Simplicity and Complexity in Design for Transportation Systems and Urban Forms

Jonathan E. D. Richmond

ABSTRACT

A metaphor of *balance* simplifies and guides transportation planning in Los Angeles and Sydney. Striving for balance, it calls for more or less of particular types of systems without examining whether those elements should instead be reconfigured. Urban consolidation plans in Sydney, as part of an effort to bring about this balance, illustrate what Christopher Alexander calls the yearning for the physical and plastic characteristics of the past. The diverse and overlapping urban interaction patterns of the automotive age—which the plans fail to recognize as natural and not to be transcended by physical planning manipulations—show why Sydney needs a more sophisticated approach. Transportation planners must move from attempting to shape lifestyles in ways which cannot succeed to appreciating the many dimensions of how people have chosen to live and interact across space and how this relates to their aspirations for life in the future.

Our traditional emphasis has been upon the physical city, conceived as an artifact; upon the spatial arrangement of activity locations, conceived as land-use pattern; and upon the urban settlement, conceived as a unitary place. We have sought to influence the form of each of these, with the purpose of improving certain behavioral aspects of the society. Yet we have neglected the conception of the city as a social system in action.

For metropolitan planning purposes it is important that we also see the city as a culturally conditioned system of dynamic interrelationships among individuals and groups, as these are modified by their locational distributions (Webber 1964, 93).

■ INTRODUCTION: SIMPLE SOLUTIONS

Christopher Alexander (1965) explains in his classic article "A City Is Not a Tree" that "the mind's first function is to reduce the ambiguity and overlap in a confusing situation.... It is endowed with a basic intolerance for ambiguity" (part 2, 60). He illustrates this with concepts from set theory to differentiate between structures in which no overlap occurs—*trees*—and those structures in which overlap does occur—*semi-lattices*, as illustrated in Figure 1. He provides examples of several cities where "tree-like" planning has taken place. Brasilia is a famous example where all functions—living, working, playing—are rigidly separated. This unnatural placing of functions into rigidly separated boxes makes the city seem lifeless. It is not the way of natural urban structures, which Alexander says are full of rich patterns of overlap.

Children's natural play, to give a striking example of overlap, does its best to avoid the confines adults might try to impose. Instead, play overlaps with a whole range of other activities:

> The playground, asphalted and fenced in, is nothing but a pictorial acknowledgment of the fact that "play" exists as an isolated concept in our minds. It has nothing to do with the life of play itself. Few self-respecting children will even play in a playground.
>
> Play itself, the play that children practice, goes on somewhere different everyday. One day it may be indoors, another day in a friendly gas station, another day down by the river, another day in a derelict building, another day on a construction site which has been abandoned for the weekend. Each of these play activities, and the objects it requires, forms a system. It is not true that these systems exist in isolation, cut off from the other systems in the city. The different systems overlap one another, and they overlap many other systems besides. The units, the physical spaces recognized as play spaces, must do the same (part 2, 59).

Jonathan E. D. Richmond is a fellow at the Taubman Center for State and Local Government, Kennedy School of Government, Harvard University; Jonathan_Richmond@harvard.edu.

The gas station, for example, may have people filling up their cars, paying for their gas, or browsing for snacks, with kids hanging out or larking about in the middle of it all. The environment is enriched by the overlaps of these elements.

To give another example (mine rather than Alexander's), old people's homes, like playgrounds, are elements of the tree-structures Alexander conceives. In the natural world, granny was integrated with the family—helping with the cooking, keeping an eye on the grandchildren, and sitting on the doorstep watching the world go by. There were multiple overlaps among the worlds of granny and her children and grandchildren and even passersby in the street. In the "home," granny is shut away from the rest of life, separated on an extremity of the tree demarcated for old people. The overlaps of the generations are removed and life experience is diminished for one and all.

With a brief historical overview, a specific focus on Sydney (where I recently held a faculty appointment) and illustrations from Los Angeles (where I researched the regions's transportation planning process), I am going to argue that much contemporary transportation planning is *tree-like*. Planning too often sees transportation as a discrete activity, rather than recognizing its overlap with the many other elements of the city and, in particular, its necessary relationship with the "culturally conditioned system of dynamic interrelationships among individuals and groups" to which Webber (1964, 93) refers. Such simplification of a complex reality comes easily: As Nietzsche put it, "we continually *need* a narrower, abbreviated, simplified world" (1968, 15; emphasis in original). It is much easier to draft attractive-looking physical plans which symbolically represent the planner's desired outcomes than to appreciate the complex forms of socioeconomic interaction, which will determine the plan's likely success or failure, or to understand and respond to public preferences, which may differ from the planner's ideal world. Our intolerance for complexity, however, makes it unlikely that creative answers to modern problems will be achieved, and we must enrich our planning processes if we are to move beyond the failed physical planning results produced by the deficient mental processes Alexander so eloquently describes.

■ FEEDBACK IN TRANSPORTATION

Let us look at how transportation as a problem is most basically understood. Almost every transportation economics course starts by defining transportation as a derived demand—something demanded in order to accomplish something else. Transportation is thereby seen as a static concept in a one-way relationship with those activities that demand it. But transportation is part of a complex and dynamic system of elements that overlap and interact in a plethora of ways at a given point in time and whose interaction patterns, to make the situation yet more unbearably complex for the planner yearning for simplicity, also shift over time in response to those interactions.

