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The dynamics of social images in a system of cities

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(provisional draft version)

Abstract

Social differences between cities are not as important as residential social segregation processes inside cities. However, a social interurban segregation does exist, even if it is not so often perceived and described. This process is linked with the two main independent features of the structure of the urban systems, first the hierarchy of size and functions, second the specialisation. After a longitudinal study of cities over thirty years in the French urban system, we can conclude that the interurban segregation process is created by the unequal diffusion of innovations within the urban system. It gives rise to differences which, once created, are maintained by population differentials in the migration flows. The interurban social differences also induce scaling phenomena in the collective representations, or "images" of the cities. The unequal qualities of those images are reflected in the global attractivities of cities. Therefore, they contribute to shape the further channels of innovation diffusion in the urban system. Nevertheless, as they have a longer persistency in time than the objective conditions of their appearance, they may mislead the predictions about the future of individual cities.

1 Introduction: the concept of social image

Whereas intra-urban social segregation has been studied quite deeply and formalised in various theories and models (Knox, 1989, Ley, 1983), social differences between cities did not receive the same attention (Bourne, 1991). Despite the differences in the social composition of population from one city to another are not often so important than between the neighbourhoods inside a single urban area, they do exist and persist long enough to deserve a study of their role and evolution within the structure of the systems of cities.

Empirically, cities have been for long characterised by their majoritarian social groups as proletarian cities, "middle class" or "bourgeoises" ones (Chatelain, 1946). More recently one

has recognised the emergence of local concentration of populations of technicians and engineers, born with the development of the technopoles (Chenu, Tabard, 1993). The typology means something more than objective differences in social profiles, because it is reinforced by collective representations. The social differentiation of cities is then not very often perceived as such, but through cultural manifestations or because of the links with other urban characteristics, the most obvious of which is the mean standard of living.

Existing theories of such differences mainly relate them to the economic basis of cities (Scott, 1988, Suarez-Villa, 1988). There is usually a strong dependence of urban social profiles upon the specialisation of the cities in certain economic activities. However, some recent investigations suggest that the local social structures may be more responsible today among a set of cities for the differentials in their attractivities upon the economic development. The specific synergies which are developed in the so called "innovative milieux" (Camagni, 1992) may be responsible for the take off of the most successful technopoles. The specific intervention of the social links in this process is not yet fully understood. It may be altogether a matter of education, skill, connections between venture capital and local powers. There is also probably a learning process in the development of complex urban economic and cultural institutions, both official and officious, which is the only possible explanation for the observed differentials in the efficiency between cities having a long history of monocentric development and conurbations of the same total size (Cattan et al. 1994).

Several authors also have demonstrated the role of social city profiles in the identity of cities, in the perception of their image, especially when those symbolisms are exemplified by urban marketing (Borchert, 1994, Dematteis, 1994). The urban societies can not only be conceived as passive secondary structures which would be explained by the location patterns of economic activities, they also are to be integrated in the problematic of unequal urban development, possibly under the mediation of social images.

Our investigation in this paper concentrates on the comparative transformations of urban social profiles in the French system of cities. We will not deal with the meaning of the contemporary social transformations nor with the role of social links into urban development, for which we only have indirect proofs. The simple description of an urban society through the social composition of its population is not sufficiently accurate for completing serious inquiries about such questions. But we will try to explain how the social differences between cities are maintained over time, and try to understand the conditions of their emergence.

Despite the not too well adapted set of data that we are forced to use, we shall try not to limit ourselves to comparative statics, but to explain our observations within a dynamic theory of the evolution of systems of cities (Pumain, 1991). Whereas the changes in urban social profiles are obviously linked with the cycles of innovations diffusion within the urban system (Suarez-Villa, 1993), we will show that the perception of their effects also play an active role, as revealed by the urban attractivities on migrations. This paper is only a preliminary study of the process of change in social image before developing a dynamic model. In a further step we would like to model it as a not entirely deterministic process of transitions of competing individual cities between various accessible states in the socio-economic space.

2 The diversity of social profiles

We are able to compare the social composition of 78 urban agglomerations larger than 50 000 inhabitants, at four points in time, in 1968, 75, 82 and 90, and for various levels of

disaggregation, from census data. There was a major change in the nomenclature of "socio-professional categories" in 1982, so in this presentation we shall concentrate on a four categories nomenclature which allow for comparisons, although we have tested more detailed descriptions at each date. For that set of urban agglomerations, other indicators are available about the economic composition of their labour force as well as various indexes evaluating the "economic health" or standard of living in cities like the amount of value added taxes per inhabitant, mean income levels, salaries, prices for housings and offices and unemployment rates. Those last informations could be collected at three dates only, around 1970, 80 and 90.

