Designing safer streets: an evidence-based approach

Through recent exchanges in the press, proponents of the New Urbanism and Secured by Design schools of thought have raised the old issue of how to best design urban places to promote safety and security in streets and enclaves. Unfortunately, neither camp has yet produced thorough and convincing evidence to support its position. ‘Space Syntax’, developed by Bill Hillier and his colleagues at University College London, provides an independent, evidence-based approach to the issue.

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The problem: natural policing

If the spatial design of our urban environment can reduce crime, then it is likely that it can do so by increasing the degree and effect of ‘natural policing’ — that is the way in which everyday movement and activity by people inhibits crime opportunity. The question is: does natural policing really exist? And if it does, what is the best way to maximise its effects?

First, we must acknowledge that there are two quite divergent views on this. The first is traceable to Jane Jacobs' book The Death and Life of the Great American Cities in 1962, in which she advocates open and permeable environments, in which strangers passing through spaces, as well as inhabitants, are part of the natural policing mechanism. The second, traceable to Oscar Newman's book Defensible Space in 1972, advocates closed and impermeable environments, in which inhabitants are the only natural police, and the fundamental mechanism is that inhabitants recognise strangers as intruders and challenge them.

We should not underestimate the differences between these two views. The first sees strangers as a source of safety, the second as a source of danger. In design terms, the first implies the classic urban formula of a continuous network of 'doubly constituted' (continuous house entrances opening onto the street on both sides) streets, the second a patchwork of inward-looking, 'defensible' enclaves — though what is supposed to happen in between the enclaves remains obscure.

Nor should we underestimate the behavioural implications of the two approaches. If you live on a normal urban street and come out of your house to see a stranger passing close to your front door, you would not feel insecure. In fact, the presence of strangers humanises the street and makes it feel more secure. If you were to challenge the stranger, you would be thought of as committing a public nuisance. However, if you had the same encounter on an upper level walkway, where the presence of a stranger would be abnormal, then you would feel nervous and inclined to challenge the stranger. In these circumstances you would not be thought of as committing a public nuisance, but behaving with urban virtue. Not only is our behaviour different, but its legitimations are different in different spatial circumstances, and these differences come from our readings of what the spatial circumstances lead us to expect. A fully 'Newmanised' environment would not be expected to sustain the ordinary civilities of urban life as manifested in ordinary street behaviour, and this, as we know from her text, would have been the despair of Jane Jacobs.

But the question we face today is not so much which combination of spatial circumstances and behaviour is best for urban civility, but which is best for security. It would be good if Jane Jacobs turned out to be right about security as well as civility, but we don’t know if this is the case. Opinion is divided. In the UK, a historic commitment to the Newmanian solution has recently been weakened, not only by research results, which suggest that street systems can be made relatively safe, but also by the sustainability agenda. If we are to revive urban living, and reduce car travel, then we must make towns and cities easier to move about on foot. The UK interpretation of Newmanism — the hierarchy of linked cul-de-sacs with a single point of entry — clearly encourages almost requires — the use of the car for even simple journeys. The question then is: can open and permeable environments be made secure? Or more simply, can streets be made safe?

The obvious answer is research. We should surely investigate crime patterns and rates in...
these contrasting types of environment and decide which is better on the basis of evidence. Unfortunately, it is not so simple. Every spatial process that generates our built environment is also a social process, and every spatial pattern of crime is also a social pattern of crime. The intimacy with which social and spatial processes are bound to each other, whether by markets sending rich people this way and poor people that, or bureaucracies assigning bad families to one estate and good families to another, means that we cannot examine the spatial distribution of crime against the background of a social and economic tabula rasa.

**Space syntax**

How can we then proceed? You will not be surprised to hear that I believe that space syntax, a form of computer modelling of space in built environments developed by my colleagues and myself at University College London and put into commercial practice by Space Syntax Limited, can serve as a powerful basic instrument for investigating the influence of space on crime patterns.

