Look back to London

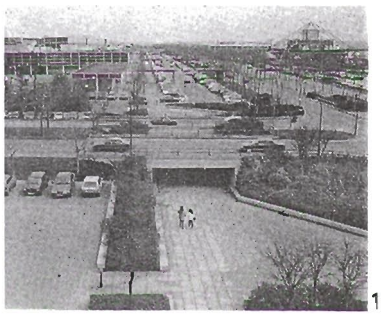
How a city or town works depends on the relationship of its parts to the whole. **Bill Hillier** analyses London and Milton Keynes — with research by Alan Penn and computer software by Nick Dalton — to see what makes a place buzz.

Cities are large collections of buildings linked by space. Buildings represent economic, cultural, social and residential opportunities. Space connects them into a system of mutual accessibility.

So what makes the difference between one city and another? What makes one place a city and another a town? Why does Milton Keynes not feel like a city, even though, on paper, it has everything: a large and successful shopping centre, restaurants, pubs, entertainments, parks, a street market — and nearly 150,000 people. Why do the bits not add up to what we recognise as a city ?

Should they? Wasn't Milton Keynes designed as the 'city of the car', the urban realism of the future? In fact this is only half true. The strategic urban design decisions — grid structure, land uses and building densities — were certainly taken with the almost single aim of avoiding traffic congestion. But the tactics of the design belong to 'romantic urbanism': the belief that the 'good' things about cities and towns — pedestrian activity, informal use of public spaces, overlapping communities, the sense of local place, aesthetic stimulation, and so on — can be recreated piecemeal, without the spatial, functional and scale realities that gave rise to them in the first place. The belief that we can have the good things about cities and towns without the bad.

