ORDER AND STRUCTURE IN URBAN SPACE:
a Morphological History of the City of London

by

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Abstract.

This thesis has its origin in three general and three specific issues for the design of architectural and urban space. The first general question is about the interplay of structure and order in design, which in turn raises questions about the visual and functional properties of built form. The second is about the relationship between history and morphology, and the part that concepts like 'continuity' and 'conservation' might mean in respect of both history and morphology in relation to the urban grid. The third general question addresses the issue of the kinds of relation that space might in principle have to society.

The three issues which are specific to the City of London take the form of assumptions by the majority of authors writing on the subject. The first is that the urban grid of the City is of great antiquity, of Saxon or mediaeval origin. The second is that the City is an outstanding example of a town which has grown up organically, and hence the shape and form of the urban grid is unplanned. The final assumption is that the urban grid somehow corresponds to social groupings, in that the city is a collection of 'natural neighbourhoods'.

In order to disentangle these specific and general issues, the urban grid the City of London, is described and characterised. The argument is advanced that the City has a sub-area structure which is historically generated, but whose morphological combination is fine-tuned and adjusted so that the whole comes to dominate the parts. It is suggested that the street pattern constructs an intelligible movement interface between inhabitants locally and strangers passing through, so that all may take advantage of the statistical distribution of people which is brought about by the configuration of the urban grid. Changes in the interface relate to changes in social solidarity, particularly to those which are a function of the organisation of trade within the City over time.
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Chapter One - The Problem Definition.

Quantitative History and the world we have lost¹.

To know any phenomenon is to know what it consists of, and to formulate that almost always requires some knowledge of its history. This is self-evident in the case of the history of our towns and cities where it is a standard procedure to tell the story of urban growth and change chronologically, supplemented with some contextual information about geography, economics, social institutions and cultural practices. However, history tends to be conditioned by contemporary concerns and in the field of urban design it is evident that in most 'learning from the past', the lessons which are spelled out have to do with today's urban issues. The way we view our architectural and urban heritage is intimately bound up with our diagnosis of current urban ills and with our concerns about the future shape and form of towns.

This thesis has its genesis in the realisation that many of the lessons which architects draw from history add up to scarcely more than a mythology. Rob Krier is a case in point. In his influential attempt to produce a typology of urban space² he gives a thumbnail sketch of the origins of town form which is as follows: 'in all probability the square was the first way man discovered of using urban space. It is produced by the grouping of houses around an open space. This arrangement afforded a high degree of control of the inner space, as well as facilitating a ready defence against external aggression by minimising the external surface area liable to attack. This kind of courtyard frequently came to bear a symbolic value and was therefore chosen as the model for the construction of numerous holy places (Agora, Forum, cloister, mosque courtyard)....The street is a product of the spread of a settlement once houses have been built on all available space around its central square.'³

This account does violence to the wealth of material which urban archeology has at its disposal. Nothing could be clearer from the

¹ Laslett, P., The world we have lost, Methuen, London, 1965.
³ Krier, R., op. cit., p17.
archeological record that towns arose independently in several parts of the world, and show a variety of spatial configuration which defies easy analysis. There seem to be at least two routes to urbanism; one path is characterised by dense, compact and contiguous clumps of buildings while the other prefers dispersed, freestanding clusters. However, there is not a single case in the record of the specific evolutionary sequence from central square to outlying streets, which is cited by Krier as the norm.

The assertion, that 'streets' and 'squares' are the two elementary types of 'urban space' from which all traditional city space can be derived, is the justification which lies behind Krier's interest in setting out a typology of streets and squares. However, his interest is not purely academic and the purpose of the typology is to inform and guide contemporary urban design. It is a little disconcerting to discover that in such an important area of human activity as urban regeneration and design, influential ideas which are instrumental in shaping contemporary practise can be formulated largely upon a misunderstanding of the past, but here at least archeology has provided the wherewithall for history to 'speak back' and permit that false understanding to be challenged.

The same cannot be said of the more recent past, where lessons have been drawn from the European cities of the Middle Ages which relate built form and space to speculations about the shape of urban society and its institutions, and even to the role of the individual within society. Mumford is typical of those who see not only aesthetic preoccupations at the heart of mediaeval town planning but also the operation of functional and social laws. The aesthetic is given by the particular contrasting relation of street and square in mediaeval towns: 'contrast between the narrow, winding streets which make every journey a voyage of discovery and the irregular, informal open market places, which recapture the spirit and function of the earliest

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2 archeologists draw contrasts between the origin of towns in the Near East and in both Europe and Mesoamerica precisely along these lines.
forum or agora'. The social principle is given through the larger-scale prototypes of the natural neighbourhood unit and the functional precinct.

