas in between the old streetcar and rail lines (Vance, 1991). Areas in between, while still at higher densities relative to many of today's suburbs could be built less densely, since a much larger area of the urban envelope could have access to downtown with the use of the motorized bus.

Transit-Auto Mixed Development

In the inter-war years and particularly following WWII, the use of the auto for more than recreation was evolving (Newman & Kenworthy, 1996). It began to be a tool for everyday movement. Through unionization and the emergence of Fordism, the blue-collar middle class emerged as a major new market for the private automobile. Along with government encouragement in the form of low-interest mortgages and the massive building of urban roads, freeways, and inter-city routes (interstates, the 400 series highways in Ontario, etc.), private developers began to build large-scale, low density developments on the edges of cities exclusively for the new auto users (Kay, 1998). Of course, in most cases, these developments were built entirely around a dependence on the private automobile as a symbol of freedom of mobility and the rise of the consumer society in North America.

Figure 1-3. The Radial (Transit) City.



Source: Newman & Kenworthy, 1996, Figure 2.

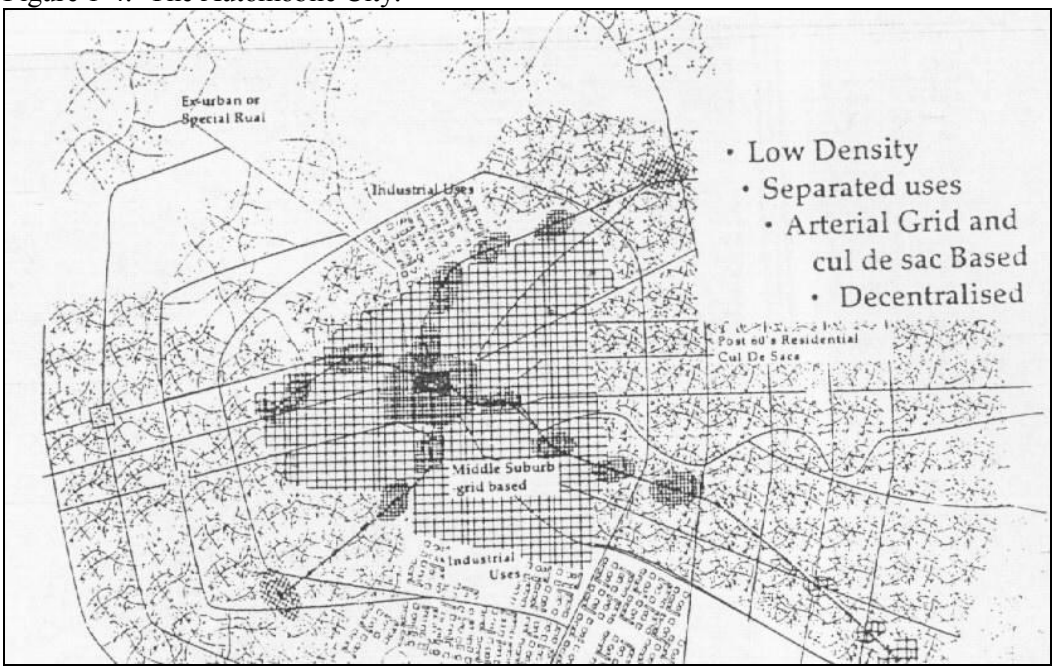
The Auto-dominated City

The massive public and private investments in a car-focused society, car-dependent settlement, and the socio-psychological draw of the car culture led to a mass exodus from the once successful public transit systems across North America. While U.S. systems were particularly hard hit, even Canadian systems had to switch to government operation, with large subsidies and operating deficits to remain operating. Most new development in the 1950s, 1960s, and early 1970s was car-focused in the so-called "car-burb" (Kay, 1998, p.2) (see Figures 1-4 and 1-5). The strip retailing, low-density curvilinear subdivisions, and the regional mall (now 'power centre') all emerged as meccas to the auto-consumer society. The outward growth at levels faster than that of population meant a population exodus from many North American inner cities and core areas. Retailing, industry, and the population itself left the old city for locations in the suburbs which could be built ready made for auto use. There it could be segregated to prohibit conflicting uses which, it was argued, had made the central cities dirty, unsafe, and uncomfortable places to be in past years (Friedman, 1989; Newman & Kenworthy, 1996; Vance, 1991).

According to research, low density and so-called 'leapfrog' styles of development, spatial segregation of uses, the auto dominance of the landscape, and commercial strip development are all associated with the definition of urban sprawl and all are linked strongly with increasing auto use over other transportation alternatives (transit, foot, cycling) (Southworth, 2001). Overall, density is a key determinant in automobile dependence (Raad & Kenworthy, 1998) (see Figure 1-6) .

The automobile enabled maximum flexibility in the road network. Car travel allowed the individual to travel to his/her needs with much reduced limits in personal time and cost (Vance, 1991). In fact, the relationship of urban concentration to the need for reducing costs of movement became substantially weaker. The land use-transport connection has been dramatically altered by the private car, since it substantially reduces urban form's ties to transportation limitations -- urbanization can take almost any form given the car's flexibility. This bi-directional relationship, therefore, is out of balance. And the private automobile comes also with a host of other problems which have arisen despite initial thoughts that the car would be the saviour to urban transportation and mobility constraints (Kunstler, 1993).

Figure 1-4. The Automobile City.

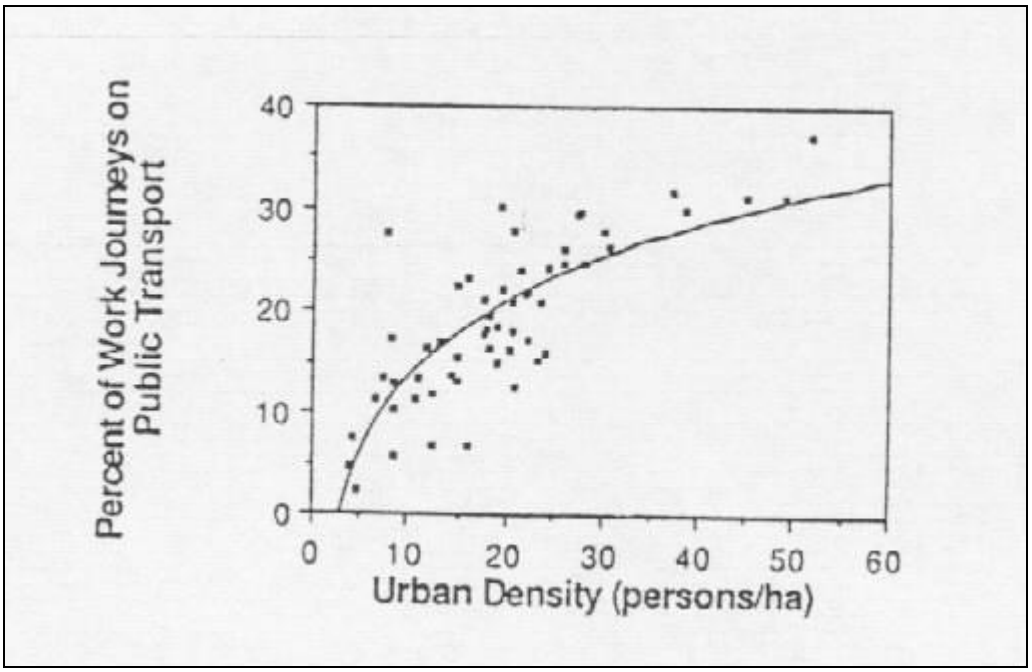


Source: Newman & Kenworthy, 1996, Figure 3.

