Mega-city and mobility:

which one feeds or deprives the other one?

1885

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Abstract

What are mega-cities, these giant octopuses swelling at the top of the urban hierarchy over all continents? Are they delusions established in artificial boundaries by governments seeking grandeur? Are they accidents resulting from continuous settlements clotted in gargantuan troughs? Are they ghosts made of densely meshed connections floating over summoned herds? Of the three definitions, the last one is the most challenging: these huge human concentrations would be rendered possible and would indeed coalesce thanks to the transport machines and synthetic networks that crisscross them. But then, why are there such discrepancies in the level of motorisation and mass rapid transit development around the world? If the lack of vehicles may question the very existence of mega-cities, the excess of wheels is at least as intriguing since stalled traffic should prevent metropolises to work. To dismiss this puzzle, four case mega-cities are examined, two in the West with early growth, and two in the East with later growth; two in the North with high income, two in the South with middle income. The Atlantic experience may coach the Asian phenomena, which in turn may debrief the sunset standards. The boreal developments may set a target to the emerging southerly winds, which could anyway clear their own way. Paris, Sao Paulo, Seoul and Shanghai may sing a tuned quartet. But is it really a canon choir? New circumstances in economy interdependence, population aging, social cohesion, innovative technologies, energy supply, or global warming may re-shuffle the party in an unexpected fashion.

Abbreviations

GDP: Gross Domestic Product

PMG: *Perspectives Métropolitaines Globales* (Global Metropolitan Perspectives)

RER: *Réseau Express Régional* (Regional Express Network)

UN: United Nations

Introduction

Modernist urbanism preached sprawling in terms that, after a second reading, border at least ingeniousness. According to American architect Frank Lloyd Wright in 1945, sprawling ought to restore democracy by opposing city-linked despotism. Mechanism had in fact led to the enslavement of workers and to the density derived from urban rents. Curiously, this then praised free way of life yet revealed entirely dependent on the automobile. The machine should be liberating by avoiding *traffic problems* credited to the density of skyscrapers.

That kind of dialectics has been historically reviewed by our post-modernity thinkers, with equally good intentions: for them, travel increased by this very sprawl endangers the Earth; and they point out the contradiction between the car cult and the global well-being. Thus, for engineer Philippe Mühlstein, the unsustainable outburst of traffic due to the globalisation mechanisms and sprawled development *is incompatible with environment protection and with the implementation of a sustainable transport policy.*

Rejecting the "well-being + modernity = many trips" equation, we should now get accustomed to *the idea of reducing trips by increasing their price* as well as to the one of *the indispensable habitat re-densification*. The historical march that increasingly breaks the primacy of the place to the benefit of this *perpetual motion* there finds its contradiction and back-fire kick.

Private or public, mobility is good or evil, as well as the city, and lifestyles, of which mobility is mother and daughter. The mega-city having become an exacerbated form of urban growth, is it reasonable to think that it contributes to the solution of these contradictions and in which context? In particular, Asian mega-cities undergoing rapid growth and willingly striding along the path to motorisation, will they blindly dive into the unsustainable pitfalls of their Western counterparts, or will they assimilate previous experience and forge their own way through the stakes of the 21st century?

1. The universe of concentrations over ten million

Accounting metropolises is uneasy, as they are moving realities subject to divergent demographical, geographical and administrative criteria. Thus, the ranking of cities dramatically varies from one source to another, and does not converge with local statistics considered separately.

One metropolis can double its population according to the definition: such inconsistencies are blatant when international yearbooks (such as the one by UITP International Union of Public Transport) or international organisation dictionaries are compared. This research must first set appropriate rules for the definition of metropolises under study.

As a beginning, here is considered the UN (United Nation, 2004) ranking, also in use by organisations such as the World Bank, the European Commission, or OECD (Organisation for Economic Co-operation and Development) and the French Ministry for Cooperation. Figures stand for year 2005, after censuses and forecasts to homogenise data.

Thus, among the 887 world agglomerations above 500 000 inhabitants in 2005 (Ibid. Table A17), 49 lie beyond five million, 20 passing ten million. A few other metropolises are just below this threshold or beyond according to other sources. It is a new historical fact: only two cities had reached this ten million threshold in 1950 (New York city and Tokyo, Ibid Table A11); Shanghai was added in 1965, Mexico city in 1975 and Sao Paulo in 1980 making a short list of five at that date. Many more were added in the following decades. Seoul was included in 1985 and disqualified in 2000. Paris would only join the club in 2015.

Also, differentiated growth rates, from 1% to 10% per annum, are observed: the highest rate was prevailing in South America in the 1950's, and can be find now in many Asian or African cities (Sao Paulo had swollen from 60 000 inhabitants in 1890 to over two million in 1950, date when Lagos scored less than three hundred thousand citizens who have been multiplied up to eleven million nowadays).

The world urban frame winds according to Figure 1 where only mega-cities are plotted in a snail graph, from the vicinity of the ten million threshold to three times as much. Two

statistical series are reported. The first one is provided by the UN, or more exactly is the result of a consensus between experts and international organisations departing from the series set by Habitat.

According to this source, Tokyo opens the shell (35.2 million). Then follow four agglomerations of similar size, between 19.4 and 18.2 million. Taken together, these first five metropolises gather one hundred and ten million people.

These figures must be read with care, as they assume a certain internal coherence, a sufficiently homogenous specific database for the series to be comparable, and an undeniable criteria unity in full independence of administrative and geopolitical definitions. As these assumptions are not granted, this ranking remains very impressionist and it raises more questions than it gives answers to the enigma of the worldwide rise of mega-cities.

Figure 1

Variations in criteria for identifying, numbering and ranking at the world level all agglomerations according to their demographical and/or land size, as well as substantial differences between urban and national situations, are wide enough for not blindly relying on one single source. At this stage, a series of indicators can hardly be listed, in the areas of geography, demography, economy, government-administration and society-culture, so as to formulate the global metropolitan perspective (PMG) problem.

In this respect, another statistical series is plotted on the snail graph, as produced by the efforts sustained to build the *Géopolis* nucleus base (Moriconi-Ebrard, 2000, updated 2005), with a consistent criterion of continuous morphological development. In spite of dramatic swings around the UN series, this second series is no less valid. This base gives 24 cities strictly greater than ten million, plus two slightly below.

On this alternative snail graph, New York city is inflated by the inclusion of Philadelphia in the second series, Jakarta and Manila are also dramatically enlarged, while Lagos is smaller and Seoul is doubled by taking into account the metropolitan area that circles Seoul city.