The mediaeval city, Mumford argues, 'was a congeries of little cities, each with a certain degree of autonomy and self-sufficiency, each formed so naturally out of common needs and purposes that it only enriched and supplemented the whole...this integration into primary residential units, composed of families and neighbours, was complemented by another kind of division into precincts, based on vocation and interest: thus both primary and secondary groups, both Gemeinschaft and Gesellschaft, took on the same urban pattern.' It is this unity of function and purpose in a purposeful but pliant composition which, Mumford suggests, is the principal lesson to be learned from the pre-industrial city for town planning practice today.

During the last twenty years Mumford's view of the mediaeval city has remained largely unchallenged. So have his strictures for modern town planning. As a result, the programme he spelled out for design that 'there is room for fresh urban invention here: for a new kind of urban open space, more completely liberated from wheeled traffic than the Italian piazza...the reintegration of the family should be one of the serious concerns in planning for the new neighbourhood unit...all these matters in turn raise problems of architectural treatment: the height and scale of buildings, the relation of open spaces to occupied spaces, of exposure and enclosure...here the cul-de-sac the court, even the cloister have to be re-thought by the modern architect in new terms and recaptured in original designs adapted to our present needs' has occupied a far larger part of the architectural imagination than the research task he simultaneously specified: 'we need a whole series of fresh studies that will do justice both to the social pattern

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2 ibid, p.357.
3 Rather the opposite. It has passed into 'folklore' and it is assumed by more recent writers like Choay, F. *The Modern City: planning in the nineteenth century*. Braziller, New York, 1969, (who, incidentally, cites Mumford as a major source) to be self-evidently the case.
and the civic design, beginning with historic examples of the
neighbourhood plan.1,2

This thesis sets out to rectify a situation which is long overdue. A
generation of modern urban prototypes has been erected on the basis
of statements which have little in the way of detailed, historical
evidence to substantiate them. In particular the spatial correlates of
concepts like the 'natural neighbourhood' and the 'urban precinct', and
even those morphological constants which characterise the layouts of
mediaeval towns have yet to be spelled out in a way which is
meaningful to architects and town planners, whilst a cursory reading
of the rules of thumb which are set out in the most recent design
guidance3 on the subject, suggests that these too may be derived from
a systematic misreading of the past.4

The aim of this study is apparently, innocuously historical and
descriptive. It takes the City of London as a vehicle through which to
explore the evolution of the urban grid in what is generally held to be
an organic city par excellence. Through careful and detailed analysis
it is hoped to characterise the urban grid, to plot its morphological
continuities and changes over time, to see if it can be disaggregated
into configurationally distinct and distinctive sub-areas, and to see if
physical changes correspond in any way to the unfolding of social and
cultural events; in short, to bring a little rigour to a debate which is
currently conducted largely at the level of analogy and metaphor.5

This is not such a modest project as it appears at first sight. The
primacy which is given to description over causation is well-

1 Mumford, L., In Defense of the Neighborhood, Town Planning Review,

2 it is perhaps characteristic of such historians that the object of historical
study would be to confirm what their contemporary prejudices have already told
them must be the case.

3 GLC, An Introduction to Housing Layout, Architectural Press, London,
1978.

4 as, for example, in the section on Clarity of Use, pp.80-83, which
systematically overplays the numbers and the significance of the few architect-
designed, London mews from the era of the 'great estates' which have 'symbolic
portals', a cul-de-sac shape, and a chichained entrance, whilst omitting any
reference to the vast majority of traditional London mews which display none
of these features.

5 natural v. artificial, trees v. semi-lattices, etc.
understood in the sciences, but it has only recently been drawn to the
attention of historians. This enterprise is therefore located firmly
within that branch of history known as 'social structural history'
which prefers a careful attention to the statistical description of
phenomena to the imaginative reconstruction of historical events in
terms of their apparent 'causes'. If Weil is correct in his observation
that 'the experience of science accumulated in her own history has led
to the recognition that evolution is far from being the basic principle
of world understanding; it is the end rather than the beginning of an
analysis of nature. Explanation of a phenomenon is to be sought not in
its origin but in its immanent law. Knowledge of the laws and of the
inner constitution of things must be far advanced before one may
hope to understand or hypothetically to reconstruct their genesis'
then this study is indeed ambitious, for description here as in the
'hard' sciences, is not deemed to be in any way inferior to
'exploration'. It takes as its ultimate goal nothing less than a
reconstruction of the 'immanent law' of urban space and structure.