Transportation cannot be like a controlled scientific experiment in which everything else is held constant. As Colin Clark (1957) and later Peter Hall (1992) showed in their famous articles of the same title—"Transport: Maker and Breaker of Cities"—there is a symbiotic relationship between transportation and other elements of city structure. This is best illustrated historically, and *feedback*—a concept from systems theory—is helpful in doing so. If you change the transportation infrastructure in response to a demand for transportation
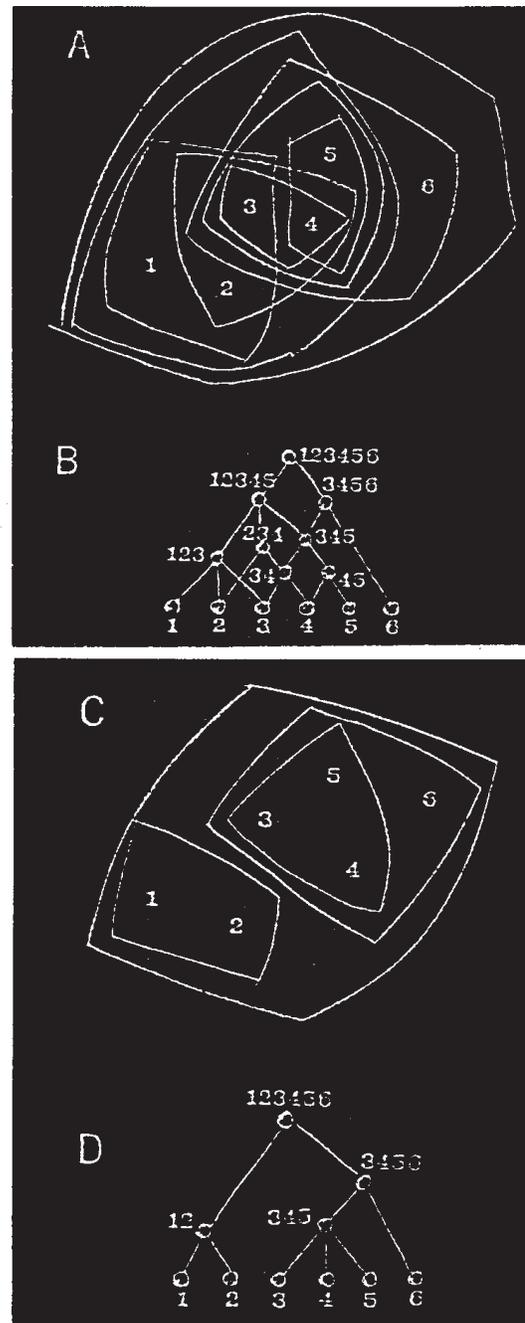

Figure 1. A and B show a semi-lattice, C and D a tree. Diagram from Alexander 1965, Part 1, 59.

innovations in a city, there is a feedback effect that alters both the initial demand for transportation—no longer the same demand that led to the innovation—and changes the form of the city itself.

History of Transportation Systems: A Dynamic Process

The streets of the medieval city were narrow and tortuous. The city was crowded and compact. Its development was limited by the distance you could conveniently walk. If you look at Jerusalem's Old City or many Third World countries today, that is what you still see. Transportation acted as a constraint to the city's development.

The mercantile and industrial revolutions changed the nature of cities. There wasn't enough space for development within existing boundaries, so new factory locations grew up which weren't always near where people lived. A spatial separation of work and residence began to take shape.

In London, the stress of expansion showed. In 1829 George Shillibeer brought the horse-drawn omnibus to London. It could take more passengers than a stage coach and it stopped more frequently, but it was still expensive and only for the wealthy. Dickens illustrated the problem in *Sketches by Boz*:

> ...the early clerk population of Somers and Camden Towns, Islington and Pentonville are fast pouring into the city.... Middle-aged men, whose salaries have by no means increased in the same proportion as their families, plod steadily along, apparently with no object in view but the counting house (1973, 51).

The clerks were living in the "walking suburbs" for people who couldn't afford the bus fare. There also was a four-mile toll footpath on the viaduct of London's first commuter railway to Deptford, used by 120,000 pedestrians in 1839 who couldn't afford to ride on the train (Weightman and Humphries 1983, 100).

The pressures grew as the century progressed, crying out for an innovation. That innovation was to be the horsecar. If two horses could draw a bus with 12 passengers, they could pull a car on rails laden with 40. With the addition of rails came greater speed, lower costs, and longer routes. Developed in New York in 1832 and arriving in London in 1870, horsecars at last provided a means of transportation for the masses. And, as Weightman and Humphries show in their most persuasive account, it was the horse—not mechanical—power that shaped modern London. The steam train encouraged development only around its widely spaced stations. The horsecar, which ran through the street and stopped frequently, stimulated a quite different continuous type of development—giving rise to the suburban forms we know today. Having created them, it not only increased and intensified the suburban demand for transportation, it shaped the concept of the suburb as a special kind of city form.

The creation of a distance between work and residence established the basis for conceiving of types of movement that are independent from the center. Certainly, this did not happen instantly. But the mere act of putting people on the urban periphery at substantial distances from their work laid the potential for dispersed transportation interaction such as could be supplied by the car—and for the demise of the very type of transportation that had created the new urban form. A static snapshot view might evaluate the city only in terms of existing forces and see only the radial city of the future implied by the horsecar innovation. A dynamic systems view, on the other hand, will see that the nature of the city-economy has been changed. New tensions of unmet demand have been established by the innovation, and they have the potential to lead to further structural change.

The electric streetcar cemented the work of the horsecar. Its impacts were spectacular in many cities. In Los Angeles, for example, Henry Huntington's Red Cars—put into operation as a real estate venture—led to the creation of far-flung communities throughout southern California. The population of Long Beach, for instance, grew from 2,200 to nearly 18,000 in less than a decade. By the 1920s, however, the trolleys were getting into financial trouble as car ownership grew and trolley ridership declined.

What did the car do? As George Hilton (1967, 380) put it, "The automobile gave Americans a lateral mobility and an opportunity for point-to-point travel which the electric railway had denied them." Already by the mid-1920s, commercial and industrial decentralization enabled suburbanites to shop and work in outlying areas, which they increasingly chose to do. The car permitted infilling away from the railway tracks. In the process, it created an urban form that was no longer amenable to service by the railway (see also Bail 1984, Brodsly 1981, Wachs 1984).