This butterfly behaviour of city boundaries may inform better on the urban animal gait than the snail crawl into surrounding foster farmlands. Our studied object is definitely urban,

which does not solve its status question: sorting between what belongs to mega-cities and what does not indeed will have to be constantly made, in the way that so called global cities are distinguished from other cities. Combining both sources, including all agglomerations flirting with the ten million threshold in either source, and saving London around nine million, 28 cities are included in Figure 1 totalling 372 million inhabitants according to UN and 423 million according to *Géopolis*.

2. Four mega-cities, three definitions

Among the world mega-cities, just above one half are located in Asia, where the swiftest growth is recorded. Here we shall consider four mega-cities that cover a variety of characteristics on the scale of the metropolises with ten million inhabitants. They are located in four countries, which, among other hegemonic ratings and over-crowded nations, have a significant role in the global economy, in the course of redefinition in the 21st century. Two of them belong to Asia, the other two do not, as a counterbalance. The two latter Westerners underwent the earliest growth before slowing down, one North of the Atlantic Ocean, Paris (Île-de-France region), in old developed Europe, one South of the Atlantic Ocean, São Paulo, in emerging Brazil. The two former Orientals resumed a more recent steep rise after having suffered hardship, one North of the Yellow Sea, Seoul, in now industrialised Korea, one South of the Yellow Sea, Shanghai, in today booming China. The Northerners are capital cities with high income. The Southerners are only the economic main hubs of their countries with middle income. All four are the largest conurbations in their respective countries. Table 1 provides some basic data about these four cities.

Table 1

These data immediately shed light on the stakes of appropriate definitions of mega-cities.

The first definition refers to administrative boundaries. It is a political one. But it is generally within these boundaries that most data are available. The data collected by the UN and other international organisations are bound to these territories set by member states.

After a glance to our four case cities, the most striking feature is the extreme variety of the lattice of intertwined local governments: while the Île-de-France region is divided into 8 counties and 1381 municipalities, the entire city of Shanghai is included into one single municipality. For that, it is better to use the native names of territories not to be misled by approximate translations. Some of these territories, such as Sao Paulo State are much bigger than the mega-city itself, some others such as Paris *arrondissements* are only a tiny part of it. Some other territories lie partly within the urban area, partly outside on rural lands such as Shanghai outer *xiàn* level districts. Also, as the city proper of Seoul corresponds to the UN definition, the existence of a metropolitan region shows the need (maybe on political grounds) to create a much bigger entity.

The second definition is set by geographers according to development morphology: an urban area (or agglomeration) is a continuous settlement with no more than 200 metres separating buildings. The *Géopolis* database has been constructed according to this criterion, with help of satellite photographs. This definition does not correspond to any administrative boundary. The Paris agglomeration is a subset of the Île-de-France region 1381 *communes*. Shanghai urban area is approximately made of the 9 inner districts plus part of Pudong district within Shanghai *shì* municipality, but developments continue in outer districts. Sao Paulo and Seoul agglomerations should fill in a good part of their respective metropolitan regions. Population density is a key variable to determine the urban nature of a specific territory. While *Ville de Paris*, Seoul city and Shanghai urban core just defined, with more than 100 inhabitants per hectare are clearly dense vibrant urban places, the metropolitan regions of Sao Paulo, Seoul and Shanghai besides Paris agglomeration, with a medium average density comprised between 19 and 36 inhabitants per hectare, are a patchwork of diversified fabrics including extensive industrial estates, compact mixed towns, suburban working class *cités*[1], sprawled single family houses, entertainment parks and agricultural fields. Sao Paulo State, with 1.5 inhabitant per hectare, is clearly mainly a non urban territory.

The third definition of mega-city is a functional one: a metropolitan area is an area where all parts sustain frequent relations with each other, no matter how packed together or scattered apart these parts may be. It is the most difficult to assess. It is based on the journeys that irrigate the mega-city, turning it into a living creature, and not only an accumulation of buildings. Transport data are essential, on the one hand on the supply side to know both qualitatively and quantitatively which networks as well as which vehicles are available and how long the infrastructures are as well as how many vehicles are in use, on the other hand on the demand side to investigate who makes trips, from where to where, how often, how long and by which mode.

3. The expansion of travel networks and means

Table 1 shows that the availability of cars is good in three out of the four mega-cities, with approximately one car for each second person in Île-de-France and one car for each fourth person in Sao Paulo and Seoul. Meanwhile, Shanghai lags far behind, with one personal automobile for some 80 people. Nevertheless, car ownership is significantly lower in the central city of Paris, is higher in the central city of Sao Paulo, and is nearly the same in the central city of Seoul: this shows different steps in the path to motorisation; at the beginning of the automobile market, the city centres acquire cars first, as it can be seen from historical data from Paris; then, as the city centre becomes congested and wealth increases, automobile spreads to the suburbs; finally, as the economy reorganises itself around the automobile, a car becomes indispensable for residents of the outskirts of the city, while those who are forced or choose not to own a car are better off in the central area where alternative transport services are available (Papon, 2004).

This can also be derived from Table 1. The density of rail networks is much higher in the city of Paris, with 2 kilometres per square kilometre; on the contrary, it is 18 times thinner in the city of Sao Paulo. Seoul city lies exactly in-between, and Shanghai is catching up at a

[1] In France, estates lined up with high or long buildings, with low rents.

fast pace. Besides, the number of buses per one thousand inhabitants is not very different from one city to another: but this overall similarity may hide discrepancies in the use of modes in different cities.

In fact, these few figures about four metropolises are symptomatic of the worldwide motorisation divide and travel contrasts. The total population of all mega-cities exceeds the size of North America. Nevertheless, car ownership is much less spread in most of those cities than in this car based new continent, archetype of the western civilisation. As the car ownership race faces saturation barriers in the "first world", a powerful appeal for growth fascinates "under-motorised" countries where cars, as well as paved roads, are concentrated in the largest cities. The automobile industry is now aware of this evolution, and seeks a suited and diversified answer to it, while going on with its concentration process into an ever more reduced number of world manufacturers. To which extent does market diversification by expanding patronage social fringes and varying products remain compatible with assets concentration?