So what is space syntax? Space syntax in a set of computer techniques for modelling buildings and cities, in which spatial layout is first represented as systems of linked geometrical elements – lines when studying movement, convex elements when studying interaction, fields of view when examining more complex patterns of behaviour – and then analysed in terms of the relations between each spatial element and all the other spatial elements in the layout. For example, Figure 1 is a representation of London as the fewest and longest lines that pass through all of its public space, analysed mathematically to give a picture of the relative complexity of routes from each line to all others within three changes of direction. If it is effective, it measures something like our intuitive sense of how easy it is to move around a local network of spaces. We call this a ‘local integration’ analysis, and, even though it is a purely spatial analysis, it has proved a powerful predictor of movement patterns, both pedestrian and vehicular. Darker means a line is more ‘integrated’ into the local network, and has more movement potential in that network, through to light grey for ‘segmented’ and least movement potential.

There are several reasons why we think space syntax models are the right instrument for investigating urban crime patterns:

First, to investigate ‘natural policing’, we can, by definition, rarely know who is around when crimes are committed. But because space syntax does give a pretty reliable indication of movement potentials, we can use it as a surrogate to investigate the likely effect of movement on crime.

Second, social processes tend to be quite gross and to differentiate this urban area or that estate from others, but they are less virulent at the micro scale of differences between individual spaces. Space syntax allows us to investigate, with equal rigour, not only the differences between areas, but also the micro-patterns of differences within areas, using the same methodology. Since the latter is much less likely to be susceptible to social processes than the former, if we find comparable spatial effects at both levels they are not likely to be social effects in disguise.

Third, we can use space syntax to give spatial variables the same numerical status as non-spatial social and economic variables in our data table, so we can make space an equal partner in multivariate analysis. In this way we can compare the effect of space and the effect of socio-economic variables – though difficulties in accessing fine scale data usually confine such analysis to the area level.

**Hidden dangers**

Unfortunately, even with the help of as powerful an instrument as space syntax, there are still hidden analytic dangers lurking just below the surface, especially at the larger scales of analysis. First and most obviously, there is always an extremely uneven distribution of crime opportunities in cities because cities have uneven distributions of people and activity with more people, cars, activities in some areas than others, and, above all, far more people and activity, and there-
fore crime opportunities, in the central areas than elsewhere. So simplistic analyses will always show the highest rates of crime in the city centres, because this is where there is by far the highest concentration of crime opportunity are, and this might be taken – mistakenly, as we will see - to reinforce the idea that people are a source of danger.

For example, Figure 2 is the distribution of all crime in a twenty-month period in a west midland town in the UK. The highest concentration of crime is along the High Street (top right on the map, running north west to south east). However, nearly all of this is property crime against commercial premises. By definition this can only happen where commercial premises are located, and commercial property crime rates are often well above those for dwellings. Crime rates must clearly then always be relativised to opportunity, and like compared with like – for example city centres to city centres, not city centres to residential areas.

This applies not only to the number of premises offering crime opportunity. For example, in Valerie Alford’s excellent work on armed thefts from persons in Deptford, the highest incidence of crime is in the High Street, but by far the highest rates set against the number of pedestrians – and therefore the highest risk to individuals – were found in certain segregated streets linking housing estates. Again a naïve analysis would have produced an incomplete and even misleading answer.

This inherent difficulty in spatial analysis is exacerbated by the spatial distribution of social and economic factors. For example, it is well known from such excellent enquiries as the British Crime Survey, that burglary rates for the poorest groups in society tend to be a good deal higher than those for the most affluent groups, that those for inner urban areas are much higher than for suburban or rural areas, and that owner-occupiers with good incomes are much less likely to be burgled than renters on low incomes. Because these social distributions are also likely to be spatial distributions, in that poorer people tend to be concentrated in and around the inner city, and the better off tend to live farther out (with many exceptions, particularly in cities like London) it follows that a naïve syntax analysis is only likely to identify spatial patterns of crime which are themselves simply reflections of social patterns. This difficulty underlies the apparently simple question: are cul-de-sacs safer than through roads? Cul-de-sacs tend to be concentrated in newer, outer urban areas and to be occupied by owner-occupiers on better incomes, while inner urban areas have older through streets with more renters and lower incomes – thus social effects can easily be mistaken for spatial effects.