The far-flung nature of southern California *was* a product of the railways; but by the very act of creating that form, the transportation mode set the stage for its own demise, once displaced by a technology that could better serve and enhance suburban mobility. With freeway construction accelerating throughout the United States and in many other areas of the developed world from the 1950s onwards, suburbs became as accessible—and possibly more so—than centers, and the decline we see in so many of today's central cities set in.

This historical picture shows just how misleading it is to talk of transportation as only a "derived demand." Transportation is a player that creates demands as well as responding to them. At the time of the horsecar, who would have said that the suburban form created would eventually wipe out its maker? And even as the electric railways were getting deeper into debt, there was a naive belief in some quarters that the automobile would have only a limited influence and that the railway would prevail. In 1925, for example, *Electric Traction*—unable to appreciate that the automobile was no mere response to demand but was shaping both city forms and

demands for transportation in ways that cast shadows on the future role of fixed-rail passenger services—talked of congestion, accidents, parking problems, and operating costs driving people from cars back to streetcars. It is only by looking at the dynamically changing total set of interrelationships within the city—at the tensions created, opportunities opened, and responses implied—that we have a chance of seeing not only how the future is shaping itself but how we may shape it.

The Public-Sector Response: *Preselected Solutions*

The public-sector response to transportation problems has focused on transportation facilities and not on the underlying problems. As Alan Altshuler (1979) remarks:

> Analytic activities have tended overwhelmingly to focus on the appraisal, advocacy, and/or incremental adaptation of...technologies and services — which we term *preselected solutions*—rather than on laying bare the character of the problems generating demands for public action or searching with a fresh eye for effective remedial strategies (ix; emphasis in orginal).

In the 1950s, road advocates saw congestion and demanded highways without looking at the consequences for cities. They didn't realize that, in a wicked variant of Parkinson's Second Law, traffic expands to fill the space available (see Downs 1962). In the absence of a systems view, which could tell us that the products of road-building would feed back to increase the demand to travel to the places those roads went (generating more traffic and more congestion), *free*ways symbolized *free*dom.

In the 1960s came a shift to issues of the environment and, in a reaction to the problems the roads had created, action began to revitalize public transportation in the United States. Unfortunately, this has mostly taken the form of capital expenditures suited to cities of the 19th century. The new Los Angeles Metrorail, for example, is focused on the core, while travel needs are widely dispersed. The result has been massive cost for low ridership systems. Because they stand to carry such a small percentage of the flows of highways, these systems cannot cure congestion, enhance the environment, or refocus development (see Richmond 1991; forthcoming).

The Sydney of the 1990s still has its suburban rail system, which carries 4.1 percent of passenger trips. The bus system (including school buses) handles an additional 4.3 percent, with ferries taking 0.2 percent. A recent report from the Independent Pricing and Regulatory Tribunal of New South Wales (1996) provides a telling commentary:

> The rail network is radial in nature with its focus on the Sydney CBD. More than 50 percent of rail trips either start or finish in the CBD. 52 percent of people who work in the CBD use rail for their journey to work. Whereas private cars account for about 67 percent of journey to work trips in Sydney, the CityRail network provides only 15 percent of journey to work trips. The high percentage of car usage occurs because the majority of trips are between suburbs, rather than from the suburbs to the CBD and other regional centers. These trips do not easily fit in with Sydney's radial public transport network (7).

Despite this, the report sees public benefits from continuing to subsidize the existing systems of public transport for the metropolis, devoting little attention to how it might be reshaped to better meet today's—and tomorrow's—needs. Documents from the New South Wales Department of Transport (1995a, 1995b) also see public transport as a generic sort of commodity and a need for it to be developed in balance with roads. One of the publications (1995a), entitled *A Balanced Transport Future for Sydney,* shows on its cover what is to be balanced: There is a train, road traffic, and a ferry boat headed for Circular Quay on the harbor in Sydney's core.

This concept of physical balance will now be examined in more detail. It is a form of potentially misleading simplification, and we must become aware of it if we are to move beyond it.

■ The Balance Metaphor

Metaphor is an instrument of understanding, specifically "understanding one kind of thing in terms of another" (Lakoff and Johnson 1980, 5). Metaphor performs a clarifying function, naming, fixing, and structuring "what might otherwise be vaguely troubling situations" (Schön 1963, 60). "The movement is usually from a more concrete and readily graspable image 'over onto' what is perhaps more vague, more problematic, or more strange" (Peters 1978, 356).

Balance is a basic metaphorical concept that comes from the experience of our body. There is a bodily equilibrium of which we are barely conscious. If it's lost, we must regain it. Stomach, bladder, walking—we're not normally aware of these things until we fall out of balance. But when the stomach is empty we realize we need to fill it; when the bladder is full that we need to empty it; that when we stumble we have to correct the balance (see Johnson 1987).

Out of balance means having too much or too little. To regain balance we have to add or subtract, and when we have done so we arrive back at the prior state of equilibrium that we know to exist.

Schön's (1963) account of the metaphorical entailments of a balance scale with two pans provides an interpretative tool for analyzing the presence of the balance metaphor in conceptions of transportation problems and remedies. Schön notes in particular that objects come to the weighing process ready to be weighed:

Objects are brought to the scales. They do not have to be invented in order to be weighed. In a sense, they are given for the weighing process; from the point of view of the weighing they are assumed. The issue is not how they came to be, but how much they weigh in comparison to one another (119-120).

In a process where the balance metaphor is operating, we would expect alternative policy actions like objects for weighing "to be treated as given for evaluation. Problems of invention or formulation would be ignored" (120). We should therefore ask if people in situations where we suspect the balance metaphor is operating are taking proposed actions as givens, rather than critically appraising them.

In the course of weighing on a balance scale, objects do not change. So "we would expect a theory of deciding based on a displaced theory of weighing to treat objects of decisions as unchanging" (121). The advantages and disadvantages of different given objects might therefore be discussed, but not the possibility of reformulating the objects themselves—of operating public transport services in different and innovative new ways, for example.