More than any other town, Milton Keynes embodies these beliefs in its plan. Its network of pedestrian and bike routes, and its attempts to relate communities by shared facilities are pure 'city-is-not-a-tree-ism'. More than anything, Milton Keynes is a town of parts, each spatially distinct and with its own idiosyncratic layout, the ultimate embodiment of the belief that good local places can be designed free-standing, then hierarchically combined to form an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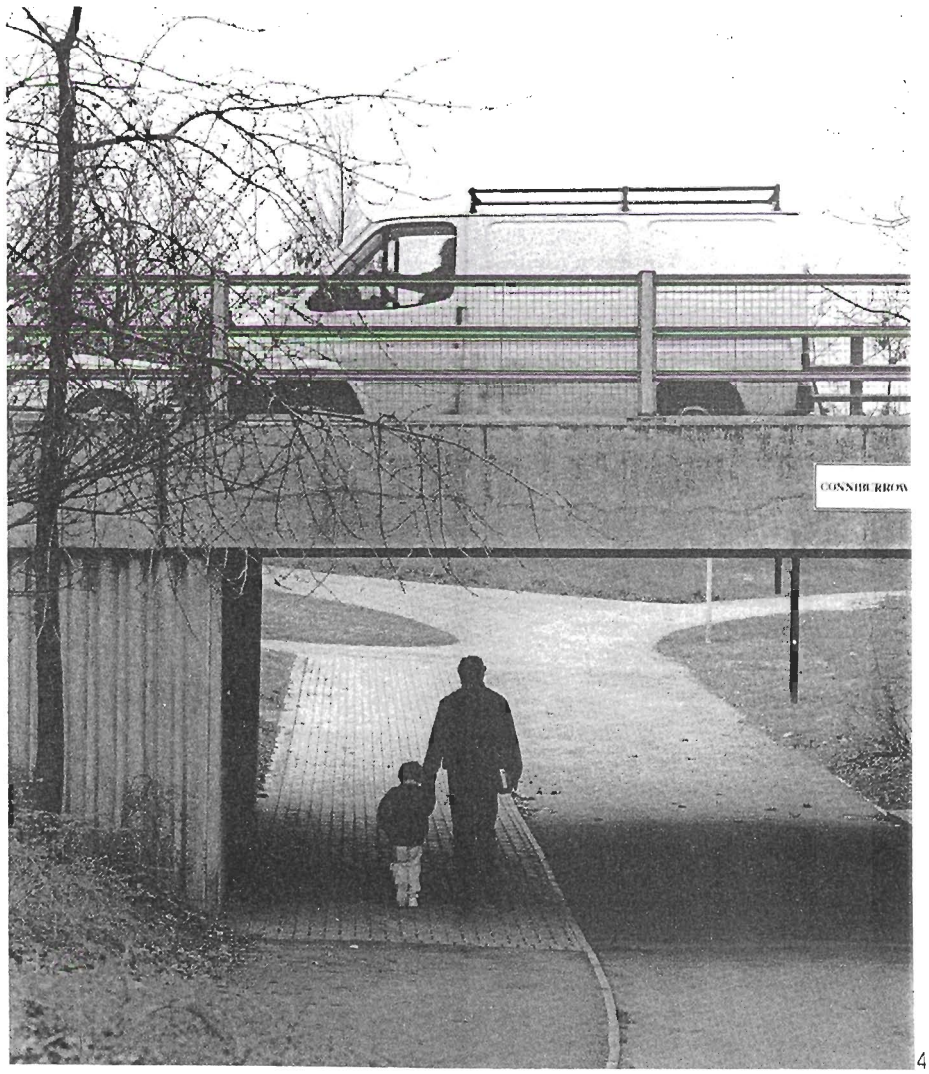
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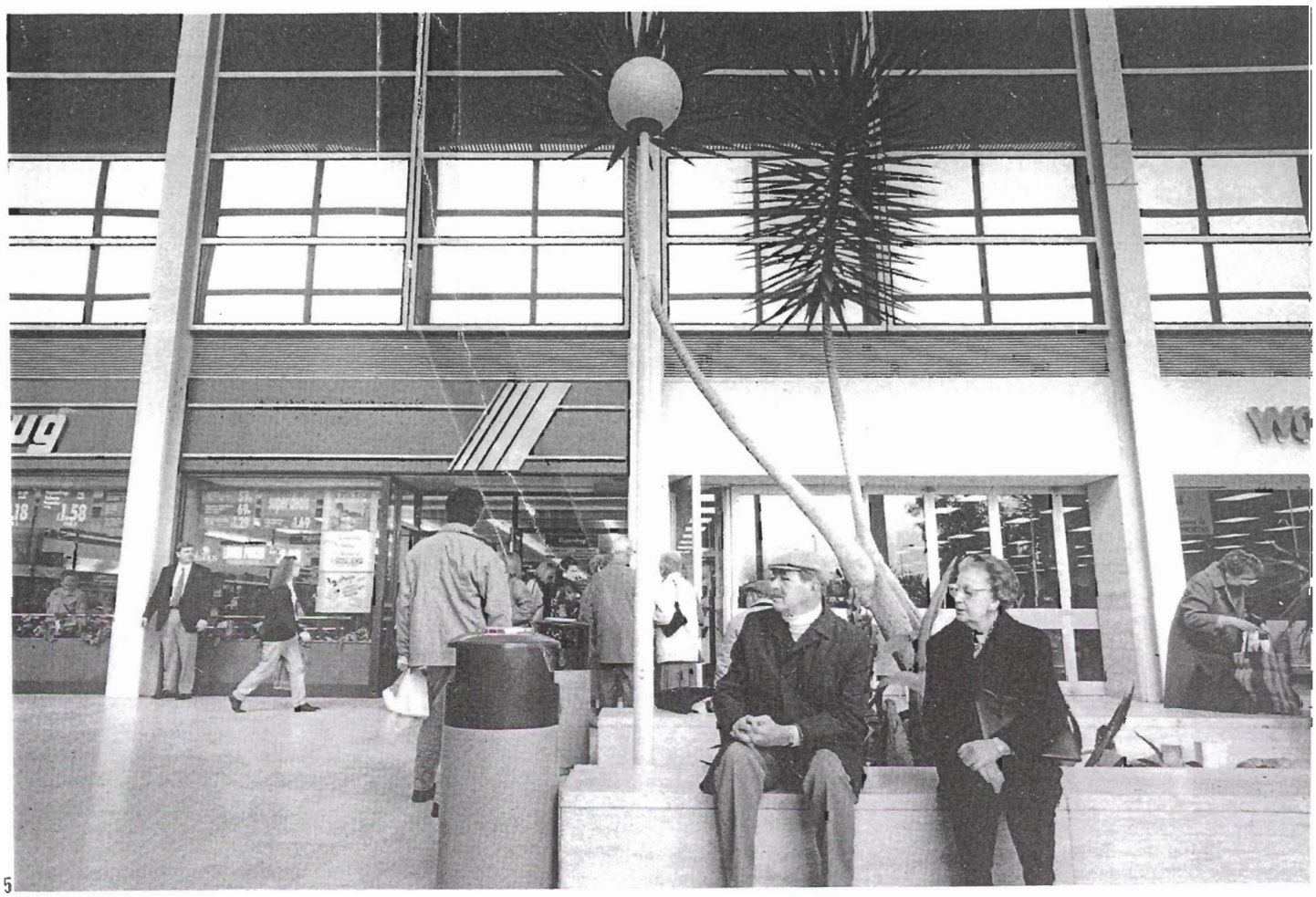