A third difficulty is that different crimes have different spatial logics: pickpockets are helped by crowded streets, muggers need victims one at a time, burglars need secluded access to dwellings and so on. Again Alford’s work shows that different crimes have different distributions (and also different distributions by night and day), but all are powerful related to space. An overly aggregated analysis might well have missed the genuinely singular influences on crime distributions that she articulates so well.

A fourth difficulty arises from the familiar search for ‘crime hot spots’. The identification of these can of course be very useful for the police in deciding where to deploy their resources, but from the point of view of identifying spatial influences on crime, they tend to be misleading because most hot spots turn out to have social explanations. Figure 3 for example, shows the pattern of burglary (the black dots) against the spatial layout (with footpaths shown but buildings removed for clarity) in an area of a UK town with a mixed but generally rather non-affluent population. There is a clear ‘hot spot’ in the two cul-de-sacs bottom of main map, left of centre in the picture. Should we therefore suspect that living in a cul-de-sac might predispose you to burglary?

There are two reasons why this would be an error. First, discussion with the local police revealed that this pair of cul-de-sacs was the local dumping ground for poor, often large families, and that the burglary was largely endogenous: kids pinching videos and so on from neighbours houses. As so often is the case, then, the spatial hot spot had a social explanation. But, second, even spatially, things are not what they seem. Dr Simon Shu, who carried out the research in this area, not only located each burglary to the dwelling, he also investigated the police records and reconstructed how each burglar gained access to the premises from public space, as indicated by the ‘tails’ attached to each dot. His interest was in what kinds of public space burglars generally used to gain access to dwellings, arguing that there was no purpose in living in a ‘safe’ street or cul-de-sac if you were in fact vulnerable from some kind of secondary access to the dwelling. In this area, we can see that in each and every case, the burglar gained access to the dwelling not from the cul-de-sac itself, but from the network of footpaths that surrounded the dwellings at the back and side. The lesson is then about secondary access to premises through footpaths, not about cul-de-sacs.

Looking for dispersed patterns

In fact, further inspection of Figure 3 suggests that the kind of spatial patterning we should be looking for is not spatial clusters, but the spatial diffusion of certain kinds of locations. If we look at the pattern of dots and tails above and to the left of the ‘hot spot’, we notice some remarkable consistencies. First, there are no burglaries on the first lines of sight into cul-de-sacs complexes from the through roads. The burglaries are dispersed but are usually found in the deep parts of cul-de-sacs, and most of all at the end of the cul-de-sac. If this pattern were repeated – as it has been in all the studies we have done – then it is in itself a refutation of Newman’s core argument, since by his reasoning the safest places would be at the ends of cul-de-sacs where small groups of neighbours can conjointly survey the sole space from which their dwelling are accessible, and less safe along the more anonymous entry lines where
strangers pass through on their way to the deeper parts of the cul-de-sac complex. This is the contrary of the case.

Even so, further analysis of Figure 3 shows that this cannot be the whole story. The clearest pattern of burglary—though hardly a ‘hot spot’ in the sense that the two cul-de-sacs were—is found top left in the deep parts of a large cul-de-sac complex, and most especially where the linking pedestrian footpaths are found. A suggestive reason why this might be the case can be shown by replacing the plan with the analysed axial map, as in Figure 4 (note that the pair of cul-de-sacs with the ‘hot spot’ do not appear as cul-de-sacs because here we are analysing the whole system of roads and footpaths). This shows very graphically that in general the pattern of burglary shifts to the lighter shaded spaces—that is, those with low movement potential and local visibility. Not surprisingly, perhaps, burglars seek to gain access to (and escape from, of course) premises by way of lines where they are likely to be alone and that have limited visual connection to other spaces.