Finally, "because of the very structure of a balance scale, weighing is always a comparison of two things or sets of things" (122). We would expect to see an evaluation process operating under this metaphor to perform trade-offs between two opposing options or sets of options. All that is at stake here is adding or subtracting particular substances; as when filling our stomach or emptying our bladder there is a pre-defined response to the problem, which it seems obvious will result in its resolution.

There are frequent references to the need for "balanced transportation" in Los Angeles.[1] County Supervisor Deane Dana had this to say, for example:

> Until the 1940s, the Pacific Electric provided our citizens along with our highway system with a good balanced transportation system....We now have to keep pace with the future and we require a more balanced system. Streets and highways alone cannot always provide a reasonable level of service to keep pace with even the most conservative population and development projections in the area (California Legislature 1981, 96-97).

Among those echoing Dana's view in interviews conducted for my study of Los Angeles (Richmond 1991, forthcoming) were Supervisor Kenneth Hahn, who wanted to "bring a balanced transportation system back to Los Angeles"; an alternate member of the Los Angeles County Transportation Commission (LACTC), Walter King, who called for Los Angeles to have the "balanced transportation" of Paris; and LACTC staff member Richard Stanger who talked of the potential of light rail to "balance transportation subregions."

There seem to be two ideas of balance when it comes to transportation. Firstly, if a transportation system operates under conditions of free-flow, it is in balance. If it is over-loaded, it falls out of balance. Secondly, if the components of that transportation system—say road and rail—are in the wrong proportions, they are out of balance. The two under-standings are connected: If a road system loses its internal balance by being overloaded, that balance can be restored by transferring the load to a new rail system.

The idea of the balance scale is evoked by the language used: There is talk of the traffic being *unbearable* and the need to remove the *load* from the freeways. And if there's too much weight on the freeways, the answer is to put more weight on the other side of the scale.

As Jerome Premo, former Executive Director of the County Transportation Commission, saw it:

> I think in a historical sense, the tragedy of transportation development in Los Angeles isn't necessarily the freeways, but how it was an issue of using those old transit right of ways for freeways to the exclusion of transit. So there was a tradition of exclusion in the decision-making process—it was an either/or. I think the expectation in California in the mid-70s was that there could be some thinking about balance.

Premo's statement contains the idea that there are two distinct entities—freeways and transit—to be balanced. However, it is not simply that roads are to be balanced with transit in general, but with *rail* transit in particular. The assumption that roads are to be balanced with transit in general can hide the fact that freeways need to be balanced with rail transit. As deputy to Supervisor Kenneth Hahn, Burke Roche, said "buses cause congestion on the streets, and the light rail system we would hope would not." Buses must therefore be put on the road side of the balance scale for weighing. They are a part of the problem: an extra burden that it is up to rail to relieve. As Hahn (LACTC 1982) said:

> Every other major metropolitan area in the nation and the world has a balanced mix of rubber and rail transit. Only in Los Angeles have we tried to get by with only automobile and bus transporta-tion and for this we have to pay a steep price in pollution, in hour-plus commuting times, and in the necessity for every family to own two cars.

Hahn is nonetheless a supporter of the area bus system, so long as it is balanced with rail. "You have to have two forms," he said in an interview. "The rail is not the substitute for the bus, Jonathan. You have to have buses. I'm a strong believer. And you have to have mass transit, too—rail."

Alternate Commissioner Walter King, while defending rail for southern California, conceded that new articulated buses were being tried out in San Francisco: "But they also have a balance. They have the heavy rail, they have the light rail, and then the buses, and then the electrified."

King evokes a natural order[2] metaphor here, which both is consistent with the balance metaphor and provides additional implications. In King's conception, the bus and the train each have their places in the *natural order* of things. There is a desirable equilibrium balance between them at which the transportation system as a whole works harmoniously. If this order is disturbed, the system will be knocked out of balance:

> I don't want to be limited by cars; I don't want to be limited by bus; I don't want to be limited by rail. I want them all in their place.

As Dan Roberts, a staff member for Congressman Mineta (San Jose), said: "The trick is to balance them [different modes] off, a desire to plan that puts each mode where it needs to be."

"It's like an orchestra," said Congressman Jim Bates (San Diego). "You've got the violins, and the trumpets and the horns, the cellos, you know." San Diego Councilman Ed Struiksma also used the musical metaphor, calling for light rail to work "in harmony in an overall system."[3]

Just as we bring items ready to be weighed to a balance scale—and they undergo no change in the process—the discussions above center on balancing off pre-defined technologies, not on changing ways in which those technologies might be used, let alone in considering changes beyond the scope of transportation technology choice or beyond the realm of transportation itself. In calling for a return to balance, there is little talk of innovation which might, for example, have improved the operation of buses, freeways, or both. Interviewees talk of buses and trains as givens, as things that come standardized out of a box to be put into operation. In the same way that you can't make cellos sound like horns, it is thought that you can't give buses the supposed advantages of rail-like characteristics. The train is thereby seen as a necessary part of a *balanced* system, excluding the possibility that rail service might not be appropriate for all cities.

The mythology hits home when we see that this concept of balance can be no more than a fiction. A November 1990 on-board study (the most recent cited by MTA 1996) found that only 21 percent of Los Angeles Blue Line passengers had previously driven, while 63 percent had taken the bus. The new Los Angeles rail system has so far made no visible difference to road loadings and is unlikely to ever do so. But even if it did, the result would be the attraction of more cars to the higher highway speeds, then a slowing down until the old congestion is regained. While any notion of balance is illusory, the vast per capita expenditures on the rail system take away opportunities for the more productive use of scarce resources.

Ridership numbers do not tell the full story. While the Long Beach Blue Line carried 44,900 passengers on average each weekday during June 1996 (MTA 1996), total transit ridership by all modes in Los Angeles is down since the rail program began. A major loss is directly attributable to the fare increase that occurred when a funding source for reduced bus fares was transferred to rail construction. Transit patronage fell by 46.8 million annual passengers in just one year following the July 1985 fare increase. This is more than twice the number of annual passengers to be expected on the Blue Line light rail under the most optimistic assumptions.