2.1 Social diversity and inequalities in standards of living

Table 1 gives a simplified but clear image of the evolution of social profiles since the end of the sixties. Two social groups are losing their relative importance: the self-employed, from 9% to about 6% of the labour force, and the blue collar workers, from 43 to 32%. In both cases, the retraction of the groups is accompanied by a reduction of their weight in the more specialised cities, whereas their relative dispersion in the whole set of cities does not change much. The two other social groups are growing, the managers from 22 to 29 % and the employees from 25 to 31% of the active population. In that case, both minimal and maximal values are increasing, and this corresponds to a general diffusion of those categories in the whole urban system. However, the relative inequalities in the representation of the managers (as measured by the variation coefficients) remain much more important than the differences in the shares of employees, which are converging towards an homogeneisation of the presence of this category in the large towns.

The urban society is only roughly described by such four aggregated social groups. Nevertheless, the inequalities that they reveal in the social composition of cities are relatively important, when compared to the dispersion of the indicators of the standards of living which are linked with the social status of the population. Whatever the social group, the salaries are the more homogeneously distributed: their variation coefficient is less than 0.1, even less than 0.05 in 1990 in the case of employees (table 2). The indicators related to household incomes are a little more unevenly distributed, as well as the housing prices (variation coefficients between 1.0 and 1.5). Only the prices of the business offices keep a higher level of inequalities from one city to another, which is comparable with the ones of the distributions of social groups. Contrary to observations made in the United States (Massey and Eggers, 1993), there was no increase of the interurban disparities of those standard of living indices during that period.

The low level of dispersion of the prices from one city to another is probably the result of the high speed of adjustment of those variables. They are also positively correlated in a rather systematic manner with the net migration rates. Similar results were obtained when comparing the evolution of interregional differences in housing prices through England (Alexander and Barrow, 1994, Thomas, 1993). This indicates that high prices are merely an attractive factor on migrants but more probably that they result of a pressure on the housing market due to net immigration.

The social and economic disparities, which are structural urban properties, are rather weak when compared to the unevenness of a more conjunctural flow variable like the net migration rates, whose inequalities, as measured by the variation coefficient, reach according to the period between 1.5 and 2 (table 1).

The spatial distribution of the specialisation of urban social profiles (chi square deviation to the mean profile) is represented on map 1. It shows that the peculiarities of urban societies are still mostly linked to the unequal spatial diffusion of the first industrial revolution. A few industrial cities of northern and central France have rather specialised profiles, with more blue collar workers, while some southern cities like Béziers exhibit a strong underrepresentation of those categories but many self-employed.

2.2 Social composition and economic performance

The correlations between social groups and the other variables are not very surprising. As expected, industrialised cities with many blue collar workers are poor, whereas tertiary ones having more managers and white collar employees are richer. Some details of the study of correlations are interesting however (table 3). The indicator of urban wealth which is measured after the amount of collected value added tax is not only low in cities of industrial workers and high in tertiary cities completing central place functions, it is also high in cities having large shares of self-employed in their labour force, i.e. cities where trade and tourism are well developed activities. On the contrary, the net income as measured after income tax sources is not higher in this last type of cities, the correlation is insignificant. The distribution of the salaries is also peculiar: the mean level of wages for the employees is not correlated with any feature of the social profile of cities. The mean salary of the workers used to be distributed in an opposite way to the wealth and the net income in the middle of the sixties: it was higher in industrial cities and lower in cities of self-employed and employees. The correlations are no longer significant. The general level of salaries is becoming positively correlated in the eighties with the share of managers in urban employment only.

It is also worthwhile to note that only the proportion of the self-employed has something to do (a positive correlation) with the level of business offices prices, which on the contrary are much lower in blue collar worker cities. Housing prices are beginning to follow the same pattern only from the end of the eighties on.

Those various links may be summarized in a simple manner with a principal component analysis made on all social and economic indicators. (The stability of the results was tested on more desaggregated nomenclatures, or by removing the too redundant variables and a city with an extreme position on the two main axes like Paris - the results are globally the same in any cases).

