5

Against enclosure

Bill Hillier

Introduction: enclosure, repetition, hierarchy = fragmentation

Architectural ideas typically associate social values with spatial concepts. In the recent past, a common social value in housing design has been that of the small, relatively bounded community, forming an identifiable unit of a larger whole. Architecturally this has been reflected in a preoccupation with linking groups of dwellings to identifiable and distinct external spaces in the hope that the 'enclosures' or 'clusters' so created would help group identification and interaction. The idea is justified spatially by invoking urban squares, courts and village greens, and socially through notions of 'group territory', the 'need for a hierarchy from public to private space', and the assumption that space can only be socially significant if a definite group of people are identified with it (Hanson and Hillier, 1987).

In its extreme form, enclosure becomes the basis for a methodology of layout design in which local enclosures are either repeated or subjected to simple geometrical transformations, then reproduced at a higher level to create an 'enclosure of enclosures', or a similar hierarchical design. Figure 5.1, a design for a village in Algeria by Ricardo Bofil, is a perfect summary of these three principles of enclosure, repetition and hierarchy, working at three levels. Dwellings are first wrapped round a small, local space. A set of these composite units is then wrapped around a larger space. Then these second order composites are wrapped around a central 'square'.

Figure 5.2 shows an international selection of schemes from *Residential Districts* (Kirschenman and Munschalek, 1977) in which over a hundred housing schemes from many countries are reviewed. In spite of their geometrical dissimilarity, all the schemes in Figure 5.2 are based on some variant of the principles of enclosure, repetition and hierarchy. Similar principles can be detected in most of the schemes in the book. The 'enclosure-repetition-hierarchy' method became at some stage of our recent past, it seems, a kind of international style of spatial design.

But the idea of the localized enclosure is not new. Nor is it dead. It was a common form in those precursors of modern housing, the 'philanthropic' estates of 19th century London (Tarn, 1973). It was proposed by Le Corbusier as the fundamental local unit of the new city in *La Ville Contemporaine* (Le Corbusier, 1929, p. 217 & 221). It was proposed by the late Greater London Council as the basis of 'good housing layout' (GLC, 1977). Indeed, one of the curious things about the enclosure concept is the number of times it has been proposed as a new idea to remedy past errors. It might not be too fanciful to argue that it has acquired the

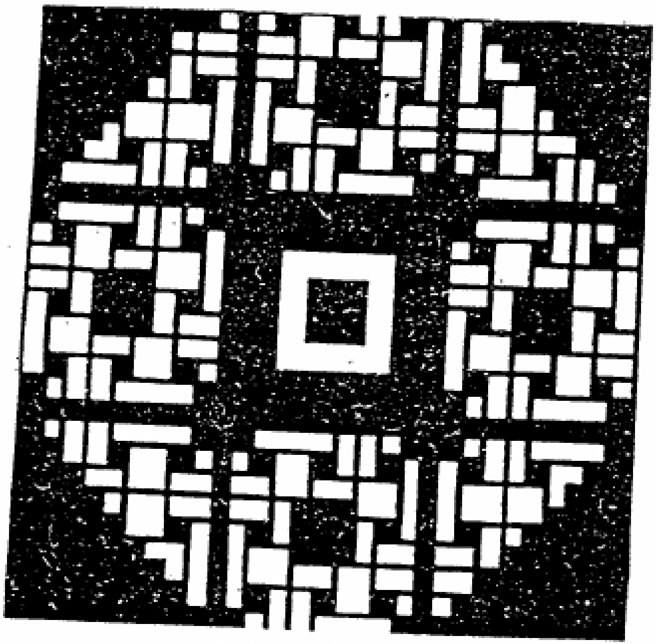


Figure 5.1 Design for a village in Algeria by Ricardo Bofil, with space black and buildings white

kind of protected status we assign to concepts of unquestionable virtue, like 'motherhood' or 'community'. It encapsulates a moral imperative in a spatial idea.

My contention in this paper is, however, that the enclosure is not the answer to the urban problem, but the problem itself. Its indiscriminate use has been responsible for the creation of the fragmentary, unintelligible and largely under-used spaces which form a significant proportion of our urban environment today. My aim in this paper is to make this argument precise by using a method of urban analysis—space syntax (Hillier and Hanson, 1984; Hillier *et al.*, 1983)—to show first how intelligibility and continuous use was created by urban space in the past, then show how the unintelligibility and under-use of much modern space arises from the uncritical use of over-localized concepts like 'enclosure'.

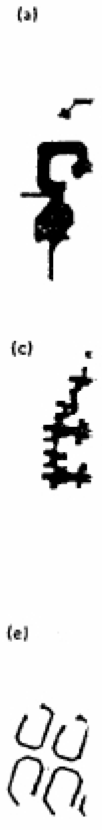
I will also show that there is now preliminary evidence that such environments may increase vulnerability to certain types of crime, even though we commonly think of them as 'defensible'. In conclusion, I will argue that to rehumanize our urban environment we must restrict the use of the enclosure concept to those places where it is genuinely applicable, and for run-of-the-mill public space re-establish the idea of open, outward facing layouts, with intelligibility and integration given priority over exclusion and group territory.

Urban space isn't about enclosure

The enclosure concept claims legitimacy above all from the urban past. Now it is perfectly clear that there are enclosed spaces in our historic towns, and that the

---

(a)



(e)

Figure 5.2
Sweden, (
shoop, Fe

sense o
basis of
Figur
pattern.
localize
defined
lines of
are the
century
gic spac
be seen
Figur
ing all t
to from
structur

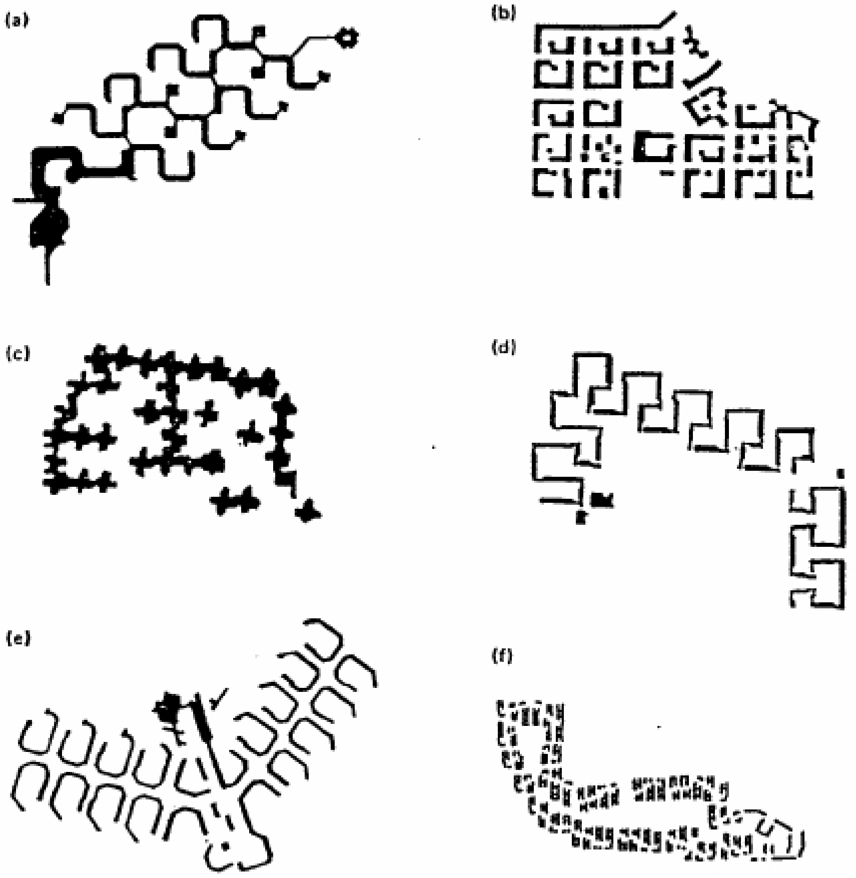


Figure 5.2 An international selection of housing schemes: (a) Dimona, Israel, (b) Bruket, Sandviken, Sweden, (c) Oriental Masonic Gardens, New Haven, USA, (d) Pollards Hill, England, (e) Steilshoop, Federal Republic of Germany, (f) Basildon, England

sense of enclosure can indeed be a pleasurable thing. But the belief that it is the basis of urban form is quite wrong.

