THE IMPOSSIBILITY OF A BALANCED TRANSPORTATION SYSTEM

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Introduction:

In much of the Western world and beyond, the automobile has become the most convenient mode of human locomotion, so omnipresent only four generations after its invention that people struggle to imagine life without it. Thus, despite the car's responsibility for a litany of negative impacts on humanity and nature, the various calls for reform have largely fallen on deaf ears or lead to feelings of individual powerlessness, as people long for a workable exit route from the hour-long commute and the incessant ferrying of children and the elderly back and forth to their daily destinations.

In response to this latent demand for change, most contemporary transport reformers advocate a 'balance among transportation modes' or a 'level playing field' among the various 'options' or 'alternatives.' Notable, however, is the absence of debate as to whether such a state is possible, let alone desirable. Is the ideal transportation system simply a matter of personal choice among a palette of what could be peacefully co-existing options, as market ideology would suggest? Or does the rise of one mode typically occur at the expense of another, such that our priorities must be decided collectively rather than individually? Might there be such a thing as incompatible modes – modes that influence each other negatively and cannot peacefully share the same street space or even the same environment?

What follows is a sampling of quotations that highlight the widespread belief in transportation balance:

"New Urbanism seeks to achieve a ***balance*** between the automobile and the pedestrian that accommodates automobile use without degrading the pedestrian experience."
- City of Palo Alto, CA, USA, New Urbanism Discussion Paper, January 25, 2002 [http://www.city.palo-alto.ca.us/zoning/newurbanism.html]

"'Cities for People' will take place in the Danish capital, Copenhagen, where 40 years of continuous work has resulted in a fine ***balance*** between pedestrians, cyclists, public transport and motor traffic."
- promotional literature of the Cities for People conference (WALK21 #5), organised by The Centre for Public Space Research and others, June 2004 [http://www.citiesforpeople.dk]

"…Another of Copenhagen's special features is that city center traffic has been pacified. However, car traffic can still get to most destinations, and generally, car traffic is in reasonable balance with pedestrian and bicycle traffic. If this rather peaceful coexistence […] continues, there are no strong arguments for pushing cars further back in the city center."
- "Public Spaces – Public Life," by Jan Gehl and Lars Gemzoe, Danish Architectural Press, 1999

"Do not close the street to traffic. Street reclaiming is built on finding a better ***balance*** between the movement function and the neighborhood-building function of streets. These events are to demonstrate how cars and people can coexist more harmoniously in the same space. If you want to close the street to traffic, do not call it a Street Reclaiming event."
- David Engwicht, author of "Street Reclaiming: Creating Livable Streets and Vibrant Communities" [http://www.lesstraffic.com/Articles/Traffic/SRinstant.htm]

"Intersections should not favor either motorist or pedestrian, but give equal service and support to both..."
- The "Pedestrian Preamble," Florida Walkable Communities Guide, Florida DOT, 1995

This paper analyses both the pedestrian's and the automobile's ideal 'habitats,' followed by a detailed discussion of what an imaginary, 'balanced' city structure might look like, and what its repercussions on society might be. Then, we judge whether the 'Balanced City' is equally suitable to the pedestrian and the automobile as compared to their ideal 'habitats,' or whether such a city structure serves as a compromise rather than a true balance. Finally, we explore some possible alternatives to the idea of 'balance.'

<u>Urban Form 1-2-3</u>:

Since the beginning of civilisation, people have structured their habitats in one of three basic urban forms, each of which lacks what today we might call 'balance.' That is, each was shaped primarily by the dominant mode of transportation at the time, to the exclusion or limitation of other modes. A detailed discussion of each of the three urban forms is necessary before we can move on to an assessment of the idea of a 'Balanced City' – which could either represent a fourth urban form, or exist as a modification of any of the three urban forms described below.

The Pedestrian City

Humans have an innate ability to move about on foot as autonomous beings, without motorised or mechanical assistance. From pre-historic times to the mid-1800s, the urban form of virtually every city, town and village in the world embraced this natural human capacity for movement.

The city was compact, dense, rich in destinations and events, lively, multifarious, closely knit, intimate, human-scaled. All this made walking pace the ideal speed at which to experience it, as there was so much to see and do within a small area. Characteristic were narrow cobblestoned streets one to eight metres wide twisting and turning, bordered by buildings two to six stories tall.

Rarely were these medieval or pre-medieval pedestrian cities more than five km across, since, among other reasons, all destinations needed to be within walking distance. The distance from the centre to the outer edge of the city could be reached on foot in 30 minutes or less – the same time it takes by car today in a typical Car City.

The streets were used just as much for community interaction as for transit: Activity spilled out from shops and workplaces. Friends, neighbours and acquaintances would meet spontaneously and stop to chat. Without the danger of cars, children were free to play in the streets without formal supervision.

This traditional emphasis on interaction, or 'exchange,' is no triviality. Walking is much more than a means of locomotion, and the way Pedestrian Cities were built did not reduce it to such. The city, as defined by David Engwicht, is "an invention to maximise exchange and to minimise travel":

> These exchanges may be exchanges of goods, friendship, knowledge, culture, work, education or emotional and spiritual support. We choose to live in cities because exchange, or human interaction, is the real stuff of life. As humans, we crave reciprocal relationships, new ideas, and surroundings that stimulate all our senses. Cities are a deliberate concentration of these exchange opportunities in order to increase their accessibility. However, we still need to move to gain access to these exchange opportunities – albeit not as far as if they were scattered all over the globe. This means that cities cannot just be a concentration of exchange opportunities; they must devote some of their space to movement. Cities are therefore composed of two types of space: exchange space and movement space. Now, the more space a city devotes to movement, the more the exchange space becomes diluted and scattered. And the more it becomes diluted and scattered, the more the city begins to lose the very thing that makes it a city: a concentration of exchange opportunities.

By definition, the *only* way to maximise exchange and minimise travel is to build a Pedestrian City – a compact, high-density, mixed-use city which accommodates only low-speed, space-efficient transportation. It is simply not possible to maximise exchange while devoting 10-60 percent of the urban surface to roads, parking lots and other infrastructure that provides little if any social exchange space. Nor is it possible to minimise travel while simultaneously accommodating the automobile or other high-speed transportation.

Although from the isolation of his or her metal box, the motorist may engage in some level of distanced communication such as a telephone call, this is not the true, face-to-face, direct interaction for which the city is necessary – interaction which the automobile inhibits and obstructs. At the beginning and end of the day, no matter where we live or how much money we have, we are all pedestrians. Almost all of our meaningful daily interactions – at home, at school, at work and at play – occur while on foot.

With the Pedestrian City's structure, most of one's daily needs can be fulfilled within a short walk. While Engwicht suggests that exchange space and movement space are to be segregated, in the Pedestrian City street space doubles as exchange space. Not only does this maximise the space available for exchange, it also eliminates the space

devoted *solely* to movement. The distinction is then blurred between the pedestrian the walker and the pedestrian the social being, because walking is to a great extent intermingled with other activities – or more accurately, fused into a single activity. And because pedestrians share space only with compatible transportation modes such as handcarts, they are not forced to forfeit the centre of street and resign themselves to a sidewalk. The fact that nowhere is off-limits to the pedestrian contributes to the profound sense of place characteristic of Pedestrian Cities.

In the rich, dense, labyrinthine environment where the pedestrian thrives, the streets are often too narrow for cars. The precious street space is filled with activity. Let us presume for sake of argument that a car could physically fit, and could push through the crowd – going perhaps little over walking pace. Everything and everyone would have to temporarily move aside to allow its passage. Even one car every 15 minutes would result in a loss of space for public interaction; the centre of the street, for example, could no longer be used as a marketplace or workspace. If the driver were lucky he would find a 'parking space' on a public square, after honking to scatter its previous occupants. Inviting a car to such a place would be like inviting an elephant into your bedroom. It would defy the purpose for which the city was built. The first casualties would be the peaceful atmosphere, the vibrant street life and the children playing outdoors. The passage of a single car would inconvenience dozens if not hundreds of people. Nevermind that in such a place driving would provide no practical advantage over walking.

The advantages of the Pedestrian City are many: a friendly, vibrant, bustling, interactive, peaceful, pollution-free environment built according to a human scale; a sense of place, of community, of security, of charm, of tradition; ample daily exercise without it becoming an activity in itself; a lack of depression-breeding isolation and alienation; and the feeling of independence that comes with reaching one's destinations under one's own power, regardless of age or physical ability.