The general configuration of the interurban social structure is very similar to those which were observed on broader sets of cities in France, or at lower geographical scale, inside urban areas (Pumain, Saint-Julien, 1995). The main difference is between "proletarian" cities, with many blue collar workers, and the ones which concentrate more tertiary professions. Those again divide between commercial cities, with many self-employed, (craftmen and traders mainly), and service cities, with office employees and managers. The first two axes of principal component analysis are strongly defined by this structure (table 4).

Clearly, this very apparent, simple model of the social structure is a cross-sectionnal image resulting of an historical process of specialisation and differentiation of urban societies, linked itself to the the spatial division of labour. The main difference today between social profiles is an inheritance of the industrial revolution of the last century, whereas the second factor illustrates a further differentiation from pre-industrial urban profiles of predominant non-salaried work into societies dominated by the more recent models of the organisation of labour in services, administration and production.

The grouping of the economic sectors and of the other urban indicators around the social categories helps to risk a more global and evolutive interpretation of the factors (table 4). The first one has very narrow links with the recent attractiveness of cities (as measured by the net migration rates), the ordering of the cities that it generates corresponds to the perception of the quality of their image of today (see also the positive correlation of this factor with the indices of the standard of living, especially those others than household income). The second factor is positively correlated with the levels of all kind of salaries, it also ranks the economic sectors according to their main development period, from the oldest (now decreasing) to the newest (still increasing). That factor can then be interpreted as the interurban differentiation created by the unequal spatial diffusion of the last technical innovations.

3 Changes in social image

This interpretation of the 1990 data not surprisingly is of the same kind than the explanation found in former studies of this very slowly evolving structure of the urban system (Pumain, Saint-Julien, 1978). The analysis of the evolution of this structure raises however difficult methodological problems.

3.1 Methodological problems

The representation of urban change and of the trajectories of each city in a space of phases is very difficult. Several authors suggested to describe the structure of urban systems after a small number of latent dimensions (Berry, Kasarda, 1972, Parr, Reiner, 1980). It can be agreed that the concept of a structural dimension of an urban system is necessarily a multivariate description. Because of the complexity of the cities, the changes are always multiple and simultaneous, they never affect only a single feature of the urban structure at a time. Perhaps we still lack of the complex indicator which would summarize the multiple facets where urban changes are occurring. The few differentiation principles which are represented in a synthetic way by the main factors of a principal component analysis can be taken as a proxy for the structural dimensions of the urban system, and most often for the traces of past differentiation processes.

Such a representation has nevertheless several inconvenients. The first is that it can hardly be dynamic, or, better, adaptive: the content of a factor that we decide to call "urban image" or "modernisation of economic structure" should continuously be changing over time. The variables which are defining a factor slowly change their correlations with the factor (they even change their actual technical and cultural content, even if they keep the same denomination). It may be said that in any case factors keep the same structural significance, from the point of view of the urban system: we always can distinguish at a given moment between the cities which are attractive and those which are not, and between the ones which are adopting the innovations of the period more quickly than others which remain backwards. The real interpretation of the factors lay actually in the relative dynamics of cities, and not in momentarily fixed structural variables.

The use of a factor analytic description leads however to a reductionist view of urban structure and dynamics. Principal component analysis operates as a filter on the total socio-economic information brought by the socio-economic differences between cities. It can be seen as a first attempt to capture the nature and direction of urban dynamics, before trying more complex models of urban change.

3.2 Structural stability

As mentioned in an earlier work (Pumain, Saint-Julien, 1984), multivariate analysis of the social composition of cities at different dates illustrate the high degree of stability of the pattern of socio-economic differentiation in the system of cities (table 4).

The same global structure is maintained. The main social change appears with the diffusion of the employees, which are no longer representative of any innovative model. The position of workers on the second factor is slightly evolving closer towards the more obsolete types of social structure. The main change affects the position of the net migration rates: during the first period the most attractive cities were those characterised by innovative socio-economic structure, and progressively there is a shift of the attractivity towards cities with more obsolete structures, but which can be transformed because of their good image.

There were also some slight changes in the significance of the factors, as attested by the correlation coefficient between the factors of the four PCA (figure 1). The first factor remains the more stable in terms of ranking of cities (correlation of 0.9 between the first and last period, with a progressive deformation) whereas the second has a stronger evolution (correlation of 0.7). There is also a growing correlation, although not very significant, between the first factor of the first period and the second ones of the following periods. The reverse is not true: the correlation between the second factor of the first period and the first ones of following periods remain weak and fluctuates around 0. This may be interpreted by giving an incentive role to the differentiation brought by the modernisation of socio-economic structure (as expressed by the second factor) on the changes of the distribution of city images in the urban system.