Figure 5.3, the French town of Apt, is a fairly typical case of a traditional urban pattern. First, very little of the open space can be described as enclosed in the localized sense of Figure 5.2. Admittedly, all parts of open space are shaped and defined by their relation to building entrances; but, equally, all parts are related by lines of sight and access to the larger scale space structure. Even the 'squares' which are the most obviously 'enclosed' spaces (and for the most part they are nineteenth century interventions) have the important additional property of being also strategic spaces from which a good deal of the larger scale space structure of the town can be seen.

Figure 5.4 shows this graphically. For each space I have drawn a shape comprising all the space of the square, plus all the space that can be seen and gone directly to from any point in the square. The shapes almost join up to form a continuous structure, and with the exception of space D (a comparatively recent space which

Figure 5.3 The French town of Apt, Vaucluse, with buildings shown in white and open space in black

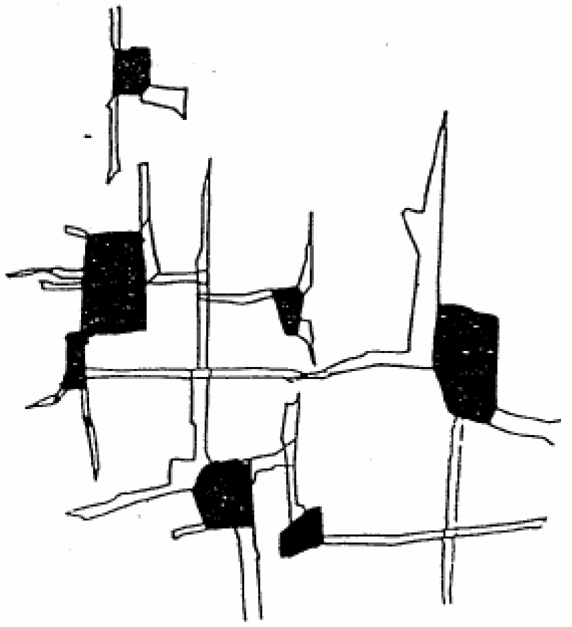


Figure 5.4 The 'convex isovists' of the squares of Apt, showing how 'local' enclosed spaces are related to the 'global' structure of space in the town

failed t
the squ
that sq
which i
structu
found i
The t
virtuall
unlike
idiosync
'hierarc
anythin
But t
types. T
But if w
similarit
tee that
properti
we have
natural i
or warn
read the

Towns

How ca
built int
concept
order is
differen
to devel
We c
are wha
topolog
each sur
But its
changes
that the
and *two*
These
First, th
As show
and acc
quite ea
regular
fattest a
fattest s
the conv

failed to develop as a market square), there is a clear relation between the size of the square and the size of the overall shape visible from the square. We might say that squares which are bigger 'locally' are also bigger 'globally'. Or that a space which is well defined as a local enclosure is also well defined in terms of the global structure of the town. This is quite unlike the localized concept of enclosure to be found in Figure 5.2.

The town also differs from the modern environments of Figure 5.2 in that there is virtually no morphological repetition anywhere. On the contrary, each part seems unlike all the others, to the point where one wonders how such a collection of idiosyncratic spaces can form a coherent system. As with 'repetition', so with 'hierarchy'. Only by stretching the meaning of the word to its limits can we detect anything resembling the modern idea of spatial hierarchy in the town.

But there is an even more fundamental difference between the old and new plan types. The new plans of Figures 5.1 and 5.2 are intelligible from the air, as plans. But if we try to move around them we quickly lose all sense of where we are. The similarity of the parts, and their predominantly localized reference points, guarantee that on the ground they *lack* intelligibility. The old town plan has the opposite properties. From the air it appears disordered, in that it lacks the kind of regularity we have come to identify as urban order. But on the ground, it has a degree of natural intelligibility which means that we do not need signs to tell us where to go, or warnings to tell us when we are straying from the beaten track. We know how to read the town, and we know how to use it.

Towns as deformed grids

How can this be? The answer of course is that traditional towns had forms of order built into them which gave them this intelligibility and workability, even though the concepts of urban order we have are quite incapable of expressing this order. This order is not mysterious. It is as well defined as any other kind of order. But it is different, and requires us to stop imposing our preconceived ideas on space and try to develop forms of analysis which are sensitive to these subtler types of order.

We can begin by noting that the great majority of towns built in human history are what I call '*deformed grids*'. By this I mean that the town has the general topology of a grid, being made up of a series of islands of outward-facing buildings, each surrounded by a ring of open space which forms part of an interconnected net. But its plan is 'deformed' in two senses. First, the length of spaces you can see changes as you move about; and second the width of spaces changes. We might say that the grid is deformed *one-dimensionally*, in terms of its lines of sight and access; and *two-dimensionally*, in terms of the changing 'fatness' of its spaces.

These two types of deformation of the grid can be formalized and quantified. First, the two-dimensional variation can be analyzed using the concept of *convexity*. As shown in Figure 5.5, a convex space is one in which all points are directly visible and accessible from all other points—there are no hiding places. Now although it is quite easy to devise layouts which cannot be so analyzed (for example, perfectly regular grids) it is in practice quite easy to divide most deformed grids up into their fattest and fewest convex spaces by simply requiring every point to be part of the fattest space it can. Since the boundary of each convex space will involve a vertex, the convex spaces can also be identified by drawing a line from each vertex to the

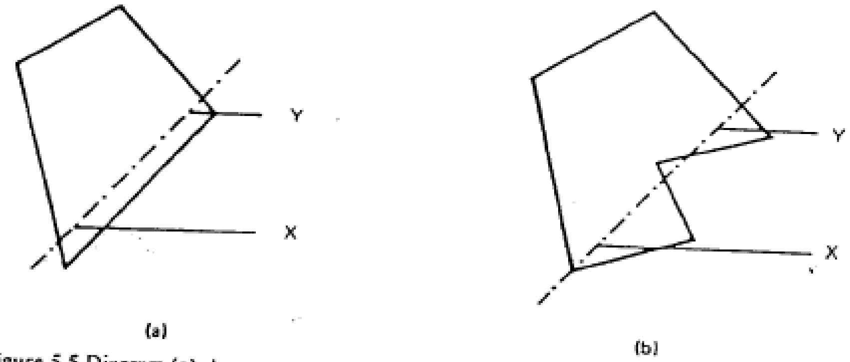


Figure 5.5 Diagram (a) shows a convex space, meaning that all points within the space can be joined to all others without passing outside the boundary of the space. In diagram (b) the line from X to Y passes outside the space, which is therefore not convex

nearest point on another island within the area defined by projecting the lines constituting the original vertex.

As soon as this decomposition is done, two key points immediately become clear. First, almost every convex space so defined, however small or narrow, has building entrances opening directly onto it. This is a social property as much as a spatial property. It means that every space from which all points can see all other points is also a space in which entrances participate in this 'all-play-all'. It also means that wherever you are in urban space, however localized, you are always under the potential surveillance of entrances. This is the opposite of modern enclosure-ism, where typically entrances are deliberately concentrated onto a few spaces, to give these spaces identification and surveillance, leaving all other spaces without entrances and defined only by blank walls. The urban principle of the *continuous definition* of open space by building entrances is systematically violated in modern environments.

But convex spaces are not only related to entrances. They are also related to each other by lines of sight and access which pass through several and perhaps many convex spaces, depending on which part of the settlement we are in. Again this principle is commonly violated in modern imitations of the urban past. Lines of sight tend to be reduced towards the single convex space. The implications of this are also clear. It is the linking of convex spaces through lines of sight that give the deformed grid its sense of operating at two scales at once. Wherever you are, you are aware of the local space you are in through the convex organization. But at the same time you are aware of the global system of space by virtue of the lines of sight and access which connect directly to it. This way of operating at two scales at once is, I suggest, the single most important property of the deformed grid type of urban space structure.