Figure 1-5. Car-Dependent Urban Settlement. An example of auto-dependent suburban sprawl: single family housing; curvilinear, hierarchical streets; low densities with open space; encroachment on surrounding rural land.

Source: Kay, 1998, Chapter 12.

Figure 1-6. The Importance of Density in Auto Dependence. As density decreases, there is an accelerating decrease in the use of transit as an alternative.



Source: Newman & Kenworthy, 1996, Figure 4.

2.0 What's Wrong With the Private Automobile?

Although auto dependency is a part of most North American urban space at the turn of the 21st Century, there are a number of difficulties which have arisen due to the characteristics of a built environment that is so car-centred. Despite this, there are obviously benefits of auto ownership, evidenced by the fact that auto use has become so prevalent for urban movement; after all, if the masses did not view it as a beneficial technology, would its use have become so overwhelming a part of our culture? With evolving technology, in fact, and a future dispersed "tele-city", any remaining physical flows may depend on the car due its flexibility.

2.1 Auto-dependent Urban Form: Negative Externalities

Some of the impacts of auto-dependent urban form are listed in Table 2-1. These generally fall into the broad categories of social, environmental, and economic impacts.

Social Polarization and Mobility Inequity

The suburban form, particularly the move toward separation of uses and the development of large tracts of similar housing, has led to a spatial segregation of income classes (Raad & Kenworthy, 1998; Safdie & Kohn, 1998; Vance, 1991). The formation of a 'dual city' (Castells, 1989) results in those of middle and better incomes becoming largely located in socially-stratified suburban neighbourhoods, and those of lower income, who need access to transit and/or cannot afford auto travel or new housing being left behind in the central city. The spatial separation of a "wall of poverty" (Kay, 1998, p.43) can lead to a lack of understanding of diversity, lack of empathy and political attention towards social problems, and general social intolerance. Glaeser even argues against a continuation of redistributive spending to reduce spatial social disparities, arguing that it will hurt the future role and competitiveness of a city (2000).

As Kay notes, "A racist and inequitable society heightens poverty. A car-dependent one underscores and enhances the divide with a lack of mobility" (1998, p.37). Many of those who cannot afford the private car, those who have not obtained a licence yet (teenagers), and older people who can no longer drive for health reasons can be left trapped in a car-dependent world (Newman & Kenworthy, 1996). With the erosion and inadequacy of public transit to serve most low-density areas (Pucher, 1998) large urban and suburban areas, where employment, retail, and housing has moved, remain inaccessible to a significant part of the population (Dunn, 1998; Durlak, 1994; Ewing, 1997; Kay, 1998). This population represents nearly 35 per cent of Americans, according to Kay (p.33). This inequity in mobility and accessibility serves to further divide the social structure of the urban environment: the old, the young and the poor lose their independence while the auto-owning public enjoys an entrenched societal bias toward the car. Suburban developments are "built with the assumption that almost everyone over the age of 16 owns a car" (Raad & Kenworthy, 1998, p.19); "it is a practical impossibility to go about the ordinary business of living without a car" (Kunstler, 1993, p.114).

Loss of Social Interaction

Another social concern is the car's replacement of personal interactions on the retail street and in the neighbourhood (Kunstler, 1993). In car-dependent environments, the car is the main device of interaction, often through aggressive encounters associated with congestion, or through the visible symbol of the two-car garage which greets visitors to the prototypical suburban house (Kay, 1998). Removing the people from the street, according to urbanists like Jane Jacobs (1961), removes the 'eyes on the street' and can lead to more intimating streetscapes, higher levels of crime, further disamenity with the traditional urban environment and a greater draw to what is perceived as the pleasant, green, safe suburbs. Car use "accentuates an environment of exclusion" (Kay, 1998, p.51) and leads to a reduction in the sense of community (Ewing, 1997).

A loss of social interaction can also contribute to denied opportunities for innovation. Face-to-face contact is an important force in making decisions and in generating ideas (the concept of 'implosion' or Glaeser's "creative milieu" [2000, p.14]).

Connected with this loss of social interaction is also an increasingly declining connection with the city. The city's sense of scale and the private space devoted to the car have increased in response to auto-dependency (Friedman, 1989; Safdie & Kohn, 1998).

Environmental Costs

The predominant use of the automobile for urban transportation is also associated with global problems of environmental pollution and modification (Dunn, 1998; Kay, 1998). The transportation sector is a major source of greenhouse gases in North America, associated with scenarios of global climate change. Car use is also associated with localized damage of water and soil as well as reductions in overall city attractiveness (Banister, 1999). High levels of salt use in the more northerly climates also causes damage to water and habitats. In their production, use and disposal, cars release tons of carbon monoxide, hydrocarbons, and PCBs, just to name a few (Kay, 1998).

The suburban style of building which occurs in tandem with auto-dependency is associated with growth that removes thousands of hectares of land from existing uses. Loss of important agricultural land (especially in the farming belts of the U.S. and Southern Ontario) is cited as an important impact (Ewing, 1997). Automobiles' use of fossil fuels is also depleting non-renewable natural resources (Safdie & Kohn, 1998), not to mention driving an increasing overseas dependency for oil (Kunstler, 1993).

Infrastructure Costs and Subsidies

The tremendous costs associated with low-density transportation infrastructure maintenance and new building represent significant amounts of public money diverted toward auto-based mobility solutions (Ewing, 1997; Litman, 1998; Southworth, 2001). Governments subsidize auto infrastructure, and have a history of encouraging suburbanization with 1940s and 1950s programs to provide reduced-cost mortgages for new home buyers (Kay, 1998; Kunstler, 1993) and build extensive urban and inter-urban expressway networks (Dunn, 1998; Kunstler, 1993; Vance, 1991). While the average cost per year for auto ownership borne by the owner is about $6000, there is an additional $3000-$5000 in external costs borne by society to operate each car each year (Kay, 1998, p.120).