The idea of balance is as simple as it is basic, and it gives us an easy answer. The problem is that it is not a real-world answer; it cannot be attained, let alone sustained. And the answer is misleading because the assumption that we need certain proportions of rail systems versus roads may be false. Rail systems may not be suited to the environment in question. Therefore they are not in fact as necessary as violins in an orchestra. To find out if any particular type of transportation system is needed, however, we have to get away from our fascination with balancing physical technologies and devote more attention to studying the underlying social problems and the systemic relationships among them.

A Balanced Approach in Sydney

There is a fear that Sydney will become another Los Angeles. Since the 1950s, low-density suburban development has fueled the expansion of the Sydney metropolitan area. Decentralization of employment has followed the outward moving of housing, decreasing the role of radially based public transport. Despite substantial public transport services, this is a car-dominated society living a suburban lifestyle—a lifestyle that most people in fact enjoy.

The planning reaction in Sydney, as in Los Angeles, seems to have started with technology and physical actions. By building transportation facilities and shaping the human activities, it is assumed that the problem will be solved.

There is an "over-dependence" on motor vehicles, to quote the *Integrated Transport Strategy for the Greater Metropolitan Region* (New South Wales Department of Transport 1995b, 16), and factors such as "the patterns of urban development in recent years...especially low density fringe growth and employment decentralization—have reduced the effectiveness of public transport and increased reliance on the private car" (i). This has led to increased infrastructure costs and environmental problems, the report says.

The response is adoption of:

> ...urban containment, or the "compact city".... The objective is to manage travel demand by promoting land use patterns which make more efficient use of highly accessible land, by increasing residential densities and by encouraging concentrated employment patterns. The more compact city will have improved accessibility, more efficient

patterns of movement and optimized public transport use. Reduced car dependence will assist in maintaining and improving the quality of the environment (iv).

Reducing this "dependence" is intrinsically connected with the idea of restoring "balance." According to the report, "The system will operate effectively and efficiently when the system is balanced, using the right mode for each task, and ensuring integration within the system" (vi). And how is this balance to be achieved? The provision of physical transportation infrastructure, whether it be rail lines, multimodal interchanges, or motorway extensions, predominates. The balance is supposedly arrived at by having the "right" quantity of each technology, and in a more compact city form in which an apparently more "balanced" mix of private and public transportation demands is supported.

As we have seen, such a balance is imaginary. Rail lines are likely to attract few cars off the roads. Even if road speeds are marginally increased, this will be a temporary phenomenon at best, since the improvement would attract more drivers. It can be argued, furthermore, that high-density living can concentrate pollution and other environmental degradation. In particular, it focuses congestion in sometimes unexpected ways. Suppose sub-centers are promoted as hubs and equipped with high-quality public transport links. Unfortunately, new development at such centers attracts people coming by car as well as public transport, concentrating congestion there.

Alexander's depiction of modern open society systems (Figure 2), as contrasted with those of traditional societies, helps us focus on the problems with high-density urban forms prescribed as antidote to Sydney's supposed addiction to cars:

> In a traditional society, if we ask a man to name his best friends and then ask each of these in turn to name their best friends, they will all name each other so that they form a closed group. A village is made of a number of separate closed groups of this kind.
>
> But today's social structure is utterly different. If we ask a man to name his friends and then ask them in turn to name their friends, they will all name different people, very likely unknown to the first person; these people would again name others, and so on outwards. There are virtually no closed groups of people in modern society. The reality of today's social structure is thick with overlap—the system of friends and acquaintances form a semilattice, not a tree (Part 1, 62).

If we look at an extract (see Figure 3) from *Cities for the 21st Century* (New South Wales Department of Planning 1995, 19), developed in conjunction with the *Integrated Transport Strategy*, we can see just how its dated traditional society
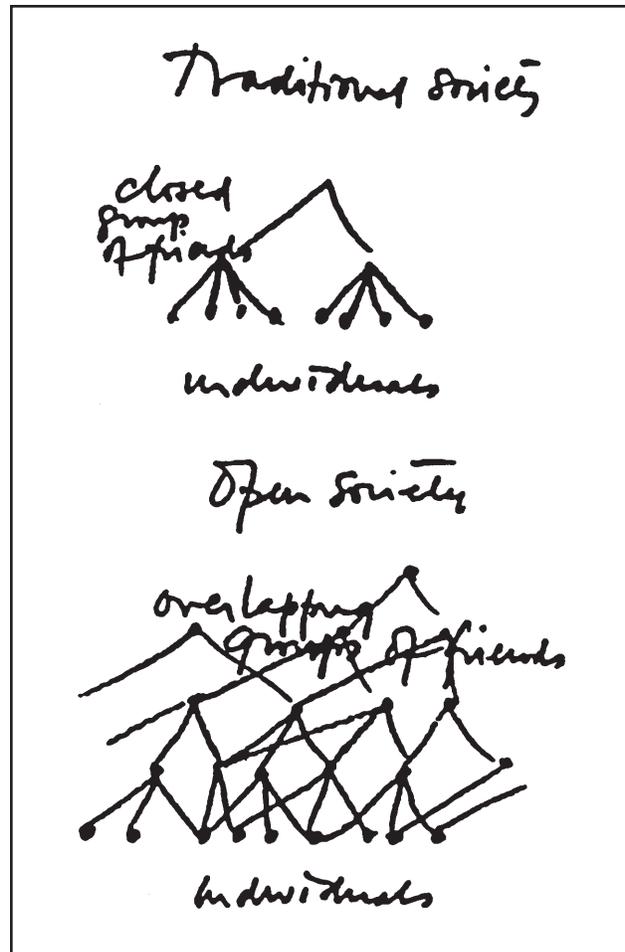

Figure 2. *Traditional and open soceieties. Diagram from Alexander 1965, Part 1, 62.*

concepts clash with the realities of today's open and overlapping patterns of urban interaction. A description is provided of a young couple who choose to move to a redevelopment area based around a local center with rail links to the region's two largest centers. The vision outlined here is unrealistic because it does not match the patterns of interaction created by automobility, patterns which have enhanced the overlapping quality of modern open society and which cannot be displaced by physical construction.

