ingly discussed in numerous papers. In our opinion, anthropological first principles impose face-to-face contacts in most cases. If we are wrong, the wired city will eliminate the component No. 1 in travel, i.e., travel to work (50 minutes – 35 km – per day for car owners, in the mean).

In Rodger, ed. (1993) various authors describe the recent evolution of Europe from a historical point of view, but tainted with economics, social structures, and urbanistics.

The urban development, and its strong dependence on transportation, is stressed. The arguments are qualitative but worth a reflection. Applicable is the extensive bibliography in urban history.

Hart (1992) gives a good example of the point of view of a historian with a bent in forecasting. He is descriptive but with a lot of factual data. Transport, which is in evidence in the title, is considered an effect more than a cause of city patterns. In his forecasting chapter, Hart quotes various studies to come out of the impasses that sprawl-cities create, with proposals of compact cities and conurbation clustering. As described in our report (Marchetti, 1994a) compact pedestrian islands (500 m diameter) connected with fast and frequent subways could be a solution compatible with the most modern technologies (Maglevs). The islands could be distributed at random with open spaces in between. After all, as urbanists slowly realize, a city is a time structure more than a geometrical one.

Jenkins et al. (1992) provide indirectly some information on our problems, as its aim is to assess environmental effects of transportation. One of the observations is that in California, people spend around 6% (six percent) only of their time outdoors. Perhaps air quality indoors (radon
and chemical vapors) should be stressed more by environmentalists as the paper suggests.

Holliday et al. (1991) is a good specimen in the state of the art of evaluating the effects of constructing a tunnel, the reshuffling of territorials, and urban relations and settlements. The methodology, however, has been superseded by that used by Marchetti “Building Bridges and Tunnels”, to assess the urban effects of tunnels and bridges built in Lisbon, Istanbul, and Hong Kong.

Roehner (1991) is an outsider, a theoretical physicist, and as it sometimes happens, it brings some fresh air into the area of urban theories. However, the paper deals with the next problem of our context, the distribution in size and in space of the cities of a certain country.

Roehner is able to calculate from first principles the case of city size distribution (Pareto distribution) for an archaic situation where the bottleneck was the transport of food from the country to the cities. He also models the spatial distribution (with a logic very different from Christaller). Because the rules of organization are very similar, outside and inside the city, we signal this paper for its methodological significance, although it does not deal directly with the problem of transportation and city form.

Daniels, ed. (1991) is a collection of articles devoted to the geographical distribution of services, and the recent changes on this distribution. The book is not centered on urban structure, but provides much contextual information, in the Christaller sense, on the forces that shape the hierarchy of cities. Transport speed as usual is the modulus (the unit) that links structures to space. The book is rich in information and
a recommended reading.

Marchetti (1990) is probably the most explicitly quantitative paper in dealing with the problem of the effects of transport on the internal organization of a city. The traffic of three cities was analyzed, over almost a century, across a natural barrier bottlenecking it: a river for Lisbon and sea channels for Istanbul and Hong Kong.

It is shown that going from a slow connecting mode (the ferry, about one hour) to a fast one (the bridge or tunnel, 10 minutes), the two parts of the city across the impediment become one. This is manifested by an increase in traffic by two orders of magnitude. A two order of magnitude is actually the ratio of traffic intensity between intercity mode and intracity mode. The shift in mode occurs when the transit time crosses the value of about 25 minutes. The modeling we used is simple, quantitative, and predictive.

A similar methodology has been used in Marchetti (1993). It shows that the city boundaries are defined in time and consequently existing cities can be aggregated into larger ones by sufficiently fast transportation.

Parr and O’Neill (1989): A particularly appropriate form of the density function is the lognormal and the broad features of this function are outlined.

Because a model has to fit actual data, the empirical way of fitting has some interest as it can influence the search for the appropriate model.

Gordon et al. (1989) show that travel patterns are invariants to income, race, and religion, so to speak, supports our tenet that travel patterns are anchored in anthropological traits (Marchetti, 1994a). Which
is a safe conceptual point to start searching for a general model.

Topalov (1989) gives an interesting reconstruction of the interaction between politicians, academy, exploding cities, and builders. The obvious clue could have been efficient models that could describe and forecast reality. But in spite of the variegated efforts, under varying political and ideological banners, the phoenix never concretized.

