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Space as a Resource*

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At the micro level of a shelter programme, space is the most important commodity, which needs to be optimally used not only for upgrading the immediate and overall environment but also for reasons of the economics, finance, life style, tradition and culture of the people who are expected to live there. The author, one of the leading architects and planners in India today, brings out the futility of a cosmetic approach to planning ideas, where significant resources are ignored and which remain untapped and unutilized but which could make our living environment more congenial and desirable. This paper highlights the most intimate relationship of man with the immediate environment in our settlements. The author has made suggestions which can integrate and transform the space we are wasting as an invaluable resource for upgrading the quality of life in human settlements. (Ed.)

VISITING a city like Bombay or Calcutta, the first thing that strikes one is the poverty all around which is perhaps the worst pollution of all. Way before you see smoke in the sky or smell sulphur in the air, you see people all around, living and dying on the pavements. Is it inevitable that poverty should degrade life in this manner?

The same poverty, in rural India, has a far different expression. The people are as poor, in fact perhaps even poorer, but they are not so dehumanized. In the village environment, there is always space to meet and talk, to cook, to wash clothes and for the children to play. Need we take a look at how these same activities occur in our cities? Obviously, there is no relation between the way our cities have been built and the way people have to use them.

Urban living involves much more than just the use of a small room of, say, 10 m^2. The room, the cell, is only one element in a whole system of spaces that people need. This system is generally hierarchical. Under Indian conditions, it appears to have four major elements:

- Firstly, the space needed by the family for exclusively private use, such as cooking, sleeping, storage and so forth;
- Secondly, the areas of intimate contact, i.e. the front doorstep where children play;
- Thirdly, the neighbourhood meeting places (e.g. the city watertap or the village well) where you become part of your community;
- Finally, the principal urban area, e.g. the *maidan* (open area, e.g. park etc.) used by the whole city.

In different societies, the number of elements and their inter-relation might vary, but all human settlements throughout the globe (from the little hill towns of Italy to the sprawling metropolises of London or Tokyo) have some analogue of such a system; an analogue which modulates with climate, income levels, cultural patterns, etc. of the society concerned.

Now there are two important facts about the workings of these systems. The first is that each of the elements consists of both covered spaces as well as open-to-sky spaces. This is of fundamental significance to developing countries, since almost all of them are located in warm tropical climates where a number of essential activities can—and indeed do—take place outdoors. For example, cooking, sleeping, entertaining friends, children's play, etc. need not be exclusively indoor but can function effectively in an open courtyard (provided of course, that privacy is reasonably assured). In Bombay, for instance, we estimate that at least 75% of essential functions of living (sleeping, cooking, entertaining friends, etc.) can occur in an open-to-sky space; and since the monsoons are limited to 3 months, this holds time for about 70% of the year. Thus open-to-sky space has a usability coefficient of about half (i.e. 75× usability coefficient) of the other built form conditions (verandahs, pergola-covered terraces, and so forth even that of the tree-shaded courtyard) that lie in the spectrum between the enclosed room and open-to-sky space.

Now, just as they have usability coefficients, each of these spaces also has a production cost: brick and cement in the case of the room, more urban land (and hence longer service infrastructure lines) in the case of the courtyard. The point of trade-off between these two variables determines the optimal pattern and density of housing at a particular location. And if you look around you will find countless examples of marvellously innovative habitat, from the Casbah in Algiers to the paper houses of Tokyo. Each one is an adroit trade-off between the usability coefficient of these various kinds of spaces on the one hand, and their production cost on the other.

The second important fact about this hierarchy is that all the elements are mutually inter-dependent. This is to say, less space in one can be adjusted by providing more in one of the others. For example, smaller dwelling units may be compensated by larger imbalances: public open spaces in Delhi, for instance, follow the usual norm of

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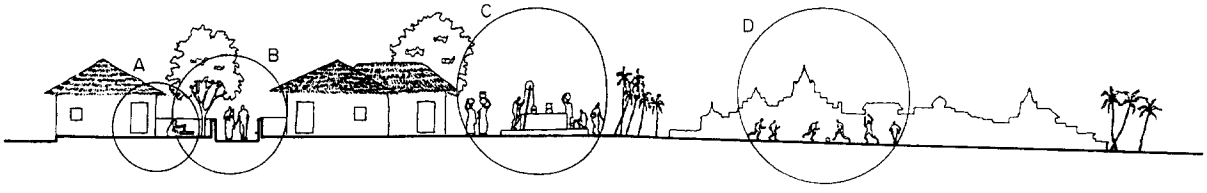

Fig. 1. Hierarchy of spaces. (A) Courtyard; (B) doorstep; (C) water tap; (D) the community space.

1.5 hectare per 1000 persons which works out to about 75 m^2 of public open space per family. But what a staggering difference it would have made to the families living in the packed hovels of Old Delhi if even just a fraction of this public space (now mostly squandered in the monumental vistas and parks of New Delhi) had been traded off as a small courtyard for each family. The pattern of their lives would undergo a sensational improvement.