We can show the other side of this by looking at another of Shu’s cases. Figure 5 shows the layout of a housing area in a UK new town with fairly homogeneous social composition, again with burglaries as dots with tails. The most striking thing about the distribution of dots is their absence in certain parts. Most strikingly, not a single one is found on the long main residential road. This is a fairly wide and linear road, and it is more or less continuously lined on both sides with dwelling entrances, so that the comparative length and linearity of the spaces (compared with others in the layout) gives unusually good intervisibility of dwelling entrances. This seems to be a significant property in terms of crime inhibition. Figure 6, the analysed axial map of Figure 5, shows the distribution of burglary against the pattern of integration. Once again there is a clear shift of burglary from linear, integrated spaces, whose linearity also imparts good intervisibility, toward shorter and poorly ‘constituted’ (by dwelling entrances) lighter shaded spaces.

So are streets safer?

Does this then mean that streets are safer? Not necessarily. Figure 7 shows the layout with burglaries in a third area from Shu’s study; this time part of a highly affluent town in the UK. We should compare two through roads, each running bottom right to top left, but one on the edge of the area, the other through the main residential area. The through road within the area is wide and is everywhere doubly constituted with excellent intervisibility of dwelling entrances across considerable distances—and has not a single case of burglary. In contrast, on the through road on the edge of the area, which is even more upmarket, houses cannot be seen, most being concealed by four metre hedges and distanced by long drive-ways. In some parts, the large houses have been demolished and replaced by small groups of houses off what Shu calls ‘cul-de-sac drives’, most of which are well concealed from the road. In contrast to the first road, this one is a veritable burglary ‘hot line’, with a high rate of burglary when set against the small number of houses.

This illustrates what we call the ‘flip over’ effect for integrated streets. When integrated streets are continuously constituted with ‘joined-up’ buildings on both sides, reasonably linear to give good intervisibility of the front entrances, and having no secondary access in the form of side or back alleys or exposure to other public space such as parks or car parks, then integrated streets tend to be fairly safe. But when the integrated street does have these ‘local’ vulnerability factors then it can become more vulnerable than other types of space. This points to a critical lesson in space syntax crime analysis: spatial factors do not operate once at a time to increase of reduce security—they interact. Most importantly, local and global spatial factors interact, and both must be right together if security is to be enhanced.

We can illustrate the ‘flip over’ effect with singular clarity by coming back to the town shown in Figure 2. Figure 8 shows the pattern of burglary against the background of the axial map. At first sight, it suggests particularly high rates of burglary where the two main integrating lines intersect. However, if we plot each burglary on the line from which access to the premises was gained, we find that in every case, access was gained from the network of alleys around and between the houses. Within large, relatively segregated area of lighter shaded lines, many more burglaries are from the front of the dwelling. If we then move to the extreme left limit of that area, we find two parallel lines of houses with an integrated road running north–south down one side, and an open park on the other. Again, there seems to be quite a high rate of burglary. But if we again plot burglaries from their point of access, again we find that every burglary from the road was committed from the alleys between the lines of houses. Of the houses facing the park, however, two were burgled from the park-side as well as others from the alley—an instance of how not having your house entrance facing others increases your vulnerability, even if you have a nice view!

The conclusion is that the relative safety of streets depends very much on local spatial conditions. But if the local conditions are right—continuous constitution on both sides, linearity and so strong intervisibility, and no secondary access—then traditional streets can be pretty safe places. But we must beware of the flip over effect, where changes in local conditions can suddenly make them very much less safe.

In fact, we also find a ‘flip over’ effect in cul-de-sacs. Where cul-de-sacs are simple and linear have a visual connection to a through street (part of the classic urban formula), and also have the local conditions right, then they can be very safe places. However, when they are combined together to form hierarchical systems of interconnected cul-de-sacs, they can become extremely vulnerable, especially if the deep parts of the cul-de-sac complex are reconnected by segregated footpaths.

So what does the best evidence tell us about crime and space?

So what does the best evidence tell us about crime and space? First, it gives us some warning about methodology. To detect the real influence of space on crime we need precise, locationally specific data, and we need methodologies of spatial analysis capable of dealing with some precision with the interaction between local (the vulnerability of that space or that house) and global (the layout type of the area) spatial factors. We need both because precise data is useless if the spatial analysis cannot deal with that precision
effectively. For example, GIS programmes that take crime distributions and create threedimensional 'crime surfaces' are, from the point of view of understanding the relation between crime and design, taking precise data and making it fuzzy. The raw plot of crime on a map is usually more informative than the 'crime surface', especially if we know what we are looking for and what the dangers are facing analysis.