This boom in the car market is paralleled by the development of mass transit networks. Mega-cities concentrate approximately one third of the urban rail network, but with huge contrasts between cities. While the motorisation divide is more a north-south one, linked with wealth, the rail intensity obeys more an east-west law, with very active networks in Japanese, Indian and Russian cities, fairly developed supply in European cities, sparser services in the Americas, and hardly any train running in Africa. Of course, population density is a key reason for that, but transport policy also plays its role. While some south-east Asian cities such as Bangkok have had a lax public policy leaving private motor vehicles clog the roadways, some others such as Honk Kong have enforced from the start very strict rules (Barter, 1999). But also some other cities such as Taipei in the mid 1990's went through a reversal of their policy. So the scenery of urban rail is very diversified; it is all the more so that many different and unique systems are implemented: short regional trains linking neighbouring towns, long suburban convoys into crowded suburbs, heavy duty subways at the metropolitan level, medium range metros servicing central cities, light car lines as side

supply, odd occasional monorails, classical or modern trams on green or grey right-of-ways. The distinction between Heavy Rail Transit (HRT) and Light Rail Transit (LRT) needs to be clarified, as not everyone uses the same definition. To add confusion, the French call "tramways" guided road trolleybuses on tyres, while the Americans call "trolleys" what is rail based tramways in Britain, so that the demarcation line between rail and road becomes fuzzy and experts get flurried. Recently, Bus Rapid Transit (BRT) systems have become popular, but there again the greatest care is needed to evaluate the level of protection of the right-of-ways and the priorities at junctions, as throughputs may differ considerably. Nevertheless bus systems do also play a significant role at the metropolitan level, and remain the backbone of public transport in many cities.

Besides this classical opposition between the private car and public transport, a number of other modes compete for the transport market, in particular in developing cities. Some of them are motorised, and fill the gap between privately owned automobiles and formal public transport services: carpools, vanpools, car sharing clubs, car rental, taxis, shared taxis, demand responsive transport, special services, shuttle buses, motorcycles, mopeds. Other modes are non motorised: walking, bicycles, rickshaws. In fact, walking has historically played the major if not unique role for moving in cities, and still retains a high share in the largest modern metropolises (one third of all trips in the Paris region); this share is higher than in smaller towns, setting a paradox: the larger the city, the longer the distance to be travelled, but the more people walk.

Now, let us take a closer look at the mobility landscape in our four case mega-cities.

4. Paris, the old lady

First and unique capital region of France (Clovis, 5th century), the Île-de-France region extends over 12000 km2 or 2% of the French territory. Its land area makes it close to Seoul Metropolitan Region. Thanks to this role, Paris has along time built and backed a strong demographic and economic power. Ancient settlement area, the region is today home of

nearly 11 million inhabitants (similar to Sao Paulo city alone), and its population growth is now slow. First European urban area (followed by London), it is ten times as populated as the following French agglomerations of Lyon, Lille and Marseille.

The Île-de-France region (Figure 2) is divided into eight *départements* (counties) four of which are totally urbanised around the centre (3600 inh/km2), and the other four on the periphery have low density and include secondary towns and historical cities. The hyper central area is made of the city of Paris, which has been both municipality and *département* since 1964. On a tiny land (105 km2, less than 1% of the region) Paris *intra-muros* concentrates one fifth of the region population with 2.13 million, for that displaying very high density (20 300 inhabitants/km2), that compares to the one of Shanghai old city.

The Île-de-France region totals 1381 municipalities including Paris, whose boulevards were carved by Hausmann, and later divided into twenty *arrondissements* (districts), each one with its own mayor and council. The other 1380 municipalities outside Paris vary in population from 57 inhabitants to 106 thousand inhabitants, in surface area from 10 hectares to 17 200 hectares, and in population density from 3 inh/km2 to 23 700 inh/km2. As the whole of France (36 600 municipalities), the Paris region administrative structure is thus extremely crumbled.

Five new towns have been created since 1965 to absorb the then significant demographic growth; they are today home of 700 000 people and are serviced in particular by high capacity high efficiency rail network: RER (regional express network). In fact, the Île-de-France region takes advantage of one of the admittedly densest public transport network in the world, including heavy modes (suburban trains 844 km, RER 539 km, urban metro 212 km), and light modes (tramway tracks 21 km and bus routes 2780 km plus private lines).

Considered as the third world economic metropolitan region after New York City and Tokyo, Île-de-France produces 29% of national GDP (Gross National Product), with 22% of the French workforce. Its economic system essentially comprises services, 550 000 industrial firms, construction, trade and one important agricultural sector. One third of the business headquarters of French firms employing more than one hundred persons are located in this

region, mainly in Paris city and in the Hauts-de-Seine *département*. Besides, the Île-de-France region is the premier world tourist venue, with 36 million annual visitors, one third of whose are foreigners, with a cash flow of 32 billion euros, i.e. 10% of the regional GDP.

Figure 2

Core of a rich agricultural region, prosperous with one thousand trades, Paris has industrialised in the nineteenth and twentieth century in particular with automobile plants, developing its suburbs along railway routes. Thanks to the diffusion of these very automobiles, developments filled the areas between these routes and beyond, and urban dwellers settled further away from the centre. Then activity declined in industry and was replaced by jobs in the service sector that increasingly prefer suburban locations. This sprawling rendered walking less convenient and made it difficult for public transport companies to cope with this new geography, in spite of huge investments: the private car won nearly most of the new trips that were generated mainly in outer suburbs (Figure 3).

Figure 3

Nevertheless, people are more and more sensitive to the problems that the automobile creates on the environmental level (noise and pollution force them to flee the city), on the social level (when remote from the city, they have more accidents and less access to urban amenities), and on the economic level (outside the agglomeration, the cost of running a car exceeds the cost of housing). Motorised mobility has bred the mega-city, will it choke it to decay? Or will the city of Enlightenment stand at the cutting-edge of new humanised mobility? The answer might be relevant for Asian cities rushing into the smog of tailpipes.

5. Saint Paul's achievement

Soon home of twenty million (not including some five million inhabitants in two contiguous metropolitan regions), São Paulo is the most populated settlement in South America and one of the five American world mega cities. It is located 450 km away from Rio de Janeiro, which had been until 1970 the political Brazilian capital city. The city proper of São Paulo that

hardly scored one hundred thousand people one century ago, is at present itself ten million; its growth has now come to a halt, as other very large Latin American cities.

This gigantic municipality (Figure 4), in land area as well as population, is directly articulated with the closest surrounding municipalities, which are autonomous under federal and metropolitan control. This makes more complicated the economic and social stakes as well as the stakes involving the powers in place. The whole is included in a State comparable to California in population and dynamism, but not in other respects.