Three assumptions, three confusions and the questions which arise.

In reading the literature on the City of London, it soon becomes clear
that three assumptions are held ubiquitously about the origin and
nature of its built form and spatial organisation. The first is that the
street grid of the City is of mediaeval or even of Saxon origin; the
second is that the grid is irregular, organic or unplanned, and the third
is that the City is, sociologically speaking, a collection of local regions
or even a cluster of neighbourhood units.

Most historians now agree that the morphology of the modern street
grid in the City of London dates to well before the Norman conquest.

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1 Lazlett terms this view of history 'naif-sociologism'. By this he means history
which 'tells a story' rather than history as a description of what is objectively
known and knowable about the constitution of societies, and the ways in which
they cohere, change, and evolve: 'we have glanced back over our history books
and found them full of the crudest sociological generalisation, of highly
unconvincing speculation on the nature of social development' ibid. p. 245. This
criticism applies to much of architectural history, particularly where it moves
beyond the detailed exposition of particular styles and personalities to address
issues of a more general import, like the evolution of the house or the history of
town form.

2 Weil, H., Philosophy of Mathematics and Natural Science, Atheneum,
Grey is clear on the issue, stating that "even in purely physical terms the Saxon influence persists, for not only the parish and ward boundaries but the very street plan of the City derive from before the Norman conquest".\(^1\) Schofield places the date of crystallisation at about the same time: "it now seems a fair conclusion that the tenth and eleventh centuries saw the laying out of several streets and the establishment of property boundaries which were to last throughout the Middle Ages".\(^2\)

Milne does not commit himself on the point at which the City's street plan originated but he is clear about its perpetuation in the modern plan, for he suggests that "it is still just possible to trace the extent of this redevelopment (the Great Rebuilding in the wake of the fire of 1666) in the 20th century streets of London, in spite of the ravages of the blitz and post-war urban renewal" and elsewhere within the ancient City of London, the best preserved element is the street pattern itself which, with the exception of such roads as London Wall, Queen Victoria Street and King William Street, is in most essentials that shown on the map of 1677.\(^3\) Likewise, Lord Holford placed great value on the historical significance of the street grid and the discussion which surrounded his proposals for the reconstruction of the City after the devastation of the Second World War recognised the debt which it owed to history: "London has to the present day remained surprisingly true to its mediaeval self, in spite of the fact that fewer mediaeval houses and churches survive than in plenty of other European cities".\(^4\) Thus, in a recent overview of city form throughout history Benevolo argues that "London has retained the City, the old mediaeval centre that now functions as its economic and commercial heart".\(^5\)

The value of the City's street pattern lies not merely in its great age, but in what it is seen to represent. A number of commentators have made the point that the City is a spontaneous, organic growth, and its

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4 Architectural Review, June 1945.  
street grid a product of what Benevolo calls ‘a mosaic of small enterprises’¹. This is seen to reflect the degree to which the interests of the common man are reflected in the street pattern of the City, as opposed to the dictates of some higher and more centralised planning authority. Olsen waxes lyrical upon the subject. The attitude of the City Fathers he states, is ‘one of pragmatism, of muddling through, of the absence of mind theory of the Empire. Depending on one’s point of view, London can serve as an object lesson of the deplorable results when planning and foresight are not used, or as the happy result of natural, organic adaptation to historical change’².

The Architectural Review is unequivocal on the subject: ‘following none but the dictates of its own nature, bowing to no designer however brilliant or imperious, the City is that rare thing, a truly functional town’³. Summerson refers to the City as ‘an organic urban growth’⁴ and elsewhere he elaborates by suggesting that ‘London has never been planned. Beside other eighteenth century capitals, London is remarkable for the freedom with which it developed. It is the City raised by private not public wealth: the least authoritarian city in Europe’⁵ Grey makes a similar point, suggesting that ‘this is possibly the most single important fact about London’s development, the metropolis grew according to the whims of private capital, relatively untrammelled by the restrictions and plans of monarchs or bureaucrats. That is why a closer knowledge of London forever reveals new quirks, oddities and delights that reflect the avarice, ideals, competence and taste of those who owned the land.’⁶