Integrating cores

Just how important the linear or *axial* structure of urban space is can be seen by using it to develop a mathematical analysis of the global structure of the town. First, we construct an *axial map* by drawing the fewest and longest straight lines which pass through all the convex spaces of the settlement. Figure 5.6 is such a map

Figure
straigh

for A
throu
count
other
measu
to go f
the m
integra
al., 19
We
If we s
of the
black,
typical
small s
directi
also fo
by this
The
plan. I
describ
be fund

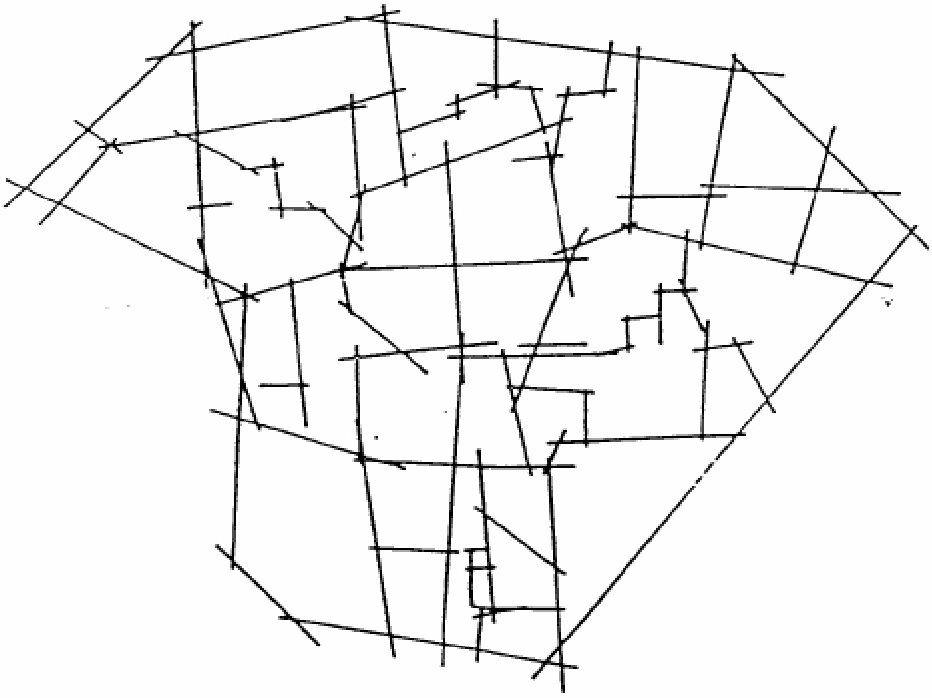


Figure 5.6 Axial map (or 'line diagram') of the town of Apt, made up of the fewest and longest straight lines that can be drawn through all the convex spaces of the plan

for Apt. We can then see that to pass from each line to any other line we must pass through a minimum number of intervening lines, or segments of lines. If we then count up the minimum number of lines we must use to go from each line to every other line, it turns out that all the sums will be different. This gives us the basis for a measure of *integration*: the fewer intervening lines which need to be passed through to go from a line to every other line, then the more integrating that line; the more, the more segregating. The computer can in this way be used to calculate an *integration value* for each line (for equations see Hillier and Hanson, 1984; Hillier *et al.*, 1983).

We then return to the axial map and draw in the most integrating lines in order. If we stop at, say 10%, then the resulting diagram we call the 10% *integrating core* of the settlement. Figure 5.7 is the 10% integrating core of Apt shown in heavy black, with the 50% most segregated lines shown dotted. The core takes a form typical of many types of town or urban area, which we call a *deformed wheel*. A small semi-grid of lines in the heart of the settlement (the hub) is linked in several directions (the spokes) to lines on the periphery of the settlement (the rim), which also form part of the core. The segregated areas are found in the interstices formed by this wheel.

The integration core is probably the most important *deep structure* of the town plan. Its structure will vary from one type of town to another, but can usually be described as some part of the deformed wheel core (which we therefore believe to be fundamental). For example, we find *covering* cores (hub and spokes without the

Figure 5.7 Axial map of Apt with the 10% integration core shown in heavy black, and the 50% most segregated lines shown dotted

rim), *centralized* cores (hub only), *peripheral* cores (rim only), *penetrating* cores (one spoke and part of the rim), *linear* cores (one series of lines), and so on. Cores of any of these morphological types can then be *localized* in one part of the plan or *globalized* in the plan as a whole; *shallow* or *deep* in the plan; *fragmented* or *unified*, and so on.

Why should towns and urban areas have such different kinds of 'integrating cores'? Because, as the old adage says, towns are mechanisms for generating contact. But they do not all do it in the same way. The adage needs to be qualified: *how* towns generate contact, and *what* kind of pattern of contact they engender is critical, and this is largely created by the way in which the town plan creates a pattern of integration and particular shape of core.

For example, the deformed wheel core type seems to exist to access strangers through into the heart of the town, while ensuring that the natural movement of inhabitants to, from and between the more segregated zones within the towns continually intersects the spaces used by strangers. This creates a strong natural 'probabilistic interface' between inhabitants and strangers in the town. In contrast, towns like Ghardaia in the Algerian Mzab (Salah-Salah, 1987) restrict the global core and the movement of strangers to well defined peripheral areas, and segregate large areas of the town for the more exclusive use of inhabitants. Others again, like Venice (Zeliotis, 1985) create a much more localized structure of dispersed cores, with an overall core concentrated in central areas.

Enc

These
unde
patte
facto
which
patter
ing h
the fa
cal an
This
field is
town p
conclu
bulk o
decide
of faci
levels
This
plan it
system
to each
with in
strong
the sp
Figu
Figure
showin
resider
setting
along t
perfect
of inte
Rese
integra
individ
every
spaces
plan, n
'part' w
a much
street
5.12, th
past th
against
studies
althoug
How
looking

Encounter fields

These arguments link cultural variation in urban spatial forms to a common underlying principle: that the pattern of movement in a town is a function of its pattern of integration. This is in fact only conditionally true. It depends on other factors, the most important of which is another 'syntactic' property of the plan which we call 'intelligibility', discussed below. Even so, the relation between the pattern of integration and the pattern of movement is fundamental to understanding how towns and urban areas work as 'mechanisms for generating contact'; and the fact that 'integration' is a quantitative concept, derived only from a mathematical analysis of the plan, means that this is a testable proposition.

This can be clarified through the concept of the *encounter field*. The encounter field is the natural pattern of background space use and movement created by the town plan and the distribution of buildings within it. Research has led us to the firm conclusion that it is the structure of the town plan itself that is responsible for the bulk of this natural 'background' pattern of space use and movement, and that this decides the general level of use of the constituent spaces of the plan. The location of facilities and 'magnets' is important, but it is less influential in creating overall levels of space use than the town plan itself.

This proposition that the pattern of movement is fundamentally a function of the plan itself has been extensively tested by observation. The technique is simple. By systematically observing the pattern of movement in a set of spaces, we can assign to each space an *encounter rate*. We may then statistically correlate encounter rates with integration values (and with any other spatial parameters) and, obviously, the stronger the correlation, the better the prediction of the movement pattern from the spatial structure.

Figure 5.8, for example, is a map of the inner London area of Barnsbury, and Figure 5.9 its axial map with integration and segregation marked in the usual way, showing a 'covering core' centred on the 'village' (the short line marked 1) and the residential squares as the more segregated spaces. Figure 5.10 is then a scattergram setting encounter rates of lines along the horizontal axis and integration values along the vertical. The correlation of 0.8 (on a scale from 0 = no relation to 1 = a perfect relation) shows how consistently the encounter rate varies with the degree of integration of the line.

Research has shown that this type of result is normal in street-based urban areas: integration values are strong (and the best) predictors of the encounter rates of individual spaces. Because integration is a measure which relates each space to every other space in the plan, this implies that the encounter rates of individual spaces are in the main a function of their position in the 'global' structure of the plan, not the more 'local' properties of the space. In other words, how the urban 'part' works depends on its relation to the urban 'whole'. This can be found even at a much larger scale of analysis. Figure 5.11, for example, is an axial map of the street pattern of a much larger urban area, of which Barnsbury is a part, Figure 5.12, the same with the addition of the ground level of housing estates built over the past three decades, and Figure 5.13 a scattergram plotting integration values against encounter rates for a much larger sample of spaces taken from six separate studies distributed throughout the area. The correlation is still remarkably good, although the scatter shows more 'spread' than in the more localized area.