Note first that the couple's friends and family are said to live centrally. The reality, however, is that their social connections are likely to be dispersed throughout the Sydney area, since the car has made the locality of these relationships of far less significance than in the public transportation city.[4]

For similar reasons, while some residents may work centrally, others will continue to commute to dispersed locations. Putting a local center in does not, furthermore, mean that it will become the center of residents' lives. It may be used some of the time, but if the couple happens to like a particular bagel shop in Bondi or surf shop in Manly or

restaurant in Newtown (all of which are popular suburban neighborhoods regularly frequented by residents from other suburbs throughout Sydney), why should they depend on the local center when their car offers a better alternative?

The center may have good rail service to Sydney and Parramatta (a regional center), but will that service go to exactly where that couple wishes to go—and are they any more likely to use a local minibus or cycle to reach the station than they are to do so now? And even if shops are within walking distance, will they carry their groceries home on foot when they can just throw them in the back of the car?

While the car is often seen as an unnatural phenomenon by planners who want a return to public transport, the opposite appears to be true. The car has facilitated a rich pattern of interactions throughout the city. Sydney residents may drive 10 miles to a friend and during a halt at a traffic light be enticed to check out an interesting-looking shop. They may visit a store on the other side of town that has exactly the type of cheese they like and stop to take in a movie at a cinema

nearby. These are the overlaps Alexander talks of as belonging to a natural city, and these are the patterns which have naturally arisen to reflect the opportunities that automobility has presented to the people of Sydney. The artificially created "urban village" is a "tree" because it does not reflect the richness of today's multifaceted and overlapping urban possibilities. It is not likely to become the resident's center of life for any longer than a purpose-built playground will occupy a "self-respecting child." Because residents will remain attracted to exploiting the overlapping richness of the city with their automobiles in ways that will remain beyond the ready capabilities of public transport, there is no reason to believe that consolidated urban forms will assist in bringing about the desired balance between transport modes—even if the concept were not illusory.

The idea of "balance" is attractive because it simplifies complex ideas into a physically based metaphor of adding or subtracting weights to return a scale to an imaginary state of equilibrium. The concept of urban consolidation is appealing

The key principles in practice

To get a better idea of what the vision, goals and key principles mean for individuals and families, consider two hypothetical households in the year 2020: a couple with school-age children, and an older couple approaching retirement.

Back at the turn of the century, the young woman purchased one of the many new, small and affordable residential units constructed in recycled woolstore building in the Ultimo-Pyrmont area. Working in the tourist industry in Central Sydney, she was able to use the light rail to travel to work on the occasions she did not walk. They enjoyed inner-city living.

Deciding to start a family, the young couple considered buying a block of land and building their own house, but many of the opportunities available were a long way from family and friends and the inner-city lifestyle they enjoyed. They would have had to buy another larger car to meet separate work and home commitments.

Eventually they settled on one of the new redevelopment areas in the inner south west. These offered a good life style with yard space and were located close to existing good quality community facilities. The local centre, which offers a range of community, retail and entertainment facilities, is within walking distance. The centre is based around the rail station, with quick, frequent, reliable and comfortable services to Sydney and Parramatta.

In the event that a walk to the centre is not possible, the family can choose from a variety of options. Conventional taxis offer a cheap and comfortable alternative, and a locally operated minibus regularly traverses the neighborhood. The centre is only a few minutes away by

cycle along dedicated landscaped cycle routes. Cycle lockers are available at the railway station for rail/cycle commuters.

The young family lives in a house designed to take full advantage of the moderate climate, including solar orientation and on-site recycling of stormwater for use on the garden. The children of the family attend the local primary school and high school, located near the centre. The school is part of a cluster of educational and community facilities. The library, gymnasium, hall and ovals are shared between public and private schools and are used out-of-hours by numerous local community groups.

The older couple lived most of their working lives in a large home in a middle-ring Sydney suburb. Some of their friends moved to the north coast and Queensland following retirement, but were less than satisfied with separation from family and friends. Fortunately, by the time the couple reached this stage, there were many choices.

Small, well-designed homes were available in many locations across the city, close to shops, services, and facilities, and within walking distance to public transport. The couple chose a unit in a medium-rise block of units located near the centre of one of the city's many urban districts. Their home is naturally heated, ventilated and lit, is large enough to accommodate a visiting grandchild, and has its own private courtyard space.

Visits to family and friends can be accomplished via a short walk to the local rail station, or by using the locally operated community taxi. The local senior citizen's centre is situated nearby, and the local shops include a doctor's rooms. Trips to Sydney and Parramatta CBD's are short and comfortable, and leafy streets and attractive public spaces make these centres a pleasant option for an afternoon or morning out.

Figure 3. This example from the New South Wales Department of Planning (1995, 19) shows planners' conception of transportation principles.

because it is seen to contribute to this process by shifting weight from the supposedly overloaded roads side of the fulcrum to the lightweight public transport—and in particular rail public transport—side. The notion can only come alive, however, as a drawing on an idealistic planner's sketch pad, since it ignores the complexity of the auto-mobile lifeforms of the close of the 20th century. The naive beauty of the compact city shares a pattern of simplification with the metaphor of "balance" to which it provides an essential input: Both concepts collapse complex urban and economic relationships into issues of physical structure. There is an easy appeal to such simplifications. But they cannot solve our urban problems.