Saint Paul's primacy, within a State that is also the first in Brazil and could be a genuine nation by its size and several features, is mainly due to its economic and financial importance. The coffee Lords invested huge amounts in the textile and other industries that attracted European and Asian migrations at the beginning of the last century. Then, local industry substituted imports and concentrated the first industrial assets in this continent, attracting interior migrants (overall from pauperised Nordeste), mainly located in municipalities bordering the mother city. At last, a high skill tertiary hub now yields an important place to São Paulo in the new global economy. This cosmopolitan area, with blatant socio-cultural contrasts, is also a privileged arena to observe the mobility play, ascent along the social scale, migrations between countries and regions, professional changes, residential moves and daily travel.

A permanent feedback and redefinition movement takes place between the rationales for locating jobs, homes, streets and commutes. Transport infrastructure, though quite modern as regards technology and organisation, is yet rough as far as network capacity is concerned. So that congestion is overwhelming and the governance thresholds are pushed back beyond admitted bounds, without excluding the collapse threat. More than fifteen thousand urban and metropolitan buses, three primary regional rail routes in the course of modernisation, three metro lines plus a projected fourth one that has been approved for funding by the World Bank and a fifth recently inaugurated stretch make four physically integrated but institutionally superimposed networks. This dense and massive mega-city,

discontinuous according to some aspects but forming a system, is also the kingdom of individual transport, in particular automobile undergoing swift growth... (over five million cars, Henry, 2003) without correlative growth in travel!

These paradoxes, issues and challenges make São Paulo an excellent terrain to apprehend the perspectives of mega-cities, all the more that it has emerged for long. In this respect, its study provides benchmarks for more recently growing cities. But it also raises methodological and theoretical questions that may be fruitful worldwide.

Figure 4

6. Seoul's struggle for success

South Korea is extending over one hundred thousand square kilometres and has been mainly urban since its still hot carving in half in 1953. Its capital city (Figure 5) is extremely dense and is cut in half by river Han: 308 km2 in the south against 298 km2 in the north are linked by 23 bridges. Its metropolitan area, exceeding 11 700 km2, would make it a mega-city over twenty million inhabitants absorbing nearly half of the country population (48 million Koreans) of a demographic size closer to that of Sao Paulo State than to that of France.

Seoul has always played a dominant role in national trading and transport and has become the economic hub of the Korean peninsula. Its westernisation has driven its modernisation in numerous areas: telegraph in 1888, railways and first electric tram in 1899.

While already millionaire in the forties, the old city was partly turned into rubbles during the 1950-53 war. Development programmes in the sixties have grown residential high-rise buildings and office skyscrapers by polarising new secondary business and entertainment centres.

So Seoul reached 8.39 million inhabitants in 1980 and extended towards the Kyeonggi province surrounding the city, then home of five million; this couple continued to grow continuously until it hosted a eight-digit population (10,726,000 in 1990).

Moving homes into satellite towns began in 1990, so that the capital city decreased to 10.4 million in 1997. In the head of this Asian dragon, the number of jobs never ceased to

increase, in particular in the exporting transformation industry (textile, automobile, ship building, etc.) and in services, multiplying entailed daily commutes into Seoul.

The rail network supporting this functional oil stain expansion is hybrid, with routes corresponding as much to metros in the centre as to regional trains in the outskirts, the rest of trips being mainly met by automobile.

Beyond the row about whether Seoul deserves the second world mega-city rank for those who consider the metropolitan area, with 25 districts, as a whole, or the capital city proper should remain an autonomous unit of the Korean urban frame, which reduces Seoul within ten million inhabitants, this configuration is specific and interesting to several respects.

The influence of the Korea economy in the world productive and financial flows, the transition mode from rural to urban, the perspective of the national reunification, as well as the articulation between a violent combined growth of construction and transport, all those retain focus on the mega-city phenomenon under some distinct angle, which is useful to understand realities elsewhere.

Figure 5

7. Shanghai's flight forward

Shanghai is the main Chinese agglomeration, with some 17 million inhabitants including three million rural residents and three million migrants with a temporary permit for more than six months. However there is concentrated only one hundredth of China population –itself one fifth of mankind– whose urban development has been deliberately contained in the second half of the last century (except Hong-Kong and Macao never ruled by Maoism). Per capita income is the highest of the People's Republic. The growth of this economic castle is historically linked with international trade, the importance of which resumes with the opening of economy and the recent setting of industrial regions. As Beijing, Tianjin and recently Chongqing, Shanghai has a status of "municipality directly under central government control", equal to the one of one of the 23 provinces (including Taiwan), of the five autonomous regions (such as Tibet) and now the two special administrative regions that

Hong-Kong and Macao have become. What would be a Brazilian metropolitan region, but in the context of a country that remains rural for its main part, gets close to the size of Sao Paulo, of which it also shares the economic leadership but not the political one at the national level.

At the mouth of the river Yangzi that is sixteen kilometres wide, (Figure 6) Shanghai spans over an area extending over 6340 square kilometres, including 122 with water surface; the municipality expands over about 120 kilometres from North to South, and nearly 100 from East to West. The surface area of the agglomeration covers 2057 square kilometres, of which 410 for the old city and the new Pudong business area (four time Paris city), making it a very dense urban core (such as Seoul). The mega-city is divided into nineteen districts. When marvelling at the city model in the urban planning museum, as well as when riding around the city along its outer express ring road (circling 600 km2), the number of high-rise buildings is striking (world record). In particular, the new Pudong area becomes an emblem of the city, with its television tower and Jin Mao tower (third tallest on Earth).

The expressway network forms a cross through the city centre with two ring roads; but the car ownership level has remained low until recently, because of the high cost of parking and high taxes on vehicle purchase; in fact, taxis are more affordable than maintaining a personal car, and have a high level of use. As a result, congestion has been contained for some time on expressways, to the contrary of Beijing with more cars (Allaire, 2003). The metro lines are opening at a high pace (nearly one per year), and rapidly convey a huge patronage, in spite of awkward transfers. The massive crowding in the most famous shopping street (Nanjinglu) has led to its transformation into a pedestrian area. A number of other central arterials are also forbidden to cyclists, who are numerous in other streets and meet more trips than public transport. Economic growth, population stratification, third industry modernisation, urban cycling facing developing motorised modes, density combined with preserved rural activity, all these features drive the analysis of the Shanghai case to be focused on the transition towards mega-city, apart from the one of the Chinese economy.

Figure 6

8. The staggered path to growth

Four mega-cities have undergone or are still undergoing tremendous growth and change in several respects. These transformations have occurred in different stages taking place at different periods of history. Yet, is the story of the newest cities the exact replica of what the oldest ones lived? Or does the present time context take precedence over the succession of phases to determine the local conditions?