However, this overall result conceals more important effects that can be found by looking at the six studies independently. First, we may look carefully at the

Figure 5.8 The area of Barnsbury, North London, with open spaces shown in black

differences between Figures 5.11 and 5.12. Those estates added in Figure 5.12 vary enormously in their layout, but all involve the enclosure theme in some way. One is an early post-war modernist estate with a large scale court form, another a sixties slabs estate again arranged loosely in separate courts, another a low-rise seventies housing estate in small courts, another a low rise development round a 'village green', another a trend-setting neo-vernacular pseudo-village full of 'focal' spaces, and so on.

In spite of the differences in style and geometry, the axial map shows that all the estates have certain common properties, which make them obtrusive in the axial map. First, and most obvious, is a radical *reduction* in spatial scale, even where the

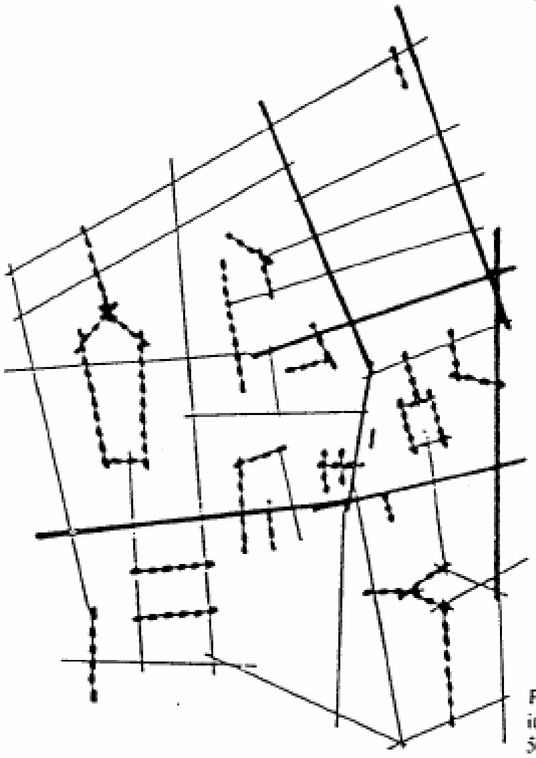


Figure 5.9 Axial map of Barnsbury, showing its 10% integration core in heavy black and 50% most segregated spaces dotted

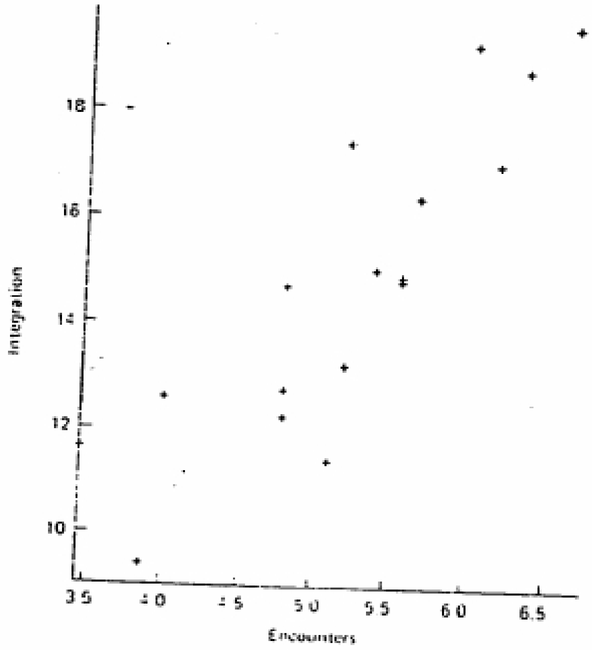


Figure 5.10 Scattergram of numbers of moving people (horizontal axis) plotted against integration (vertical axis), showing a correlation of $r = 0.8004$. Note that in this case the reciprocals of integration values are used so that higher values mean more integration

Figure 5.11 Axial map of street pattern of the large study area in Islington

Figure 5.12 Figure 5.11 with the addition of estates built in the last three decades

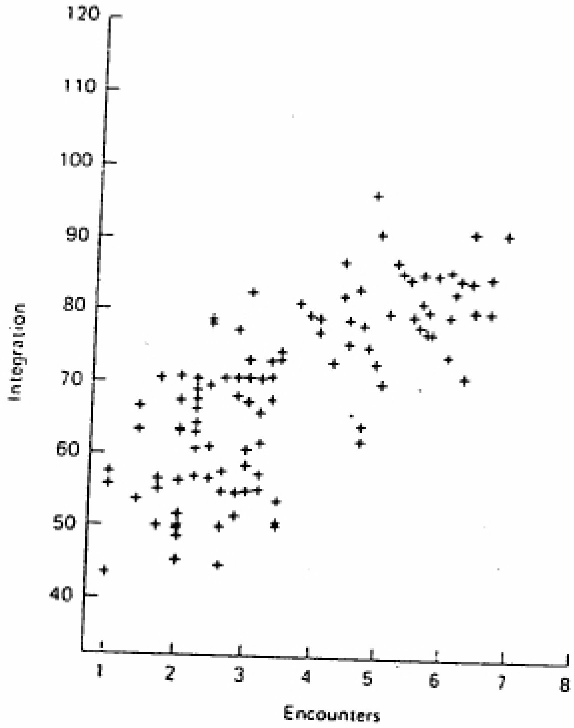


Figure 5.13 Scattergram of encounter rates against integration for all six study areas in Figure 5.12

buildings are quite massive. This is an almost universal property of modern housing. Second, the estates seem to lack any sense of an internal spatial structure, either in plan or on the ground. This turns out to be the case. Syntactic analysis shows the estates have, almost uniformly, largely peripheral integration cores. They integrate from the outside. This is reflected in the pattern of movement, which concentrates on the exterior and falls off rapidly as you move deeper into the estate. The encounter field makes sense only in terms of people moving in and out of the estate by the shortest possible route.

But the estates also share a third, less obvious property. The spatial patterns appear to lack intelligibility *either* from the air as plans *or* on the ground as places to move around. Our research has suggested there may be a powerful way of measuring this. Each line has a certain number of other lines that intersect with it. Call this number the *connectivity* of the line. Connectivity is a property of a line which can be *seen* from the line. In this sense it is a *local* property. The integration value of a line, on the other hand, cannot be seen from the line, because it is a global property. It requires knowledge of the system as a whole, most of which cannot be seen. If we then correlate the connectivity values of lines with their integration values, then we will have an index of the degree to which the spatial information available visibly from a line is a reliable guide to the importance of that line in the system as a whole.

This correlation, expressed as a value between 0 and 1 we call the 'intelligibility' of the system. Analysis of a large number of examples from different parts of the world has shown that intelligibility defined in this way is a key property of the spatial structure of towns. It has also been shown to have a powerful effect on the

ence
predi
both
feel i
spati

Lost

In the
intern
of inte
in the
relate
mover
the lo
people
the ser
But
housin
people
areas i
estates
most o
anothe
time in
people
Othe
in stre
ment, is
these d
A high
will m
other
goes n
childre

Vulner

What i
connect
into los
spatial
a docto
don. T
allowed
new wa
parame
Differe

encounter field. Roughly, the more intelligible the urban area, the better will be the prediction of encounter rates from integration values. In traditional urban areas both tend to be high. This confirms intuition. We feel they are intelligible. And we feel that there is a natural relationship between the presence of people and the spatial pattern.

Lost properties

In the estates we have studied, both of these relations commonly break down. The internal intelligibility of the spatial layout falls, and the degree to which the pattern of integration predicts encounter rates falls with it, both to much lower levels than in the surrounding urban areas. The encounter field within the estate does not relate to the internal structure of space. It only make spatial sense in terms of movement into and out of the estate by the shortest available routes. The result is the loss of both of the key elements of the 'urban' relation between space and people: the sense that the spatial layout as a whole is intelligible from its parts; and the sense that the spatial layout creates a predictable pattern of encounter.

But there is a third, even worse outcome. In almost all estates, whatever the housing density, the overall encounter rate drops from an average of around 2.6 people per hundred metres/minute of walking time in street-based residential street areas (not counting shopping streets) to somewhere between 0.4 and 0.7 inside estates. The effect is that whereas in streets you are in contact with other people most of the time, on estates you are on your own in space most of the time. Put another way, the daytime encounter field in the estates turns out to be like night-time in ordinary urban streets. In terms of their naturally available encounter field, people on these estates live in a kind of perpetual night.

