Communities of Co-presence and Surveillance:

How public open space shapes awareness and behaviour in residential developments

Julienne Hanson and Reem Zako
University College London, UK

Abstract
This paper examines a series of urban transformations that has taken place in selected inner city residential districts from three major English cities, London, Manchester and Sheffield, by carrying out a configurational analysis of thirty representative housing developments built at different historical periods during the course of the last two centuries. The objective of the analysis is to pinpoint those variables that are associated with 'liveability' in the design and experience of external space in residential neighbourhoods and any spatial factors that may contribute to the abuse of public space and antisocial behaviour.

The investigative methodology combines space syntax tools with the geographical methods of urban morphology and is based on representations and quantitative measures of key properties of the urban residential environment such as land uses, figure/ground ratios for the urban blocks, the amount and type of public open space, the way the building frontages and facades create boundaries and interfaces between interior and exterior space and axial representations of the interconnectedness and accessibility of each housing development within its immediate and embedded urban context. It therefore differs from more architecturally inspired housing studies in that it extends beyond the site boundaries of the housing development to study the relationship between the scheme and its wider urban context.

The juxtaposition of these analytic layers with a postal opinion survey of all the households living in each residential development, provides an opportunity to examine the occurrence of various types of nuisance, such as poor upkeep, heavy road traffic, vacant sites and buildings and antisocial behaviour. Simple correlations between syntactic variables and mean 'liveability' scores for each scheme fail to reveal any significant relationships, but a close visual inspection of the locations where problems arise suggest that each is associated with a clutch of spatial factors that may be conducive to poor liveability and especially to antisocial behaviour. The paper concludes with some speculations about how the housing morphologies of different historical periods give a material form to different conceptions of natural movement, co-presence and surveillance. Four representative case studies from Clerkenwell within the London Borough of Islington will be presented to illustrate this approach to the design of public open space in residential areas and its findings

1. Introduction

The research reported here was carried out within VivaCity 2020[1] , a large, government-funded, university-led and industry-partnered research consortium (2003-2008) developed in response to the UK government's need to promote more sustainable urban environments. The consortium is addressing

ways in which economic vitality and social inclusion can be enhanced through the design of the urban environment, thus improving the quality of urban life. The work package that underpins the account is concerned with showing how the design and layout of housing can make a contribution to the sustainability of the urban realm, a key planning objective for new inner city residential and mixed use developments in the UK. Fieldwork areas for the housing study were dictated by the demands of the consortium as a whole.

2

Location	Traditional Pre 1890	Early Modern 1891-1944	High Modern 1945-1980	Postmodern Post 1980
Clerkenwell	Lloyd Baker Estate 1819-1820 **Myddleton Square 1824-1827** Cavendish Mansions 1882	The Bourne Estate 1901-1903 Charles Rowan House 1928 Claremont Close, 1920 **Margery Street Estate 1930-33** Trinity Court 1934	Spa Green Estate, 1948-1950 Bevin Court 1954 Langdon House 1963 **Finsbury Estate 1966-68** Weston Rise 1964-69 The Triangle 1972 New Calthorpe Estate, 1978	Catherine Griffiths 1981 Warner House, built as a factory 1930s, refurbished as housing in 1995 Clerkenwell Central 1998 **Brewhouse Yard 2001-2003** Dallington Street 2001-2003
Manchester	Traditional Terraces 1880		Bentley House Estate 1947-1949 Royce Court 1968	Homes For Change 1996 Rolls Crescent 1997
Sheffield		Edward St. Flats mid 1930s	Exeter Drive 1968	Westfield Terrace 1985 Broomhall 1990 West One 2003-2004
	4	6	10	10

Table 1. Composition of the sample of thirty residential developments, by city, construction cycle and date of construction. The illustrative case studies are highlighted.

The three cities where the research was carried out have very different origins and place histories. Clerkenwell is a mixed use 'urban village' close to the heart of the City, London's financial centre, that dates back well over a thousand years and has evolved in a piecemeal, organic and un-planned way. Twenty housing developments from Clerkenwell have been included in the database. Hulme is a 19th century, working class industrial suburb close to the centre of Manchester, that grew up rapidly in the heyday of the cotton industry as a mixed industrial district of large factories/ware-houses and small terraced houses, and has since been redeveloped twice, during the 1960s and the 1990s. The Devonshire Quarter of Sheffield also developed as a residential and commercial area

during the 19th century, based on traditional light industries such as cutlery manufacture, but it has recently taken on a new lease of life as the focus of a new 'urban village' with residential and mixed uses based on specialist shopping, leisure and entertainment facilities. Hulme and Sheffield have each contributed five schemes to the database, see Table 1. The selected case studies are typical of the kind of housing found in each city, but they vary in terms of their morphological characteristics, age and type of housing, tenure and the social diversity of their residents.

Construction dates for the thirty residential areas that form the database for configurational analysis are shown in Table 1. The time bands utilised here are based on those adopted by the English House Condition Survey (ODPM, 2003), which provides official government statistics for all housing in England. The EHCS typology differentiates the major construction cycles that have occurred in the English housing stock during the last two hundred years[2]. These cycles were produced by global phenomena that included two world wars and a worldwide economic depression, as well as a decline in the UK's industrial base in favour of a service economy and the rise of consumerism and the information society. Each major cycle is associated with different building materials, construction methods and preferred built forms, and also with different types of tenure. Quantitative data have been calculated for all thirty schemes, to facilitate the comparison of average data for the whole sample, with that for each construction phase, city and illustrative housing development. These four housing schemes will now be briefly described.

3

Figure 1. Location maps of the four illustrative housing developments from Clerkenwell.

Myddleton Square, top left of Figure 1, is a typical late Georgian square that forms part of a larger development of London streets and squares that was laid out and lined with uniform four storey terraced houses between 1824-27. It is typical of traditional, fairly affluent housing built by speculative house builders for sale or rent to the middle classes, before the advent of state housing. The Margery Street Estate, top right, is an unremarkable example of state housing that was built by the Finsbury Borough Council in 1928 to house the working classes. The layout comprises eight detached four, five and six storey walk-up blocks that hug the perimeter of the wedge-shaped site and surround three visually linked but physically separated open spaces in the heart of the estate. All the doors overlook these central spaces. The Finsbury Estate, bottom left, comprises two high-rise and two low-rise blocks of purpose built flats in a typical Brutalist style 'mixed development' of the High Modern period. Through the configuration of the four blocks, two large open spaces have been created, which are protected from the surrounding street system. Brewhouse Yard, bottom right, is a mixed-use commercial and residential scheme developed by Berkeley Homes for sale to private middle class house buyers between 2001 and 2003. The development comprises four 6-9-storey blocks around a central square and six terraced houses in a small mews development to the south of the main piazza. An important part of the design concept has been to create a new 'hierarchy' of public open spaces and connecting routes through the site. The transparent glass office of the scheme's 24/7 concierge service is located in a strategic position on this square, overlooking all the pedestrian routes into and through the development.

2. Methodology

Data for the thirty residential areas were collected between the spring of 2005 (Clerkenwell) and the autumn of 2005 (Sheffield and Manchester), by two consecutive groups of students from the M.Sc. in Advanced Architectural Studies at UCL. Primary data were gathered on the types of land uses designated for planning purposes, the metric areas of all types of building and hard and soft landscaping, the metric length and type of all building boundaries and street frontages, the layout and type of all roads and paths. The survey work was supported by a detailed photographic survey of each development, a search of local historical and archival sources to unearth the history and evolution of each scheme and a note was made of the precise location of any obvious anti-social activity such as fly-tipping, vandalism or graffiti.