At the same time as governments have subsidized and otherwise supported auto use and their associated styles of development, support for transit has not been nearly sufficient to make it a viable alternative. Subsidization and public takeovers did increase through the 1960s and 1970s as the transit industry could not longer afford to compete. Through the 1980s and 1990s, transit subsidies stagnated or were reduced (Pucher, 1998).

The combined impact of a reduction in the provision of transit and massive subsidies toward auto-dependency have only encouraged further auto-focused urban form and the car's other externalities. In recent years, with the decreasing role of government support combined with rising demands, infrastructure investment and maintenance even for the car is now suffering; however, turning to alternative modes is no longer possible, since the built environment is now so heavily auto-dependent.

Economic Impacts: Congestion

The focus of movement using the private auto has meant, combined with increasing demands for movement in increasingly flexible ways and with longer travel times, an undercapacity for existing auto infrastructure. With governments' reduced ability to fund such projects, congestion is becoming a major economic impact; it represents $168 billion per year in lost productivity in the U.S. alone (Kay, 1998, p.121). Congestion is leading to lost time and lost money, not to mention social impacts such as aggression, accidents (leading to higher health costs), and road rage.

When infrastructure *is* put in place, the car-dependent environment can suffer the situation of 'if you build it they will come', resulting in congestion only increasing with increased capacity. Wider roads, new expressways, and new exit ramps only increase the ability of people to further disperse and still travel the same time to their destination (Kay, 1998, p.15; Safdie & Kohn, 1998; Southworth, 2001). Thus, auto-dependency's congestion can turn into a vicious cycle of positive feedback which only reinforces the problems, and creates others.

Table 2-1. Problems of Auto Dependence.

Table 2. Problems of automobile dependence.

Environmental	Economic	Social
Oil vulnerability	External costs from accidents,	Loss of street life
Photochemical smog	pollution, health impacts . . .	Loss of community
Lead, benzene . .	Congestion costs, despite	Loss of public safety
High greenhouse gas	endless road building	Isolation in remote -
contributions	High infrastructure costs in new	suburbs
Urban sprawl	sprawling suburbs	Access problems for the
Greater stormwater problems	Loss of productive rural land	carless and those with
from extra hard surface	Loss of urban land to bitumen	disabilities
Traffic problems – noise,	Loss of time due to sprawl,	
severance	increasing distances	

Source: Newman & Kenworthy, 1996, Table 2.

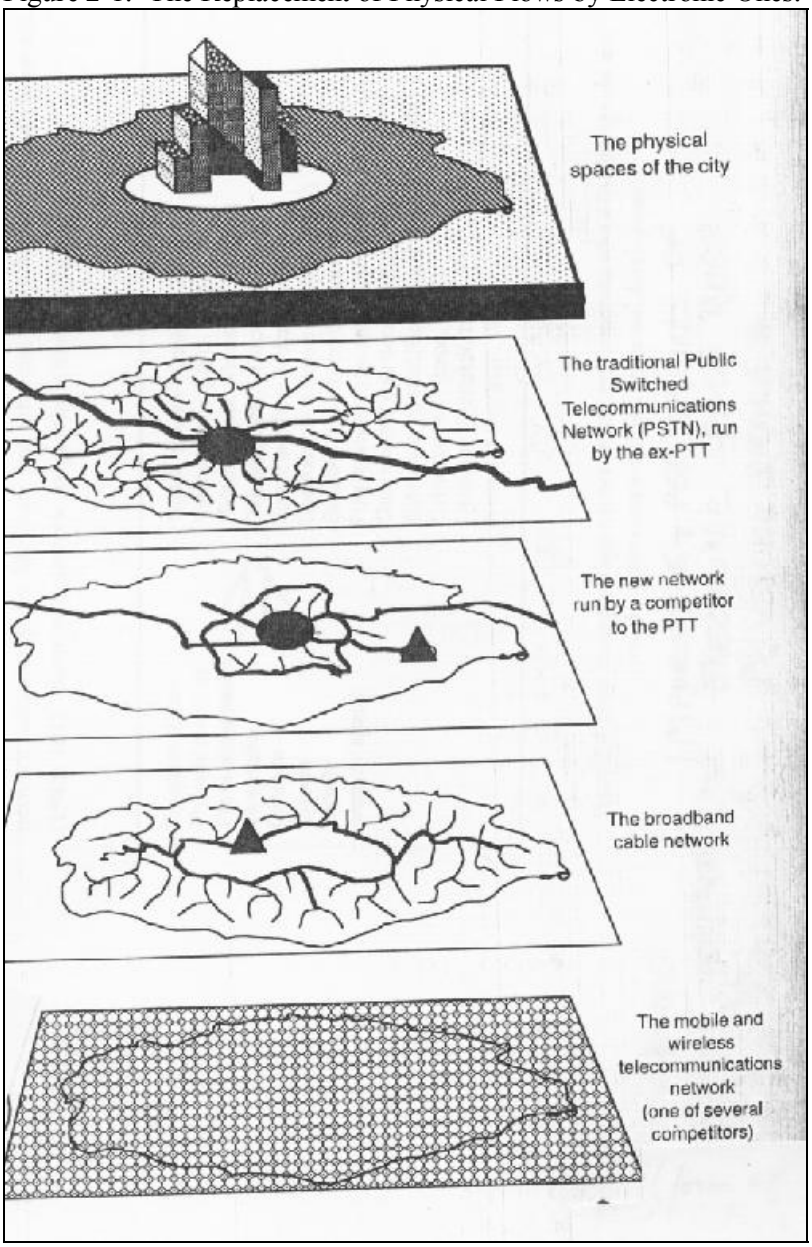
2.2 The Car as the Solution...or Part of It?

Telecities: The "Death of Distance"?

In an increasingly computerized world, it can be argued that physical flows will be increasingly replaced by electronic ones (refer to Figure 2-1). The virtually instantaneous connectivity provided by the World Wide Web, email, tele- and video-conferencing can allow people to entirely overcome the constraints of distance. In such a world, physical flows and the need to reduce transportation costs by concentration of settlement would be essentially obsolete (Dunn, 1998; Glaeser, 2000; Gordon & Richardson, 1997). This "death of distance" created by telecommunications technology can be used to suggest that the externalities of the private auto need not be addressed, since car travel will be reduced by the 'technological fix' of telecom (Cairncross, 1997; Graham & Marvin, 1996). And in such a world where distance has no meaning, concentration will not be required; settlement and economic activity can be entirely dispersed through tele-commuting, telework, the 'electronic cottage' and the 'home-based society' (Graham & Marvin, 1996). The city as a physical entity can cease to exist and instead be replaced by on-line 'communities' (Castells, 1989) (see Table 2-2 for old versus new descriptions of urban space). If settlement were to develop in such a manner, any physical flows remaining would almost certainly have to be accomplished by car, since dispersion and low densities would be so wide-spread that any sort of public transportation would not be viable. And with so few needs for physical flows, cars would not be used often, and thus their negative impacts would be substantially reduced (Safdie & Kohn, 1998).