Other, less obvious, properties of the encounter field are also lost. For example, in street-based areas, the pattern of space use by adults and children, or women and men, is more or less similar, giving a strong degree of natural interfacing between these different categories. This can again be expressed as a correlation co-efficient. A high correlation between the encounter rates of adults and children for spaces will mean that adults and children are in a constant natural interface with each other. In many estates, this correlation becomes very weak, and in some it even goes negative, implying an effective separation of the encounter fields of adults and children.

Vulnerability to crime

What the long-term social effects of these 'lost properties' may be can only be conjectured at present. But at least one important social variable can be brought into focus by these methods: vulnerability to crime. Work on the relation between spatial layout and crime location is now being carried out by Lena Tsoskounoglou, a doctoral student in the Unit for Architectural Studies, University College London. The ability to express configurational properties of layouts quantitatively has allowed her to approach the relation of architecture and crime vulnerability in a new way. Each location in an estate or urban area can be assigned various spatial parameters expressing different aspects of its relation to the layout as a whole. Different types of crime can then be plotted on the layout, and thus be assigned spatial values. From there, it is a matter of exploring how far different types of crime tend to be associated with different spatial values.

For example, Figure 5.14 is the axial map of Barnsbury, with integration and segregation marked in the usual way. All burglaries reported to the police during a recent twelve-month period are marked by heavy dots, giving an overall rate of

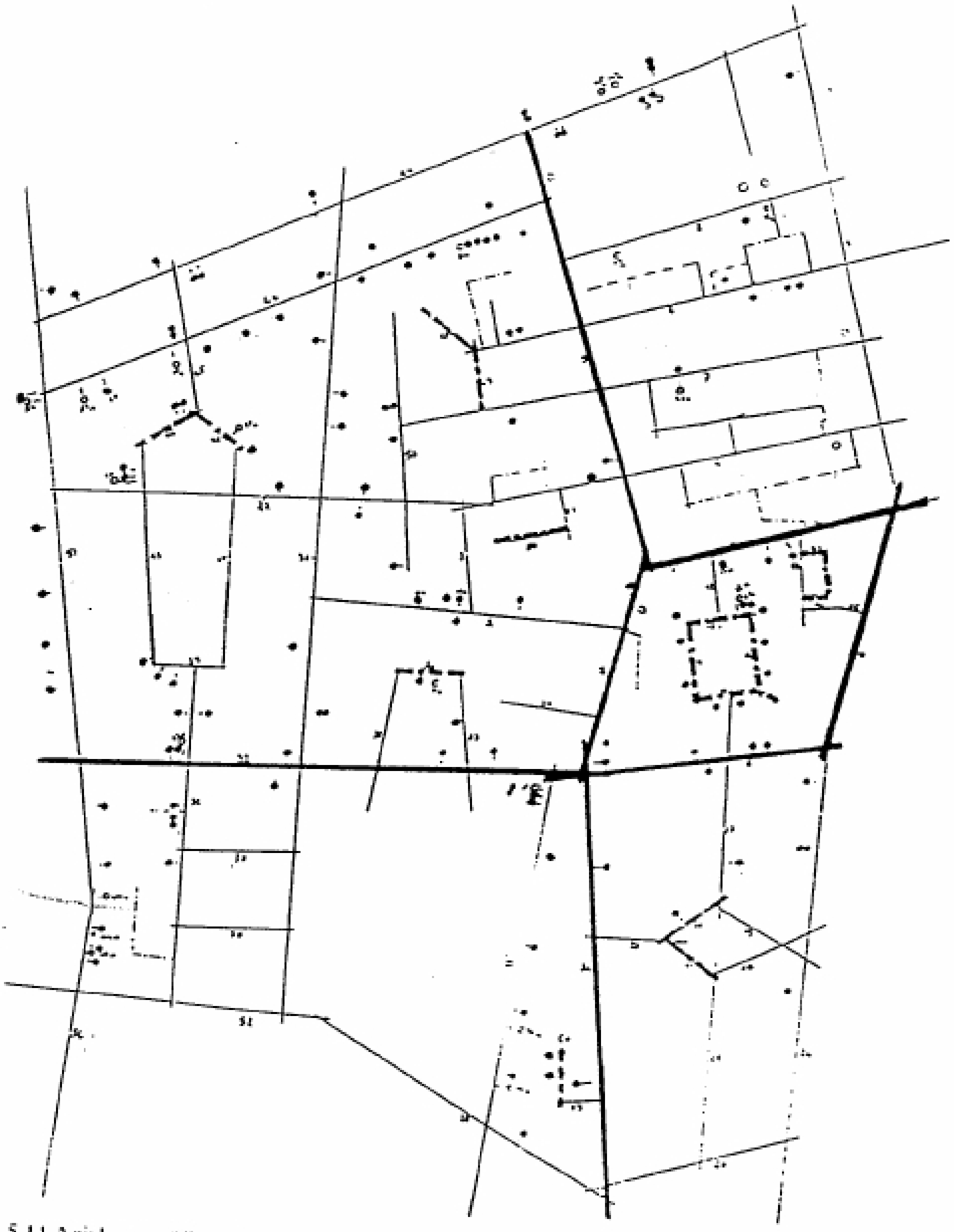


Figure 5.14 Axial map of Barnsbury with burglaries reported in a twelve-month period shown by dots

5.4% of buildings burgled in one year. Intuitively, it looks as though more segregated locations have higher rates. Can this be tested?

There are two ways of doing this. First, each dwelling is assigned the integration value of the line (or lines, if there is also a back entrance) onto which it opens, and the mean integration value of burgled dwellings and unburgled dwellings are calculated separately. The result in this case is that burgled dwellings have a mean integration value of 0.6936 whereas unburgled dwellings have a mean of 0.6539. Since low values mean more integration (i.e. less depth), this result shows that segregated dwellings are more likely to be burgled than integrated dwellings. A significance test on this difference shows that it is statistically 'highly significant' (less than 0.05 probability of having occurred by chance).

Second, we can calculate the *rate* of burglary for a line as the number of burgled dwellings over the total number of dwellings on that line. We can then correlate these rates with the integration values of the lines. If we do this for Barnsbury, then at first we find only a weak relationship between the two, showing that vulnerability to burglary increases slightly with increasing segregation. However, an inspection of the scattergram shows that this apparently weak result is entirely due to the fact that over half the total spaces had no burglary during the twelve-month period, and these are spread throughout the range of integrated and segregated spaces. A good deal of this must be due to chance. In any twelve-month period, there will only be enough burglary to give positive rates for about half the lines. If we then look only at the lines on which burglary occurred in the twelve-month period, and plot this against integration, then the result is the scattergram in Figure 5.15, showing a very strong and statistically significant relation between integration and burglary rates. The more integrated the space, the lower the burglary rate, the more segregated, the higher the burglary rate.

This result must be treated with great caution, of course, because of the fact that a single twelve-month period does not yield enough data to test this for all lines in the system. Data taken over several years would be required to eliminate this problem, and work is now in progress to try to build this up. The result is, however, very suggestive, and taken in conjunction with the first result, strongly suggests that

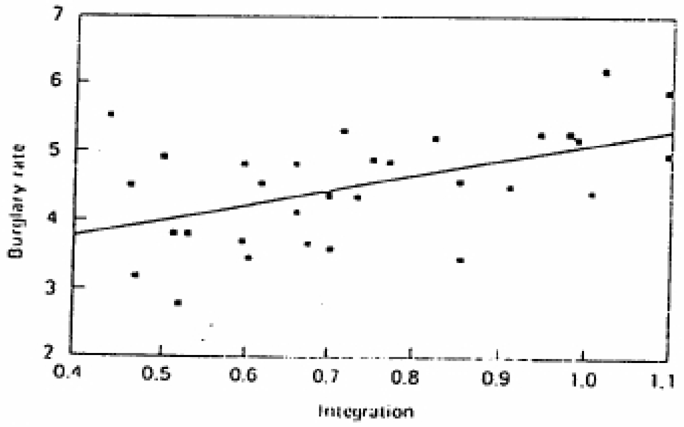


Figure 5.15 Scattergram of burglary rates (vertical axis) against integration (horizontal axis) for Barnsbury during one twelve-month period. Note that in this case ordinary integration values are used, meaning that a low value means strong integration

burglary risk *rises* with the degree of segregation, that is with the spatial variable that *reduces* the encounter rate of the space, and falls with integration, which produces higher encounter rates.