If we look at the great transportation innovations of the past, they were all responses to unmet needs: to escape from the congested center; to provide an alternative to walking from the suburbs; to provide more widespread mobility within the suburbs. There was a tension created by unmet demand, and a response to it. The difference between today's proposals for Sydney and the innovations of the past is that they are attempting to fight public preferences, rather than satisfy them. Can such attempts succeed? They can't, given the existence of a mature, auto-driven metropolis. More fundamentally, should they succeed? Instead of trying to mold today's forms to past patterns which have been displaced, it would surely be more productive to find out how people want to live and then accommodate their wishes in environmentally responsible ways. As Alexander says:

> It is vital that we discover the property of old towns which gave them life and get it back into our own artificial cities. But we cannot do this merely by remaking English villages, Italian piazzas, and Grand Central Stations. Too many designers today seem to be yearning for the physical and plastic characteristics of the past, instead of searching for the abstract ordering principle which the towns of the past happened to have, and which our modern conceptions of the city have not yet found (Part 1, 58).

Perhaps if we would accept the abstract ordering that the car has brought to our city-environment instead of fighting it in ways that fail to incorporate this understanding, we can bring about enhanced lifestyles for the mature Sydney of the future and find ways to tame the undesirable side-effects of the automotive age, too.

Alternative Approaches for Sydney

Balancing involves trading off weights, not examining them. The *Integrated Transport Strategy* sees buses and trains as generic items to be balanced with each other and with automobile use. Currently available alternatives are laid out, but there is no examination of how those available alternatives might be deployed differently. Perhaps public transport is

ineffective partly because it mirrors bygone demands; it represents a radially based city of the past. We should therefore attempt to change the nature of those services, not provide more of the same.

Bus routes and operating practices have often remained unchanged for years. Some bus lines follow the old tram routes, even though patterns of demand have shifted. Many lines cover long distances, making them unreliable at serving predominantly shorter-distance needs. Reconfiguration of routings could improve both service and efficiency. While demand will continue for some high-volume bus lines, which are best served by the currently used standard buses, services that reflect more of the attributes of the car—with smaller buses and vans on flexible and dispersed routes, for example— might be developed and better tailored to local needs. While public transport is unlikely to recapture more than a small share of the automobile market, such changes could make it more relevant and more attractive.

The low quality and lack of customer-service orientation of many public transport services in Sydney also need to be addressed. Transit management is working on improving service and efficiency, but attention must be focused on the structure as well as quantity of service and on modernizing organizational culture as well as physical infrastructure.

As we saw in the Los Angeles case, holding bus fares down can have more potential for promoting transit ridership than the construction of a misplaced rail system. Priorities for today's system should be considered as part of visions for tomorrow's. Our tendency to simplification puts the long-term in a separate box from the short-term and capital expenditures in a different category from operating costs, but we must overcome this tendency and evaluate the relationships between these elements if we are to have productive change.

Creativity is also needed in thinking of how the road system might be more efficiently managed. As David Hensher (1992) points out, Australia's road system is not effectively priced. People do not pay the full cost of travel each time they set out on a car trip. The trip therefore appears cheaper than it really is. Charging for specific road use is a sensitive political issue, but deserves further consideration if there is to be a real effort to use the road system more efficiently. Another way to use roads more efficiently is to use bus priority lanes where demand warrants them.

Don Shoup's (1995) important recent work in California has also demonstrated that there is great potential for more effectively priced parking. Traditionally, most parking has been free or subsidized to employees, hiding the cost of providing and maintaining the facilities, which is real. In the Californian instance, legislation now requires certain categories of employers who pay for their employees parking to either stop paying or provide an equal cash benefit for those who choose not to drive. Drivers are thereby made aware of the real costs their cars impose and given an incentive to use public transportation instead where it is appropriate. Most impor-

tantly, system performance is increased because of real gains in efficiency, which do not accrue by merely adding more of the same to the inefficient present system.

Looking to the longer term, we could do well to spend resources on research for developing technologies of the future—environmentally sound personal systems, for example—which address the tensions of today's urban transportation systems, rather than leave them in place.

The most important work to be done, however, is to inquire into what type of Sydney people wish to inhabit. Research is needed into why residents have fled from central to suburban lifestyles and to understand how people feel they would like to live. Studies should be completed which are both backed up with hard data to describe preferences which are currently revealed and which reflect a wide variety of community responses collected during the research process to illustrate how people would like to live in the future. The job should then be to manage the transportation system to accommodate those desires as responsibly as possible, in the recognition that prescribing a lifestyle people don't want is not only antithetical to good government—it is bound to fail given the dispersion and car ownership that have already arisen.

■ CONCLUSION

The problems we have been studying here were identified by Melvin Webber in his 1964 paper. The Christopher Alexander paper, which has illuminated this essay and which should join Webber on any compulsory reading list for beginning planning students, explains why we have become obsessed with the physical city and with the spatial arrangement of activity relationships at the same time that we neglect the conception of the city as a social system in action. Physical plans have a natural accessibility to the human mind, and the compact city has a tree-like elegance to it that we find comforting. Patterns of interaction and social behavior are much harder to fathom and even harder to accept when they depart from the traditional notions of tidy urban forms upon which we have been schooled. The need for simplification is basic to the working of the human mind, but it keeps us from finding creative solutions to our most pressing problems.

Much like a first visit to Alcoholics Anonymous, acknowledging that we simplify is the first step to attaining the courage to face complexity. By relating transportation innovation and change to urban forms and interactions, we can begin to form a historical understanding of how the elements come together and to formulate creative models of how change may affect the structure of the system in the future. An understanding of the forces and tensions created by transportation innovation can teach us which future patterns are likely to be successful.

Recognizing that transportation is inevitably tied in an intricate web of overlaps with all other urban functions and with the rich morass of human life complicates the planning task but makes it more likely to achieve meaningful results. The assumption that people will use local facilities in a village-

like community setting and that they will cycle to the train station along dedicated landscaped cycle routes is easy to make if you do not appreciate the web of complex interactions for work, shopping, and leisure that auto-mobility has created throughout the metropolis. Perhaps the hard pill to swallow is that our metaphors—our ways of seeing things—must be different from past ones. In the developing city, technological innovations could help resolve tensions between transportation demand and supply. But planning approaches based on resurrecting physical entailments of the past cannot succeed when they fail to reflect the abstract ordering of the today's communities.