The Public Transportation City

From the mid-1800s to the 1930s, the pressures of population and industry pushed cities outward along public transportation corridors. Overall density dropped from high to medium, while the physical size of the city expanded up to tenfold or more. It was often pre-existing peripheral destinations such as cemeteries that were first to receive tram service. But before long, it was possible to build medium-density residential developments (often with shops and businesses on the ground floor) along these tram corridors. Therefore, cities developed a grid-like or asterisk-shaped structure. Between the tram lines were lower density residential areas, parks and open space. The tram line terminus marked the urban periphery. Virtually every destination in the city could be reached conveniently by public transportation in combination with a short walk.

In these cities, residents typically used public transportation for trips outside the neighbourhood, although in some cases bicycles and horse-drawn carriages added to the mix. Because the majority of residents were using the trams and trains on a daily basis, it was possible to maintain higher service levels than are possible in today's Car City, or for that matter in a proposed 'Balanced City.' In the American city of Philadelphia, for example, the busiest tram streets in the 1920s offered tram departures every 30 seconds during peak hours.

If the city had sought balance among several modes rather than accommodating public transportation's hegemony, service levels would have declined to correspond roughly to the modal split. In other words, if a city's residents used public transportation for 20% of all trips, service levels would tend to be approximately three times lower than if they had used public transportation for 60% of all trips. This is true insofar as public transportation service levels are based on demand; of course other factors such as public policy, public investment, and tram or train capacity also influence service levels.

The city's embrace of public transportation increased both speed of travel and average distances travelled, so that the increase of speed did not actually result in time savings over the Pedestrian City. The time it took to travel from the city centre to the periphery remained approximately 30 minutes.

The Car City

In the modern Car City, motorists, public transport users and cyclists often complain that walking is too slow – not because, as they imply, the feet they were born with are inherently deficient, but because the Car City has destroyed or replaced the urban environment in which the pedestrian thrives. In the sprawled-out, low-density environment where the car becomes convenient and almost necessary to reach the scattered, far-flung destinations, little if anything lies within walking distance, aside from the stores of a shopping mall, once you've arrived there by car. It

typically takes five minutes of driving to reach the nearest shopping plaza, containing a chain supermarket and perhaps 20 shops. It takes 20 minutes of driving to reach the nearest shopping mall, housing 100 or more stores. Within a five-minute walk from one's home, it is typically impossible to reach anything other than a park or school, or countless rows of nearly identical houses inhabited by strangers.

The Car City can be described as an anti-city, because it defies the purpose of a city. Rather than bringing people together, it isolates them in rushing metal boxes and creates enormous distance between destinations, ensuring car dependence. The formation of a true community, a prerequisite for direct democracy, then becomes an almost pointless ambition.

Here every trip made by car compromises the ability of others to use public transportation, which is already barely viable due to the spread of destinations thinly and evenly over the landscape. When most everyone chooses the car, public transportation service declines to levels only tolerated by those who have no other choice – the poor, the elderly, the physically handicapped, and those children whose parents aren't available to serve as chauffeurs. The motorist is in a 'prisoners' dilemma' in which it would be faster to take the bus if everyone took the bus, but unless people cooperate in this behavioural change, it remains faster to drive.

In many cases, cycling, and perhaps walking, remain viable means for children to get to and from school, the nearest shopping centre, and the houses of some of their friends. But because of wide streets and plentiful parking, taking the car is usually *perceived as* faster, more convenient, safer (because of the danger of cars) and above all, more 'normal' or even 'cool.' I say 'perceived as' because the speed does not take into account such things as (a.) the extra time then required for exercise that one is not getting behind the steering wheel, (b.) the work time spent offsetting the costs of the car, fuel, insurance and repairs, and (c.) the fact that the time 'saved' is usually just spent accessing further-away destinations, rather than becoming available for other activities.

But it is only in the Car City that, except at certain times of day, the movement of one car does not have to impede the movement of another to the extent that it does in higher-density urban forms. Ample road space and abundant parking afford the motorist a monopoly on movement and convenience. Therefore, if one is set on being a motorist – which is arguably against the best interests of the motorist himself – the Car City is certainly the place to be one.

That the Car City is the ideal 'habitat' for the automobile, as well as for the motorist who wishes to remain a motorist regardless of environmental conditions, is corroborated by:
- the high percentage of Car City residents who characterise themselves as car dependent;
- the fact that the Car City was built for and around the car, facilitating its movement at the expense of other modes; and
- the high amount of street space and parking space per capita, relative to other urban forms.

Still a paradox remains: The Car City's embrace of the automobile simultaneously increased both the speed of travel and the average distances travelled. Increasingly more space was devoted to movement, and the time savings promised by the car's speed never materialised. Nothing more is accomplished than before. And further, accommodating the increase in speed degrades both our urban environment and the extent to which a social experience is possible. In all three urban forms, the time it takes to travel from the city centre to the periphery is approximately 30 minutes.

We are left to conclude that the automobile is not inherently convenient, and did not become so until our world was reshaped to accommodate it, through a century-long process of industrial influence over spending priorities and settlement patterns. In fact, since the car and other high-speed transport technologies have placed our daily destinations increasingly out of reach of our feet, the transportation industry's radical monopoly over human movement has denied us the convenience, the freedom, to go 'where we want, when we want' by foot. Engineered mobility creates an artificial need to bridge distance that it alone can satisfy, impeding both access by proximity and autonomous, self-propelled movement.

The 'Balanced City':

On cursory examination, the concept of balance appears so reasonable as to be irrefutable. Yet we have yet to assess whether such a state is possible in the context of transportation and urban form. Hence the quotation marks I use on the word 'balance.'

When transportation reformers propose 'balance,' it is often difficult to assess exactly what they mean, for the very reason that they leave it open to the imagination rather than constructing a precise proposal that would then be accessible to rigorous analysis. In this paper I make the assumption that the terms 'balance' and 'level playing field' (among all common modes of ground transportation) are intended to be synonymous. This interpretation is supported by the quotations from 'Balanced City' proponents provided in the introduction. In addition, the concept of a level playing field clarifies that the intention is a 'harmonious balance' rather than a 'balance of power.'

Separating incompatible modes

'Harmonious balance' or co-existence as represented by a level playing field implies that every transportation mode is on equal footing. None receives an unfair advantage, such as a disproportionate amount of public investment – or 'subsidies,' as non-automobile investments are derisively called today. Likewise, no mode receives a handicap, such as when incompatible modes are forced to share infrastructure. Such would be the case for a bus sharing a car lane. It is the car whose space inefficiency creates the traffic jam, yet with *shared infrastructure* the space-efficient bus must sit in that car-induced traffic jam nonetheless. Needless to say, this nullifies one of the bus's principle advantages. Similarly, if cars were allowed to drive on the tram tracks, the relative advantage of the tram would be reduced by car-induced delays.

Shared infrastructure does not result in a handicap in all cases. For example, rollerbladers, skateboarders and bicyclists can compatibly share a lane, as long as that lane is well below capacity and sufficiently wide to allow a cyclist to pass. But to seek 'balance' we must separate incompatible modes, to avoid one influencing the viability of another (insofar as that is possible). This, in contrast to shared infrastructure, is what I call *parallel infrastructure*.

Parallel infrastructure is the infrastructure of one transportation mode which is or has been added alongside, above or below the infrastructure of another mode, without detracting from the latter. A dedicated bus lane next to a dedicated tram 'lane' would be an example. Parallel infrastructure to car lanes can be sidewalks, dedicated bus or tram lanes, underground or elevated metro and rail systems, trails through parks, or bike lanes separated from car traffic.

I call *replacement infrastructure* any new transportation infrastructure whose building requires the removal of another mode's infrastructure – for example, a tram line built down the middle of a previously four-lane car street, resulting in two lanes left for cars. In practice, new infrastructure will often be some combination of parallel and replacement, and there are grey areas, such as adding a bike lane by narrowing the car lanes, rather than reducing the number of car lanes. Nonetheless, the term retains its usefulness. Any attempt to transform a Car City into a 'Balanced City' is doomed to failure if it fears replacing the infrastructure on which the automobile's monopoly depends.

How to allocate road space

The 'balance' doctrine permits three options in allocating road space among the various transportation modes: (1.) space per mode according to need, (2.) allocating space to achieve equality among modes in terms of 'modal split,' or average percentage of trips per mode, or (3.) equal space per mode. If proponents of balance fail to state such a clear definition for the sort of 'balance' they seek, then a reasoned critical response is nearly impossible.