In other words, Jane Jacobs's instinct seems to have been right when in *The Death and Life of the Great American Cities* she associated higher encounter rates with lower crime risk (Jacobs, 1961, e.g. p. 43). Does the same apply on estates, or is it better there to segregate and reduce the encounter rate, as Oscar Newman and Alice Coleman suggest (Newman, 1972, Chapter 2; Coleman, 1985, p. 147)? Figures 5.16 and 5.17 are the plan and axial map of the ground level of part of one of the estates in Figure 5.11, the Marquess estate. The overall rate of burglary at 8.9% is much higher than for the more affluent Barnsbury area, but also there are interesting differences in the levels of the estate. The rate for the upper walkway level (not shown in Figures, but it is less labyrinthine than the lower level) is only half the mean rate for the whole, while those parts of the ground level which are slightly raised by ramps or steps (but connect to the ground level rather than to the upper level) have double the mean rate for the whole.

For the ground (and ground connected) level the mean integration value of burgled dwellings is 0.8746 while for unburgled it is 0.8078—again burgled dwell-ings are more segregated than nonburgled, and once again this difference is statistically highly significant. The scattergram for burglary rates against integration values for burgled lines again shows that rates increase markedly with segregation, with a correlation of 0.59. At the upper level, where the rate is much lower, the pattern is less clear. The mean integration of burgled dwellings is in fact slightly lower than for the unburgled, but the difference is not statistically significant (there are only 11 burglaries). We still find, however, that burglary rates rise with segregation.

A visual inspection of the axial map of the ground-related level suggests that another spatial factor is implicated in the distribution of burglary. Figure 5.18 is the axial map of the estate with line segments onto which no dwelling opens drawn in heavy black. It is immediately clear that the strongest sequences of such 'blank wall' lines occur at all the entrances to the estate. A more careful look will show that nearly all burglaries occur on the first line in from the outside on which entrances occur. Burglars, it seems, like to enter and leave by routes which do not take them past entrances.

Two figures powerfully confirm this pattern. If we calculate the mean burglary rate for all such 'first' lines with entrances from the outside, then we find a rate of 21%. If, on the other hand, we look at the rates for the lines that are completely protected from the outside by lines with entrances, then the rate is around 2%. No such pattern can be found if one tries to look at the surveillance of individual lines. It is not, it seems, the surveillance of the space onto which you open that keeps you safe, but the potential surveillance of the routes to your space from the outside.

The consideration also seems to play a role in the very different spatial pattern of the second estate, the Andover estate, the ground level of which is shown in Figures 5.19 (plan) and 5.20 (axial map with burglary). Again the estate is on two levels, and once again the upper deck access level (which is not really an upper level walkway system since it continually requires one to return to the ground level to move about) is rather safer than the ground floor (6.25% as against 7.87%). The estate is unusual in that it has an integration core which passes through the heart of the estate, linking it to the outside in several directions. However, this integration