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urban whole. In urban design terms, Milton Keynes stands for the idea that towns are assemblages of parts into a whole, rather than wholes in which good parts arise. If Milton Keynes doesn't work, there is something wrong about the way we understand what makes towns and cities tick, and how the bits can and should be put together.

In a sense all urban design is about parts and wholes. We either add a new part to an existing whole or design a new whole made of parts. Strangely, in spite of the clarity of its plan, the two things that Milton Keynes is most often said to lack are a local sense of place and the sense of the urban whole.

In contrast, big messy cities like London, which seem in plan to lack any clear part/whole structure, are usually said to succeed on both counts. The 'deformed grid' of outward-facing built islands defining an apparently undisciplined network of intersecting rings of space surrounding each block is typical of historic cities. Somehow the sense of local place and global whole arise from an inner logic in this apparent disorder.

How does it happen? A substantial body of research, using computers to analyse the spatial and functional complexity of cities, suggests that the spatial form of cities, and especially their part/whole structure, may have been misunderstood. Urban forms have been conceived of essentially as static objects, with movement in well specified

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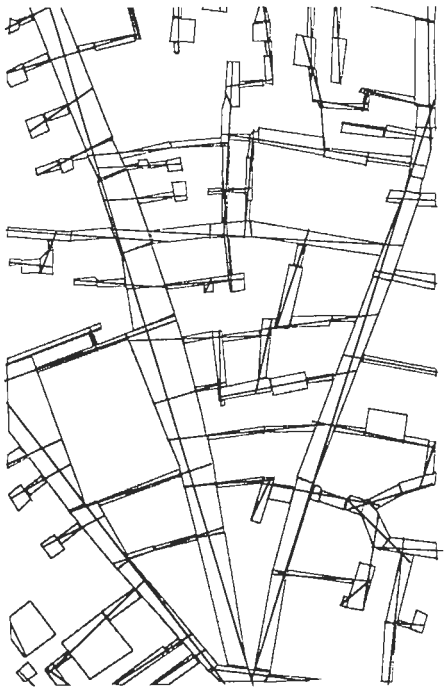
1 Central Milton Keynes, with the main shopping building on the left and The Point entertainment centre in the distance on the right.
2 Housing at Bradwell Common by Martin Richardson, pictured in 1981. This scheme was inspired by the architecture of Victorian terrace housing — but success in creating an urban feel depends on how well an area connects with the urban grid.
3,4 The town's design incorporates an extensive network of footpaths and cycleways.
5 The vast glazed shopping building in Central Milton Keynes is a successful regional shopping centre. As the town's main public space it was originally open 24 hours a day; the recent decision to close it outside shopping hours has caused local controversy.
6 Comparative figure-ground plans of part of north London (centred on King's Cross), and,
7, Milton Keynes, showing open space in white, and buildings or publicly inaccessible space in black.