For some, economy is the source of everything. In all countries, cities have taken advantage of two major economic remodelling. The first one is industrialisation that was accompanied by a dramatic increase of the city output. This proliferation of plants took place before the First World War in European and American cities, while it was delayed by the aftermath of the Second World War in continental East Asian cities. The second shift was the reduction of the share of blue-collar jobs to the benefit of white-collar jobs in services, administrations, commerce, finance. It also corresponded to the concentration of higher level activities in the biggest metropolises. This second process fed more global markets and occurred within a much shortened time lag in all mega-cities, as if the time unit for changes to spread worldwide had been cut by one order of magnitude, from decades to years.

But behind products there are always men and women. In fact, the two economic changes were rendered possible by two related demographic movements. The first one was the rural exodus of peasants making manpower for new industries, replaced later in the first world by immigrants from developing countries. These migrations entailed the massive growth of cities in population. The second phase also enlarged cities, but more in geographical size: while CBD (Central Business District) soaring rents drove residents to sprawl around the city, the massive diffusion of automobiles made commuting at a larger scale possible. Now, all post-industrialised countries display a drop in fertility rates, more particularly in big cities. Plummeting was strikingly fast in China. This phenomenon, known as the end of the demographic transition, results in fewer young persons, and more senior citizens. Population aging, already very significant in Europe and Japan, will amplify in future

decades in Korea and China. It will not leave cities and their transportation systems unaffected (Bussière & Madre, 2002).

These demographic mutations are also linked with social transformations. The development of cities has in fact led to a double segregation process. On the one hand on the spatial level, motorisation has allowed those who can afford it to bloom in privileged often gated communities, or entertain in gentrified city centres; forcing the poorest to cram into ghettoised neighbourhoods, or to stay stranded without access in remote locations. On the other hand on the lifestyle level, motorisation has created a new standard of living, where families are supposed to get supplied from regional shopping malls, to spend weekends having fun in leisure parks, to attend well advertised venues etc, which has nourished a bitter divide between those who participate and those who cannot, for instance, when they do not own a car. These evolutions have insidiously reshaped the society in western metropolises, and sometimes led to riots in Paris or Sao Paulo, while the future likely consequences in Asian cities, even possible unrest, are yet to be examined.

Technological changes have a different time frame. There are available worldwide as soon as they appear. The only obstacle is the level of economic affluence that enables or not full scale implementation. For that, when cities are developed they generally build state of the art networks, so that different mega-cities have different infrastructure design. For example the Paris metro dates back to 1900, and in spite of considerable improvements from then, it retains many of its original features. Although they may appear romantic, they also bear some significant drawbacks that are difficult to correct (narrowness of the tunnels, connections with the long distance network). On the contrary Shanghai newly expanding metro routes include all the latest innovations of the twenty first century, and Shanghai is also the first city to operate a Maglev system.

But the more demanding turns are to be traded in the future, to cope with sustainability concerns. Energy supply may not meet soaring demand, in particular as crude oil yields slow down. So the kind of city that was rendered possible in the second half of the twentieth century by cheap oil price, heavily dependent on the automobile, may not be affordable any

longer; in this respect, Asian cities enjoy a competitive advantage by remaining denser, with high demand corridors easily served by mass transit (Pan & Doulet, 2003). The other sustainable focus is of course global warming, with urban stakes similar to the energy debate. Nevertheless, mega-cities might be better places to manage these sustainability issues, as far as transport is concerned, than more scattered settlements. In this respect again, Asian populous regions turning into solid megalopolises may be a blessing.

9. Mega-cities and mobility: a chicken and egg question?

From the previous considerations, it can be assumed that mega-cities are a good remedy to the global gas dead-ends (both inlet and exhaust) where mankind is driven by the dispersal of population. It is also obvious that Asian major settlement areas intrinsically own the potential to become efficient functional metropolises complying to the new demands of sustainable development.

Nevertheless, after this short overview of five domains in the evolution of the urban life form, after having put forward four case metropolises, and after having discussed the relevance of the third definition of mega-cities, set from their internal commutes, one fascinating fact should be stressed: the car ownership rates tend to converge in mega-cities to moderate degrees, while at the national echelon, discrepancies are enormous. So under-motorised countries concentrate their automobile fleet in the core of the biggest cities, while over-motorised nations keep the central areas of their leading agglomerations alleviated from the excess of cars. This kind of equilibrium shows that some compromise has been found between mega-cities and motorisation, which would solve the chicken and egg question that has intrigued us all along this paper (Figure 7).

Figure 7

In fact this equilibrium may be the balance between two antagonist circles, one virtuous where mega-cities produce cars and built infrastructures to accommodate them, while those cars make the metropolis function and develop, the other one vicious since cars destroy the

city environment, clog the streets and induce sprawl, all preventing the city to harmoniously prosper and move, and forcing it to restrict car use. So a host of transport expertise may not be needed to attain this natural result, nevertheless this can be doubted since many detailed arrangements have to be tuned to deal with a number of issues raised by the conundrum of mega-city travel.

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Tables

Table 1: Some basic facts about four mega-cities

Four mega-cities	Paris			Shanghai	
	Region (*Île-de-France*)	Urban area	City (*Ville*)	Metropolis (*Shi*)	Inner city
Administrations	8 *départements*	396 *communes*	20 *arrondissements*	19 *xiàn* level districts	10 *xiàn level* districts
Land area, km^2	12 012	2 575	105	6 340	606
Maximum radius, km	91	35	6	72	21
Population, million	10.96	9.32	2.13	17.42	11.50
Population density, inh./ha	9	36	203	27	190
GDP, billion US$	614	573	205	93	
GDP per capita, '000 US$	56.0	61.5	96.2	5.3	
Personal cars, million	4.99	4.60	0.61	0.22	
Personal cars per capita	0.46	0.49	0.29	0.013	
Urban rail, km	865	555	211	369	82
Urban rail density, km/km^2	0.07	0.22	2.01	0.06	0.14
Buses	16 272	8 136	4 348	19 070	
Buses per 1000 inhabitants	1.5	0.9	2.0	1.1	
Motor trips per cap. per day	2.3	2.2	1.9	1.2	
Data		**São Paulo**		**Seoul**	
2 004	State (*Estado*) ESP	Metro-politan region RMSP	City (*Prefeitura Municipal*) PMSP	Metro-politan region SMR	City
Administrations	645 *pref.* 3 *RM*	39 *municipios*	31 subpref. 96 districts	29 cities	25 *gu* districts
Land area, km^2	248 600	8 051	1 509	12 438	605
Maximum radius, km		100	55		20
Population, million	38.12	18.35	10.55	23.24	10.15
Population density, inh./ha	1.5	23	70	19	168
GDP, billion US$	279	133	69	402	240
GDP per capita, '000 US$	7.3	7.2	6.5	17.3	23.6
Personal cars, million	8.87	4.76	3.36	4.94	2.69
Personal cars per capita	0.23	0.26	0.32	0.21	0.265
Urban rail, km		180	165	487	287
Urban rail density, km/km^2		0.02	0.11	0.04	0.47
Buses		22 500	12 500	15 579	14 191
Buses per 1000 inhabitants		1.2	1.2	0.67	1.4
Motor trips per cap. per day		1.3	1.4	2.4	2.3

Source: various, including IAURIF, Shanghai Statistical Yearbook (2005), Korea National Statistical Office, Korea Census 2004 Registration, Webb & Clarke (2005-2006), Wikipedia.