The first option, or definition, is extremely problematic. For one reason, it requires us to define 'need,' which may not be possible. When we put a tram line on every arterial street – rendering it no more than a five-minute walk from any home to the nearest tram stop – we could perhaps say that trams have received the amount of infrastructure that they need. Although we haven't addressed the issue of service levels – the number of trams per hour that the tram mode 'needs' – we will likely never have to lay new tram tracks through the neighbourhood again. The same might hold true for a dedicated bus lane. Similarly, when we provide a wide, safe bike lane, that capacity may suffice for eternity. But does this mean that cyclists *need* a wide bicycle lane? Do pedestrians *need* a wide sidewalk? It may be self-evident that, up to a certain point, each mode increases in viability with increased space and infrastructure allocated to it. This explains why public space architects widen sidewalks in order to create a more pedestrian-

friendly environment, going beyond pedestrians' strict needs. So if we wish to allow for such decadence, we must abandon the idea of allocating space according to need.

It may also be self-evident that the car, unlike the other modes, is never content with the space allocation that it has. As long as more and more people want to drive, its rapacious hunger must consume increasingly more space in order to maintain its current level of convenience. Just as human greed denies that any amount of money might be *enough*, the car's 'greed' denies that any current or future space allocation could be sufficient. In order to achieve a state of 'balance,' of course, we cannot allow this demand for growth to be satisfied. Instead of accommodating projected car traffic growth based on past growth – a self-fulfilling prophecy the logic of which has turned downtown Detroit into a dead zone – we must set firm limits in our space allocations if our goal is 'balance.' Arguably, doing so could result in a steady reduction over time in the level of convenience that the car provides. But we will discuss this later.

What we know for certain is that, in congested conditions – conditions where demand for car use is increasing towards capacity, especially at peak times – car traffic levels tend to expand and contract to fill the available road space. Building more car lanes leads to more driving, while removing car lanes leads to less. We could perhaps establish a minimum level of the car's 'need' for street space – say, one lane in each direction on arterial streets, and one lane in one direction on residential streets – but this would be somewhat arbitrary. Furthermore, it would lead us to similar space allocations as in a far less complicated 'equal space per mode' scenario.

The second option has not been discussed: seeking to achieve equality among modes in terms of 'modal split,' or average percentage of trips per mode. For example, we could seek to achieve 20% of trips on foot, 20% of trips by bicycle, 20% of trips by tram and/or bus, 20% by metro, and 20% of trips by car. This means that we don't have to define the space 'needs' of each mode, we just create a system in which people will tend to choose the car 20% of the time. An easy way out? Certainly some problems are solved. However, many would find the idea of social engineering on this level a bit distasteful. Whereas 'equal space per mode' allows people to vote with their feet in a democratic and free manner, 'balance by modal split' rigs the system so that an average individual (if there is such a thing) chooses to walk only 20% of the time. This makes a mockery of the idea of personal choice. There is also the not so minor problem that to achieve its 20% modal split, many cities in Europe and elsewhere – including many cities generally viewed as less than balanced – would have to actually reduce their walking, bicycling and public transportation modal shares – regression in the name of balance. Whereas the third option, 'equal space per mode,' if instituted on a city-wide basis, allows for the necessary flexibility to retain any past gains in modal share made by walking, bicycling and public transportation. Therefore I conclude that the only simple, workable, non-arbitrary and fair way to allocate space in a 'Balanced City' is to provide equal space per mode, while allowing compatible modes to share road space.

Of course, if our definition of 'balance' did not require accommodating the car, we would be free to allocate road space by any number of criteria – space efficiency per mode, energy efficiency per mode, traffic volume potential per mode, social compatibility, etc. After all, if the goal is balance, why should the car, on an arterial street, be granted a full lane in each direction (within which a maximum of 1,500 car passengers will pass in an hour, or 36,000 per day), when the same space devoted to a tramway can achieve 12,000 passengers per hour, or 288,000 per day? We must face the contradiction that selecting such criteria would reduce the car's space allocation to 12% that of the tram – well below the level of viability. Even if the average car had four occupants, automobiles would still only be granted one-fourth the street space as the tram. Therefore accommodating the car forces us to allocate road space equally by mode. So we will experiment with the 'equal space per mode' solution for now, and we will address the general problems with seeking 'balance' later.

A 'Balanced' Arterial Street:

Based on the 'equal space per mode' scenario that I have argued for – or rather, that is required to simultaneously accommodate the car and a meaningful concept of 'balance' – we will start by attempting to create a level playing field on an arterial street in a 'Balanced City.' For reasons I have explained, this will require limiting *shared infrastructure* to compatible modes, and using *parallel infrastructure* to physically separate incompatible modes.

Let us first divide the street space among each of our typical modes of locomotion, both self-propelled and conveyance. We will grant a three-metre 'lane' in each direction to:

(1) pedestrians/wheelchairs/handcarts, etc.;
(2) bicycles and other human-powered vehicles;
(3) buses or trams; and
(4) cars and other motor vehicles.

A metro system and a heavy rail system will remain out of our discussion because they do not usually affect street space (although they would contribute to increased mobility and most likely centralisation, at the expense of neighbourhood destinations reachable on foot).

Our three-metres-per-mode configuration gives us a street width of 24 metres, including space for bicycle parking, tram platforms, etc.. This is space devoted purely to transportation; additional width can be provided for pedestrian activities other than movement (eating, drinking, reading, conversing, observing, playing – all individual and social activities that can occur in public space when certain pre-conditions are met). These are average widths; the tram lane, for example, can be slightly narrower for most of its length, but wider at passenger platforms. Every mode's primary infrastructure is 'self-contained' within its three-metre 'lane.' One exception is that the bicycle lane doubles as an emergency shoulder for automobiles; emergency vehicles can use both the tram lane and the car lane. Strictly speaking, this already means that 'balance' according to equal space per mode is not possible, at least without creating a street 48 metres wide. But because this is just a concession in times of emergency, we will overlook it. If we go much beyond a 24-metre-wide street, we risk losing the quality of human scale so important to the pedestrian. We would create an oversized scale that lacks anything that can be truly called 'urban fabric.' (Arguably, with all this separation of incompatible modes into separate lanes, we have lost a human scale even at 24 metres, created the nuisance of stop lights and crossing signals, and fabricated a sort of mechanised environment. All these factors could be seen as inhibitors of balance, meaning the pedestrian was better off in the Pedestrian City.)

The three-metre bicycle lane allows two cyclists to comfortably ride side by side, in conversation if they chose – a 'right' which we unquestioningly provide to pedestrians, motorists, and tram riders. There is space left over for faster cyclists to pass, and for bicycles to be parked atop the raised right edge of the lane.

Physically handicapped people could use either a wheelchair (combined with handicapped-accessible public transport) or a Neighbourhood Electric Vehicle (NEV). An NEV is similar to a golf cart, and current models have a maximum speed of 40 kph (25 mph), a range of 80-96 km (50-60 miles), and a charging time of 6 hours for a 100% charge and two hours for an 80% charge. NEVs would be driven in the car lane. Even for general private use in the 'Balanced City,' it's difficult to see what advantage the automobile would have over the NEV (although here again we would not want the streets to be filled with them). In is unclear why proponents of 'balance' would seek to accommodate cars rather than NEVs and human-powered vehicles. In his book *Ecocities*, Richard Register reports:

> When we in Urban Ecology were planning the first Slow Street for Berkeley [California, USA] there were many people on Berkeley roads in small electric golf carts. We thought of such very small vehicles as substitutes for bicycles for in-town travel for the disabled and the aged and for dealing with the heavy loads of family shopping. We investigated these carts with great caution, being more than a little sceptical of the 'better' car, but were encouraged to find them radically less damaging. Their small electric motors were about one-tenth as energy-consuming per mile as the automobile and, since trips are much shorter in the neighborhood and in-city context, used one-thirtieth to one-fiftieth as much energy per trip. We noticed that the electric cart occupied about 20 percent of the room required for parking and maneuvering a car, and at fifteen miles per hour [24 kph], it was also radically less intrusive socially and ecologically.

Lane volumes

We can now calculate the maximum traffic volumes per lane that our 'balanced' arterial street would provide. This of course depends, among other factors, on the average speed of each mode, including stops at intersections.

In the case of motor vehicles, the average speed depends on traffic levels, road conditions, speed limits, 'green time' at traffic lights, and other factors. We will calculate maximum car traffic volumes in terms of Vehicles Per Hour Per Lane, based on our three-metre-wide lane and an average speed of 30 kph (18.6 mph). The actual speed limit would be 50 kph (31 mph), which is the maximum speed suitable for urban conditions. It is also the maximum speed compatible with an adjacent bicycle lane. (At higher speeds, a solid safety barrier between bicycles and cars would be necessary to prevent cyclists from experiencing a decline in safety – both perceived and real – posed by the proximity of the car lane. The barrier would of course make it impossible for cars to pull into the bicycle lane in an emergency, which is necessary on our 24-metre-wide street.)