As despite those very slight indications of an evolution in the structure of the factors, the structure is stable enough to allow a study of the global modifications of urban social profiles by projecting them on the same factor analysis (the four sets of cities at the four dates in rows are described by the same set of variables in column). The trajectories which link the representative projection of each city at the four dates on the first two factors are very similar, whatever the initial position of cities in the socio-economic structure (figure 2a). All illustrate the same general trend in socio-economic transformation, which combines an improvement of image and of the adaptation to innovations.

The corresponding structure (which is an intermediary one between the one of the sixties and the one of the nineties) has been represented on figure 2b according to the position of the main variables. The movement of the attractivities has been figured by projecting as supplementary variables the net migration rates, in order to visualize the instability of their position regarding to the interurban socio-economic differentiation.

4 Urban attractivities and social images

In order to get a synthetic appraisal of the relationship between urban image, as revealed by net migration rates, and the characteristics of their socio-economic structure, we experimented a series of multiple regression models, with net migration rates of each period as dependent variable and the proportions of social categories and other indicators as explanatory variables

The model is not stable but rather versatile over time (table 5). There was clearly a shift in the attractivity between the first two periods and the last ones, which corresponds to two very different spatial patterns of net migration rates as shown by their correlations over time (0.6 between the rates of 1962-68 and 1968-75 on the one hand and 0.7 between those of 1975-82 and 1982-90 on the other hand, but zero between the rates of the first and the last two periods).

Until 1975, the net migration rate of the cities was not correlated with any feature of their social structure or economic profile. A rather weak link existed with the age structure, the 50-59 years old explaining 11% of variance with a positive effect whereas the proportion of people over sixty had a negative effect, adding 7% more to the R square in a multiple linear regression (table 5). During that period of rapid demographic and economic growth, the attractivity of cities could appear as randomly distributed according to the structure of the urban system, since the components of the attractivity were many: a city could absorb "passively" the surplus of the rural labour force from its still too populated rural surroundings, as well as receive a net migration balance from its exchanges with remote regions or other cities.

At the end of the seventies, the process of the rural exodus has come to an end and the net migration rates reveal more the selective character of urban attractivity. The net benefit from migrations starts to be depending upon the social structure during the eighties only, expressing an attraction on migrations for cities with many self-employed whereas cities of blue collar workers were repulsive (table 5). This corresponds also to a shift in the economic profiles of attractive cities: first, at the end of the seventies, business services appear as an important factor of attraction, then their weight weakens compared to the one of tourism industries and telecommunications. The construction sector appears each time as a factor accompanying urban growth.

There is also since the end of the seventies a clear link between net migration rates and the prices of business offices, as well as the indicator of wealth (after VAT). But neither the general income level nor the salaries can be considered as factors of urban attraction. There has been also a reversal in the attractiveness of cities according to their age structure: The oldest category, which was a negative explanation factor of the migration rates during the 1968-75 period has become a positive one afterwards.

How those shifts in attractivity can be interpreted? One should avoid first the ecological fallacy. The factors explaining the net migrations rates at the level of cities cannot be directly related to the individual motivations for moving. Moreover, such a dramatic change in collective behaviour can hardly be imagined. The shift may more likely reveal an effect of the dynamics of the system of cities itself, which may change the global constraints on the moves of individuals without changing necessarily their own behaviour at their level.

This dynamics is linked with the process of adaptation within the urban system. Most of the adaptation to the change which is produced in various places within and outside of the system, is occurring as a continuous process. Continuous mean made of randomly distributed, unprevisible small changes, which are accelerations or delays of the same trends of changes, but which do not persist a long time enough in one direction to modify the trajectory of one city in a durable way. The main constraint which is responsible for this distribution of change within the system is its narrow and multiple connections, especially in terms of exchanges of informations. The competition between urban actors living in different cities is a strong incentive for a rapid diffusion of most of the innovations.