The data produced by the students were subsequently re-analysed by the research team and assembled into a statistical database that allowed morphological and configurational information to be compared with relevant demographic and socio-economic data available on public domain databases such as census data, measures of social deprivation, crime data and the like. At this stage, metric measurements were converted to proportions, to allow comparisons to be drawn between residential developments of different sizes.

The axial maps of the thirty residential areas in Clerkenwell, Hulme and the Devonshire Quarter, were drawn, checked on-site for accuracy and inserted into a hinterland of between three and seven kilometres radius in order to eliminate any 'edge-effects'. All the well tried and tested axial measures were calculated, both for the residential developments considered in isolation and embedded in their respective hinterlands, but in the account that follows the global (rad=n) integration of each housing development within its hinterland has been selected as the most useful representation for comparative purposes. The account that follows will begin from a figure/ground analysis of the buildings and open spaces, and will move on to consider the character of the open spaces, the proportions of primary (building) and secondary (open space) boundaries and how these relate to axial organisation of each scheme.

Finally, during the summer of 2006, a questionnaire-based postal survey was distributed to all the households living in twenty-nine [3] out of the thirty housing developments in the sample. The questionnaire was based on the British government's [4] 'liveability agenda' that has been developed in recent years (ODPM, 2006) to capture the residential satisfaction of an area. It comprised sixteen questions, broadly divided in three themes: upkeep, management or misuse of the private and public space and buildings, road traffic and transport-related issues and abandonment or non-residential use of domestic property. A further eight questions were incorporated, relating to antisocial behaviour. Householders were asked to score each issue on a scale ranging from 1 (indicating no problems) to 5 (indicating major problems). The housing areas could then be rank ordered from the most liveable (lowest score) to the least liveable (highest score), and the most serious issues (scoring higher than 3) affecting each residential neighbourhood could be identified. A map was provided, so that householders could indicate the location of any liveability issues that were causing problems on or close to the development. These could then be interrogated, to see if any relationships could be detected between spatial variables and instances of poor liveability or antisocial behaviour.

3. Figure/Ground

The foundation representation in 'space syntax', on which all other representations and measures are based, depicts the figure/ground map for each housing scheme in the form of a plan or Nolli map [5] that contrasts the buildings - shown in solid black - with the open spaces - shown in white. Figure 2, below, shows the figure/ground map for the four selected residential areas. This way of representing urban space has been popularised by Koetter and Rowe (1978) in their book, Collage City, as well as by Hillier and Hanson (1984).

Table 2 presents quantitative data for the figure / ground ratio and the proportion of the ground or unbuilt space dedicated to various outdoor functions, for the whole sample organised into the four construction cycle time bands, and Table 3 gives these for the illustrative examples. Table 2 shows that the average ratio for the whole sample is 2.9:1 [6] ground to figure, meaning that there is nearly three times as much unbuilt space as there is building footprint, but this overall mean disguises important time-related differences between the various schemes in the sample. For the traditional

5

(pre1890) urban blocks, the mean ratio is 3.5:1, whilst the early modern estates (1891-1944) and high modern (1945-1980) housing schemes share the slightly higher mean ratio (more unbuilt space) of 3.9:1. Despite its higher ground coverage, the traditional streets and squares morphology is not significantly more built-up than the early and high modern housing estates, but for the post-modern (post 1980) period the mean figure/ground ratio is a much lower figure (more built space) of 1.9:1.
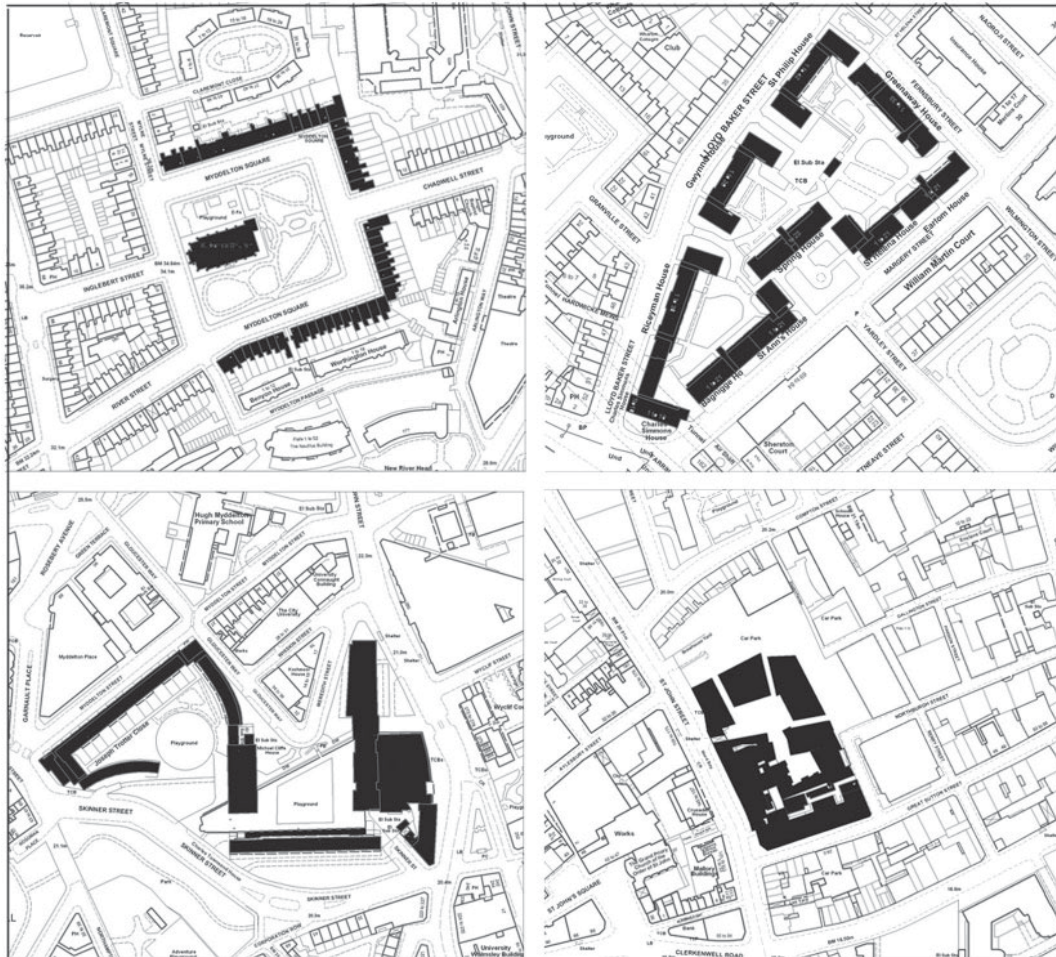
Figure 2. Figure / ground maps of the four illustrative developments from Clerkenwell

Variable	Traditional	Early Modern	High Modern	Post Modern	Postmodern Streets	Postmodern MUUBs	Average
figure / ground ratio	3.541:1	3.859:1	3.929:1	1.910:1	2.857:1	1.166:1	2.870:1
paths as % ground	41.231	47.413	37.932	49.375	37.63	67.22	44.413
green as % ground	25.039	31.922	34.039	3.208	2.47	4.24	20.956
gardens % ground	31.399	15.621	12.308	23.556	36.01	6.12	19.534
% surface parking	1.5	3.257	6.853	6.916	9.44	3.39	5.533

Table 2. Quantitative data relating to the figure / ground and open space characteristics of the thirty residential developments, by EHCS time band

The figure/ground ratios for Myddleton Square (4.7:1), Margery Street (4.1:1) and Finsbury Square (4:1) are all a little higher than their respective means, confirming that despite their Central London location the illustrative residential developments have slightly more generous ground level

external spaces than the contemporary schemes from the sample. However, the figure/ground ratio for Brewhouse Yard, 1.1:1, is far lower than the mean for the period. Almost half of the plot has been built on.