The successful transportation planner of the future must move from attempting to shape lifestyles in ways that cannot succeed in a democratic society to instead appreciate the many dimensions of how people have chosen to live and interact across space and how this relates to their aspirations for life in the future. Such an approach requires courage and may provoke discomfort as we are drawn away from the tree's protective shade. But it promises to generate creativity and open the way to the growth of real new opportunities—and opportunities that have the richness of the overlaps of the natural city, not the emptiness of a tree.

■ NOTES

1. The information on Los Angeles is from interviews with officials of the Los Angeles County Transportation Commission: Supervisor Deane Dana, Supervisor Kenneth Hahn, Alternate Commissioner Walter King, former Executive Director Jerome Premo (interviewed in New Jersey), staff member Burke Roche, and staff member Richard Stanger. They were conducted in person and tape-recorded during 1985 and 1986.
2. See Hart (1976, 59) for the origin of this term.
3. These interviews were conducted in 1985 and 1986. Interview of Dan Roberts was conducted in Washington, D.C.; Congressman Jim Bates was interviewed in Washington, D.C.; Councilman Ed Struiksma was interviewed in San Diego, Calif.
4. See Webber's 1964 classic on the "nonplace urban realm," which should be required reading for all introductory planning classes for all time.

■ REFERENCES

Alexander, Christopher. 1965. A city is not a tree. *Architectural Forum* 122 (1):58-61 and (2):58-62.

Altshuler, Alan A. 1979. *The Urban Transportation System: Politics and Policy Innovation.* Cambridge, Mass.: MIT Press.

Bail, Eli. 1984. *From Railway to Freeway: Pacific Electric and the Motor Coach.* Glendale, Calif.: Interurban Press.

Brodsly, David 1981. *L.A. Freeway: An Appreciative Essay.* Berkeley, Calif.: University of California Press.

California Legislature. 1981. Light rail transit in Southern California: Return of the red cars. Transcript of proceedings. Public Hearing before the California Assembly Committee on Transportation, Long Beach City Hall, Long Beach, Calif. August 14.

Clark, Colin 1957. Transport: Maker and breaker of cities. *Town Planning Review* 28:237-250.

Downs, Anthony. 1962. The law of peak-hour expressway congestion. *Traffic Quarterly* 16(3):393-409.

Hall, Peter 1992. Transport: Maker and breaker of cities. In *Environmental Issues in the 1990s*, ed. A.M. Mannion and S.R. Bowlby, 265-276. Chichester, U.K.: Wiley.

Hensher, David A. 1992. Socially and environmentally appropriate futures for the motor car. Working Paper ITS-WP-92-12. Institute of Transport Studies, University of Sydney.

Hilton, George W. 1967. Rail transport and the pattern of modern cities: The California case. *Traffic Quarterly* 3(3):379-393.

Independent Pricing and Regulatory Tribunal of New South Wales. 1996. An inquiry into pricing of public passenger transport services. *Transport Interim Report 3: City Rail.* Sydney, Australia.

Johnson, Mark 1987. *The Body in the Mind: The Bodily Basis of Meaning, Imagination and Reason.* Chicago, Ill.: University of Chicago Press.

Lakoff, George, and Mark Johnson. 1980. *Metaphors We Live By.* Chicago, Ill.: University of Chicago Press.

Los Angeles County Metropolitan Transportation Authority (MTA). 1996. Ridership data. Response to data request from Los Angeles County Supervisor Antonovich's office. September 13.

Los Angeles County Transportation Commission (LACTC). 1982. Press release. Los Angeles, Calif. March 24.

New South Wales Department of Planning. 1995. *Cities for the 21st Century. Integrated Urban Management for Sydney, Newcastle, the Central Coast and Wollongong.* Sydney, Australia.

New South Wales Department of Transport. 1995a. *A Balanced Transport Future for Sydney: Plans and Actions for a Quality Transport System.* Sydney, Australia.

New South Wales Department of Transport. 1995b. *Integrated Transport Strategy for the Greater Metropolitan Region.* Sydney, Australia.

Nietzsche, Friedrich. 1968. *The Will to Power.* Translated by Walter Kaufmann and R.J. Hollingdale. Edited by Walter Kaufmann. New York: Random House Vintage Books.

Richmond, Jonathan E.D. 1991. Transport of delight: The mythical conception of rail transit in Los Angeles. Ph.D. dissertation. Massachusetts Institute of Technology, Cambridge.

Richmond, Jonathan E.D. Forthcoming. The Mythical Conception of Rail Transit in Los Angeles. *Journal of Architectural and Planning Research.*

Schön, Donald A. 1963. *Displacement of Concepts.* London: Tavistock Publications.

Schön, Donald A. 1979. Generative metaphor: A perspective on problem-setting in social policy. In *Metaphor and Thought*, ed. Andrew Ortony, 254-283. Cambridge, U.K.: Cambridge University Press.

Shoup, Donald C. 1995. An opportunity to reduce minimum parking requirements. *Journal of the American Planning Association* 61(1):14-28.

Snell, Bradford C. 1974. *American Ground Transport, A Proposal for Restructuring the Automobile, Truck, Bus, and Rail Industries.* Part 4A, Appendix to Part 4. Hearings before the Subcommittee on the Judiciary, United States Senate, A1-A103.

Wachs, Martin. 1984. Autos, transit, and the sprawl of Los Angeles: The 1920s. *Journal of the American Planning Association* 50(4):297-310.

Webber, Melvin M. 1964. The urban place and the nonplace urban realm. In *Explorations into Urban Structure*, ed. Melvin M. Webber et al., 79-153. Philadelphia, Pa.: University of Pennsylvania Press.

Weightman, Gavin, and Steve Humphries. 1983. *The Making of Modern London, 1815-1914.* London: Sidgwick and Jackson.