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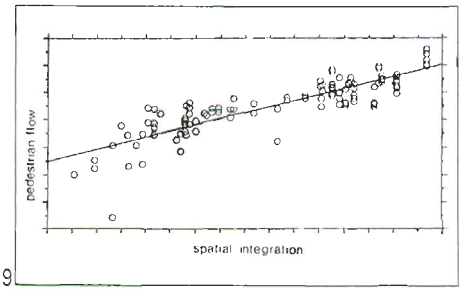

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8 Part of the City of London in 1746, showing how lines of sight pass through a series of spaces. Such lines form the basis of our analysis.
9 Typical scattergram, showing how strongly the pattern of integration and the pattern of movement are related. Each line segment in the axial map becomes a point in the scatter. The further the point is along the horizontal axis, the more integrating the street segment is; the higher on the vertical axis, the more movement was observed. A perfect correlation would be a line of points from bottom left to top right. As it is, the powerful correlation shows that nearly three-quarters of the differences in movement rates for lines are accounted for by the structure of the grid alone.

channels. Conceptually, we separate the form itself from movement in the form.

In fact, the most powerful influence shaping urban form is probably movement. This may sound initially odd, since cities seem to create movement rather than respond to it: people scurrying to and from stations, or vast influxes into urban centres each morning. Most urban movement is not this, but what we call 'natural movement'. Natural movement is the movement in urban spaces that is determined by the structure of the urban grid itself, rather than by specific attractors or generators.

Most urban movement, pedestrian and vehicular, is natural movement in this sense, because all buildings in the city attract and generate at least some movement, and movement therefore tends to be from everywhere to everywhere else. Because this is so, most movement we see in an urban space is not to-movement but through-movement, and through-movement in a space is determined by how that space relates to the rest of the grid.

By combining a new kind of computer analysis of plans with careful observation of movement, we find that a high proportion of movement in spaces — usually about three-quarters — can be predicted from a purely mathematical analysis of a property we call 'integration' in a line matrix formed by the fewest and longest lines of potential movement superimposed on the urban grid. By measuring the 'integration' of each line into a local system or the whole system, we can analyse an urban grid in such as way as to predict likely movement as well as explain actual movement.

Because this relationship is so fundamental, it is also implicated in many other aspects of urban function, including the spatial pattern of crime, the evolution of land-use pattern, rents and values, location of retail, even the distribution of various grades and types of housing.

Scales of movement

This relationship influences the development of the urban form itself by shaping the matrix of public spaces through which all movement must pass. This happens not in a simple way, but in such a way as to ensure that different scales of movement in the urban grid — people moving in and out of buildings, those on local trips, those on longer trips, and those moving in and out of the area — are continually co-present, or at least close to each other.

This creates what we call the multiplier effect of urban space. The multiplier effect happens when the spatial design exploits the simple fact that all trips produce a by-product in that each must pass through a certain number of intervening spaces, to create patterns of natural co-presence which can be turned to economic, social and cultural advantage. It is this that creates urban life out of everyday activity, and eventually turns collections of buildings into cities or towns.

How exactly does it work? Let's begin at the smallest scale in the nearest available piece of obviously historic urban fabric. In the 1746 plan of the allegedly labyrinthine part of the City of London between Cornhill and Lombard Street, the open space is broken up in two ways: into the largest and fewest convex lumps, which, however small or thin, turn out all to be connected to building entrances; and into the longest and fewest straight lines of sight and access that pass through all the convex spaces, 8.