A closer examination of the ten post-modern schemes reveals that they fall into two distinct sub-types: half are low rise 'street layouts' that are trying through their built form to replicate the urban fabric of the traditional pre-1980 era and half are innovative mixed use inner-city urban blocks (MUUBs), whose protagonists claim to be a sustainable way of combining residential with non-residential uses (Lord Rogers, 1999, Rudlin and Falk, 1999). Brewhouse Yard is a typical example of this type of development. The two sub-types have very different figure/ground ratios: 2.9:1 for the postmodern 'streets', which is close to the mean for the whole sample, and 1.2:1 for the 'MUUBs'. Brewhouse Yard is therefore typical of MUUBs in illustrating how extreme the site coverage has become in this particular type of post-modern development.

Variable	Myddleton Square	Margery St Estate	Finsbury Estate	Brewhouse Yard
figure / ground ratio	4.705:1	4.076:1	3.963:1	1.122:1
total building area in sq.m.	14225	17385	47171	25680
residential/non-residential area	6.7:1	-	11.2:1	2.2:1
households per hectare	58	191	176	306
mean area/housing unit, sq.m.	90	63	96	90
paths as % of ground/unbuilt	35.57	45.76	36.73	95.29
green space as % of ground	31.93	18.13	45.94	-
private gardens as % ground	29.18	28.98	11.27	0.75
surface parking as % ground	-	7.14	6.06	3.96

Table 3. Quantitative data relating to the figure / ground and open space characteristics of the four illustrative examples from Clerkenwell

However, building footprint gives few clues about the composition of the built form, as it does not take account of the number of stories. The built forms (described earlier) of the illustrative schemes vary widely in their height, measured in storeys. The total building area of the four schemes (in square metres), which does take account of the number of storeys as opposed to the area of the building footprint, shown as a ranked size order from the smallest to the largest scheme, is Myddleton Square (14,225 sq.m.), Margery Street (17,385 sq.m.), Brewhouse Yard (25,680 sq.m.) and Finsbury Square (47,171 sq.m.) respectively.

6

Secondly, housing density itself can be measured in various ways. Despite the fact that it seems to be a simple concept, density is quite difficult to pin down or measure accurately. The development and the residential density draw attention to the mix of uses accommodated in a housing development, which may not be exclusively residential. For the sample of thirty schemes, ten are exclusively housing, whilst the most diverse mix has eight different land uses in addition to the residential use [7].

So far as the four illustrative schemes are concerned, Margery Street is exclusively housing, Myddleton Square has two additional uses to residential, the Finsbury Estate has three and Brewhouse Yard has four different non-residential uses. The proportion of residential to non-residential area of the four illustrative schemes is 0 (Margery Street), 6.7:1 (Myddleton Square), 11.2:1 (Finsbury Square) and 2.2:1 (Brewhouse Yard). In terms of residential diversity, then, Margery Street is the most homogeneous in terms of the range of uses it accommodates and the area given over to non-residential uses, and Brewhouse Yard is the most diverse. It is both home to a greater variety of uses and also they take up a far greater proportion of the total building area, mostly at or close to ground level so that retail and commercial activities are far more visible to the passer-by than the apartments on the upper levels of the development.

For this research, household density, the most accessible way to measure residential density, was adopted. The four illustrative schemes clearly show that this also varies widely at different historical periods: Myddleton Square has 58 household per hectare, whilst Finsbury Square has 176, Margery Street has 191 and Brewhouse Yard has 306 households per hectare. This very high residential development density, as well as the diversity of the scheme, are typical of the new MUUB housing typology.

The mean area per housing unit also varies widely. The relevant figures are 63 sq.m./dwelling for Margery Street, 90 sq.m./dwelling for both Myddleton Square and Brewhouse Yard, and 96 sq.m./dwelling for the Finsbury Estate. The most generous provision coincides with the post-war state housing programme, when minimum standards applied to all public sector housing (Parker Morris, 1968). Although MUUB have acquired a reputation for accommodating small, one and two person households, the average flat size at Brewhouse Yard is the same as a typical flat in a traditional neighbourhood of terraced houses.
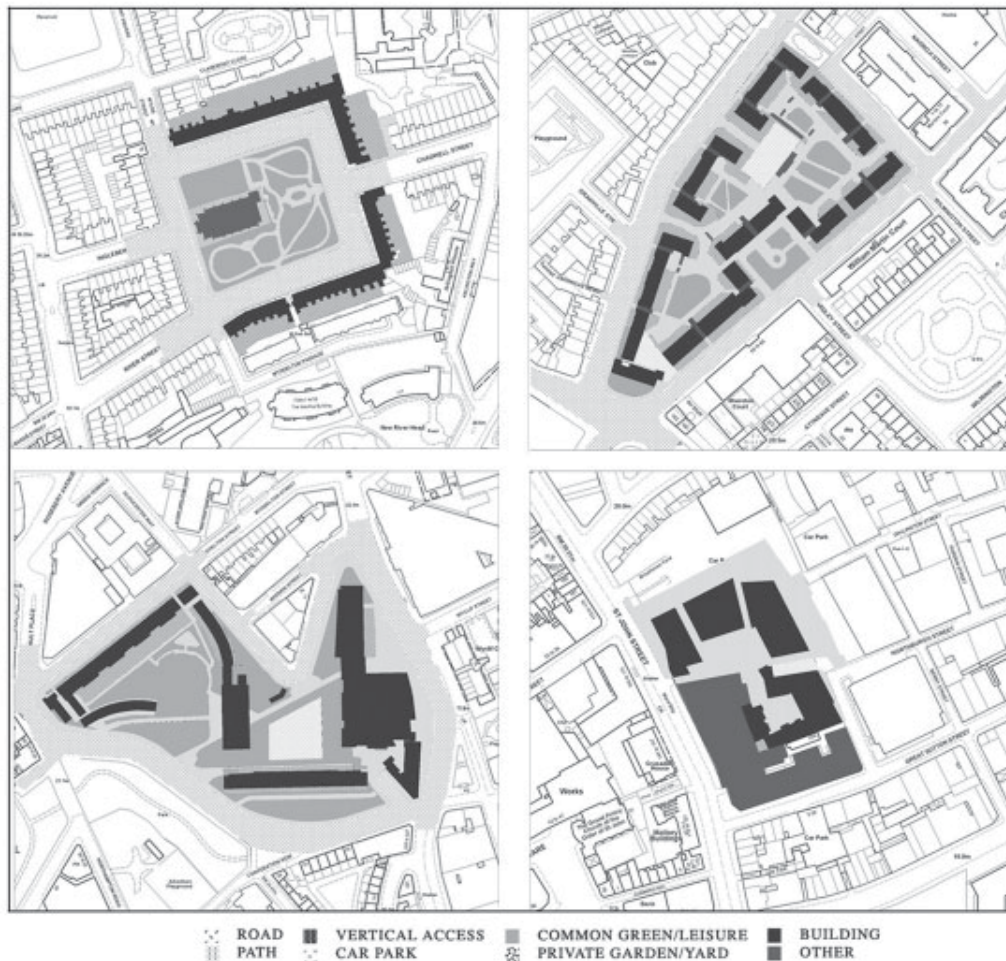
4. Open Spaces

The next representation classifies all of the 'ground'; that is, all the unbuilt open spaces within the urban blocks on which the buildings stand, in order to identify the use and 'ownership' of those spaces. Unclear ownership of spaces in the public domain has been identified with social malaise, (Coleman, 1990). The typology differentiates between pedestrian paths and other hard landscaped areas, areas for car parking, common green areas, private yards and gardens and areas of restricted access that no one can use. The proportions as well as the areas of each type of space in each estate or residential development have been calculated, see Figure 3 below and Tables 2 and 3 shown previously, in order to eliminate the effects of developments of different metric areas.