For bicycles, at a Level of Service rating of A (which our 'balanced' arterial street should provide), a standard average speed calculation is 22 kph (13.7 mph). [source: *Capacity Analysis of Pedestrian and Bicycle Facilities*, based on TRB, 1994; http://www.fhwa.dot.gov/tfhrc/safety/pubs/98-108/sect4.htm]

For pedestrians, the standard average capacity figure for a walkway recommended by the (US) Transportation Research Board's Highway Capacity Manual 2000 (4th Edition) is 4,500 pedestrians per hour per metre of width (based on an average speed of 1.25 metres/second – or 4.5 kph – and a density of 1.0 ped/m2).* Interestingly, on an escalator of the same width, the capacity doubles to 9,000 pedestrians per hour. [source: http://www.thyssen-fahrtreppen.com/faq.html] To calculate the capacity of our three-metre-wide lane, we can multiply the 4,500 figure by three, giving us 13,500 pedestrians per hour. If 20% or more of our population is elderly, this 'lane' capacity would be lowered to 10,800 pedestrians per hour, due to a reduced average walking speed (1.0 metres/second).

* V ped = S ped x D ped: (V ped = capacity [ped/min/metre]; S ped = speed [metres/second]; D ped = density [ped/m2])

Table 1: Maximum single lane capacities by mode

Mode	*Lane width for movement*	*Average speed*	*Speed limit*	*Passengers per vehicle*	*Vehicles per hour*	*Passengers per hour*
Pedestrians	3 metres	4.5 kph	unnecessary	-	-	10,800 / 13,500
Bicycles	3 metres	22 kph	unnecessary	1	13,200 *	13,200 *
Cars	3 metres	30 kph	50 kph	1.5 / 2 / 4	750 ^	1,125 / 1,500 / 3,000 ^
Trams	3 metres	30 kph	50 kph	600 (200 x 3 tram cars)	20 (service every 3 min.)	12,000

* *V bike [4,400 bikes/min/metre] = S bike [22,000 metres/second] x D bike [0.2 bikes/m2]*
^ *by comparision, the average freeway lane in the US carries 2,400 vehicles per hour, although they were designed to carry 1,500 vehicles per hour (faster speeds give lower capacities, due to increased space between vehicles):* [http://www.bts.gov/publications/issue_briefs/number_04/html/better_road_congestion_measures_are_needed.html]

It must be pointed out that, unless our 'Balanced City' is extremely dense, our arterial street will not experience such high volumes of pedestrian and bicycle traffic, nor require trams with three tram cars every three minutes. It is still important to calculate the capacities of each lane, so that we can see how the car requires 4-10 times more lane space than the other modes to achieve the same traffic volume. Moreover, having lane volume figures allows us to determine the maximum percentage of trips that could be made by car in the 'Balanced City.' An elaboration or future version of this paper would calculate this, as well as average daily traffic per mode.

Further research and simulations on the 'Balanced City' are needed to determine:

- the maximum percentage of all trips could be made by car (at 1, 2, 3 and 4 passengers per car)
- below what number of passenger-km per year does it pay not to have a car?
- exactly how much of a inconvenience would it be to drive?; if slower than alternatives, how slow?

Car parking

Our arterial street's remaining technical problems chiefly concern car traffic and parking:

On-street car parking cannot be provided without upsetting our 'equal space per mode' balance. It may however be considered balanced and fair if car owners were obliged to pay for off-street parking. If we are speaking of a built-up area, this could be in the form of multi-level, or ideally underground, parking garages, which are expensive to build and can have negative aesthetic impacts on the neighbourhood. Again, the balance doctrine requires that the full costs of car parking be absorbed by the driver and the driver alone.

What's more, a car or taxi must load/unload within its single lane, legally only at a stoplight. Stops elsewhere would be at the expense of other drivers' time and patience. This also means that motorists lose the advantage of being able to stop on impulse, or to run errands visiting several shops that line an arterial street, unless such destinations

provide off-street parking. Even so, it would be impossible to provide such parking without disadvantaging the pedestrian by creating empty, dead space (in the form of parking lots) between buildings, a distance which must be overcome on foot. We can partially address these problems by providing private parking behind businesses, with access to parking from a parallel side street rather than from the artery. In such a way the storefronts would be 'fused together' and oriented toward (rather than set back from) the sidewalk.

It would still be up to the business owner to decide whether to devote valuable space on his/her property to parking. Considering that in our 'Balanced City' the business' income would not be dependent on catering to motorists, it would be unlikely that a business owner would choose to offer this rear parking for free. It would seem to make more economic sense to increase the floor space of the business instead. Moreover, it would be an unfair advantage to motorists if the non-driving customers of the business were to subsidise this free parking through higher product prices. So there's no way around it: Every time a motorist stops to park at a business, he or she would be charged for the privilege, at whatever rate the business owner deemed appropriate. Further, it would be conceivable that such parking would be simply unavailable.

A 'Balanced' Collector Street:

We will not go into great detail here, but to say that a 'balanced' collector street could offer 1.5 metres in each direction for each of pedestrians and cyclists, and 3 metres in the centre of the street to serve as a one-way car lane. In the case of low car traffic, buses might share the car lane. Otherwise, a separate collector or light arterial street could have a dedicated bus lane.

A 'Balanced' Local Street:

Here on a residential or mixed-use side street we have far fewer problems in terms of compatibility between modes. There are no tram tracks on the local street, so we are attempting to create balance among automobiles, bicycles and pedestrians – as well as buses in some cases. By utilising traffic calming techniques and a speed limit of 30 kph (19 mph), it is not necessary to separate the bicycle and automobile traffic. This speed limit is standard in traffic calming projects and indeed throughout German cities such as Berlin and Freiburg; 30 kph is chosen in order to reduce the real and perceived danger of motor vehicles to other road users and reduce noise to a level compatible with close proximity to pedestrians and human-powered vehicles.

According to the Melbourne-based nonprofit group Bicycle Victoria:

> The most effective way to make local streets safer for cycling and walking is to reduce the speed of all vehicles to a 'human scale': 30 kph or below. Below 40 kph, impacts [with cars] are not likely to be fatal. A cyclist might be expected to contribute at least 10 kph to the combined speed of a collision with a motor vehicle. So, vehicle speeds need to be kept below 30 kph [and car] traffic volumes kept below 2,500 vpd [vehicles per day].
> [source: http://www.saferoads2004.com/papers/Sbeghen,%20Bart.pdf]

This should not, however, imply a state of balance. If there are 2,500 vehicles per day, that's more than three cars a minute – more during daytime and peak hours. Since we have decided to allow cars on our local streets, let us list some of the pedestrian activities that cannot take place on those streets as a result:

1) street sports (basketball, frisbee, etc.)
2) children playing in general, except on sidewalks
3) market stalls in the middle of street, allowing people to view products from either side
4) people lounging and reading on chairs pulled into the street (shown in drawing in *Street Reclaiming* by David Engwicht, page 12)

Again, we must take up the issue of parking. The 'equal space per mode' system can only accommodate significant car parking if we allow privately owned space to be divided unequally. Certainly it would be absurd to require home owners provide equal space in their garages to bicycles, when 12-18 bicycles can be parked in the space of one car. More absurd would be the idea of transportation 'balance' *inside* the home, allowing people to drive from the bedroom to the kitchen. We are forced to recognise that the indoor environment works precisely because of its lack of balance.

Allocation of Public Funds:

In addition to the problems with equal allocations of space, we must note that 'paying one's way' in a balanced manner proves quite difficult. It would be unjust for non-drivers to pay, via taxes, the cost of maintaining the surface of the car lane – which has a maintenance cost far greater than that of the bicycle and pedestrian 'lanes.' Either the infrastructure for each transport mode receives public funds according to person-kilometres travelled, or, more fairly, the motorist pays for the damage caused to the road surface by the heavy weight of his or her vehicle – along with the costs of traffic lights, signage, traffic calming, parking, traffic police (who of course would be unnecessary in the absence of cars), and the medical expenses caused by car-related death, injury and illness.