Such an interpretation would be consistent with the observation of the rather "passive" role of migrations within the process of socio-economic transformations occurring in cities (Pumain, 1982, Pumain, Saint-Julien, 1990)

5 Towards a dynamic model of urban social trajectories

A fundamental property of systems of cities is the interdependency of their elements, which is clearly revealed by the observations of their evolution (Pred, 1977, Pumain, Saint-Julien, 1978). The evolution of a set of cities exhibits phenomena of synergy and coherence which recall characteristic processes of the dynamics of self-organized systems: production of stable structures at a macro-scale from extremely fluctuating interaction processes at the micro-level, long-range correlations in the evolution of individual cities, transformations of the macro-structures by the amplification of small fluctuations (Sanders et al, 1991).

If we try to interpret the observed qualitative changes in the structural dimensions of the urban system and the trajectories of the cities. The more recent evolution is rather paradoxical. The social structure of cities which are now attractive (since about fifteen years), where the self-employed are over-represented, corresponds to an old mode of production. It is representative of a rather obsolete entrepreneurial structure. This social model is also a cultural feature, typical of mediterranean countries, where it resisted longer to the modernisation process of economic structures, as expressed by the diffusion of salaried work and the disappearance of many very small firms.

Our hypothesis is that it is not this obsolete economic structure which suddenly became attractive. We do not believe in a reversal back to an old social model, even if the context of economic crisis of the eighties may have been a new incentive for small firms and individual entrepreneurial initiatives. On the contrary, we think that it is the cities themselves which became attractive, despite still having this structure, and for two reasons: first because they were not yet attained by the main transformations of the previous period; second, because their social structure was oriented towards a higher educational level (in order to compensate the lack of local sources of employment, the people accumulated the academic degrees in order to find jobs in the public services or in the administration), which provided a context more favourable to the development of technopoles, that is the main socio-economic innovation of the period.

Such apparent "reversals" in the destinies of cities are actually the normal way for their evolution. It is a peculiarity of the dynamics of geographical systems when compared to the economic ones. Contrary to the material products and types of services which are substituting to during the course of time (Marchetti, 1984), it is the same set of cities competing for "market shares" which are used again and again by the successive innovation waves. To say it in other words, from the point of view of the meso-scale, cities are continuously adapting themselves for capturing the initial advantages of an early adoption of each wave of innovations. It can be expected that in this process some of them will succeed more or less efficiently.

This adaptive property is a major process in the dynamics of urban systems, it explains their main structural feature (Pumain, 1995).

An overview of the process can be given on a theoretical representation of the phase space. The structure of the urban system is represented by two dimensions which keep the same general meaning but whose concrete definition is changing over time. Why two main dimensions in this process of adaptation to change? It can may be as an expression of the delay between actual changes and their perception (figure 3).

The horizontal dimension represents the process of adaptation to the socio-economic or technical innovations of the moment. When cities succeed in keeping with the general rate of urban change, they also get a good image, and maintain a position in the upper right square. This is typical of the actual "large" cities or metropolises whose large size is explained by their succesful adaptations to a diversity of innovations cycles at successive periods of time. A city may go out of this virtuous circle, for example in becoming very specialised in one type of innovation. It will gradually shift towards the upper left square, loosing of adaptive power but keeping still a good image because of the inertia of collective representations. It is only after a long phase of deterioration of it relative situation that the city will get a bad image, and, because of it, risks of becoming trapped in the vicious circle of decay, in the lower left square of the graph.

In this process, some cities loss their importance, at least in relative terms of size and standards of living, and they cannot compete any longer with their former competitors in the urban hierarchy. There is an inexorable trend leading to the disappearance of cities which were more successful some day, but which have been let aside by several innovation cycles or which have not rapidly enough adapted themselves. This selection process can act randomly - i.e., depending upon purely local or conjonctural factors. But it also can be linked with the structural dimension of the urban systems, as for instance former studies of long-term trajectories of cities have demonstrated (Pumain, 1991). A systematic "bottom-up" simplification of urban hierarchies is caused by the space-time contraction (the increasing speed of transportation means enlarges the spatial range of the largest centers and the smallest located in intermediary positions are short-circuited, their clients are captured and they loss their rank in the hierarchy).

Many examples show that it is possible sometimes to get out of this stage by restructurating the economic activity of the city, and coming back to new cycles of adaptation (figure 3).

Such an interpretation relies on observations of the relative trajectories of cities in the structure, which can hardly be represented in the same factor analysis framework as used here. It has to be tested by developing a dynamic model of the evolution of the socio-economic specialisation within an urban system. A first attempt has been made by using a multi-agents simulation system (Bura et al, 1995). This formalism renders however validation difficult. One also should try to build a more classical version of a dynamic model using differential equations.

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