Unsurprisingly, the most common space type is paths. On average, paths occupy 44% of the ground, but the proportion of open space devoted to public circulation varies from as little 38% in the high modern era as to as much as 49% in the postmodern period. For the four illustrative schemes, however, the relevant figures are 36% for Myddleton Square, 46% for Margery Street, 37% for the

8

Finsbury Estate and an astonishing 95% for Brewhouse Yard, where the ground has been used to create an urban piazza that functions as a new public space for the entire city and not just the residents of the scheme. If the postmodern part of the urban database is split into the streets and the MUUBs, then the average amount of space devoted to paths in the 'street layouts' is 37%, less than the mean for the sample as a whole, but the comparable figure for the MUUBs is nearly twice this at 67%, admittedly not as extreme as at Brewhouse Yard but nonetheless much higher than in all previous eras.

9

Figure 3. Open space analysis of the four illustrative housing developments from Clerkenwell

A common theme across all the historical periods represented in the database, is that of creating shared, open green spaces for the local community to use. Common green spaces are the next most prevalent space type, occupying on average 21% of all the unbuilt space in the sample. A quarter of the unbuilt space is dedicated to this use in the traditional era, and it is greatest in the high modern estates (34%) but this use has almost disappeared in the postmodern period where only 3% of all unbuilt space is dedicated to common green areas. For the four illustrative examples, common greens are found at Myddleton Square, where the central garden takes up 32% of the ground, Margery Street (18%) and the Finsbury Estate (46%), but there is no common green space at all at Brewhouse Yard. If the postmodern part of the urban database is split into the streets and the MUUBs as before, this confirms that shared green space has almost disappeared as a phenomenon associated with contemporary housing, whether this be of a streets and squares (2%) or a MUUB (4%) typology.

Private gardens occupy, on average, another 20% of all the unbuilt space. These are most prevalent in traditional housing layouts, occupying, on average, 31% of unbuilt space, and in the postmodern period (24%), whilst gardens are least numerous in the early and high modern periods (16% and 12% respectively). Thus, generally speaking, the proportion of the ground dedicated to public and private green space is in an inverse ratio. A third of the schemes from across all time periods have few or no private gardens, including Brewhouse Yard, where less than 1% of the ground is devoted to private gardens. However, if the postmodern part of the urban database is split into the streets and the MUUBs, then a profound difference emerges in respect of private green space, with 36% of open space in postmodern streets given to this function, representing an even higher proportion of the 'ground' than in the traditional layouts, and just 6% on average in MUUB.

Perry (LeGates and Stout, 1998) was one of the first to observe that the car was one of the most significant drivers of change in housing morphology and this has been reiterated many times since (McCluskey 1992; Jenks et al. 1996, Panerai et al., 2004). The average proportion of unbuilt space dedicated to car parking across the sample is 6%, but this masks a profound split between the two pre WWII eras, which dedicated 2% and 3% respectively of the ground to car parking space, and the two post war eras, each of which had 7% of the ground for car parking. The figures for the illustrative schemes show that whilst Myddleton Square does not set any space at all aside for cars, which are parked on the streets, Margery Street gives 7% of outdoor space to car parking, which is higher than the average for the period, and Finsbury Square has 6%, but Brewhouse Yard has 4%, lower than the average for the period because it provides a supervised underground car park for residents. If the postmodern part of the urban database is split into the streets and the MUUBs, then the postmodern streets are unlike their traditional counterparts in that a quite generous 9% of the unbuilt space is dedicated to car parking, whilst the comparable figure for surface parking in the MUUBs is 3%, the same level as before the last world war when cars were still a novelty.

5. Boundaries

The main way in which the open spaces of the urban landscape are laid out on the ground and shaped architecturally, is by the combined placement of primary and secondary boundaries. Primary boundaries are materially formed from the perimeter of the 'figure' or building footprint that outlines the building's shape and the position of its facades. Secondary boundaries are the walls, fences and the like, that divide up the 'ground' or unbuilt spaces on which the buildings are placed, see Table 4.

The primary (building) boundaries comprise different proportions of the total boundaries that define the open space of residential developments in different time periods. Some developments have few secondary (open space) barriers whilst others have elaborate landscaped external spaces that shape, define and add complexity to the layout of the public space of the residential developments. For the whole sample, the proportion of primary to secondary boundaries is 3:2, or 60% primary boundary and 40% secondary boundary, but as before, this relationship differs for different time periods.

Variable	Traditional	Early Modern	High Modern	Post Modern	Postmodern Streets	Postmodern MUUBs	Sample
% primary	53	61	57	65	51	83	60
% doors and windows	54	29	30	34	47	15	34
% blank walls	14	12	25	21	17	28	20
% windows only	16	32	14	15	20	8	18
% upper level visibility	14	22	17	14	10	20	16
% active frontages	2	2	5	12	4	23	7
% doors only	-	2	9	3	2	5	4
% secondary	47	39	43	35	49	17	40
% low fences	35	28	20	55	63	41	36
% hi see through fences	26	22	33	22	8	46	26
% high opaque fences	31	17	30	21	28	8	24
% very low fences	7	34	17	2	1	5	14

Table 4. Average proportions of primary to secondary boundaries on thirty housing developments, by EHCS time band.

For the traditional developments, the ratio is close to that for the whole sample, 53% primary to 47% secondary boundaries. In the early modern period, this rises to 61% primary and 39% secondary boundaries, suggesting that the figure ground relationship of estates built before WWII was simple, with relatively undifferentiated external space. In the high modern period, the ratio returns to 57% and 43% respectively and in the postmodern era it climbs again to 65% primary and 35% secondary boundaries. Looking separately at the postmodern streets and MUUBs, the relevant percentages for the postmodern streets are 51% primary to 49% secondary boundaries, almost the same as for traditional streets, but for the MUUBs it is 83% primary and 17% secondary boundaries, showing that for this particular residential typology, the space is overwhelmingly shaped by buildings and not nearly so much by landscaping.

The definition of buildings and open spaces in the housing database by boundaries of various kinds, has been further broken down to examine the proportion of primary (building) boundaries that comprise 'active' frontages constituted by retail or commercial premises, houses or flats with doors and windows at ground level, homes with just doors or just windows at ground level, buildings with blank walls at ground level and upper level visibility, and buildings with totally blank walls. Secondary (open space) boundaries have been subdivided to identify which boundaries are high [8] opaque walls/fences, high see-through walls/fences, low [9] walls/fences or very low walls/fences that can easily be stepped over.

Figure 4. The various types of primary and secondary boundaries found in one of the four illustrative developments, Margery Street Estate, Clerkenwell.

So far as primary boundaries are concerned, the mean figures for the whole sample, see Table 5 , reveal that the primary boundary with the greatest proportion of metric length is constituted by doors and windows (34%), followed by blank walls (20%), windows only (18%), and upper level visibility (16%). The other two categories, active frontages (7%) and doors only (4%) are only weakly represented. These relationships can be further simplified to differentiate the proportion of the boundaries at ground level that are permeable (active frontages, doors and windows, doors), as opposed to transparent, thus permitting visibility at ground level (windows) or that are opaque and impermeable at the ground level (upper level visibility, blank walls). For the sample as a whole, just under half of all primary boundaries are permeable (46%), just over a third are opaque and impermeable (36%) and just over a fifth permit a visual link (18%).