Figures

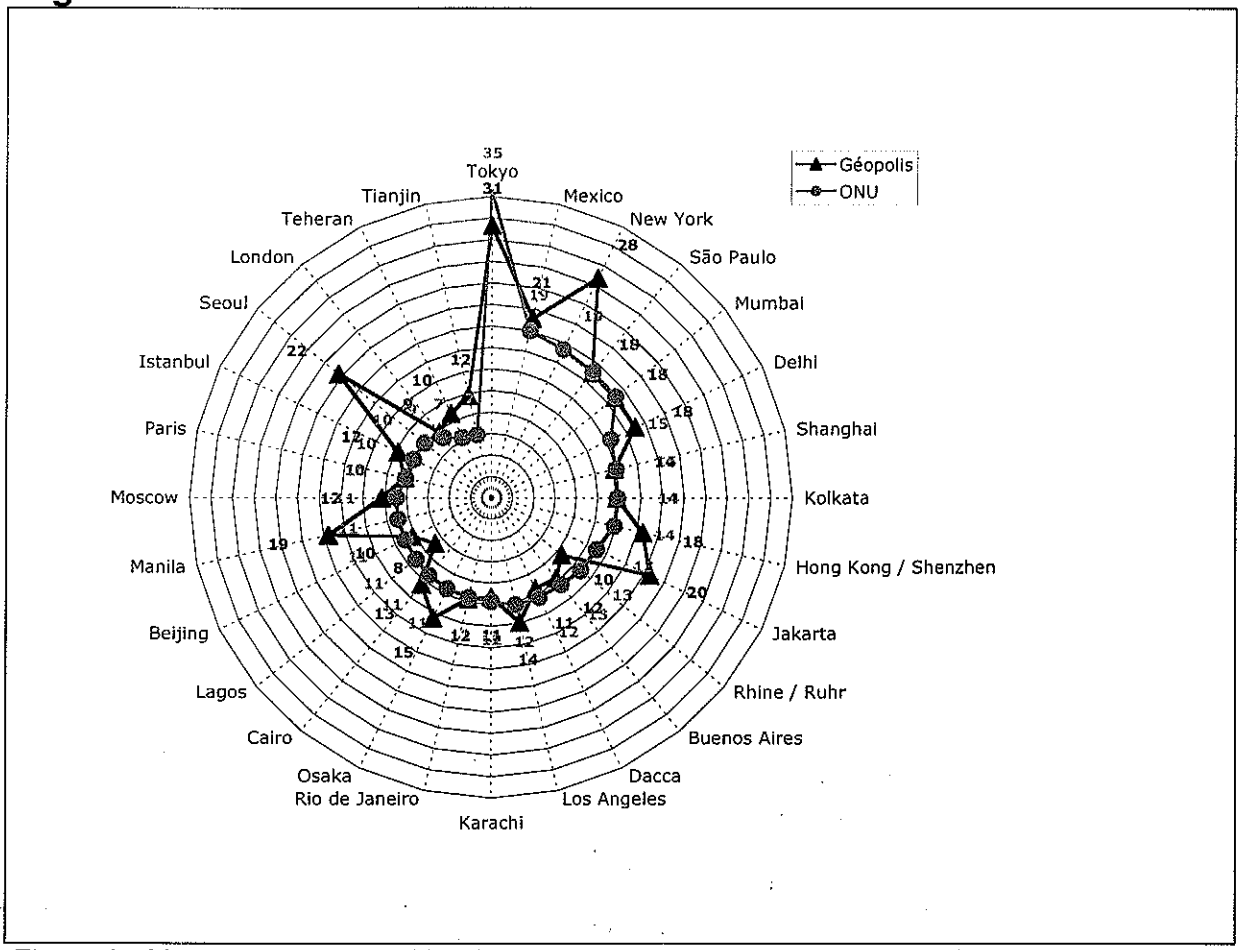
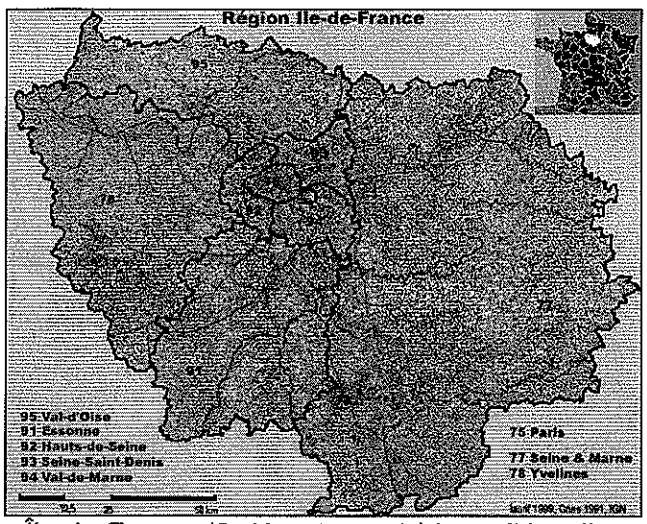
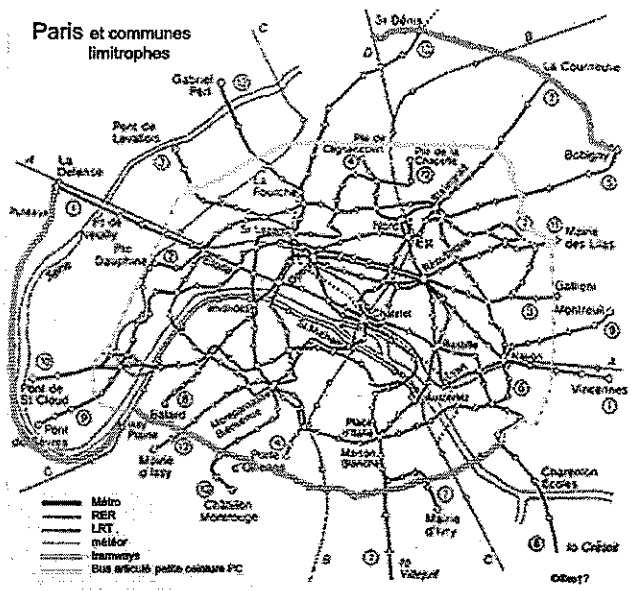


Figure 1 : 28 mega-cities over 10 million snail-plotted by population according to two series
Source: United Nation (2003), Moriconi-Ebrard (2000) both updated to 2005.