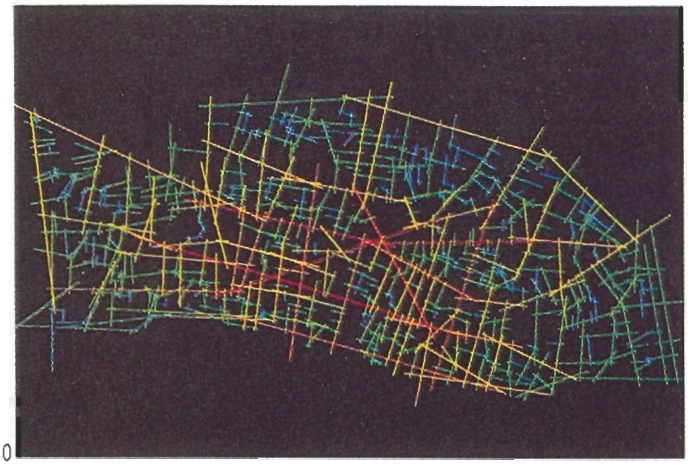
By superimposing one on the other, we see how strong is the tendency for lines to pass through a series of convex spaces, making the line structure much simpler than it appears at first sight.

A closer look shows a principle. When after entering the complex you make a turn, thus losing sight of where you have come from, then either the second line already shows you another way out, or it takes you to an intersection with a line which does show you another way out. This makes it difficult to go very far into the labyrinth. The line principle makes the complex easily intelligible, both in itself and from the main grid, and as a result it is well used for movement.

A similar effect is found at the larger scale urban grid, an 'axial map' of the city as it is today, 10. If you enter the City at one of its gates, and take the longest line available, the second line you pass along has a longest line intersection from which the centre of the City at Bank railway interchange can be seen.

Beneath the apparent disorder of the City grid there is a concealed logic. Because people move in lines, try to approximate lines on more complex journeys, and are guided in movement by available lines of sight. The effect of this is that space is so arranged as to be a reliable guide to movement, and to the relation between different scales of movement. Many of the picturesque properties of urban space — lines of sight passing through intervening spaces, the sense of two scales at once, angles of incidence of lines of sight on building surfaces — which we find aesthetically pleasing in cities, turn out to be intimately related to movement, the most basic of urban functions.

Movement also shapes the part/whole structure of the City. If we take a small sub-area, say Leadenhall Market, 14, and ask how it is structured, we find a pattern of integration rather like a small-scale version of the city as a whole: integrating lines link edge to centre in all main directions, making a kind of irregular wheel form, with clusters of less integrating lines in the interstices.



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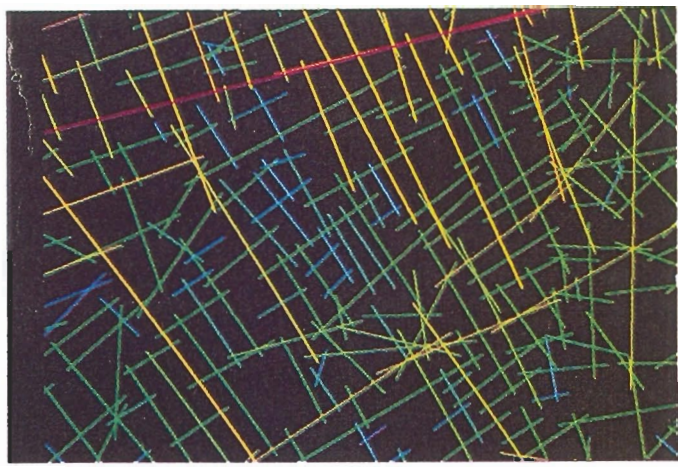