The comparable ratios for the four illustrative residential developments are as follows: 56% and 44% for Myddleton Square, which closely follows the mean for the time band, and 67% and 32% for Margery Street Estate, which suggests that the estate is rather more constituted by buildings and rather less by walls and fences than was typical of the time. The proportions for the Finsbury Estate are 45% and 55% respectively, which indicates that the building boundaries there are rather less significant and the open space barriers more so than is typical of developments from this time band. However, the values of 100% primary and 0% secondary boundaries in the case of Brewhouse Yard marks it out as a very different kind of development from those found in all previous historical eras under consideration.

The most consistent way of relating the buildings to open space right up until the postmodern era is by doors and windows, though in the early modern period windows only are even more common and in the high modern period blank walls are also often found. Doors and windows are also the most common type of façade on postmodern streets, but blank walls and active frontages are prevalent in the MUUBs. showing a radical discontinuity with earlier housing morphologies. The main secondary boundaries for both traditional and postmodern streets are low (front) and high opaque (back) fences. The early modern period employs low and very low fences to designate public space, which is suggestive of a more expressive or symbolic boundary maintenance, whilst high see-through and opaque fences are more common on high modern estates, suggesting a more instrumental order is being imposed, whilst the MUUBs have very few secondary boundaries at all.

Variable	Myddleton Square	Margery St Estate	Finsbury Estate	Brewhouse Yard	Sample
% primary boundaries	56	67	45	100	60
% doors and windows	93	58	25	4	34
% blank walls	4	8	5	24	20
% windows only	3	-	29	-	18
% upper level visibility	-	25	31	19	16
% active frontages	-	-	9	48	7
% doors only	-	9	less than 1%	5	4
% secondary boundaries	44	32	55	0	40
% low fences	100	47	8	-	36
% hi see through fences	-	-	30	-	26
% high opaque fences	-	-	2	-	24
% very low fences	-	53	60	-	14

Table 5. Proportions of primary and secondary boundaries constituted by different interface conditions, in respect of permeability and degrees of transparency or opacity.

The distribution of primary and secondary boundary conditions is therefore very different in each of the four illustrative examples under consideration, see Table 5 above. Doors and windows comprise 93% of the primary boundaries at Myddleton Square, with 4% of blank walls and 3% of windows. None of the other types of primary boundary are found there. Doors and windows are still the most significant boundary type at Margery Street, but the proportion they take up has fallen to 58%, with 25% of boundaries being upper level visibility, 9% comprising doors only and 8% being blank walls. The Finsbury Estate stands out from the high modern sample in that the most prevalent boundary condition is upper level visibility (31%) and it also has more windows only (29%) than doors and windows (25%). It is an estate whose boundaries are dedicated to creating the conditions for surveillance. Just over 9% of primary boundaries are active frontages, representing retail outlets, and 5% are blank walls. By the time Brewhouse Yard is designed, doors and windows comprise just 4% of primary boundaries. The greatest proportion of building boundaries here (48%) are the active frontages of its retail and office units, whilst 24% of the development is blank walls, 19% upper level visibility and 5% of walls have only doors at ground level. None of the boundaries here comprise just windows.

Looking in more detail at the composition of secondary boundaries, the rank order for the whole sample is as follows: low fences are the most numerous (36%), followed by high see-though fences (26%) and high opaque fences (24%%) and finally very low fences (14%). The greatest pro-portion of secondary boundaries across the sample therefore maintain real, as opposed to symbolic, distinctions within the public realm. However, in the case of Myddleton Square, the secondary bound-aries are 100% low fences (railings) that define the curtilage of the dwelling. Myddleton Square, however, is atypical in this respect as for the traditional sample as a whole there are fairly equal proportions of high opaque (31%), high see-through (26%) and low fences (35%). For the postmodern streets, however there are twice as many low fences (63%) as high opaque ones (28%), with few high see-through and almost no low fences at all. The use of these in both eras to symbolise the front (low, surveillance) and back (high opaque, target-hardened) of the dwellings is far more clear-cut than in the traditional neighbourhoods.

Secondary boundaries on the Margery Street Estate are either very low (53%), or low (47%). There are no high opaque or see-through fences at all. This suggests that the primary means of defin-ing public open space on this estate are symbolic and ensure surveillance throughout the public realm. In the Finsbury Estate, the most prevalent boundary type is also very low fences (60%), but the next most prevalent type of boundary is high see-through fences that allow surveillance but prevent unauthorised access (30%). There are a few low fences on the estate (8%), and almost no high opaque fences (2%). Brewhouse Yard, as we have seen, has no secondary boundaries at all. For the set of MUUBs, half of the boundaries that do exist are low, and the rest are almost equally split between high opaque and high see-through fences

13

5. Axiality

The external residential environment that has been previously described constitutes both a network of routes through the unbuilt space that connects each residential development with the wider urban context, and also an interface that either encourage or inhibits co-presence among inhabitants and between those resident locally and passers-by. Various integration values for the 'walkable' axial map of each site plan in isolation and embedded within a larger urban hinterland, were calculated for each example on the database to explore the structure of urban space created by the various residential developments.

The location of all three case study areas is at the urban fringe of each city centre, the cities themselves are very different in size, population and density and hence in urban built form characteristics, see Table 6 . This is reflected in the axial maps of the urban hinterlands for the three study areas. The residential developments from Clerkenwell are embedded in an axial map that is just over 3 Km. in radius and covers an area of just under 33 sq. Km. Cut from a pre-existing axial map of Greater London, it reaches the villages of Highgate and Hampstead to the north, eastwards as far as Bow and Tower Hamlets, down to the Elephant and Castle in the south and to the Edgware Road in west London. The map contains just over 5,000 axial lines, resulting in an axial line density of 157 lines per sq.Km.

Being a much smaller and more discrete entity than London, it made no sense artificially to limit the boundary of the axial map and so the developments from the Devonshire Quarter of Sheffield are embedded is a larger map that extends to the boundaries of the entire city. It was purpose-made for the VivaCity consortium, and covers a radius of nearly 7 Km. and a metric area of 142 sq. Km. It has the highest number of axial lines, 11625, but the lowest axial line density (81 lines per sq. Km.). The map of Manchester's hinterland is based on an existing map of the city centre, which was extended in all directions and re-centred on Hulme. This map stretches out over a 4 Km. radius and includes 50 sq. Km. of urban fabric. With just over 10,000 axial lines, it map has the highest axial density of 206 lines per sq. Km.

The axial map of Clerkenwell's hinterland together with all its residential developments is over twice as integrated (mean integration 1.274) as the Devonshire Quarter's (0.517) and nearly one and a half times as integrated as Hulme's (0.897). The residential developments themselves constitute only a fraction of the axial lines in each map; 288 for London, 125 for Sheffield and 76 for Manchester, and so the local structure of the residential developments has a negligible impact on

Variable	London	Manchester	Sheffield
Area of city in square kilometres	1579	1276	368
Population of each city in millions	7.2	2.5	0.5
Density of people per hectare	46	20	14
	Clerkenwell	Hulme	Devonshire
Radius of axial map in Km.	3	4	7
Area axial map in sq. Km	33	50	142
Total number of lines	5000	10341	11625
Axial line density per sq. Km	157	206	81
Mean global integration	1.274	0.897	0.517
Total axial lines of all developments	288	76	125
Mean integration minus housing	1.272	0.895	0.513

Table 6. Axial data for the three study areas

the mean integration of the axial maps (1.272, 0.513 and 0.895 respectively). Thus, it can be said that the overall structure of the urban grid is very robust, in the sense that it is not greatly transformed by even quite major housing redevelopments.