A simple alternative would be to divide public funds equally among the four categories of transportation modes that we identified earlier: (1) pedestrians/wheelchairs/etc., (2) bicycles/skateboards/etc., (3) buses or trams, and (4) cars/trucks/motorcycles/etc. This makes sense for practical reasons (although this system might be considered unfair if fewer than 25% of all trips were made in the car lane). It would be easy enough to establish four sections of a city's transportation department, each responsible for one of these categories. Any additional costs incurred by the bus/tram category would have to be paid by passenger fares. Likewise, additional costs in the car/truck category would have to be raised by taxes, tolls or fees directed solely at motorists. (Petrol taxes could be most fair, as long as nearly all cars are run on petrol, because the tax is based roughly on distance travelled, while penalising those who drive less efficient vehicles.) In the case of products delivered by truck, these costs would be incorporated in the retail price of the product. Products delivered by bicycle might therefore be cheaper, and rightly so.

Motorists alone, rather than the general public, should pay the full medical, funeral and burial expenses of those injured and killed by cars. This is consistent with current European Union law, which holds that motorists are considered responsible in accidents involving pedestrians or cyclists, regardless of who is at fault. A fund could be established from petrol taxes for this purpose. Although in Europe today only a fraction of the 50,000 annual road fatalities are due to public transportation, for sake of consistency the full medical, funeral and burial expenses of those injured and killed by buses and trams should be paid by public transport users. This money could be collected via a small tax included in the ticket price.

Walking- and cycling-related medical expenses (those unrelated to contact with cars or public transportation) could be paid for by individuals and their personal insurance. These expenses would likely be negligible, and therefore it wouldn't make sense to establish, for example, bicycle registration fees – or more absurdly, sidewalk users' fees – to offset the costs. Avoiding such fees also keeps society from opening a can of worms in which doctors would have to decide whether, and to what extent, a walking or cycling injury was caused by an unrelated medical condition. Whereas when someone is hit by a car, tram or bus, it is quite obvious and verifiable.

Inhibitors of Balance:

We have discussed or touched upon numerous factors that stubbornly block our efforts to achieve a state of balance among transportation modes. Other such factors have remained unstated due to space constraints. In this section I provide commentary on two additional factors which I see as inhibitors to balance.

Excessive consumption of space

One major inhibitor of balance, which we have attempted to rectify in the 'Balanced City,' is the automobile's appetite for space, which to enable mass motorisation requires far more space than the other modes.

In part because the private car spends 90% (or approximately 20-22 hours per day) of its life stationary, an exceedingly large amount of space must be devoted to parking. As Jean Robert wrote in *The Time Consumers* (1980):

> A car [in America] requires on average 30 square metres of space at one's home, 30 square metres near one's destination, 60 square metres of road surface, and about 20 square metres to be sold, repaired and maintained. Each car thus requires a ground surface equivalent to that of a four-person apartment.

According to the International Association of Public Transport (UITP), "An average daily journey from home to work by car consumes 90 times more space than the same journey made by metro, and 20 times more than if it was made by bus or tram."
[source: *Ticket to the Future: Three Stops to Sustainable Mobility*]

And as Ivan Illich wrote in Energy and Equity (1973):

> Eighteen bikes can be parked in the space of one car, thirty of them can move along in the space devoured by a single automobile. It takes two lanes of a given size to move 40,000 people across a bridge in one hour by using modern trains, four to move them by buses, twelve to move them in their cars and only one lane for them to pedal across on bicycles.

The automobile's consumption of space for roads, parking and other infrastructure has resulted in 30-50 percent of urban American land being paved over with asphalt and concrete. As Jane Holtz Kay writes in *Asphalt Nation*, "Sixty percent of Los Angeles is paved. In Houston, Texas, the figure for the amount of asphalt is 30 car spaces per resident." This results in the physical expansion of the urban area far beyond what would be required for a Pedestrian City, creating what is now known as sprawl. Instead of a population density of 440 people per hectare, as in Fes, we have 30 people per hectare, as in Houston and Los Angeles.

The car's consumption of space also requires that everything be built on a scale some ten times greater than human scale. Because of its incompatibility with a pedestrian-friendly environment – and because it inhibits a sense of place and sense of community – I call this a scale of alienation. Streets are devoted almost exclusively to movement, and everyone seems intent on getting elsewhere as fast as possible – not always possible when everyone else is attempting the same. Life is diluted, dispersed and pushed indoors, often to the shopping mall that serves as the surrogate community centre.

A product conceived as a luxury good cannot be democratised and retain its use value

While under normal conditions pedestrians do not greatly obstruct other pedestrians, nor cyclists other cyclists, nor tram passengers other tram passengers, motorists however do observably obstruct one another. The result is what we call congestion, defined as "a traffic flow phenomenon when travel demand approaches or exceeds capacity of the facility." If the maximum car traffic volume of our 'balanced' artery is 750 vehicles per hour in each direction (one lane at 50 kmh), and if the average morning commute is 20 minutes, this means that fewer than 2,250 vehicles per hour will be physically able to use the artery in each direction. The more vehicles join the traffic, the more the average speed declines.

Excess 'demand' could be absorbed by the other modes, rather than necessarily leading to political demand for more car infrastructure. But this should lead us to an inherent negative quality of the car which should not be overlooked: The car's monopoly on convenience rests somewhat contradictorily on both scarcity in numbers and a dominance over alternatives. This position of dominance creates an insatiable demand for more vehicles and more car-based infrastructure, in turn reducing the car's use value in relation to alternatives (which by this point may no longer exist). No matter how many new roads are built, they tend to quickly fill to capacity. In our 'balanced' traffic system – in which we refuse to accommodate such cancerous demand – the car's advantage only holds when one's neighbours leave theirs in the garage. As André Gorz observed in *The Social Ideology of the Motorcar*, a product conceived as a luxury good cannot be democratised and retain its use value:

> The worst thing about cars is that they are like castles or villas by the sea: luxury goods invented for the exclusive pleasure of a very rich minority, and which in conception and nature were never intended for the people. Unlike the vacuum cleaner, the radio, or the bicycle, which retain their use value when everyone has one, the car, like a villa by the sea, is only desirable and useful insofar as the masses don't have one. That is how in both conception and original purpose the car is a luxury good. And the essence of luxury is that it cannot be democratised. If everyone can have luxury, no one gets any advantages from it. On the contrary, everyone diddles, cheats, and frustrates everyone else, and is diddled, cheated, and frustrated in return.

While Gorz' argument is certainly less applicable to rural areas and low-density suburbia, we immediately see the paradox of introducing the car into our 'Balanced City.' When we put a tram line on every arterial street – rendering it no more than a five-minute walk from any home to the nearest tram stop – we will never need to lay new tram tracks through the neighbourhood again. When we provide a wide, safe bike lane, that capacity may suffice for eternity. But the car is never content with what it has. As long as more and more people want to drive, its rapacious hunger must consume increasingly more space in order to maintain its current level of convenience.

What are the moral implications of driving in an environment in which the car's use value advantage is removed? A utilitarian position for driving – based on use value gained by the individual motorist offset by potential for harm to others – becomes untenable if that use value is reduced to nil by changes in transportation infrastructure and urban form. If the pro-driving position is based on pleasure (rather than use value) gained, this would have to be an argument in favour of any behaviour that causes pleasure to one while endangering the lives of others. It should not be morally relevant whether those others engage in the behaviour themselves.

Beyond 'Balance':

In our imaginary 'balanced' world, does the car retain any of the advantages it affords us today? What happened to that 'freedom to go where you want, when you want' that we so closely associate with the automobile? An illusion? A myth? A self-fulfilling consequence of designing and reshaping our world for and around it?

Convenience is the principle reason offered by transport reformers for accommodating the car in today's cities, yet curiously, it is also a quality that the car no longer retains when we create, to the greatest extent possible, a 'Balanced City.' When we try to create a level playing field by giving each mode equal space, the result is not in fact a level playing field at all. It is more of a 'balance of power' than a 'harmonious balance.' The automobile is put at a distinct disadvantage – so much so that using or even owning one would seem a major hassle and expense. Via other modes, people would have no problem moving around and efficiently accessing their destinations. Most people would walk or cycle to neighbourhood destinations, and use public transportation or cycling for longer trips. The amount of road space allocated to the automobile does not allow driving to be an every-day, mainstream activity. It would seem that convenience can only be maintained when the car is subsidised and accommodated far beyond the level of the other modes.