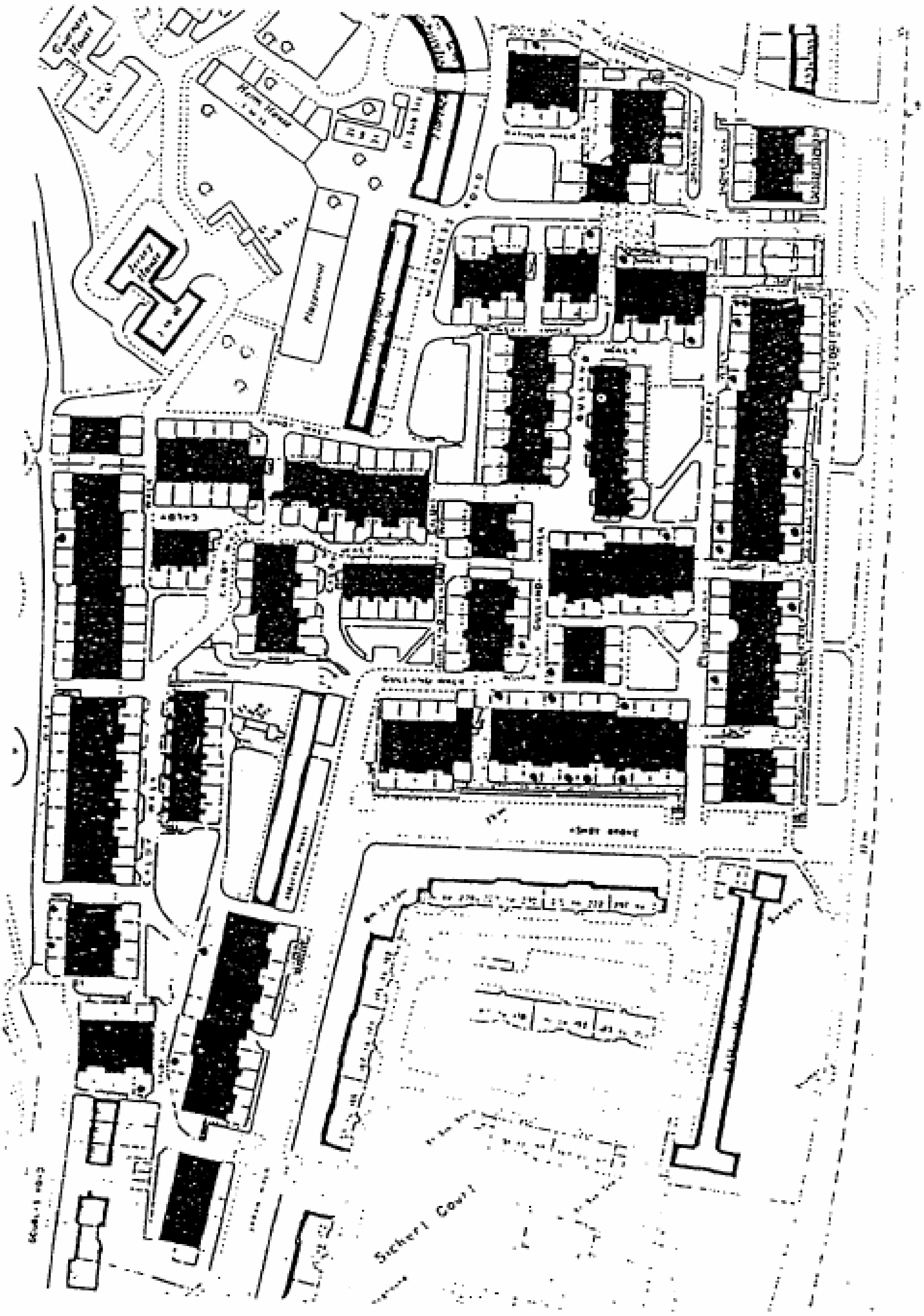


Figure 5.16 Plan of the ground level of part of the Marquess estate in Islington

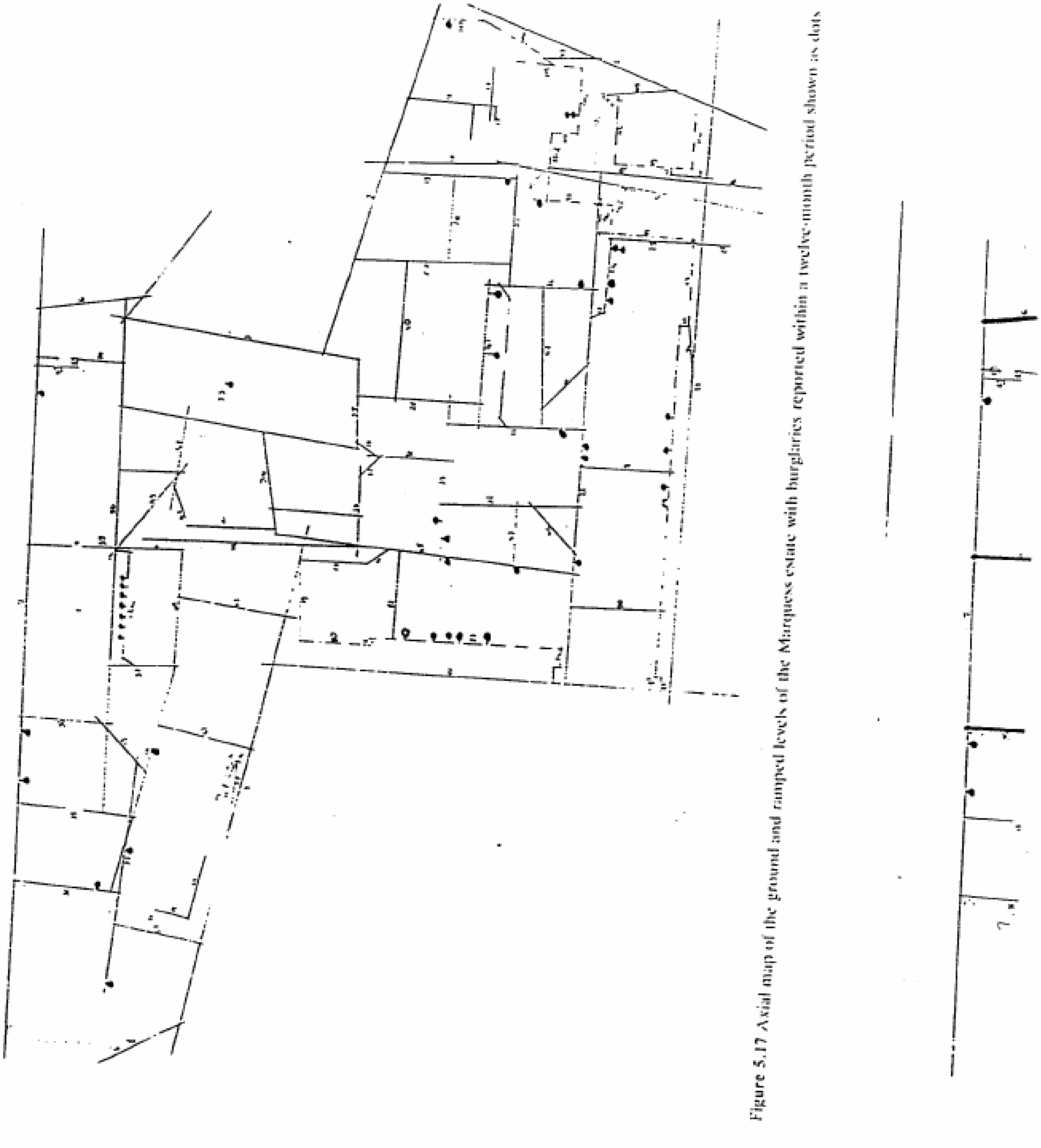


Figure 5.17 Axial map of the ground and ramped levels of the Marquess estate with burglaries reported within a twelve-month period shown as dots

Figure 5.18 Axial map Figure 5.17 showing spaces without building entrances opening onto them in heavy black

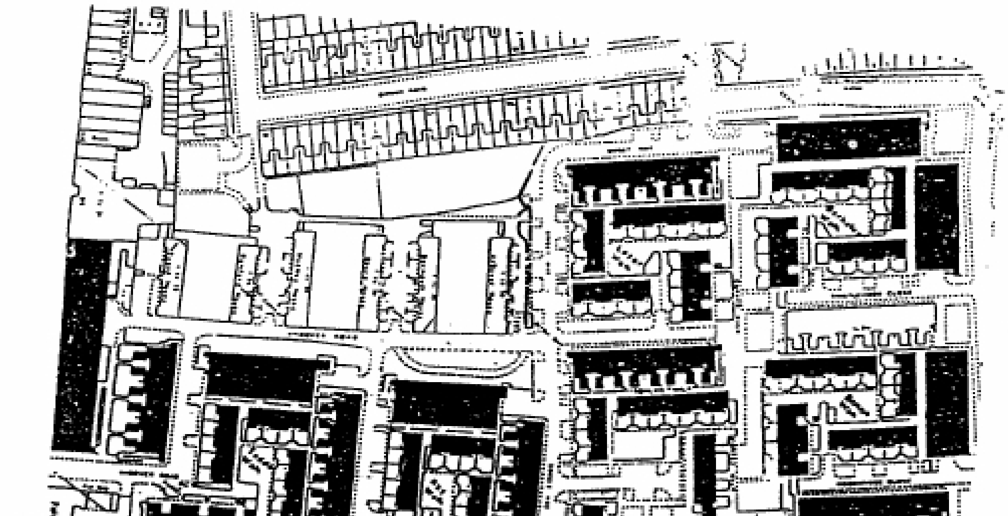


Figure 5.19 Ground level plan of the Andover estate, Islington

core is almost entirely made up of entrance-free lines, so that there is no direct interface between dwellings and people moving through the estate.

Again we find a different pattern for the ground and upper levels. On the ground the mean rate for burgled dwellings at 0.5936 is marginally more integrated than for unburgled dwellings at 0.6147, though again this is not statistically significant. This could be because, as we have said, the integration core passes through the heart of the estate almost entirely unrelated to dwelling entrances. At the upper level, however, there is a strongly significant difference the other way: burgled dwellings

---

Figure 5.2
month per

at 0.9807
scattergra
(the uppe
a strong t
Taking
burgled d
i.e. burgl
substantia

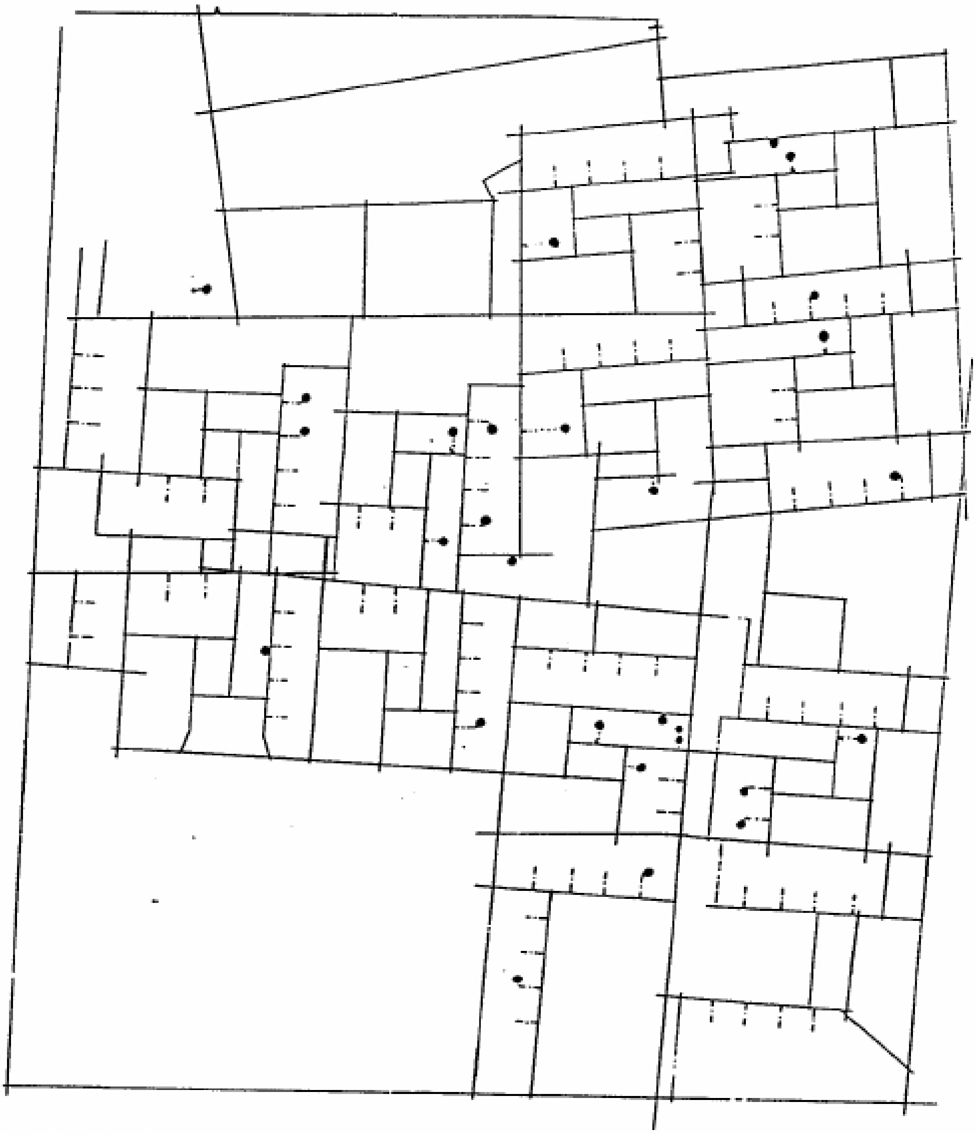


Figure 5.20 Axial map of the ground level of the Andover estate with burglaries during a twelve-month period shown as dots

at 0.9807 are significantly more segregated than unburgled dwellings at 0.9361. The scattergram for burglary rate against integration for the burgled lines on both levels (the upper level cannot be dealt with as a separate system in this case) again shows a strong tendency for rates to increase with segregation, with a correlation of 0.55.