The mean number of axial lines created by the housing schemes is 22, but this figure varies markedly for different historical periods. The average number of axial lines contributed by the traditional developments is 9, for the early modern it is 23, for the high modern estates this rises to 38 but the recent post modern developments have on average just 12 axial lines, with almost no difference between the streets (12) and MUUBs (11). The four illustrative examples exaggerate these differences, in that Myddleton Square on its own comprises just 7 axial lines, the Margery Street and Finsbury Estates each have 45 and Brewhouse Yard has 12.

Variable	Traditional	Early Modern	High Modern	Postmodern	Postmodern Streets	Postmodern MUUBs	Sample
int. r=n	1.400	1.238	1.178	1.159	1.129	1.200	1.210
	Myddleton Square	Margery Street	Finsbury Square	Brewhouse Yard			
int. r=n	1.458	1.217	1.311	1.429			

Table 7. **Mean global integration values of residential developments constructed at different time periods**

This trend can be further examined by considering how the various schemes in the housing database are integrated within their localities. The mean global integration of all the residential developments embedded within their hinterlands is 1.210 and the mean global integration values for each time period suggests a gradual decrease in mean integration with the passage of time, from 1.400 in the traditional streets to 1.238 in the early modern period, 1.178 in high modernism and 1.159 in the postmodern period, see Table 7.

However, this is an illusion. If the mean integration values of the developments are plotted separately against time for each of the three cities, only London shows a negative trend (greater segregation from 1820 to early 2000s) and this so weakly as to have occurred by chance, whilst there is a strong and positive association between time and mean integration in Sheffield (the more modern the more integrated) and a weaker and positive association in Manchester. At the city level, the mean integration of all the residential developments within their surroundings is slightly higher than the mean for the city as a whole, but in all three cities, the values for the two periods of modernism are below the mean integration for all time periods and are balanced by the values for the traditional and post-modern schemes, which are above mean integration. In effect, the pattern of integration needs to be understood in and of itself, especially insofar as it creates (or fails to create) an interface among residents and between resident and passers-by.

Although it lies in a quiet largely residential area, Myddleton Square, top left, is axially shallow from London's main supergrid. It is one axial step from the historic routes of the Pentonville Road (red [10]) and St John Street (orange), which meet at the Angel, Islington. The area is slightly

more segregated to the south, due to the historic blocking effect of the New River, but it is well connected to the west by long, penetrating, quite well integrated axial lines that reach as far west as another of London's supergrid roads, the Kings Cross/Farringdon Road [11]. This may account for the fact that Myddleton Square has the highest global integration value of the four illustrative examples (1.458).

Figure 5. Axial maps of the four illustrative residential developments from Clerkenwell

It is almost impossible to unstitch the square from its hinterland. Three important axial lines reach deep into the square from different directions and the situation of the church takes advantage of this to make its presence felt at a larger urban scale. In this sense, Myddleton Square epitomises the concept of residence in a historic city as described by Hillier (1996:171): 'each local area has its heart linked to the supergrid lines that surround it by strong integrators. These form an edge-to-centre structure in all directions, and the less integrated areas are within the interstices formed by the structure'.

The Margery Street Estate, top right, is also located close to London's supergrid. The line of the Kings Cross/Farringdon Road (orange) grazes the southern boundary of the estate at an important intersection, Mount Pleasant, where Calthorpe Street and Margery Street (yellow) tie the southern

edge of the estate into London's supergrid by long, direct axial lines. Lloyd Baker Street (yellow) to the immediate north of the estate also reaches the Mount Pleasant intersection but, in marked contrast to the previous example, all these strong integrators skirt the perimeter of the estate. Five axial lines surround the wedge-shaped perimeter of the estate. These either skirt past or strike onto the external faces of the housing blocks and are thus prevented from penetrating to the heart of the estate. Unsurprisingly its mean global integration with its hinterland is the lowest of the four illustrative examples (1.217).

The Finsbury Estate, bottom left, is also strategically placed with respect to London's supergrid, though the main roads that surround it are not as well integrated as in the previous examples. Roseberry Avenue to the north (yellow) leads directly into Exmouth Market, which is an important local shopping street at a key intersection with Skinner Street and Percival Street (green) that together define the southern boundary of the estate. St John Street (yellow) that defines the eastern edge, is a mediaeval route that intersects with Roseberry Avenue at Saddlers Wells to the north, and continues south beyond the estate to Smithfield Market on the edge of the City of London [12]. The mean integration of this estate in its hinterland is a little better than at Margery Street (1.311).

Brewhouse Yard, bottom right, is located at the southern end of St. John Street close to where it intersects with Clerkenwell Road and Old Street (both red) on the edge of the City of London. It is particularly well connected to the south and west but less so to the north and east where, due to wartime damage, connectivity with the adjacent urban fabric has been lost. The mean integration of this scheme with its urban hinterland is almost as high as Myddleton Square (1.429).

7. Liveability

The final piece in the jigsaw is to see how the patterns of integration for the housing developments and the interfaces created by the arrangement of the buildings and the open space relate to issues of liveability and antisocial behaviour. Simple correlations between syntactic variables and mean liveability scores fail to pinpoint any immediate causal relationships, but a close visual inspection of the sites where problems have been reported to arise reveals that each is associated with a profile of spatial factors that may explain the reported behaviour in each case. As the picture of liveability appears to be intimately bound up with the detailed design of each locale, only the four illustrative schemes will be discussed here to illustrate the approach.

In all, 4886 surveys were distributed, of which 502 were received back. Eight of these were excluded from the analysis, resulting in an overall response rate of 10.11% [13]. Out of the four illustrative schemes, Middleton Square with 137 households had a relatively high response rate of 16%, Brewhouse Yard's 196 households produced a response rate of 10%, and Margery Street's 274 households and Finsbury Square's 450 households each returned a rather low 8%. The highest possible score for the twenty-four items of the questionnaire is 120 but the 'least liveable' estate in the sample had a mean score of 63, whilst the 'most liveable' development scored 38. The average for the sample

was 50. Brewhouse Yard, the second most liveable development, also had a mean score of 38, Myddleton Square scored 49, Margery Street 51 and Finsbury Square 55. This order is in line with the sample as a whole, in that the average score for the postmodern developments (46) is less than that for the traditional areas (49), whilst the early modern estates (50) are generally more liveable than the high modern estates (54).

There are no major problems at Brewhouse Yard, though the development does have some low-level (scoring 1 or 2) liveability issues relating mainly to adjacent sites. The vacant and boarded-up site to the north of the development is unsightly and attracts vandalism, squatters and graffiti. Car vandalism, theft and crimes against property are reported to take place in the open rear yards of some buildings to the south of the development, and on the more segregated street at the back of Brewhouse Yard where the ground floor shops are not yet let and so there is no surveillance at street level. The short, rather segregated passage between Brewhouse Yard and the boarded-up site suffers from litter and rubbish from the Tesco Metro store that has taken the corner retail outlet. A CCTV camera has been installed on the corner of St. John Street to monitor the entrance to Tesco, but out of office hours the lack of surveillance at street level may be a contributory factor. Though it is given over to public uses and is crossed by several pedestrian routes, the central square has no reported problems, but this is unsurprising given the constant surveillance of the concierge whose presence is announced by a strategically-sited, glazed office in the heart of the square. Brewhouse Yard is therefore atypical of postmodern MUUBs, in that it does not appear to suffer from problems with drunken behaviour.