To identify this hierarchical system, and to understand the nature of these trade-offs, is of course the first essential step towards providing viable housing. Without this, one is in grave danger of formulating the wrong questions. This misunderstanding is the reason why so many attempts at low-cost housing perceive it only as a simplistic issue of trying to pile up as many dwelling units, for the other spaces involved in the hierarchy. The result: environments which are inhuman, uneconomical and quite unusable. Environments that ignore the fundamental principle, namely, that in a warm climate—like cement, like steel—space itself is a resource.

In using open-to-sky spaces, the territorial privacy of the families is of decisive importance. For as the surrounding buildings get taller, these spaces get more and more restricted in function. A ground floor courtyard can be used by a family for many purposes, including sleeping at night. Two storeys, and you can still cook in it. Five storeys, and it's only for children to play in. Ten storeys, and it's a parking lot. The old indicators of so many square metres of open space per 1000 persons are too simplistic and crude; we have got to disaggregate these numbers, both qualitatively and quantitatively, in order to anticipate their real usefulness.

Estimating accurately the production cost of these

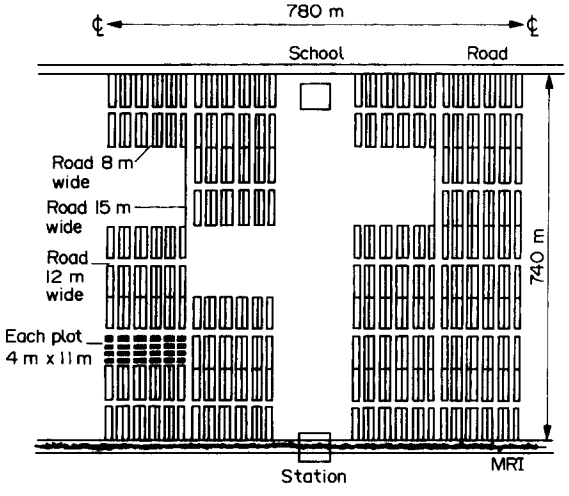

Fig. 2. A diagramatic study for a housing sector.

various spaces (rooms, courtyards, verandahs, etc.) of course involves examining the relation between building heights and overall densities, since the latter is a key determinant of infrastructure costs at the city scale. This relationship depends on a number of factors, including the size of the housing units and the community space per family. For Indian urban conditions (i.e. an average housing unit of 25 m^2 and a community area of 30 m^2 per family for tot-lots, health centres), we find that ground floor housing can accommodate per hectare about 125 families, each on a plot of 44 m^2. Five-storey walk up apartments double this figure to about 250 families; 20-storey buildings will double it again to about 500 families. Thus as the building heights increase twenty-fold, gross neighbourhood densities increase only about four-fold.

And if we step back to see a larger context—the overall city—then the variations in density become even less pronounced. For, contrary to popular belief, doubling building heights do not save drastically on the overall area of a city. Only about a third of a city is used for housing (the rest is for industry, transport, green areas, educational institutions, etc.). Furthermore, if we calculate the housing sital area itself (i.e. the area of housing sites, without the neighbourhood roads, etc.), then we find that the percentage of land use devoted to housing sites is usually about 20%, the variation being dependent on the floor area ratio (i.e., FAR) permissible on each site.

Studies undertaken three decades ago for Hook New Town in the U.K. demonstrated that for a circular town, reducing residential densities from 250 persons per hectare to 100 persons per hectare would increase the area of the circle by 42% and the radius (i.e. distance from periphery to city centre) by only 19%. This is an important principle even in cold climates, but what I seek to emphasize here is that in the context of warm climates, prevailing in the Third World, these variations in residential densities will cause crucial mutations in the living patterns—really the lifestyles—of the people! In exchange for only marginal decreases in overall city size, they drastically reduced the open-to-sky space (and hence, in our climates, the usability) of the housing.

Furthermore, these variations will make decisive differences to the cost of the construction. For in a warm climate, shelter can be made from a wide variety of simple materials ranging from mud and bamboo to sun-dried brick. These constructions are of necessity low-rise. As they go taller (to four storey walk-ups and higher) the construction has to change to RCC not because the climate demands it, but for structural strength. This of course brings an enormous escalation in cost. In contrast, in the cold climates of Europe and North America varia-