Île-de-France (8 *départements*) is traditionally cropland, with urbanised and industrialised core, and has become a tertiary capital city



Paris: 5 RER lines, 14 metro lines, 3 tramways

Figure 2: Île-de-France and its transport networks
Source: IAURIF, STIF, DREIF, Webb & Clarke 2006

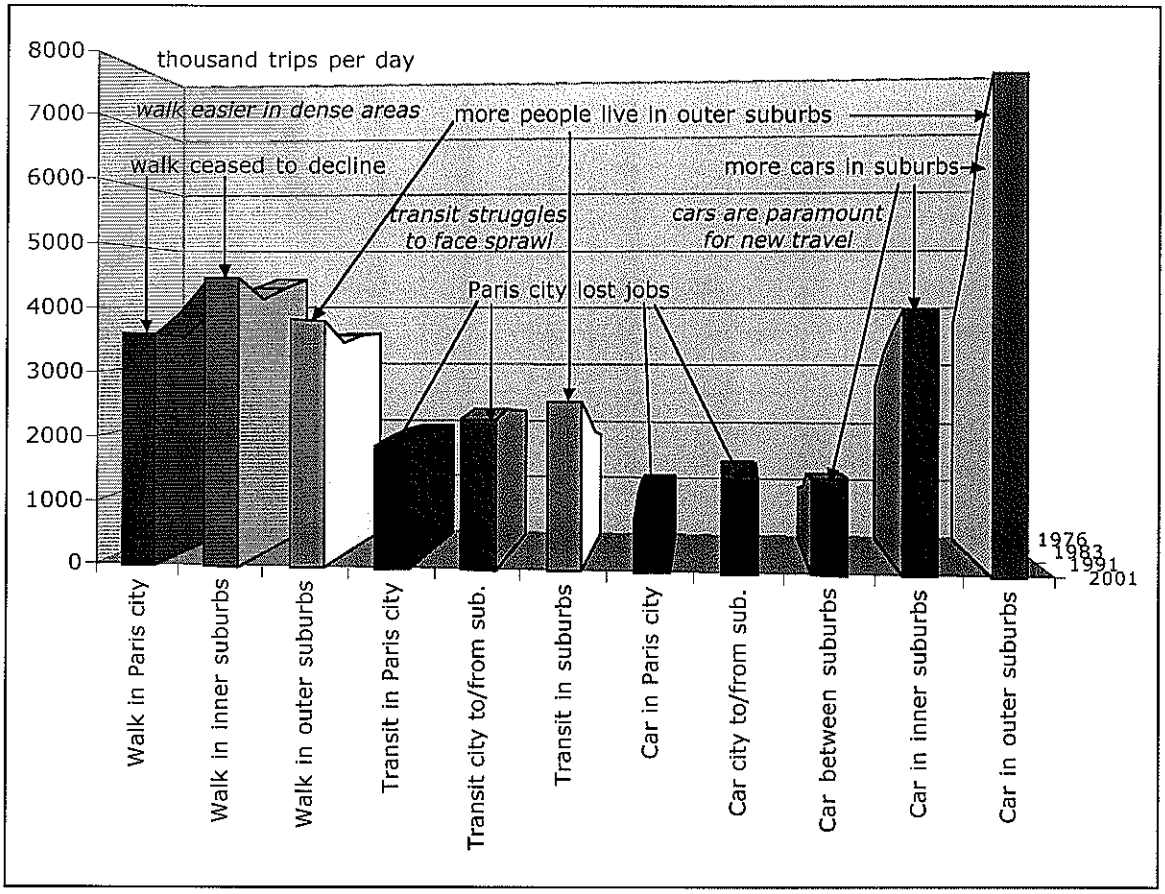
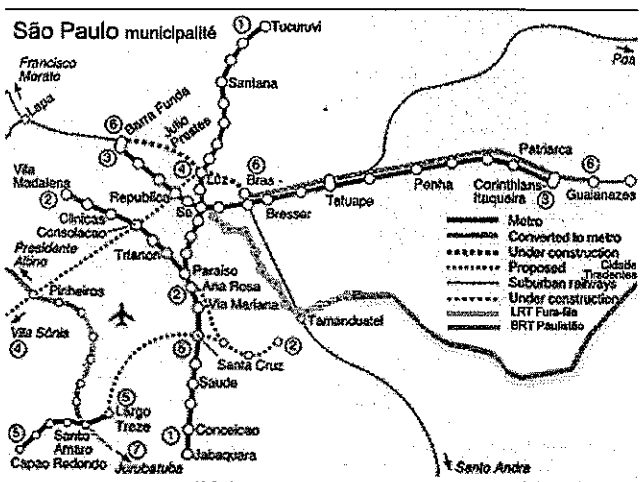


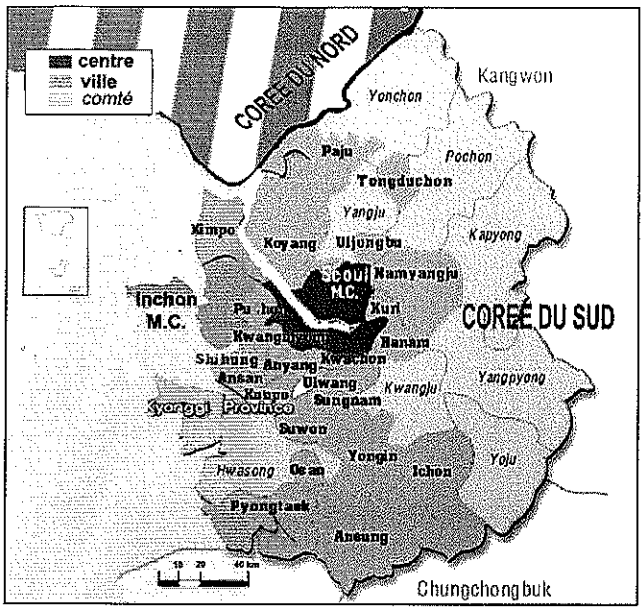
Figure 3: Travel in Île-de-France is more scattered and car oriented.
Source: Ile-de-France travel surveys (EGT: Enquête Globale de Transport) 1976 to 2001, after Courel et al., 2005.