This scenario, at least in such an extreme, is not likely to ever occur however, especially given recent evidence. Physical flows remain, if not increase, with the addition of electronic flows (Cairncross, 1997; Durlak, 1994; Glaeser, 2000) (see Figure 2-2). There is also a continuing importance of face-to-face contact for some activities like high-level decision making, and therefore a continued need to concentrate (Castells, 1989; Safdie & Kohn, 1998). This trend toward reconcentration is most evident in the so-called 'command and control centres' or 'world cities' which have emerged as a network in the internationalization of the economy (Durlak, 1994; Glaeser, 2000). Also, the technological scenarios do not indicate what becomes of those without access to the technology or in employment which cannot depend exclusively on telecom (Durlak, 1994). This scenario only seems to increase the spatial and social polarization of society. Still, though, telecom technology is helping to continue the dispersion of cities which began with private auto use -- this is leading to even more dependency on the private auto. Nevertheless, reconcentration trends and the inertia of the invested capital stock of the concentrated city do hold out hope for auto alternatives (Durlak, 1994).

Figure 2-1. The Replacement of Physical Flows by Electronic Ones: The Death of Distance.



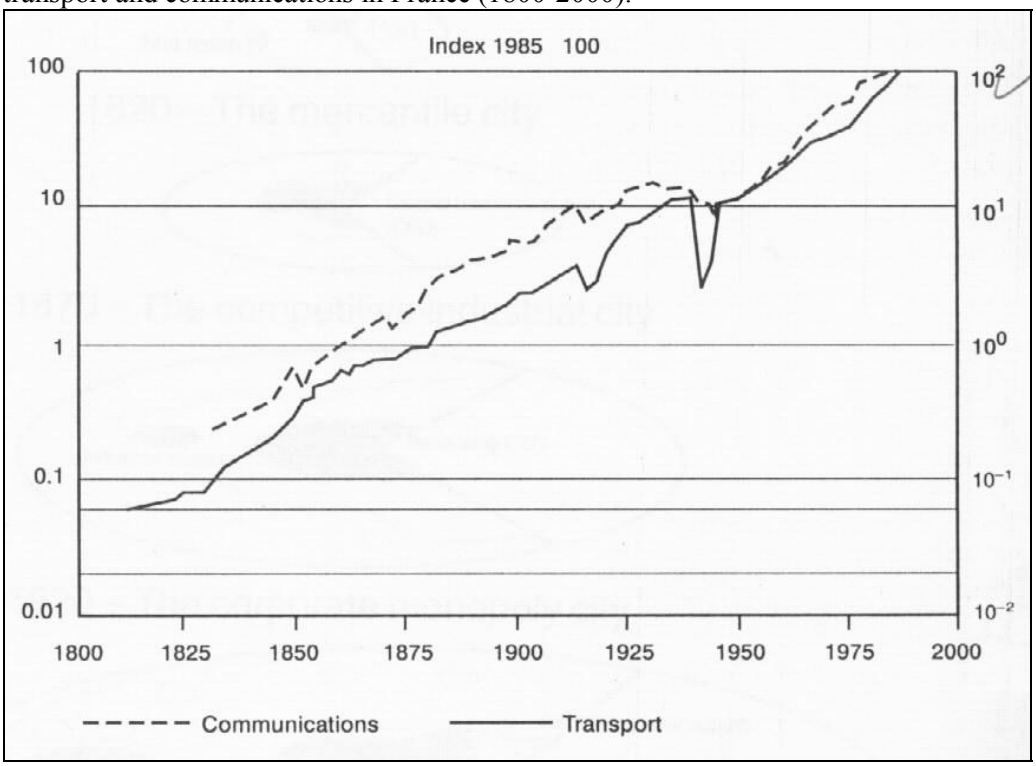
Source: Graham & Marvin, 1996, Figure 1.8.

Table 2-2. Old and New Descriptions of Urban Space.

'Space of places'	'Space of flows' (Castells, 1989)
Physical presence	'Telepresence' (CEC, 1992)
Physical mediation	'Telemediation' (Richardson, 1994b)
Geography	'Telegeography' (Staple, 1992)
Distance	Speed and time (Mulgan, 1991)
Closure	Openness and exposure (Virilio, 1987)
Locality	Globality (Knight and Gappert, 1989)
'Modern' space	Post-modern 'hyperspace' (Jameson, 1984)
	'Data spaces' (Murdock, 1993)
	'Electronic spaces' (Robins and Hepworth, 1988)
	'Cyberspace' (Gibson, 1984)
	'Netscape' (Hemrick, 1992)
	'Networld' (Harasim, 1993)

Source: Graham & Marvin, 1996, Figure 2.4.

Figure 2-2. The Growth of Both Physical and Electronic Flows, in tandem. The growth of passenger transport and communications in France (1800-2000).



Source: Graham & Marvin, 1996, Figure 6.2.

Deconcentrated and Dispersed Urban Form: Flexibility of the Car

In a dispersed city form, there is no clear centrality. Physical flows (trips) are not focused toward a centre or centres, and instead exist across and between various parts of the urban field, without clear patterns. Transit in such a city form is almost impossible, beyond a basic service for captive users (witness Kitchener-Waterloo-Cambridge, St. Catharines, or Windsor). In cities which have decentralized at the edges or are completely dispersed in form, transportation needs have to be provided through planning for the private auto; it is the only current mobility technology which provides enough flexibility to achieve access, reaching beyond and between the corridors served by fixed transit lines (Kunstler, 1993). Dunn (1998) stresses the chief benefits of the car for personal mobility and social access in his 'Auto, Plus' perspective. He argues for direct subsidies to the mobility-disadvantaged rather than the much larger subsidies involved in providing comparably-effective transit service to today's typical urban form. Even when mixed-used 'edge city' employment nodes are created, transit is still often not supported or used (Durlak, 1994). As discussed below, despite wishes to re-plan cities to be more transit-friendly, the inertia of the built environment for existing low density uses means that cars must have a major role for many years to come. As Dunn puts it, "The automobile is the *solution* to most Americans' transportation problems and has been for at least two generations" (p.1).