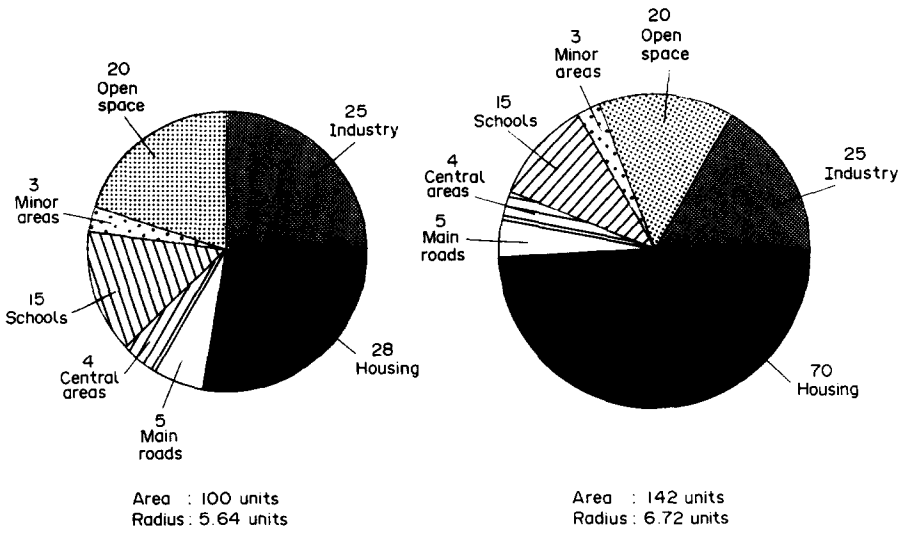

Fig. 3. Residential density and city size.

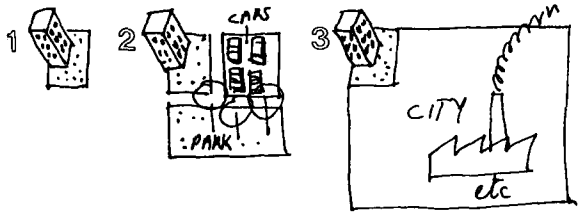

Fig. 4. The hierarchy of scale and elements.

tions in construction costs as a function of building height have a much narrower range, since even a ground floor house must be constructed of relatively expensive thermally insulated materials.

By low rise, one means not only self-help housing, but traditional vernacular architecture in general—those wonderfully rich languages created by people all over the world, without benefit of professional architects! Not only are these indigenous building systems more successful in economic, aesthetic and human terms (as any reasonably honest architect will cheerfully admit) but far more appropriate socio-economic processes are involved in their production. For, as we have seen earlier, money invested in vernacular housing is pumped into the economy at the bazaar level, right where it generates the greatest amount of tertiary employment, namely for those migrants pouring in from the rural areas.

How then does one explain the staggeringly high densities prevailing in Third World cities around the globe? Sadly enough, these are generally achieved not through high rise buildings, but, firstly, from an extraordinarily high occupancy rate per room and, secondly, by the criminal omission of play spaces, hospitals, schools and other social infrastructure in the neighbourhood. London, for instance, has approximately 3 hectares of green area per thousand population, Delhi has 1.5 hectares; in Bombay island the figure is 0.1 hectare and this includes the grass on the traffic islands! Even roads, usually at least 25% of land use (higher in Los Angeles), are only 8% in Bombay island. So naturally the gross residential densities become astronomical, reaching figures which make living conditions quite impossible.

Yet, merely increasing the *maidans* (open spaces) is not necessarily the solution, for they are not used by the entire populace, but only by certain age groups for cricket, football and other such games. No little toddler of two or three years would dare to play here; nor does one see middle-aged couples using them for evening strolls. On the other hand, the pavements along the seafront in Bombay, which incidentally do not show up in the statistics, are the great community spaces of this city. Obviously we should generate many more such promenades. They are the heart of the social life of the tropical temperate zones. The Latin cities, Paris, Rome, Rio de Janeiro, have always understood this, hence the boulevards with their broad pavements and cafes. Land used for such boulevards is far more cost effective than conventional "green areas". (Perhaps one tree on the Boulevard San Michel is worth an acre of green in the Bois du Boulogne?)

In conclusion, it must be emphasized that any investigation of optimal densities is largely determined by the scale of the context we establish. For instance, to a developer looking at an individual, urban site, the trade-off between cost of construction (which rises with building height) and the land component (which varies inversely with the floor space generated), will lead to a certain density.

To an authority responsible for a larger context, say the whole neighbourhood, this trade-off will certainly give another answer, since they must take into account the area needed for the schools, roads, and other infrastructure necessitated by any decision.

To anyone looking at the overall city, in fact at the whole nation and its resources, the answer will change again. Given the awesome scale of urban growth facing the Third World, there can be little doubt that it is within the larger parameters that we should view this issue.

For too long have we allowed the densities of our cities to be determined in the narrowest context by the random (and self-interested) decisions of individual commercial developers, higher densities triggering off higher land values, and vice versa, in an increasingly vicious spiral, like a serpent that feeds off its own tail. Today, almost

the entire building industry in all our major cities is turning out a product that only the middle and upper classes can afford, forcing half of our society out on to the pavements. In their confusion and desperation, architects and engineers start searching for new "miracle" technologies (rather like the medieval alchemist's fevered hunt for the elusive touchstone which would convert dross into gold). Too long we have struggled for these answers, when all along the land-use planners have stated the question wrongly to begin with. The problem of housing the vast majority of our urban people is not one of finding miracle building materials or construction technologies; it is primarily a matter of density, of re-establishing land-use allocations.