Substantially, though, a provisional picture is beginning to emerge. However complex, this picture is capable of supporting 'best evidence' design guidance, providing we allow that it will need to be updated as new studies come on stream. Much of this work is being done in London, where space syntax models are currently being used to understand and address crime issues—both by the Space Syntax Laboratory in ESPRC-funded research and at Space Syntax Limited on projects such as the creation of the Elephant and Castle Masterplan and as part of the EU-funded Stockwell Urban II Community Initiative.

What we feel can be safely said on present evidence comes are three levels: the dwelling itself and its relation to its neighbours (but omitting target hardening and alarms which are separate issues); the type of space in which the dwelling is located—through street, cul-de-sac, integrated (more movement potential) or segregated (less movement potential) and so on; and the spatial type of area in which the dwelling is located—traditional street pattern, complex of vehicular cul-de-sacs linked by footpaths, and so on.

At the level of the dwelling, there are pretty unambiguous results. The British Crime Survey shows that if you control for social and economic variables—meaning, in effect, that you take the same family and put them in different types of dwelling—then the most secure type is the flat, then the mid-terrace house, then the semi-detached house, and finally the detached house, which is the least secure. In other words, the fewer sides on which your dwelling is exposed to the public realm the safer you are likely to be. This result shows the vital importance of multivariate analysis, because the raw data shown exactly the contrary pattern. (Unfortunately, many newspapers tend to report only on the raw picture, thus promulgating exactly the wrong message). We have found exactly the same thing, in exactly the same order, with the additional vital fact that not only are flats the safest kind of dwelling and detached houses the least safe, but also that in flats you are a good deal safer off the ground than on the ground.

Putting this together with our findings on secondary exposure and having the entrances of 'opposite neighbours' facing you, these results seem to indicate some powerful and simple factors inhibiting crime that deal with nothing more complex than the embedding of the dwelling in its immediate surroundings. This can be summarised in very simple design guidance:

- join buildings together
- avoid any kind of secondary access (even to a high wall, if it is exposed to the public realm)
- make sure that all public spaces are continuously 'constituted' by dwelling entrances (including the entrances to blocks of flats); and
- maximise the intervisibility of these entrances by a linear rather than a broken up layout.

At the level of the type of space in which the dwelling is embedded, the picture is more complex. Because of the 'flip over' effects for both through streets and cul-de-sacs. But although we cannot say that cul-de-sacs or through roads are good in themselves, we can say that there are ways of designing each that are likely to optimise security. Both streets and cul-de-sacs should be:

a) reasonably well integrated (adding a simple linear cul-de-sac to a through street does not decrease integration—in fact it increases the integration value of the street), and
b) designed in a doubly constituted linear form. All cul-de-sacs should be on simple lines linking them visually to through routes, and they should not form hierarchical complexes segregated from the main local circulation system. The worst type of layout seems to be the hierarchy of cul-de-sacs linked by segregated footpaths to provide pedestrian permeability. However integrated streets with significant local vulnerability—for example, the system of back alleys shown in Figure 2 can also be pretty bad.

At the level of the overall layout, we can say, fairly unambiguously, that reasonably regular street layouts with fairly large blocks (to structure movement and reduce unnecessary permeability) are best. Provided the 'flip over effect' is avoided by the local spatial detail. If such a layout is then interspersed with simple linear cul-de-sacs directly attached to the through street, then the cul-de-sacs may well be the most secure parts of the layout—but only if the street system is there in the first place to keep the cul-de-sacs simple and linear.

So a layout works as a whole. We cannot isolate elements and say that this is good and that is bad. It all depends on how the elements are put together in themselves and how they are combined to form the overall layout. Although pick-pockets need busy streets, and ruggers locations where integration turns to segregation so that victims are available one at a time, it is clear that burglars—and to a lesser extent car criminals—need secluded access. The less we provide it either by breaking up layouts into poorly used, low visibility public spaces, or creating secluded secondary access to premises, the more difficult the burglar's job will be.