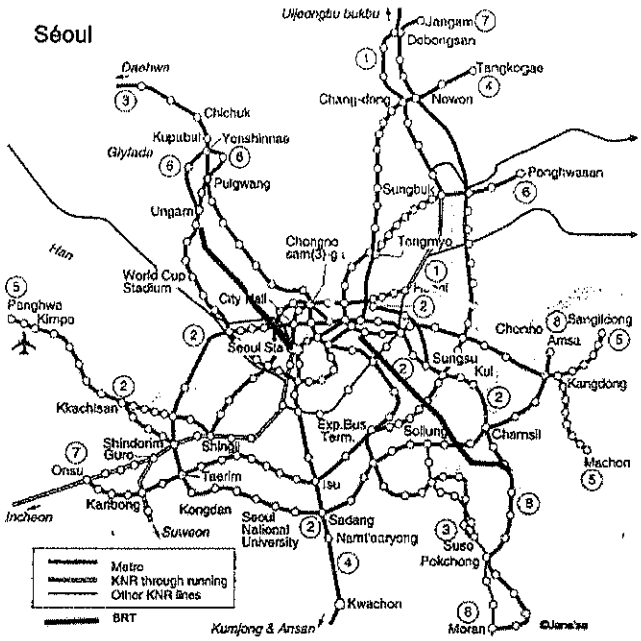
50 km metro routes operated by CMSP
(4 lines operating + 1 under construction);
120 km urban railroads by CPTM (Sao Paulo State);
proposed LRT (Fura-Fila)

São Paulo State: 3 metropolitan regions, including
São Paulo Metropolitan Region: 39 municipalities
Including mother city, **Prefeitura Municipal de São Paulo**

Figure 4: Sao Paulo, engine of the Brazilian economy
Source: Henry 2003, Webb & Clarke 2006



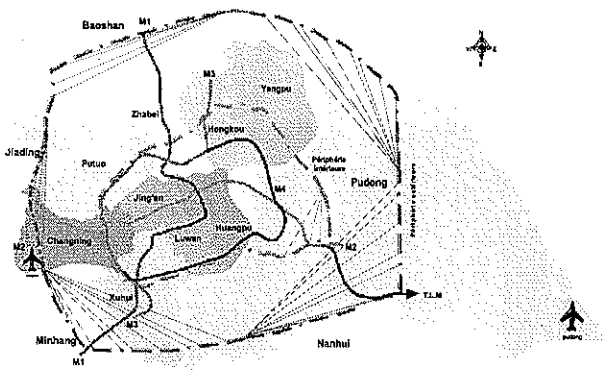
Seoul and neighbouring cities, forming a metropolitan area with administrative and geographical boundaries under discussion



Metro: 8 lines operated by two companies; Suburban railways operated by KNR; BRT routes

Figure 5: Seoul metropolitan area
Source: Korea Local Authorities Foundation for International Relations, Webb & Clarke 2006.

Shanghai: 9 inner *xiàn* level districts (darker); 9 outer*xiàn* level districts plus Chongming island county (lighter)



Shanghai city centre (Huangpu, Luwan, Jing'an, Hongkou districts) within inner ring road (dotted line); inner area (Xuhui, Changning, Putuo, Zhabei, Yangpu districts plus part of Pudong) within outer ring road (dotted line); serviced by four metro lines by 2006 (solid lines).

Figure 6: Shanghai infrastructures and districts
Source: Shanghai Municipal Government.

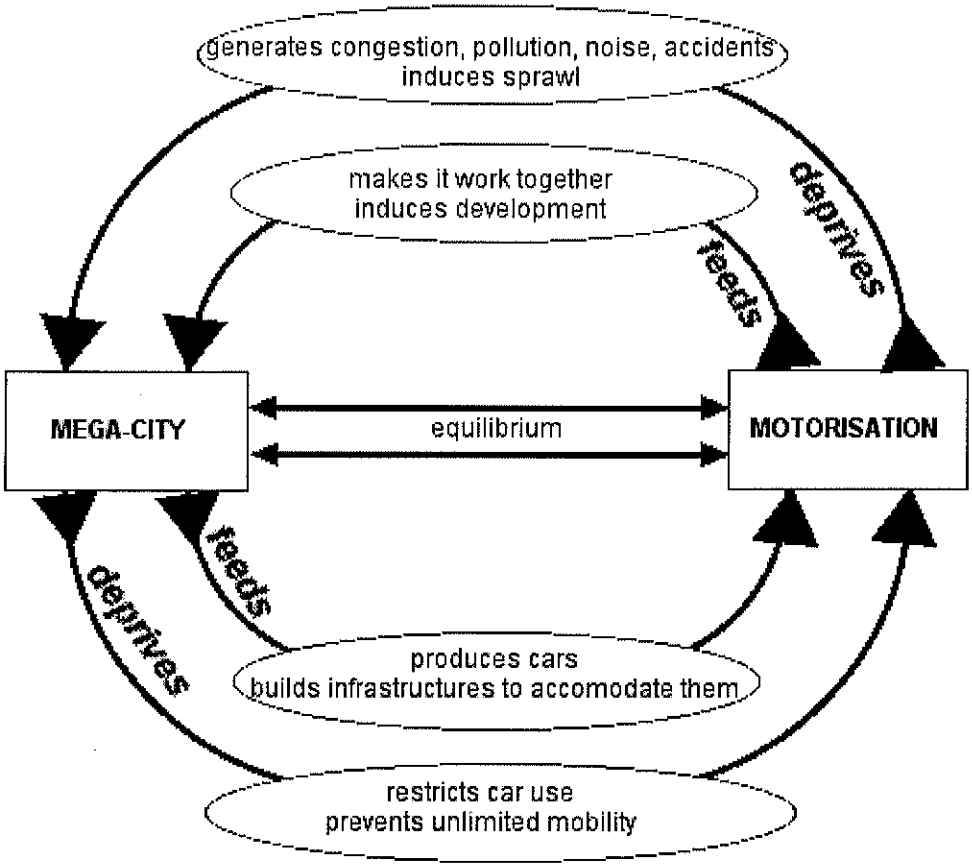


Figure 7: The chicken and egg vicious & virtuous cycles between mega-city and motorisation