With respect to car use as a minority activity, or as an activity that each citizen engages in equally but infrequently, there are several possible scenarios for the 'Balanced City.' Reducing car use to below the level of monopoly would likely have one of the following effects:

1. Car ownership remains high, but each car is used far less frequently. Because the car would be used perhaps two hours a week or month compared to today's two hours a day, its consumption of space would be even less justifiable than today. And further, because of the reduced road space per vehicle, the car lanes could often be clogged with vehicles going half the speed of a bicycle.
2. Car ownership is drastically reduced, making car use even less democratic than today. Because paying the true costs of car use would be expensive, the car could return to its original role – a means for a wealthy elite to flaunt their wealth. Aside from the cost, for cross-town journeys, cars still offer an A to B trip time competitive with public transportation and cycling. Car traffic is light, as people other than the rich voluntarily abandon their motor vehicles in exchange for the increased convenience and attractiveness of other modes. Private motor vehicles are also used for goods transport and business purposes.
3. Car ownership is largely replaced by other modes as well as private taxis, car sharing and car pooling. Car traffic is light to moderate, and private motor vehicles are reserved mainly for goods transport and business purposes. For cross-town journeys, cars still offer an A to B trip time competitive with public transportation and cycling – although the financial cost of driving is still prohibitive for the private individual.

Only in the third case does the car's presence seem justifiable, and then only if more benign modes cannot adequately replace it. Why for example should not the cheaper, lighter, safer and more space-efficient Neighbourhood Electric Vehicle, or NEV, replace car traffic for in-town use? Considering the car's responsibility for a host of environmental and social ills, we would be well-advised to conduct a thorough search for such alternatives. Such a search would yield an astonishing array of tested and proven human-powered, animal-powered, and electric vehicles that can fill in any gap left by walking, cycling and public transportation. It would seem prudent to accommodate such low-impact vehicles *instead of* the automobile. If such options are not available outside the city, cars could simply be parked at designated places on the city's periphery. Care would need to be taken that this does not reduce the quality of life at the periphery – an 'edge habitat' where people could get the best of both the urban and rural environments. (Currently, suburbia offers neither an urban environment nor a rural environment.)

Up until now, without much evidence, we've assumed the car's convenience is an intrinsic quality, yet it is environment-specific to the habitat we have created for it. We have accommodated the car, and proposed to continue doing so under the banner or guise of 'balance,' in order to maintain this 'go where you want, when you want' practicality that in fact Pedestrian Cities once offered to those on foot. What's really most *convenient* is this self-fulfilling prophecy, which allows us to avoid a systematic weighing of each transportation mode's inherent positive and negative qualities, and therefore to ignore the automobile's unjustifiably high social and environmental costs. Moreover, proponents of 'balance' provide themselves with a convenient rhetorical exit route: Once they deem a situation as representing 'balance,' the implication is that the work is done; there's nothing more to be achieved.

'Balance' fallaciously implies that all modes can be made benign, especially in relation to each other. Even when we separate transportation modes into groups that can share space compatibly, we can still observe (given a stable human population) that the rise in one mode occurs at the expense of another. If 80% of the population takes the tram, that mode will be more convenient (offering higher service levels) than if 20% of the population takes the tram. Somewhat conversely (given equal space per mode), if 80% of the population drives a car, that mode will be very much *less* convenient than if 20% of the population drives a car. Moreover, that 80% of the population driving cars would lead to lower service levels for the tram rider.

It becomes increasingly clear that proponents of 'balance' argue their position because they feel, for reasons that invariably remain unstated, that the car should not be rejected. For example, such reformers often recite a reasonable-sounding but superficial disclaimer such as "My message, mind you, should not be taken as a statement of opposition to the car. The car holds an important place in our society, but it is equally important to keep it in its place." We are left to wonder exactly where the car's place is, and why it should remain the car's place. Horse-drawn carriages, as well as smoking and slavery, once held important places in our society – it does not follow that they will, or should, still do so in the future. Reformers' arguments never seem comprehensive enough to choose the automobile after a careful analysis of each mode's positive and negative intrinsic qualities. For example, a reformer would never say: "Despite the one million people killed annually by the car, and the fact that the car consumes 800 times more energy per kilometre than the bicycle, I nevertheless wish to continue accommodating the car for reasons x, y and z."

These transportation reformers want 'balance,' but they also want cars everywhere, and we are left – in the absence of convincing argumentation on their side – to wonder why. We are left to wonder whether they think there is something wrong with the traditional Pedestrian Cities that still remain virtually or totally carfree today. To be consistent, they would have to be able to look at Venice with a straight face and say that it lacks balance, that it is inconvenient to get around on foot, that the streets are too narrow, that there is not enough pollution and noise, that the use of space is over-efficient, that there are not enough people being killed and injured on the roads, and further, that it is an outrage in the twenty-first century to still deprive citizens of their God-given right to drive, take a bus, or bicycle.

Likewise for the world's great cycling cities. Advocating balance implies there is something wrong with cities – Groningen, in the Netherlands, for example – that achieve 50% of all trips by bicycle (or Tianjin, China, which achieves 77%).

Yet these existing cities – whose human-scaled structure favours the pedestrian or cyclist and rejects the idea of balance – go completely unchallenged by the same people who emphatically insist on balance elsewhere. Why is this? Is it simply because these cities are old? That explanation doesn't hold in Groningen, where the pro-cycling policies were not implemented until the 1970s.

The notion of transportation 'balance' may imply a 'right to live carfree,' but it refuses to recognise a 'right to live in a carfree environment' or even admit that a carfree environment might have some value. Yet for the carfree and car-dependent citizen alike, the idea of a carfree city or district may be extremely attractive. Venice has more than twice as many annual visitors as Rome or Florence, both of which have a greater number of specific tourist attractions than Venice. Without necessarily being able to articulate it, many people hold a deep appreciation for environments in which pedestrians enjoy a monopoly on movement and convenience. They may actively seek out such places. Whereas in an environment that accommodates the car, those same people may find it immaterial whether they drive or not; they may even read motoring magazines, cover their walls with Ferrari posters, and consider the car their most precious possession. Such a person may drive ten times more than a proponent of

'balance,' yet would still like to visit a carfree city that the well-meaning transportation reformer would deny him. [footnote: …or her.]

Is the 'Balanced City' as suitable a habitat for the pedestrian as is the Pedestrian City? A full and systematic response requires the creation of a rating system for each of several factors:

1) **Intensity of experience –** Since pedestrians seek a lively, bustling environment, this suggests we must find a way to calculate urban space on a scale from living to dead – for example, average amount of activity per 100 square metres of public space. This allows us to see how well various places live up to Engwicht's definition of a city: "an invention to maximise exchange and to minimise travel." We could devise a crude system to measure exchange activity – giving points to outdoor markets and cafes, shops and businesses oriented to or located in public space, playgrounds and infrastructure for outdoor games and sports, people addressing the public by voice, street entertainers, pedestrian traffic volumes, number of lingering pedestrians, etc. (Note: Beyond a certain threshold, ratings would lower as more public space per capita is provided, due to the dilution factor. This would imply that the amount of public space, or street space in general, should be limited, in order for it to be filled with activity.) Space devoted solely to non-pedestrian traffic and parking would be considered dead space, as it is devoid of activity of interest to the pedestrian. For now I would suggest simply counting average numbers of people per 100 square metres of public space, *including street space*. We must classify the crowd to give them different 'public space values': each pedestrian in movement receives 1 point; lingering pedestrians receive 2 points; and salespeople, entertainers and others present to address or engage with passers-by each receive 3 points. Rating 1: more than 200 points/100 m2. Rating 2: 101-200 points/100 m2. Rating 3: 81-100 points/100 m2. Rating 4: 61-80 points/100 m2. Rating 5: 41-60 points/100 m2. Rating 6: 21-40 points/100 m2. Rating 7: 16-20 points/m2. Rating 8: 11-15 points/100 m2. Rating 9: 6-10 points/100 m2. Rating 10: 5 or fewer points/100 m2.
2) **Human scale** – Pedestrians feel secure and at home in an intimate, human-scaled environment, while oversized environments breed alienation, making pedestrians feel small and uncomfortable. Consider the hiker's preference for the narrow path over the wide road, even when both are equally devoid of car traffic. However, it is difficult to make universal assessments in this area. For example, an occasional large public square can work beautifully within the context of a human-scaled street network. Also, wider streets can be acceptable if they are filled with activity (having high ratings for intensity of experience). Moreover, the issue is subjective; some pedestrians who have become accustomed to an oversized outdoor environment feel uncomfortable when the outdoor environment assumes the scale they are used to finding in the indoor environment. I would suggest the following range as a general guideline for average street widths; the lower the rating, the better: Rating 1: less than 5 metres wide. Rating 2: 5-10 metres wide. Rating 3: 10-15 metres wide. Rating 4: 15-20 metres wide. Rating 5: 20-25 metres wide. Rating 6: 25-30 metres wide. Rating 7: 30-35 metres wide. Rating 8: 35-40 metres wide. Rating 9: 40-45 metres wide. Rating 10: more than 45 metres wide.
3) **Concentration of destinations –** Calculate the number of destinations reachable within a five-minute walk of a city's 'average location': (a.) Select at random ten points at street level within a city; (b.) Count the number of destinations (other than homes) reachable on foot in five minutes from each, based on a flat walking speed of 4.5 kmh (giving a walking radius of 0.375 metres); (c.) Then take an average of the results. Examples of destinations: businesses, services, public facilities, places of worship, etc. Rating 1: more than 1,000. Rating 2: 501-1,000. Rating 3: 401-500. Rating 4: 301-400. Rating 5: 201-300. Rating 6: 101-200. Rating 7: 76-100. Rating 8: 51-75. Rating 9: 26-50. Rating 10: 25 or fewer. Remaining issues: Shouldn't there be some method of giving a better rating to a high diversity of destinations, rather than, say, giving equal weight to each of ten tomato stands. And how should we count supermarkets and department stores, which replace the need for a larger number of smaller businesses? Similarly, do we count each stall within a marketplace as a separate business?