The Challenge of Urban Inertia

The legacy of our journey to auto-dependency will be a long-lasting one. The car will retain majority status in transportation in most suburban areas by virtue of the length of existing of the built environment. Short of levelling all of our car-dependent landscapes and building again for sustainablity, the land uses of much of the urban landscape dictate access to a flexible transportation technology like the car (Gordon & Richardson, 1997; Kunstler, 1993). Realistically, there are substantial (if not insurmountable) political and economic constraints involved in replacing the private car as the basis of urban transportation (Dunn, 1998). This does not mean that public transportation will never again play a role, but the struggle will be a long one and the inertia of low density buildings means that transit simply cannot function cost-effectively for large areas of our current urban landscapes.

The problem of urban inertia must also call attention to the need to decide how to build our cities now, since the choices society makes now for its land use-transportation relationships will endure for decades or more. The past investments in the car culture mean that a smaller-scale strategy to reversing the car's seniority is the realistic approach (Banister, 1999).

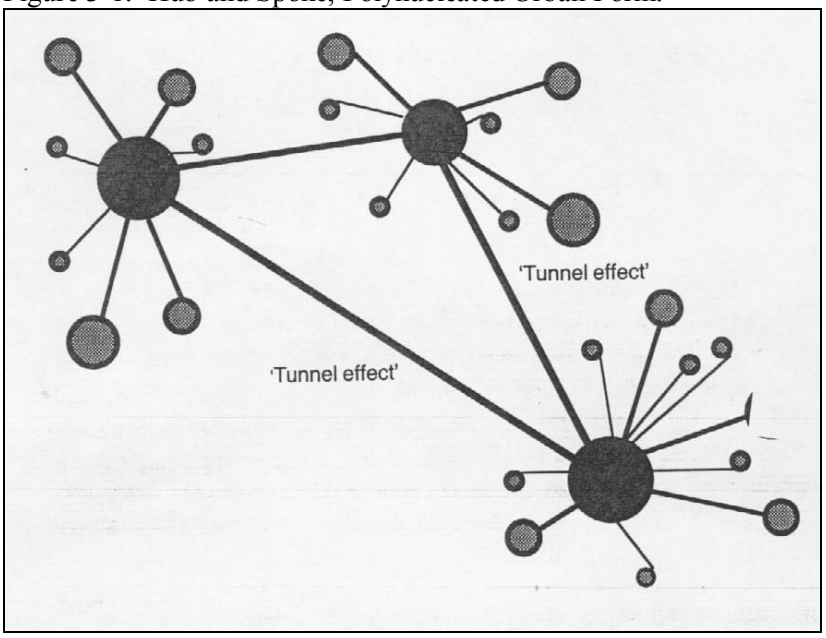
3.0 The Future of Auto Use in the Urban Environment

3.1 A Return to the Auto-Transit City?

From the previous discussion on the problems of auto dependency for both mobility and development styles, it is becoming evident that the future city, despite the telecom revolution and the fact that pro-car development already exists, cannot continue to develop along a entirely car-dependent path. Although some cities are experiencing a natural reconcentration due to globalization (Durlak, 1994), most cities are continuing to pull outward (Gordon & Richardson, 1997). A paradox thus exists: a need to plan more balanced transportation through land uses, with a continued desire for the private suburbs and convenient cars that contradict this balance (Smith, 2000). Accepting that the car must play a role due to styles of development, to respond to societal demands for convenience in a democratic society, and due to the large areal extent of today's cities, the sole realistic alternative (applicable to only certain trips) is public transportation. Some researchers (Kay, 1998; Newman & Kenworthy, 1996; and others), therefore advocate a return to a city more in line with the past auto-transit city, particularly in areas that are going to be developed in the future, in areas to be redeveloped, and toward a transit-strengthening in original core areas.

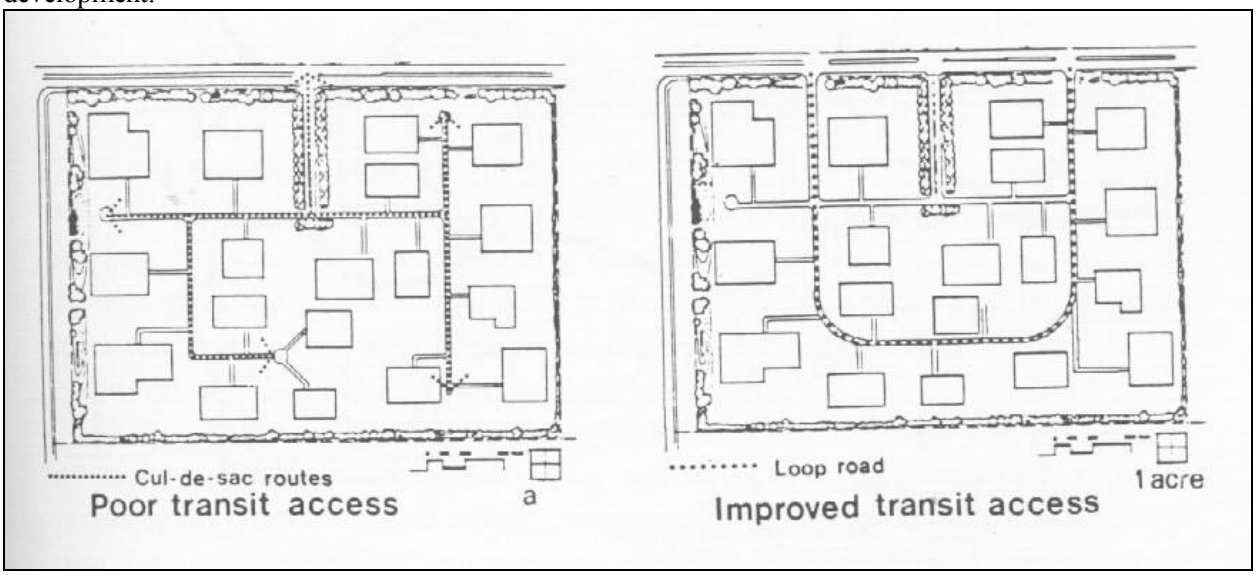
The planning styles that advocate the return to such a balance almost always include the provision for mixed uses and higher densities, land use planning for a jobs-housing spatial balance (Cervero, 1989), together with appropriate transportation infrastructure. This may take the form of so-called multi-use activity 'nodes' (Durlak, 1994; Kay, 1998), 'transit oriented developments' (TODs) (Dunn, 1998), or Safdie and Kohn's (1998) 'interactive centres' that mix offices, higher and medium-density residential, and retail uses. These often locate at the juncture of expressways and/or fixed transit lines (see Figure 3-1 for a representation of such a hub-spoke city form). Together with the original core (CBD), they create a 'polynucleated' urban form (Southworth, 2001). Planning better residential communities, while still trying to maintain the private, green suburban environment is attempted through the use of traditional neighbourhood development (TNDs) and principles of new-urbanism/neo-traditionalism (Ewing, 1997; Southworth, 2001). These try to encourage pedestrianization, community spirit, and (theoretically) a greater mix of uses and of social categories through the use of mixed residential types, higher densities, and pleasant streetscapes (Furuseth, 1997). The goal is also to reduce auto use by encouraging walking within the neighbourhood and transit use to outside areas. Both neo-traditional planning initiatives and multi-use nodes, however, have not shown the predicted results in the real world (Gordon & Richardson, 1997). Auto-dependency has not decreased as much as initially thought because of commonly incorrect or incomplete adoption of the strategies (Furuseth, 1997; Kay, 1998; Safdie & Kohn, 1998). Multi-use nodes have been built without attention given to providing adequate, direct transit service or have provided too much free parking, for example (see Figure 3-2) (Cervero, 1989). As a result, it is clear that the principles have to be adhered to strictly to really work in breaking car-dependency.