The main problems highlighted by householders at Myddleton Square are litter and rubbish, young people gathering and car vandalism. Car vandalism, litter, dog litter, rubbish and noisy gatherings of young people are reported to take place in and around the edge of the public gardens in the centre of the square, which is both more segregated and where surveillance from the surrounding properties is reduced due to the dense shrubbery. Fly tipping takes place at the northern corner of the gardens, where the well-integrated road widens out to create an enlarged, poorly supervised convex space where people driving by can stop a car to unload rubbish. Car vandalism also occurs on the more enclosed sides and corners of the square, where there are doors and windows onto the street but few passers-by. By contrast, the main areas where young people are reported to gather are at well-integrated street intersections with large, penetrating visual fields that provide opportunities to 'watch the world go by' in locations where there are short sections of blank wall that prevent the youngsters themselves from being overlooked from the adjacent houses. Car vandalism is the most common problem on postmodern streets, along with litter and rubbish.

Margery Street's residents also report problems with drunken behaviour, young people gathering and dog excrement[14]. Concentrations of young people, drunken behaviour and drug dealing appear to take place at most, if not all of the entrances to the estate, precisely at those points where short axial lines pass from the surrounding streets into the centre of the estate between the blank walls of the housing blocks. Inside the estate itself, these behaviours are also found around the stairwells,

18

which form small pockets of unsupervised, highly segregated and blank-walled space at ground level. Dog litter is confined to a rather segregated, small green space in the middle of the estate that is overlooked from the upper level flats but where ground level visibility is comparatively poor.

The Finsbury Estate suffers from a greater variety of liveability issues, but the main problems reported by its residents relate to antisocial behaviour. Only 25% of its building boundaries are constituted and though the landscaped exterior spaces are quite open, the estate's uninviting and segregated interior means that despite its density there are few people out and about in public space. Gatherings of young people, drunken and antisocial behaviour and vandalism occur all along the estate's frontage with Skinner Street and Percival Street, which have large areas of unconstituted common green space on both sides of the road. Litter, rubbish and dog litter are concentrated along the northern approaches to the large green space between the slab and the tower block. Like its southern counterpart, these routes are rather segregated, open and unconstituted. Drug dealing takes place at the foot of the tower and the slab blocks, in locations that are unconstituted, segregated, have large visual fields that overlook the adjacent open green spaces and several different ways quickly to reach the edge of the estate, but where there is only minimal upper level visibility from the surrounding flats.

5. Discussion

Although the cities have different physiognomies, architecture is more generic. International design trends dictate local fashions and so all three cities contain housing schemes that are similar to one another and typical of their period. The main characteristics of residential developments from these different time periods are summarised in Table 8. The traditional streets and squares, of which Myddleton Square is an example, are often taken as a benchmark for civilised and sociable urban living (Cowan 1997, Neal 2003, Rogers 1999, Rudlin and Falk 1999) but they are not without problems. However, the sense of neighbourliness, mutual awareness, co-presence and the mix of inhabitants and passers by on the street outside lead to a particular kind of informal sense of belonging (Hillier 1996, Hanson 2000) that architects and designers from all periods have tried to emulate.

The estate morphologies of modernism, whether these are early modern walk-up flats or high modern mixed developments, tend to be 'small-scale, separate, inward facing unconstituted and hierarchical' (Hanson, 2000), to the point where Hillier (1996) has coined the term 'disurbanism' to refer to the complex and segregated morphologies that mark out modern housing estates within axial maps of cities. Public green space, rather than the doorstep, is the imagined locus of community. Throughout the Modernist period, architects and planners believed that to create liveable neighbourhoods it was necessary to ensure that residential districts were designed in such a way as to facilitate community formation, by grouping housing around a central open green spaces that supported community development, but the morphologies of early, and especially high modernism, are sparse landscapes, with large shared open green spaces, few private gardens and many short and

tortuous routes through the landscape that are defined mainly by low or high see-though secondary boundaries. The buildings relate to this landscape not only by doors and windows, but increasingly with the passage of time by windows, upper level visibility and blank walls.

Variable	Traditional	Early Modern	High Modern	Postmodern Streets	Postmodern MUUBs
morphology	streets and squares	inward facing walk-up blocks	mixed high and low rise blocks	streets	squares
proportion of space invested in paths	medium	medium	relatively little	relatively little	large investment
main open space types	public and private gardens	public green space, few gardens	public green space, few gardens	private gardens	no gardens
parking	on street	surface parking on estate	surface parking on estate	locked parking courtyards	underground parking
household density	rather low	high	high	rather low	very high
diversity mix+ proportion of non-residential uses	medium or low	almost exclusively residential	low	low	very diverse indeed
figure / ground characteristics	more ground than figure	far more ground than figure	far more ground than figure	more ground than figure	nearly as much figure as ground
primary / secondary boundaries	about 50/50	more primary than secondary	more primary than secondary	about 50/50	very much more primary boundary
main primary	doors and windows	windows + doors and windows	doors and windows + blank walls	doors and windows	blank walls + active frontages
main secondary	low fences + high opaque fences	very low + low fences	high see through + high opaque fences	low + high opaque fences	few secondary boundaries
integration	more integrated than hinterland	more segregated than hinterland	more segregated than hinterland	more integrated than hinterland	more integrated than hinterland
axial complexity	few long lines	many short lines	many short lines	few short lines	few short lines
liveability problems	litter, youths, car vandalism	drunken behaviour, youths, drugs, dogs	drunken behaviour, youths, drugs, dogs litter, vandalism	car vandalism + litter	drunken behaviour + litter
community type	co-presence + surveillance	surveillance	non-surveillance	co-presence + surveillance	active frontages + CCTV / concierge

Table 8. Summary of morphological characteristics for the four time periods: Postmodern streets and MUUBs shown separately

In his seminal text 'Discipline and Punish', Michel Foucault (1975) highlighted the transformative, disciplinary potential of surveillance (seeing), explaining the power structures that are inherent in surveillance techniques. Surveillance is a key theme in the literature on panopticism, alongside that of the 'gaze'. In his description of a plague city, Foucault even suggested the mechanism by which space and surveillance can come together to express power relations through a process of spatial separation, segregation and partitioning. The stasis that is achieved by these means physically immobilizes people and constructs both a counter-city and a perfect society. Reversing the apparatus of panopticism so that 'the many' look out on 'the few', these schemes create the potential for many residents, immobile and separated from one another in their homes, to look out from their flats onto

the spaces that people move through, but these 'human ants' that are surveyed from on high are more likely to live on the estate than to be passing through. A pedestrian at ground level feels the collective gaze, even though no one at all may actually be looking down. Close to the buildings, blank walls provide opportunities for unsupervised antisocial behaviour.

Described as 'the urban renaissance' (Rogers, 1999) post modern urban designers and town planners have set about achieving urban integration, through making direct connections between the buildings and the streets and public spaces of the city. In this respect, the UK's postmodern schemes appear to have reversed the process of disurbanism by stitching themselves into the city, an effect that may even be directly attributable to the impact of space syntax (Rogers, ibid. p.57). Postmodern urban designers therefore promote 'natural surveillance' as a naturally occurring process that involves both space occupancy or co-presence and space observation or surveillance. As people are moving around an area, they will be able to observe what is going on around them, provided the public space is open and generously proportioned. Supporting a diversity of uses within a public space is believed to be a highly effective natural surveillance strategy. Making spaces well integrated so that they are well used is another. Also included are features that maximize the visibility of people in public space.