If history teaches something, a large number of pitfalls are described here to be avoided if a program on city modeling will be established by the EC.

Bowyer and Botterill (1988) start off well: An understanding of the interactions between urban transport systems and spatial and demographic characteristics has long been sought. The need is increasing as urban systems increase in size and complexities.

The problem is explicitly stated, no solutions are presented here (or elsewhere, by the way). The paper is interesting in terms of fixing procedures to gather data compatible with the testing of models.

Richardson (1988) reviews models on regional policy analysis covering various aspects, including transport. The models incorporate econometric thinking and do not work.

The reason for quoting this paper is that it may be useful for a historical search on the evolution of models.

Edmonston et al. (1984) is interesting for statistical data for checking models. Canadian cities have steeper gradients and denser population at the center than US cities. Perhaps climate cools off bucolic dreams. Apart from transport speed, very similar in the USA and Canada, these data show that also cultural traits may be important to define city structures.
Moslem and Mediterranean cities lean to the compact. Nordic ones are more influenced by the bucolic dream.

**Griffith and Lea, eds. (1983):** When a system of specialists gets stuck, liberation comes often from outside when the innocent specialist in another discipline finds the appropriate metaphor. In this sense the book on “Evolving Geographical Structures”, proceedings of a NATO conference, is worth reading. To give an example: “The Empirical Evidence of Volterra-Lotka Dynamics in the United States Metropolitan Areas 1949–1977” by D. Dendrinos and H. Mullally (page 170), represents an interesting attempt to transfer biological population modeling, successfully introduced by Volterra and Lotka in the 1920s, to human populations.

**Bennet (1981):** Chapter 14 of *The Evolution of Urban Spatial Structure* is a fairly comprehensive state of the art of the thinking and modeling. However, as economists often do, influencing geographers, the cost of travel and not the time is given priority in terms of traveler choices (time is given a value, but not a budget).

**Thomson (1977)** produced a good source of information and of statistical data on the transport systems of 30 large cities around the world. There is some classification in the structure of the cities depending on the intensity of aggregation (weak and strong center). There are no theoretical hints to interpret the variegated structures of the cities described.

**Angel and Hyman (1976):** In spite of being almost 20 years old, the book still represents the best in the area of space versus speed. The main thrust of the treatment is the introduction of time (of transit) warped
geometrics, which in a sense represent the visualization of space by the traveler. In spite of the quality, complexity, and insights of the book, the basic problem of modeling from first principles (anthropological?), the density distribution of population in a city (and its relation to transport speed) is not resolved.

Cripps, ed. (1974) represents well the various attempts made in modeling space–time in urban configurations. Although the basic problems end, unsolved, in mathematical tangle (just as in energy modeling about which we have a long and personal experience), the book is worth leafing because of the numerous examples and seeds of ideas that could be developed. In terms of subject, the conference reported in the book centers on our problem: spatial organization of cities and regions and the effect of transit time on them.

Brown (1968) presents a review and amelioration of Hägerstrand results on diffusion processes in social systems. We think that diffusion is at the root of social dynamics, including the structuring of cities.
Conclusions

The mechanism we have described being at work, the planner has finally the choice of creating a set of alternative cities or conurbations by creating appropriate boundary conditions.

In the substance the city can be seen either

- as a compact structure where people move on foot or by elevator (New York); or

- as a loose spatial structure where basically personal transportation ensures mobility (Los Angeles).

The compact city provides a strong simplification in terms of services, organization, and people movement. Before 1800, when most of the moving was on foot, cities were all compact.

Density does not seem in itself to have negative effects, even if very often experiments on crowded rats have been considered decisive in that sense. Actually the important point is to make the limited space available to a person extremely pleasant (as chronically crowded Japanese have learned to do) and provide the hierarchy of personal privacy and group privacy that old cities realized with the internal courts and the small piazzas.

Once density has been matched with human demand, what medieval cites did to a large extent, as the flux of tourists suggests, then we can realize human settlements very economically in terms of construction, distributed services – like water, electricity, and sewage, plus, naturally, working and shopping. If we connect a few such compact “medieval” cities with superfast vehicles, e.g., Maglevs, we can realize a cluster city...
having all the functional characteristics of a very large city.