Figure 3-1. Hub and Spoke, Polynucleated Urban Form.



Source: Graham & Marvin, 1996, Figure 2.2.

Figure 3-2. Application of Transit in Multi-use Suburban Developments. A pro-transit road network (right) is contrasted with a road network not supportive of transit access (left) for the same layout of development.

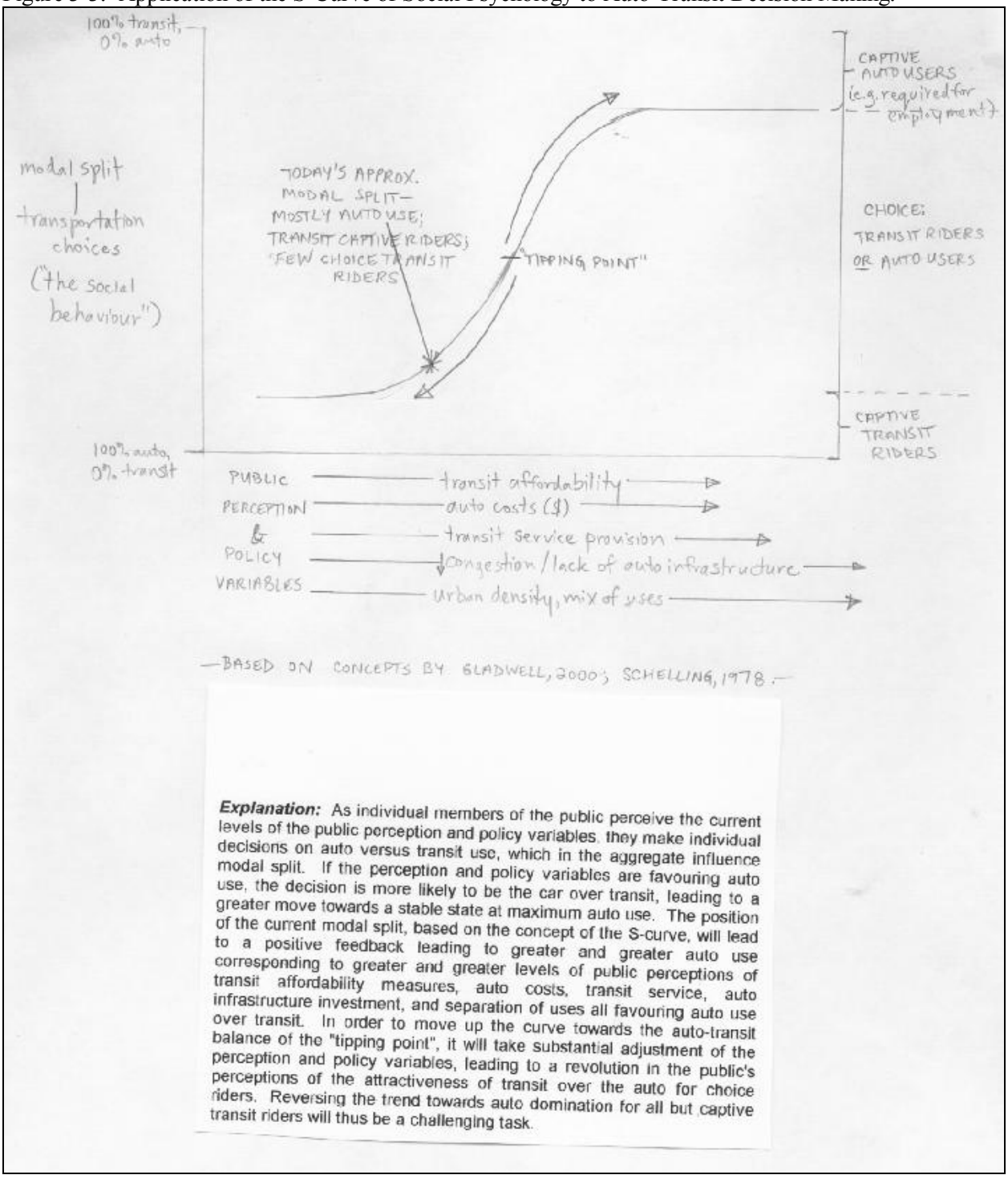


Source: Cervero, 1989, p. 203.

Other ways to improve transit's opportunities have been suggestions to increase the subsidization of the transit industry to make transit more competitive with cars for selected trips (mostly journey-to-work at concentrated nodes) (Kay, 1998). Also, often suggested by the car's critics is a more efficient method of having auto users pay the full cost of their choice of technology (so-called 'full-cost pricing') (Litman, 1998). This would consist of higher fuel costs, pollution taxes, costs for recycling to reduce future resource use, and so forth.