Postmodern streets claim to achieve this by drawing on traditional urban typologies and indeed many examples do share some attributes of the traditional 'streets and squares' morphology that encourage the 'intimate anonymity' found on traditional urban residential streets, but there are also subtle differences. The scale of intervention in the urban grid is smaller and axially more localised, there is less investment in the street itself, and public gardens have given way almost entirely to private ones. On street parking in front of the house where the car is easily accessed and supervised from indoors, has been replaced by locked parking courtyards in the interior of the urban blocks that are restricted to residents only. Even so, car vandalism is rife, as the courts are only overlooked from the upper levels of the surrounding houses and not supervised at ground level, where high opaque fences and few gateways to the surrounding homes create new opportunities for crime.

However, it is in the MUUBs that the most innovative experimentation is currently taking place, creating what is an entirely new typology for UK residential development, and not only because the density and diversity of the uses represented is far greater than in traditional mixed use urban neighbourhoods like Clerkenwell. Challenging the convention that the dwellings present a public face to the street whilst the interior of the urban block should remain a purely private domain (Bentley, 1985) these developments create new public routes and destinations within the heart of the urban block that are well integrated and dominated by strangers, whilst the interface with local residents has become almost invisible. There is a large investment in the public realm and almost none in private or green space. The edges of the public realm are defined by buildings, obviating the need for secondary boundaries. Ground level uses are either blank walls or the transparent glazed facades of retail and commercial outlets, that colonise or exercise surveillance over the space outside during the day but close at night to leave the new piazzas deserted and unsupervised, except for the presence of

an occasional drunk whose behaviour is monitored by the ubiquitous but impersonal CCTV monitors or, in upmarket developments like Brewhouse Yard, by a concierge. Meanwhile, the entrances to the upper level flats are discrete, shared by only a few dwellings and well spaced out along the surrounding streets, so that even quite close neighbours are unlikely to meet by chance.

The community of the street, whether traditional or postmodern, is made up of a complex layering of intimacy and anonymity, in which social encounter and urban safety are maintained by the co-presence of strangers on the street, the interface between local residents and passers-by on the doorstep and the surveillance of residents over street space from the privacy of their front windows. The panoptic models of modernism rupture this spatial interface between inhabitants and passers by and instead they rely almost entirely on surveillance to preserve safety and generate community. With the benefit of hindsight, we can see that where surveillance is weak or absent, it is replaced by sousveillance[15], in the sense that the very openness and unconstitutedness of the public domain allows the perpetrators of antisocial activities to keep a lookout for anyone in the vicinity and to escape unchallenged if necessary. So far as the MUUBs are concerned, the primary spatial interface here is not about the creation of a residential culture, but rather it is dedicated to commercial transactions and to the celebration of relatively transient and transpatial forms of human socialisation and encounter such as 'pubbing and clubbing', whilst the occupants of the flats above are free to enjoy the spectacle (Debord, 1967) or to ignore it.

Notes

[1] The research is being conducted under EPSRC's SUE Programme (grant number GR/S18380/01) and is being carried out collaboratively the Universities of Lancaster, Salford, Sheffield, London Metropolitan and University College London, as well as over 30 partner organisations.

[2] To simplify the analysis, the eight time bands of the EHCS, which reflect minor changes in the construction cycles, have been paired to yield four major construction periods.

[3] We were not permitted to distribute the survey in one estate in Sheffield.

[4] Department for Communities and Local Government (DCLG), then known as the Office of the Deputy Prime Minister (ODPM).

[5] After the black and white ichnographic plan map of Rome drawn by surveyor Giambattista Nolli in1748 (ca. 1692-1756) The map, the first to be drawn in plan as opposed to a bird's eye perspective since antiquity, records the streets, squares and public urban spaces of Rome, and all its buildings are accurately recorded, hundreds of which show the detailed plans of the interior.

[6] All figures reported in this paper have been calculated to three decimal places and are shown in full in the relevant tables, but for convenience they have been rounded in the text, as we are concerned more with identifying large rather than pinpointing minute numerical differences between individual residential developments.

[7] The land use classification adopted for the research had 19 different uses.

[8] over about 6ft. or 2m. high, so that it is not possible for an adult of average stature to see over the top

[9] set at about 3ft. or 1m. high, at about waist height, so that it is possible to see over the boundary but not, under normal social conditions, to step over it.

[10] The accompanying black and white figures show axial lines in various tones of grey, which are hard to describe in words so as to differentiate one shade clearly from another. The colour spectrum has therefore been used to indicate the relative integration of named individual axial lines, following the well-established convention that red = most integrated and blue = least integrated.

[11] Beyond the immediate area of the map shown

[12] St John Street therefore marks the route that, since mediaeval times, cattle have taken from the countryside outside London to be slaughtered at Smithfield.

[13] An acceptable rate for a postal survey, especially given the numbers involved and the fact that all households were included.

[14] This may be related to space configuration as, although dogs may not understand the 'logic' of space, their owners may well

do so and as these are urban housing developments, the overwhelming majority of dogs are walked on a lead.

[15] 'Sousveillance' means the opposite of 'surveillance' in the generally accepted use of the term, because rather than looking down on phenomena from above and subjecting them to forms of surveillance (in French, 'sur' means 'above') the observer's gaze is brought down to a human level, with ordinary people doing the watching (from the French, 'sous', meaning 'below'), either in respect of one another or even by watching agents of the state or formal authority, such as the police.

References

Bentley I (1985) Responsive Environments: a manual for designers, Oxford, Butterworth Architecture.

Coleman A (1990) Utopia on Trial. London, Shipman

Cowan R (1997) The Connected City. London, Urban Initiatives.

Debord G (1967) translated by Perlman F and John Supak J, (1977) The Society of the Spectacle, London, Black and Red Publishers.

Foucault M (1975) Discipline and Punish, Harmondsworth, Penguin

Hanson J (2000) Urban transformations: a history of design ideas, Urban Design International, 5, pp. 97-122.

Hillier B (1996) Space is the Machine, Cambridge, CUP

Hillier B and Hanson J (1984) The Social Logic of Space, Cambridge, CUP

Jenks M Burton E and Williams K (1996) The Compact City: a sustainable urban form? London, SPON.

Koetter F and Rowe C (1978) Collage City. Cambridge Mass. & London, MIT Press

McCluskey J (1992) Road Form and Townscape, Oxford & Boston, Butterworth Architecture

Neil P ed. (2003) Urban villages and the making of communities. London, SPON.

Office of National Statistics - ONS (2001) The Census 2001. Accessed on line at http://www.statistics.gov.uk/census/default.asp

Office of the Deputy Prime Minister - ODPM (2003) English House Condition Survey 2001: a regional report, London, The Department.

ODPM (2006) English House Condition Survey 2003 Annual Report: Decent Homes and Decent Places. London, The Stationery Office.

Panerai P Castex J Depaule JC and Samuels I. (2004) Urban Forms: the death and life of the urban block, Oxford, Architectural Press.

Rogers R, Lord (1999) Towards an Urban Renaissance, London, SPON & Urban Task Force.

Rudlin D and Falk N (1999) Building the 21st Century Home, Oxford, Architectural Press.

Contact Details:

Prof. Julienne Hanson   j.hanson@ucl.ac.uk
Reem Zako   r.zako@ucl.ac.uk

Bartlett School of Graduate Studies
UCL (University College London)
1-19 Torrington Place
Gower Street
London WC1E 6BT
United Kingdom