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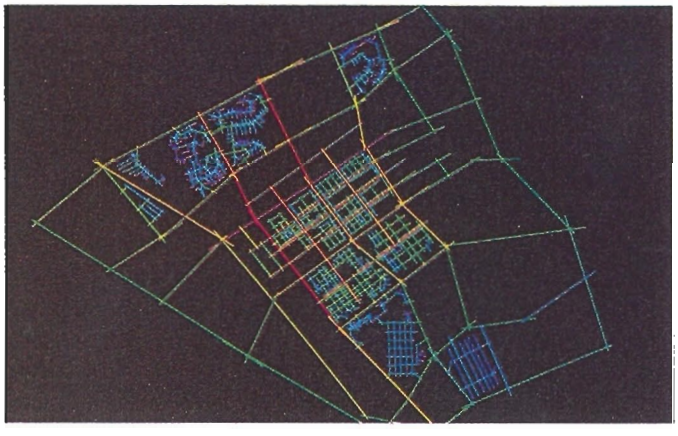

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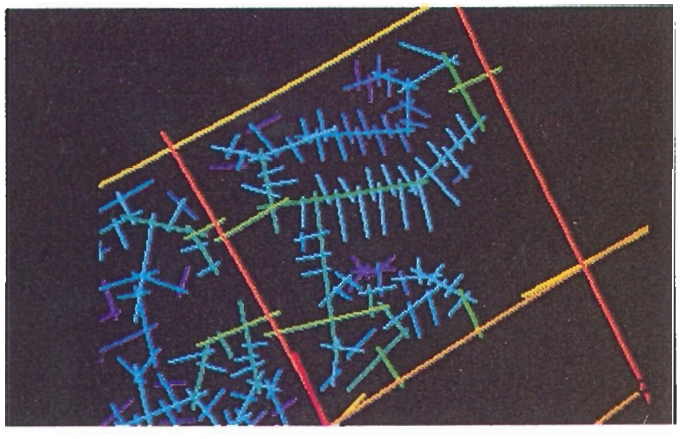

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This makes the Leadenhall Market area into an intelligible local intensification of the grid, rather as a town is a local intensification of the road network in a region.

The pattern, coupled with the constant relation to building entrances, creates natural co-presence between scales of movement in the urban grid, giving rise to the multiplier effect.

The same pattern is found on a larger scale in seventeenth and eighteenth century areas like Soho, 12, and in quiet nineteenth century residential areas like Barnsbury, with its 'urban village' at its heart, powerfully connected to the supergrid in all directions, 15.

Until this century, this local 'deformed wheel' was the generic structure of London — the secret of giving a very big city a local sense of place, and of combining the free continuity of space with a differentiation in the spatial character of areas.

Wherever it is found, there is some kind of multiplier effect from space, whether contributing to the sense of urban safety that comes from natural co-presence in residential areas, or contributing to the urban life in public spaces. It is this property which is now being sought through new urban projects where this kind of analysis has been used in the design, such as Sir Norman Foster's King's Cross proposals, the Farrell-Simpson-Beeby Paternoster Square scheme, and Farrell's Brindleyplace in Birmingham.

Unfortunately, twentieth century interventions in the urban fabric, especially housing, have tended to disrupt every aspect of this generic pattern, in particular the delicate relation between the definition of the part and the relation to the whole. The relations between building entrances and public space, between local and global movement and between inhabitants and strangers are systematically pulled apart. Obsessed with internal 'layout' rather than the relation between internal and external structure, twentieth century disurbanism disrupts the part/whole pattern, eliminates all multiplier effect, and creates zones that are so remote from the public realm that they no longer operate as urban space. The ambiguities and dangers of this type of space have become a major problem the world over in the late twentieth century.

The romance of the cities

Why did this happen? It happened because false ideologies of segregated urban communities and collective territorialism created concepts of space which were local, rather than global, static rather than dynamic, and all too often visual rather than functional. The plain fact is that the romance of cities is created by function.