A great many additional factors could be added to the equation, for example: Personal safety – Do women feel safe walking alone at night? Are children allowed to play outside without formal adult supervision? Childhood independence – To what extent does the environment outside their homes offer children a means of developing their character, self-confidence and independence, through interactions with and observations of others? These factors may be difficult or impossible to quantify, but that does not reduce their importance.

The scores for each of the above factors can be averaged (in the case of three factors, the scores can be added together and divided by three) to achieve an overall score from 1 to 10, with 1 being superior. As one might predict, the rating system suggests that the pedestrian thrives in the Pedestrian City, is most impoverished in the Car City, and falls somewhere in between in the 'Balanced City' (where exactly depends on the definition of balance). We could create a similar rating system to measure the viability of the motoring environment, in which we give points to drive-thru businesses and the like. Regardless of what mode we assess, we will find its viability is highest in an environment where it holds a monopoly, and substantially lower in an environment seeking (but not achieving) balance among several modes.

The fallacy of balance leads us to occupy ourselves marketing various forms of locomotion to the public as 'alternatives' or 'options,' as if the various modes can somehow coexist without reducing the viability of each other – as if a level playing field were possible. This portrayal of the situation as a matter of responsible personal choice might make sense from a consumer marketing standpoint, or for reasons of political expediency, yet the facts do not support such a view. The pedestrian and the car simply cannot coexist to their full potentials, as the jarringly contrasting descriptions of the Pedestrian City and the Car City bear out. The resulting environment is a poor compromise, ideal for neither.

Further, it can only be a false sense of personal choice if the urban form and infrastructure dictate that choice. In an environment built for and around the car, most people will 'choose' to drive. In an environment built for and around the pedestrian, most people will 'choose' to walk. These are not so much individual choices as choices the environment makes for us. The conditions that make the car convenient in today's Car City are the very same conditions that make the alternatives lag behind. Conversely, the conditions that make walking convenient (not to mention stimulating to eyes, ears, nose and mind) in the traditional Pedestrian City are the same conditions that make driving inconvenient or impossible, as well as extremely destructive to the social and urban fabric. Where any convenience is maintained by driving in the Pedestrian City, it is a function of time saved by the driver at the expense of time lost – and quality of experience degraded – by others.

Here we might be reminded of movie scenes from India in which the motorist drives with his hand on the horn in order to clear a dense crowd and allow for a single car's passage, inconveniencing and endangering hundreds of people. Even if the car in question were a taxi rather than a private car, would such a situation be desirable? Such a scenario can only exist at low levels of car traffic, beyond which the car inevitably asserts a monopoly over street space. This begs the question: Is it enough to simply reduce our car use?

A state of balance among transportation modes is just as undesirable as it is unattainable. Without the recognition that contemporary urban form is a toxic by-product of an industrially imposed automobile system, we would perhaps, like many others, give up hope for real change, beginning to believe such pronouncements as 'people will never give up their cars.' We would then busy ourselves making the structure of our settlements some kind of compromise between the various transportation modes, serving neither the pedestrian nor the motorist very well. We would retreat from insisting on our natural right to autonomous movement to focus on alternative fuels, alternative vehicles, and higher fuel efficiency standards.

Yet there comes a point at which we must decide whether we wish every-day walking and cycling to be alternative lifestyle choices for a minority or the most viable means of locomotion for the majority. Social and environmental factors necessitate the latter course. Not until we decide emphatically in their favour will we shift our attention to the radical transformation of urban form. If and when we succeed, the playing field will not be level, but much like our indoor environment, tipped sharply in favour of the pedestrian.

Recognising the undesirability and impossibility of balance requires us to make collective decisions about which transportation modes we should accommodate where, and to what extent, in an unequal manner according to social and environmental compatibility. We would start by creating the ideal environment for people (establishing our feet as the dominant 'mode'), and then carefully assess how human-powered vehicles, NEVs and trams might fit in as a supplement to our feet. In this way we might increase our mobility and lighten our loads without creating an ever-increasing demand for mobility, which would inevitably occur at the expense of access. In other words, a transportation mode, like any technology, can either fulfill a need or *create* a need. We must recognise this and take extreme care to prevent the latter.

"[T]ransportation can enhance freedom of movement only within the limits in which one can renounce it," as Ivan Illich and Jean Robert wrote in *Autostop*. "[…] Beyond a certain threshold, it diminishes personal mobility in proportion to more passenger miles generated."

Engineered mobility impedes access by proximity; unchecked industrial 'development' impedes freedom of movement. When we move beyond low-energy, autonomous technologies, technocracy prevails. Consumption of time in transport breeds time scarcity, while the human being is degradingly deformed into an habitual passenger, a package helplessly transported to distances beyond his own reach.

While allowing our cities to spread ever outward, today's planners often declare the problem to be one of insufficient mobility – that people must become mobile enough to easily reach all these new scattered-out destinations. In fact we should be attempting the opposite – providing everything people need close at hand so that extended daily travel becomes unnecessary. In a word, *access*. This is not a matter of infringing on people's right to travel; it's about minimising *obligatory*, socially destructive and often unwanted travel. We do not merely need 'alternative' transportation; we need *less* transportation.

Accommodating the Car: Various Interpretations:

What if a community wishes to be 'multi-modal,' using various modes including the automobile for different purposes? This suggests a compromise among modes, either by attempting to accommodate them equally in the same area, segregating them by district, or prioritising which modes to put in dominant and subservient positions. However, to repeat, any compromise should be based on actually comparing the relative inherent advantages of each mode – not just taking people's preference for cars in the Car City as a universal preference that, despite the social and environmental impacts, must be accommodated.

In the case of collective disagreement on whether to make a given city carfree, segregating modes by neighbourhood or district might be the best pragmatic alternative, considering that we have discussed in detail the drawbacks of accommodating incompatible modes within the same district. A carfree pedestrian- and cycling-oriented district could conceivably exist side by side with a car-oriented district, as is the case today in many European and Moroccan city centres. People would be free to compare the two and choose in which place they wished to live and spend their time.

In such applications where we aim to prioritise one or more particular modes rather than seeking balance, it might be useful to invent a new terminology to refer to such areas, neighbourhoods or districts. I would propose the following, based on the three urban forms discussed earlier:

Pedestrian-Oriented Development (POD) – An urban or semi-urban area that accommodates or prioritises the pedestrian above and beyond the level of other transportation modes, to the exclusion of incompatible modes, thus offering high ratings for Intensity of Experience, Human Scale, and Concentration of Destinations. The area may contain a public transportation hub to facilitate movement outside the POD.
Transit-Oriented Development (TOD) – An urban or semi-urban area that accommodates or prioritises public transportation above and beyond the level of other transportation modes. (This term is in current use as a misnomer to describe a medium- or high-density [usually mixed-use] pedestrian-oriented development centred around a public transportation hub. In practice a TOD may be much more car-oriented than either transit- or pedestrian-oriented, in terms of space allocation per mode and other criteria.)
Car-Oriented Development (COD) – An urban or semi-urban area that accommodates or prioritises the automobile above and beyond the level of other transportation modes, to the limitation or exclusion of other modes.

There is also a fourth option, which is perhaps closest to the idea of 'balance,' although more in the sense of 'balance of power':

Mixed-Orientation Development (MOD) – An urban or semi-urban area that accommodates or prioritises a number of modes simultaneously at a roughly equal level, serving as a compromise among those modes. Other modes may still be limited or excluded. A MOD may include the car among the modes to be prioritised, among the modes to be limited, or among the modes to be excluded.

What about the precise role of the automobile within a car-limiting (or car-lite) MOD? Indeed it is possible to accommodate the car's presence to some extent in an environment that, rather than seeking balance, favours one or more modes of 'alternative' transportation. Without relying upon an appeal for balance, arguments can be made that this might be acceptable. However, such arguments rest on widely diverging interpretations of 'accommodate.'