The other basic alternative is the sprawl city, well epitomized by Los Angeles, were deprived peasants from the Middle West recreated their peasant symbols on a microscale – the hut, a grass corridor around, and a fence. This nostalgic-psychotic choice created the basis of an awful city where, incidentally, all the charm and poetry of living “in the green” is completely lost. Incidentally, as the rules of city travel show, low density makes public transport practically impossible and leads to about 40 km/day/car traveling into the city limits.

If the planner just looks at things as they go, the periphery provides an attraction through lower prices of land and building, which overcompensates for the cost of traveling. If the travel time stays below $30 \times 2$ min/day, the periphery is functionally part of the city and its inhabitants feel to be in. However, this creates strong transportation problems partly due to the Circadian structure of social behavior.

To conclude this literature survey of city versus transport, we would say that a compact city, perhaps split into a number of pieces, has much to recommend in view of an increasing urbanization of world population.

The key to a compact city is to make compactness very pleasant and desirable to the inhabitant, a primary task for the anthropologist, with the help of the engineer, and the artist. Venice is very near to the solution in spite of the fact that in recent years its inhabitants had to leave to make a living in an active center nearby. This applies for many medieval walled cities where the solution had to be found for the economic survival of its inhabitants.

Inside these cities a system of very frequent, very fast subways may
completely solve the medium distance intracity human movement. In a sense a single city can be decomposed into a set of foot villages connected by the subway. Compact cities can then be connected by fast Maglevs and integrated into larger and larger complexes.
Journal Articles (in alphabetical order)


d-10, International Institute for Applied Systems Analysis, Laxenburg, Austria.

tional Institute for Applied Systems Analysis, Laxenburg, Austria.

Charpentier, J.-P., 1975b, Overview on Techniques and Models Used in the Energy Field, RM-
75-8, International Institute for Applied Systems Analysis, Laxenburg, Austria.

Dendrinos, D.S., 1976, Mode Choice, Transport Pricing, and Urban Form, Environment and

Dendrinos, D.S., 1979, Energy Costs, the Transport Network, and Urban Form, Environment

Edmonston, B., Goldberg, M.A., Mercer, J., 1985, Urban Form in Canada and the United

Evans, G.W., Smith, C., and Pezdek, K., 1982, Cognitive Maps and Urban Form, Journal of
the American Planning Association, Spring, pp. 232–244, American Planning Association,
Chicago, IL, USA.


Gilbert, A., 1992, Third World Cities: Housing, Infrastructure and Servicing, Urban Studies,

Glasson, J., 1992, The Fall and Rise of Regional Planning in the Economically Advanced Nations,

Golob, T.F., Beckman, M.J., and Zahavi, Y., 1981, A Utility-Theory Travel Demand Model

New Evidence, Urban Studies, 26:315–326.

Haring, J.E., Slobko, T., and Chapman, J., 1976, The Impact of Alternative Transportation


fornians: Use of and Proximity to Indoor Pollutant Sources, Atmospheric Environment,


Tanner, J.C., 1961, Factors Affecting the Amount of Travel, *Road Research Technical Papers*, No. 51:1–26, Road Research Laboratory Great Britain.


Journal Articles (in chronological order)


Tanner, J.C., 1961, Factors Affecting the Amount of Travel, Road Research Technical Papers, No. 51:1-26, Road Research Laboratory Great Britain.


Association, Chicago, IL, USA.


Books (in alphabetical order)


Hall, P., and Hass-Klau, C., 1985, *Can Rail Save the City? The Impacts of Rail Rapid Transit and Pedestrianisation on British and German Cities*, Gower, Aldershot, UK.


Higgins, B., and Savoie, D.J., eds., 1988, Regional Economic Development: Essays in Honour of Francois Perroux, Unwin Hyman, Boston, MA, USA.


Marchetti, C., 1990, Building Bridges and Tunnels: The Effects on the Evolution of Traffic, Chapter 4 in A. Montanari, ed., Under and Over the Water: The Economic and Social Effects of Building Bridges and Tunnels, Edizioni Scientifiche Italiane, Napoli, Italy.


Books (in chronological order)


Chandler, T., and Fox, G., 1974, 3000 Years of Urban Growth, Academic Press, New York, NY, USA.


Hall, P., and Hass-Klau, C., 1985, Can Rail Save the City? The Impacts of Rail Rapid Transit and Pedestrianisation on British and German Cities, Gower, Aldershot, UK.