Cities are romantic in their outcomes, not their genesis. The effect of romantic urbanism, however sincere its intentions, was to cover the tracks of twentieth century disurbanism. Of course, we never did it to ourselves. We have only to contrast the fate of the street systems of east and west London to see

10 Axial map (showing the fewest and longest lines of sight and access) of the City of London, coloured according to the spatial integration of each line. To move from any line to another involves passing through a minimum number of intervening lines; each line is a minimum number of changes of direction from all other lines. This is the basis of integration: the less tortuous the paths on average, the more integrated the line. Red lines have the highest integration, down through brown, yellow and green to light blue and dark blue for least. 'Integration' indicates the movement potential of the line. Short trips — such as those by foot — tend to be calculated by integration calculated up to three lines away from each line. The colours result from analysing only the structure of the grid, and take no account of natural movement rates, land uses or built form densities — so the degree to which the pattern of integration in the grid predicts potential movement is remarkable.

11 Equivalent diagram of parts of Milton Keynes — the centre and some typical grid squares.

12 Larger-scale analysis of London's Soho and, 13, a Milton Keynes grid square.

that disurbanism is a form of architecture aimed at the less privileged members of our society.

We can now turn to Milton Keynes and ask what it is. Reality and experiment suggest that Milton Keynes is not the first town of a new kind of urbanism, but the first whole-city expression of twentieth century disurbanism disguised as romantic urbanism — the end of a tradition, not the beginning of the new.

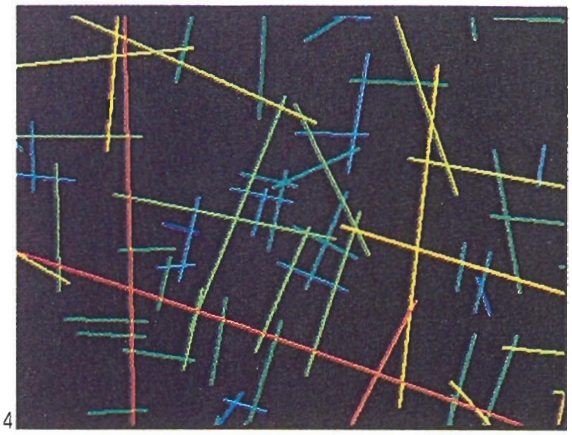
Milton Keynes is not, I suggest, the city built for the car but the first town to systematically try to separate all relations between levels of movement: between building and street, between local and global movement, and between inhabitants and strangers. In doing this it extracts everyday movement, and canalises it into specialised systems. Each aspect of movement is separated from all others and from the life that they could create together. In terms of the multiplier effect, Milton Keynes is a town of stasis. What it provides through its built forms, it provides more cheaply than elsewhere. But the town itself adds nothing through its design.

It is easy to see how it happened: in the design of Milton Keynes, the strategic decisions pre-empted the tactical ones. Once the decisions about urban grid, land-use distribution and densities were in place, the tactics of romantic urbanism were whistling in the wind. Cities and towns are created by how they handle movement and the relation between movement and life. Milton Keynes is a town of separations. While its strategic design principles remain in place — a large-scale grid without buildings, grid square layouts which do not contribute to a larger scale structure, and separation of forms and scales of movement — Milton Keynes cannot be other than it is now.

Urbanity, it seems, is not mysterious. Good space is used space. Most urban space use is movement. Most movement is through-movement, the by-product of how the grid offers routes from everywhere to everywhere else in the grid. Most informal space use is movement-related, as is the sense and fact of urban safety.

Land use and building density follow movement in the grid, both adapting to and multiplying its effects. The urban buzz, or the lack of it when it suits us, is the combination of these.