In the case of the medieval pedestrian city, or *medina*, in Fes, Morocco, state and local officials, supported by the World Bank, plan to accommodate the car by placing a peripheral parking lot within a 14-minute walk of every location in this 870-acre virtually carfree area. They concluded that to criss-cross the dense medina with roads would be to destroy the very place that such roads would attempt to access. It would be like paving a road through your living room in order to make it convenient to get to your living room. The Fes plan demonstrates that it is possible to have a carfree city that accommodates the car, however much of a contradiction that might seem. By providing greater opportunities for peripheral parking, Fes officials have agreed to accommodate the car for travel between the medina and outside locations, but it will remain extremely inconvenient – in most cases, impossible – to drive from one location in the medina to another without also resorting to one's feet. Furthermore, in most cases it would be much faster to simply take the whole journey by foot.

Most people's definitions of 'accommodate' of course go far beyond that which is proposed in Fes. Nevertheless, as the example shows, the salient issue is not *whether* we accommodate the car, but *to what extent*.

At the other extreme (assuming we can call Fes officials and the World Bank *anti-car extremists*), in a Western city we can calculate predictions, based on past car traffic growth, that traffic demand will continue to grow at, say, two percent per year. Therefore, in order to avoid traffic chaos and congestion, we can argue that we must continually expand road infrastructure, also at the rate of two percent per year. We now know that, in congested conditions, traffic tends to expand and contract to fill the available road space. We can reduce demand by removing road and parking infrastructure, and we can increase demand by building more infrastructure. Therefore, the idea of expanding car infrastructure to meet demand is nothing but a self-fulfilling prophecy. In such a way we have seen extensive traffic growth even in cities that are dropping in population! The additional road infrastructure does not reduce congestion in the long-run, nor necessarily in the short-term, and serves only to increase car dependence.

In between these extremes, of course, transportation reformers of various sorts seek to curb the car's dominance without either expanding demand or requiring motorists to walk 14 minutes from their cars to their final destinations. For example, streets accessible by car might be limited, just as we do today with heavy trucks. Today the word 'street' implies car access, unless prefaced by a word such as 'pedestrian.' Tomorrow the word 'street' could conceivably imply a pedestrian zone, unless prefaced by the word 'car.'

<u>On Motorist Acceptance of Carfree Environments</u>:

It may however not be necessary to accommodate the car for reasons of political pragmatism. Surprisingly, under certain environmental conditions, motorists seem to universally accept carfree areas – that is, urban areas that reject balance and strongly favour pedestrians and other modes to the exclusion of cars.

In the traditional Moroccan pedestrian city, or *medina*, people accept the outdoor environment as carfree much the same way that we accept the indoor environment as carfree. In the medina, the indoor and outdoor environments are built according to the same scale, the human scale. The outdoor corridors (streets) are no wider than the indoor corridors, the outdoor rooms (squares, though rarely square in shape) no larger than the indoor rooms or interior courtyards. Rather than having a harsh transition from indoor to outdoor, it's often difficult to say for sure which you're in.

In modern cities, we have come to expect that the indoor environment should be built on a human scale. It is precisely this lack of balance – this radical exclusion of motorised vehicles of all kinds – that makes the indoor environment work. Consider why, even in a large building such as a shopping mall, no one seems to find walking particularly slothlike. Even inside the Pentagon, one of the world's largest buildings, it takes no more than 7 minutes to reach a given location. Upon entering a building on foot, no one argues that his or her right to drive or cycle indoors has been infringed upon. No one complains of long walks, limited transportation options, or outright discrimination against them by anti-car fanatics. It is simply obvious to everyone that the activities which take place

inside buildings – talking, shopping, cooking, moving between rooms, eating, socialising, especially sleep-walking – are best carried out at speeds no greater than walking pace. People intuitively realise that it makes no sense to make a supermarket 75 times larger in order to accommodate customers who don't want to get out of their cars. Only in a seriously sprawled-out, oversized indoor environment do people find it useful to increase their speed. Think of airport conveyer belts or hypermarkets in which employees zip around on rollerblades. Yet still, even there the situation is not bad enough to require motor vehicles, transportation planners and engineers.

However, many motorists would find it intolerable if an urban district or neighbourhood were to declare itself off-limits to cars. So should proponents of carfree cities get around these objections by simply putting a roof over an entire neighbourhood, or for that matter over the entire city? If the area in question became a sort of multi-level shopping mall with offices and housing above, motorists would be hard-pressed to feel offended.

So why the disparity in our attitudes toward the indoor versus the outdoor environment? Why do we accept as normal that the indoor environment should be built on a human scale while the outdoor environment is built on a scale of alienation – sacrificed to speed, cluttered up with roads and vehicles, and left virtually devoid of life? We, like the fish incapable of questioning the water, have accepted it until now because we are products of our environment and as such find it difficult to envision an alternative urban form, especially when we don't necessarily realise that such a thing as urban form exists. Those who seek balance among transportation modes in the outdoor environment would never consider that their standard should also be applied to the indoor environment.

Immediately following a trip to the *medinas*, or Pedestrian Cities, of Morocco, I entered a covered marketplace in Barcelona. Founded in 1836 and named 'El Mercat de la Boqueria,' it houses 276 businesses on one level under one roof on a 2 hectare (5 acre) site. (The number of businesses can rise to 710, but today each business takes the space of three market stalls.) It has been called the best market in Europe, but what was interesting to me was not the quality of the food on offer – it was the floor plan. Specifically, when walking in from the street, I experienced an immediate change in scale by a factor of ten. I had come from The Ramblas, Barcelona's famous strolling boulevard, which is 30 metres (98 feet) wide, building to building. In contrast, here in the market, the corridors between market stalls looked a bit like streets, but they averaged just 3 metres wide. The way these corridors curved around the stalls, I noticed that there was no difference in scale between this market and the marketplaces in Morocco's *medinas*. The main difference was that here, because I happened to be indoors, the corridors were not considered streets.

Why is it that we hold such different standards and expectations for the indoor and outdoor environments? It is perhaps simply that our experience has taught us that indoor environments are generally places to experience on foot. It is not simply a question of the indoor environment being built on a human scale. Even when a building – for example, a shopping mall – is the same size as an entire neighbourhood, and the shopping mall's indoor 'street' is the same width as many outdoor streets, the prohibition of cars is accepted without question. The motorist is denied the right to drive up to the front of every shop in a shopping mall, and yet he doesn't complain.

Still, the indoor/outdoor phenomenon does not entirely explain our collective Western cultural sentiment that some spaces should be for cars and others not. We of course find many indoor parking garages. And on the other side, we find carfree outdoor marketplaces, for example in Prague, that have similar corridor widths and stall sizes as La Boqueria. Despite being outdoors, the corridors are not considered as streets.

Then occasionally between buildings, where you would expect to find a 30-metre-wide street, we instead find a park-like environment with only pedestrian paths meandering among the greenery. Surprisingly, such a place can at times carry a street name, and the buildings on either side may be lined with shops. If a 'proper' street had been built on such a site, it certainly would have been used for driving and parking cars. But yet, motorists do not get upset that their right to drive there has been infringed upon. This suggests a factor of prior use – that is, if cars were never allowed in a particular place, motorists tend to accept that. If motorists have not established a place as their territory, they do not object to being banished from it. This explains why some conservatives, for example, object to carfree areas because of the resulting loss of motorists' 'freedom.' However, closer analysis reveals that they don't object to existing carfree areas, only new ones. The implication, inconsistent with their view on motorists' freedom, is that today we have exactly the right amount of carfree space – there can be no more and no less.

So it's not only a question of scale, not only a question of indoor vs. outdoor, not only a question of prior use, and not only a question of whether the place is considered a street. Perhaps the most important factor is in fact a combination of the above factors: Motorists will tend to accept a carfree area if they perceive that the place has not been designed to accommodate cars. Features that will help impart that perception include a human scale, an indoor or partially covered environment, a site that exists as separate from the road network, an environment filled with activity (such that there doesn't appear to be space left for driving and parking), entrances and streets/corridors too narrow to drive through, elevation via steps or stairs, the presence of public art, benches and other 'street furniture,' and a park-like environment. These features should be elaborated upon, in order to thoroughly evaluate how to create carfree areas that will be universally accepted.

Conclusion:

Proponents of 'balance' arguably hold the burden of proof in their (as yet unstated) argument that balance is both possible and desirable. The evidence to back up their claims is conspicuously absent, while the counter-evidence abounds.

[end]