Taking the three areas together, then, for a total of 2,816 dwellings the 211 burgled dwellings have a mean integration of 0.780 while the unburgled are 0.759, i.e. burgled dwellings are markedly more segregated. This difference is clearly substantial although, for technical reasons (the three systems have not yet been assembled into a single spatial data base, because of the size this system would need to be) it has not yet been possible to compute a significance test for it. It leaves little doubt, however, that in general the properties of urban space that emerged as the key ones in our studies—those of integration and those of continuous relations to building entrances—are both critically bound up with the pattern of burglary.

The results also cast quite fundamental doubts on the whole concept of 'defensible space', at least insofar as one of the main assumptions behind it is that the elimination of natural movement and encounter within housing estates will increase safety. Advocates of defensible space from Newman onwards seem to believe that the criminals seeking victims are part of the passing crowd, and that strangers are therefore in principle dangerous. Something like the opposite appears to be the case. The natural presence of people may be the primary means by which space is policed naturally. The more you eliminate this, then the more you create danger once a potential criminal has appeared on the scene. It is true that people behave more 'territorially' in segregated spaces. The more segregated, the more likely one is to question the presence of strangers. But this is associated with feeling more unsafe. No one feels the need to question strangers passing down a street. On the contrary, their natural presence increases the sense of security. It may also, it seems, increase actual security—although much more research is needed before these suggestive findings can be turned into unequivocal results.

So how should we rehumanize housing?

The design strategies that are implied by these new research findings can be set out at two levels: at the level of the 'rules of thumb', which ought to be adequate in the case of smaller scale design problems; and the level of the proper 'preparatory study' before design is initiated, which becomes more necessary as the size and complexity of the design task increases. In either case, what is proposed below is intended to deal as much with the problem of modifying existing housing areas and estates—and avoiding expenditure on modifications which will not improve the situation—as with the design of new developments. The rules proposed would apply as much to shopping areas and mixed areas as to housing areas.

First, the rules of thumb. We use the term 'line diagram' for the axial structure of a proposed scheme, and 'space diagram' for the convex structure. The following can be proposed:

- If it is intended that the new or modified area should relate effectively to the surrounding area, make sure that the 'line diagram' of the sketch design links the heart of the scheme with the surrounding area in several directions with lines that permit both visibility and direct access. These key lines should not pass right through the scheme, but reach important destinations within the scheme with one line, before changing direction to another. These lines should take into account the dominant lines that already exist in the surrounding area, not by continuing them, but by redirecting them. In effect, this first stage of design is the design of an integrating core of the type desired.
- In developing the line diagram of the scheme, make sure that all lines are at most two lines deep both from the outside and from the integrating core, with no more than an occasional line three steps deep.
- Make sure that any rings in the line diagram (i.e. choices of routes), including

those that form rings with the surrounding area, are related to the integration core. If rings are too segregated, then it creates access without adequate use. Choices of route are good, provided they are all adequately used.

- Make sure that all spaces in the space diagram, however small or narrow, have building entrances opening directly onto them. If this is impracticable for small spaces, then avoid creating those small spaces. Avoid clustering too many entrances on too few spaces, and concentrate instead on trying to ensure that every part of the scheme is in touch with entrances. Particularly sensitive in this respect are the spaces leading into the scheme from outside. These should always be related directly to building entrances.
- Make sure that spaces in the space diagram have links of visibility and direct access through the line diagram to the larger scale structure of the scheme. The 'isovist' (what can be seen and gone to directly from a space) of a space should be roughly proportional to its size.
- Make sure that the orientation of building facades and their entrances are such as to clarify the line and space structure of the scheme. For example, lines of sight striking buildings at open angles will suggest further movement possibilities; and marking important moments in the spatial structure with key facades will aid intelligibility and memorability.
- Avoid over-enclosing spaces, except where this deliberately reflects the place of that space in the overall spatial syntax of the scheme.
- Avoid repetition and simple geometrical permutations as far as possible; local differences aid global intelligibility if they are handled well.
- Avoid over-hierarchization of space; a range of rather more integrating and rather more segregating spaces is enough to differentiate the parts of the system into busier and quieter zones, and will avoid creating space that is empty for most of the time.

If the scheme is large or complex enough to merit a proper preparatory study, then:

- The area surrounding the proposed scheme or modification should be analyzed syntactically to establish its existing structure. This should be done both with and without whatever is on the redevelopment site at present. An area with a diameter of about 1 kilometre is usually adequate to give a firm basis to the study.
- The existing pattern of space use and movement in the area should be studied through a sample of spaces selected to cover the range of space types in the area: integrating and segregating, shopping and residential, and so on. The various types of encounter rates should be correlated with the spatial analyses to give a clear picture of the functioning of the area as it stands, and how it relates to the spatial structure.
- Use the analysis of the area to generate alternative sketch layouts, then insert these into the computer model of the area and re-run the analyses. This will show the effect of the area on each scheme and the effect of each scheme on the area. It is also possible at this stage to simulate likely movement patterns in each of the design alternatives, using the knowledge gained in the study of the existing area.
- Use this analysis to locate key buildings and facilities which need a particular type of relation to the surrounding area, and to the internal structure of space on this site.
- Then proceed as in the 'rules of thumb' section, but at each stage check the

design against the computer analysis by simply adapting the computer model (a few moments work). In this way, intuitive design and systematic evaluation can proceed cyclically to generate a scheme that satisfies the given objectives.

References

COLEMAN, A. (1985) *Utopia on Trial*. London: Hilary Shipman
GREATER LONDON COUNCIL (1978) *Introduction to Housing Layout*. London: Architectural Press
HANSON, J. and HILLIER, B. (1987) The architecture of community: Lausanne. *Architecture and Behav-*
iour: special issue on the work of the Unit for Architectural Studies, Bartlett School of Architecture
and Planning, University College London
HILLIER, B. and HANSON, J. (1984) *The Social Logic of Space*. Cambridge: Cambridge University Press
HILLIER, B. *et al.* (1983) Space syntax: a new urban perspective. *Architects' Journal*, 30 November,
pp. 47–63
HILLIER, B. *et al.* (1983) Space syntax: a new urban perspective. *Architects' Journal*, 30 November
JACOBS, J. (1961) *The Death and Life of the Great American Cities*. London: Random House; Pelican,
1965
KIRSCHENMANN, J.G. and MUSCHALEK, C. (1980) *Residential Districts*. London: Granada Publishing
(originally in German as *Quartiere zum Wohnen*; Deutsche Verlags-Anstalt, 1977)
LE CORBUSIER (1929) *La Ville Contemporaine* (trans. F. Etchells). London: Rodker
NEWMAN, O. (1972) *Defensible Space*. London: Architectural Press
SALAH-SALAH, F. (1987) Cities in the Sahara: spatial structure and generative processes. *Ph.D. thesis*,
Unit for Architectural Studies, University College London
TARN, J. (1973) *Five per cent philanthropy*. Cambridge: Cambridge University Press
ZELIOTIS, C. (1985) The spatial structure of Venice. *MSc thesis*, Unit for Architectural Studies, Univer-
sity College London

6

U
h

M

Int

Cur
betv
publ
own
adva
Th
incre
less c
its ph
The i
vand
housi
Thi
by the
Broad

Hous
block

Concep
ing the
evolve
During
that ha
form.
The s
into the
tured to
form in
facilities
self-cont
privately