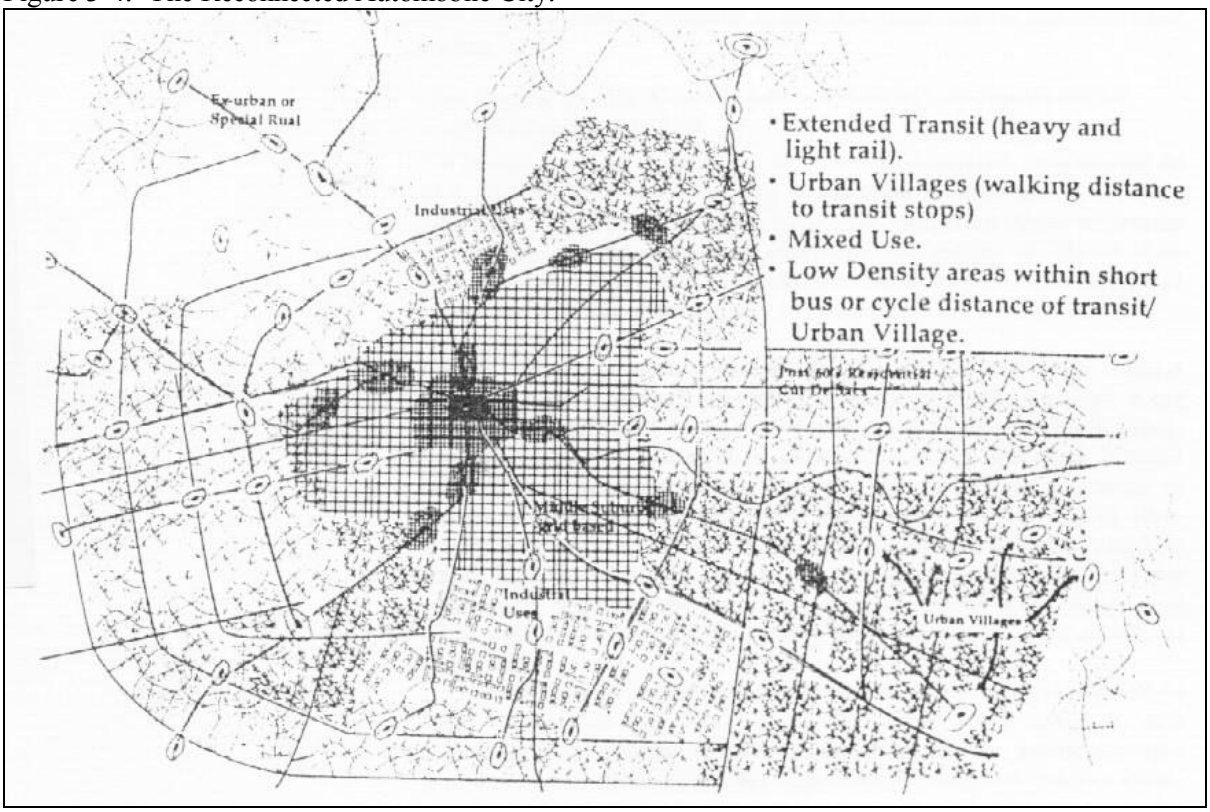
Convincing average people to actually use public transit over the car is, however, "an unprecedented social engineering challenge", as Dunn describes it (1998, p.19). The modal split of transit versus auto can be theorized to follow what social psychologists refer to as 'tipping points' and the 'S-curve' of social behaviour. According to the theory, the state of auto-transit modal split can only be constant in three states: majority auto use, majority transit use, or a perfect balance. Anywhere on the curve with more of one or the other will inevitably lead to the ultimate decline of the opposite mode, until it is used by a constant, captive percentage (the captive riders of transit, for example). Figure 3-3 depicts the S-curve as it applies to public attitudes towards urban transportation options. Because transit will not and probably cannot become the majority use (Southworth, 2001), the goal must then be to establish an effective and stable balance between transit and auto, a "three-legged stool" of highway, transit and land use (Kay, 1998, p.6). This vision is the one put forward by Newman and Kenworthy (1996) as the "reconnected automobile city" (Figure 3-4) or something along the lines of Dunn's (1998) "auto, plus" solution. Dunn even suggests an alternative to the 'auto-transit' city as a sort of 'auto-taxi' city where the accessibility-challenged would receive subsidies for taxi use, rather than providing for fixed public transit.

Figure 3-3. Application of the S-Curve of Social Psychology to Auto-Transit Decision Making.



Explanation: As individual members of the public perceive the current levels of the public perception and policy variables, they make individual decisions on auto versus transit use, which in the aggregate influence modal split. If the perception and policy variables are favouring auto use, the decision is more likely to be the car over transit, leading to a greater move towards a stable state at maximum auto use. The position of the current modal split, based on the concept of the S-curve, will lead to a positive feedback leading to greater and greater auto use corresponding to greater and greater levels of public perceptions of transit affordability measures, auto costs, transit service, auto infrastructure investment, and separation of uses all favouring auto use over transit. In order to move up the curve towards the auto-transit balance of the "tipping point", it will take substantial adjustment of the perception and policy variables, leading to a revolution in the public's perceptions of the attractiveness of transit over the auto for choice riders. Reversing the trend towards auto domination for all but captive transit riders will thus be a challenging task.

Figure 3-4. The Reconnected Automobile City.



Source: Newman & Kenworthy, 1996, Figure 8.

3.2 Auto Use in the Post-Industrial City: Reconcentration and Dispersion

As mentioned above, there are forces of both deconcentration and reconcentration at work in some cities (Figure 3-5). While the majority of urban areas in North America are tending towards more spread and high auto-dependency, growth in the rural-urban fringe, and the creation of dispersed urban form, some cities (Toronto, Calgary, Vancouver, and perhaps Halifax in Canada) are moving towards establishing themselves as part of the world network of globalization; cities in the upper levels of global business or important regional centres of contact (Figure 3-6). In these centres, forces encourage a revitalization of 'sense of place' (Cairncross, 1997; Glaeser, 2000) and an increasing role as centres of 'command and control' (advanced service sector, national or regional head offices, an importance of face-to-face contact for business and innovation) (Castells, 1989; Durlak, 1994; Ewing, 1997; Graham & Marvin, 1996). In these centres, a concentration at the centre means an evolving opportunity for auto alternatives, as the mixed use, high density nature of core vitality can support core-focused transit, walking and biking. In fact, given the pre-auto age development of many cores, the car is at a disadvantage (lack of and high cost of parking; narrower, congested road networks; difficulty of downtown access from suburban locations). Such cities, then, have the opportunity to maintain and enhance alternatives.

In cities where such reconcentration energies are less apparent and in the outer portions of cities where these are apparent, the shift towards car-dependent development means the car is going to have to play a substantial role (Kunstler, 1993). To reduce its role, the main avenues have been to attempt to plan more suburban concentrations (quasi-copies of the CBD -- 'suburban downtowns', 'regional town centres', 'edge cities') which can allow new developments to be more alternative-supporting (Glaeser, 2000; Vance, 1991). But, the shear existence of a multi-nodal structure and the pervasion of the auto in our culture means that alternatives to the car can never play as great a role as they once did.

Figure 3-5. Evolution of Urban Form in North America: Forces of Dispersion. Transformation of the city from mercantile through to Fordist structure involved transportation and telecommunications improvements driving deconcentration and dispersion. Those forces continue in the latest era of city structure (see Figure 3-6) as automobiles, telecom and globalization.