The architecture of the urban grid is fundamental to the life of the city and town. It must therefore be a primary object of architectural thought and creativity. The proper design of the grid is the pre-condition for urban success. If handled right, the grid, and the grid alone, can bring the whole system of land uses and densities into a structure which maximises the multiplier effect which is the principal source of the distinctive life of cities and towns. □



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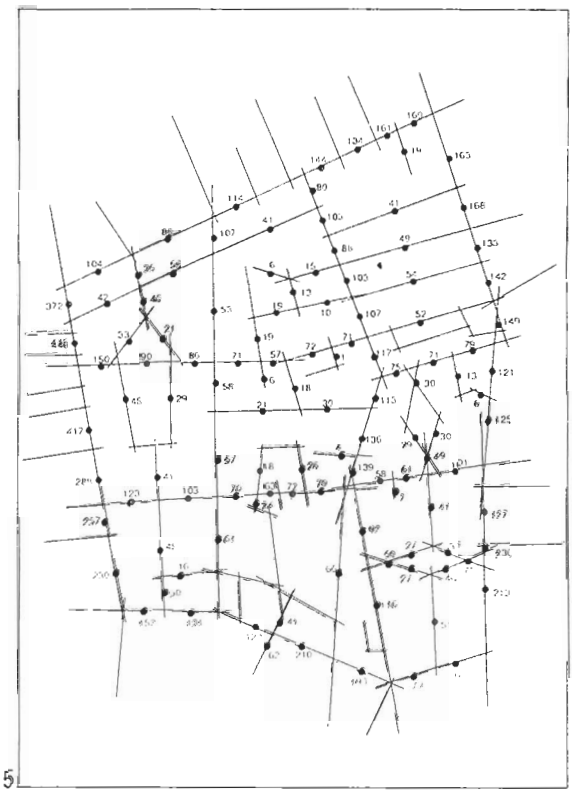

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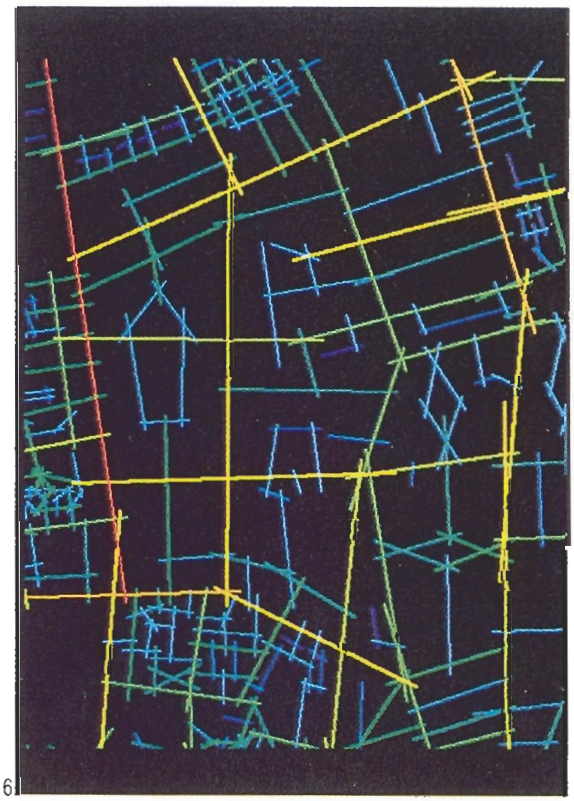

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14 London's Leadenhall Market shows a high degree of local integration, linking the surrounding streets through the market area and acting as a local intensification of the street grid.
15 Typical diagram showing the average hourly pedestrian movement, throughout the working day, for each line segment (this same data provides the vertical axis in figure 9). This example relates to the nineteenth century north London suburb of Barnsbury.
16 Diagram showing the degree of spatial integration for the same area, calculated from the way streets connect with each other. The strength of the relationship between the computer model and real patterns of pedestrian movement is shown in 9.

Photo credit
Photographs by Philip Wolmuth.

Reference
For a fuller description of these techniques, see 'Space syntax: a different urban perspective', AJ 30.11.83 p47.