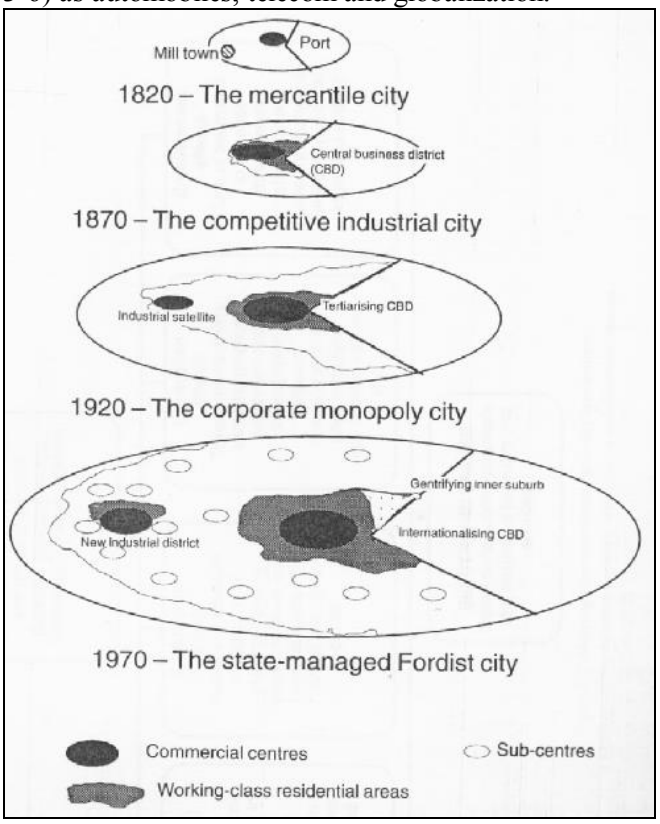
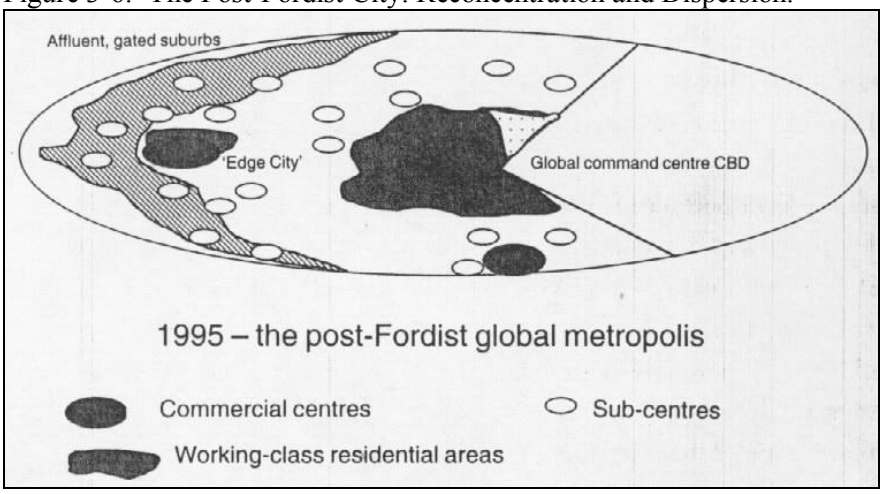


Figure 3-6. The Post-Fordist City: Reconcentration and Dispersion.



Sources: Graham & Marvin, 1996, Figures 8.1 and 8.3.

3.3 Ideal versus Reality: Can Auto Dependency be Reduced?

> While it is unlikely that the private automobile ever will, and perhaps ever should, fall from its reign as the dominant mode of commuting, at the same time steps need to be taken to make ridesharing, mass transit, walking, and cycling respectable alternatives. As suburbia continues to become the destination of more and more travel, it is essential that the joint influences of land use and transportation be carefully weighed when designing workplaces of the future. Future levels of mobility and overall quality of suburban living could very well depend on it.
>
> [Cervero, 1989, pp.209-10]

The ideal might be to replace the automobile in the urban transportation mix. To others it is to balance the private auto with other alternatives. The reality is that neither ideal will met in the near future. Realistically, the car is dominant; it is the symbol of freedom of mobility for the majority of North Americans (Dunn, 1998). It enables most citizens to make a choice on where to locate and the choice has been overwhelmingly to the low density, 'green' landscape of suburbia. For this majority, the car is their device of choice and the most effective means of mobility for their chosen landscape (Gordon & Richardson, 1997). For others, who choose to reconcentrate, want the cosmopolitianism of city life, need to maintain close social interactions for lifestyle or employment, the density of the inner cities and suburban downtowns is the option and it is available. The reality is that urban environments provide the choice in transportation options and the majority decides what those transportation options are going to be. It is up to society at large to make a new choice to move beyond car-dependency (Southworth, 2001). It is also society's choice on whether or how to provide for those left behind by it. The choice of the recent past has been to push individual goals over collective ones, individual freedom perhaps over the freedom of movement for all. A wider societal change, beyond specific planning initiatives is needed to truly move toward a vision of balanced, sustainable urban transportation (Dunn, 1998) that meets everyone's needs reasonably, rather than meeting many people's needs ideally and some people's needs not at all. Education, along with the 'sticks' of planning principles and 'carrots' of real benefits of auto alternatives need to be our long-term goals (Kay, 1998).

4.0 Summary and Conclusions

This paper has outlined both what is wrong with the private auto and auto-dependent urban form, and some of the benefits of the technology given its versatility for movement, societal demands and existing building styles. It has been argued that auto-dependency alone cannot continue. Government costs to build infrastructure, the feedback of congestion, the environmental externalities and resource use, and the spin-offs of increased social polarization and inequities in mobility are too great to continue towards basing our society with the assumption that everyone can drive a private car. The opposite scenario, to eliminate the car as a transportation option, is not a possibility either. Many existing built environments will depend on the car, since they already exist and cannot economically support widespread use of alternatives and still provide for all of people's mobility needs.

The scenarios of telecities replacing auto use (or the need for alternatives) are not likely either, as electronic society only breeds more face-to-face contact and other physical flows. The reality, then, in the absence of a revolutionary new transportation technology to continue the evolution of the land use-transport link, is a reversal towards a more balanced city form that uses the car *with alternatives* (transit being the most competitive option in many cases). To achieve this, a variety of options must be considered. More competitive pricing needs to exist, probably through more 'full cost pricing' of the car and its externalities. Cities, in the planning of new development and the re-planning of old development, need to carefully consider the land use-transport relationship, in ways that include instituting higher densities, focusing on more mixed uses, and encouraging pedestrianization, which in turn all help to provide an environment which is supportive to auto alternatives.

Given evidence that planning measures will not help alone, it will also take a greater societal change, one towards meeting collective rather than individual goals through collective rather than individual transportation choices (Dunn, 1998). This will involve trying to tip the scale back away from car-dependency towards transit, biking and walking, towards a higher overarching goal of sustainable urban transportation. In the end, the car is *part* of the solution, but not the only part.

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