Finally, this ancient, organic and democratic City is seen to be a product of a particular form of devolved socio-spatial structure. Rasmussen describes it, not as a single city but rather as ‘a collection of towns’ and he goes on to elaborate that ‘at many places two such towns are separated by only a street. Yet, when you go from one to

¹ ibid. p. 723.
³ Architectural Review, 1945, op.cit.
⁵ Summerson, ibid. p.25.
⁶ Gray, op.cit., p. 12-13
the other there is a marked difference. The inhabitants speak another dialect, hold different political views. A similar point, that the City is polyfocal, is made by Mumford, who cites London as a key example of the 'spontaneous neighbourhood grouping, so well defined before the seventeenth century'.

Mumford places his emphasis upon neighbourhood and community as the underlying social generator of physical diversity. He does however acknowledge another generator of enclosed local areas within the town, that of the functional precinct. This was taken up by the post-war planners as the model for the modern City, and here too it was argued that history provided the precedent in the traditional organisation of the City along diversified commercial lines. Ash stresses the importance of understanding the 'precinctual order' of the City's civic core. Lord Holford stresses the role of trade and commerce in shaping the social organisation of the City, suggesting that 'each trade still has a quarter of its own and a character of its own. Within their clearly defined boundaries, building groups have preserved that close-contact relationship which is the very essence of commerce.' and elsewhere that 'where trades and professions were as powerful in money as most trades are now, they developed building groups of a distinct character and visual coherence...they are the visual expression of a working community bound together by ties of common interest.' In addition to proposing new 'precincts', Lord Holford used trade distinctions as the basis for setting up over a dozen comprehensive redevelopment areas within the war-damaged City. Insofar as the residential community is assumed also to have formed the work community throughout the Middle Ages the distinction is perhaps an idle one.

1 Rasmussen, S.E. *Towns and Buildings*, University Press, Liverpool, 1951 p.105-6.
3 three were named, designed and rebuilt at St Paul's, the Guildhall and the Tower.
5 Architectural Review, June 1945, op.cit.
These three assumptions - the antiquity of the grid, the organic form of the grid and its correspondence to social groupings of one form or another - tend to feed off each other. Moreover, because some components are analytic in nature (those which use archaeological material to demonstrate the antiquity of building lines and street frontages would be a case in point) whilst others are more normative (as, for example, the assertion that commercial ties are expressed and reinforced through unity of architectural style and layout) they tend to stand or fall together, with the more rigorous components lending credibility to inferences drawn about the less tried and tested aspects of what amounts to a conceptual scheme.

At the same time, it is clear that all three propositions cannot be simultaneously and equally correct. If we take first the simple proposition about the global form of the City: that the street grid is continuous with that of the mediaeval and Saxon past, then the question arises as to what exactly we mean by historical and morphological continuity. The building fabric of the City has an average lifespan of well under a century. Schofield describes his detailed study of the pre-Fire City before 1666 as a paper reconstruction of 'a city that no longer exists'. The phenomenal form of the City, that is, its appearance, has changed dramatically at least three times in its history: from 'a city of gables, mullioned windows, carved barge boards, corner-posts and brackets, a city in which architectural novelty consisted in exceptional feats of carpentry, in curious enrichment or in the extravagant use of stone' to one of warm, red brick and uniform architectural detailing at the post-Fire rebuilding. The nineteenth century saw a transformation to brick of a sombre grey, and finally the post-war City acquired a fourth 'new face' as the skyline was transformed by high rise office buildings.

Moreover, the street space of the City is not actually the same throughout history, even in a simple Cartesian sense. The grid of the Roman foundation and the Saxon and mediaeval Cities rest up to six metres below today's pavement level. In a naive sense, the modern citizen does not experience the same universe as his mediaeval

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1 Schofield, op cit. p. 178.
2 Summerson, op. cit. p 28.
counterpart, though if change is restricted to a simple translation through time, in appearance and in vertical space perhaps this does not matter.

Change in the street grid of the City is not, however, this limited. For every continuity in building lines and street frontages there are transformations, both the elimination of old streets and the introduction of entirely new ones. With this admission, a more subtle problem emerges. To characterise a street grid is a different morphological problem from that of characterising a particular street within that grid. The former requires a global description and the latter a local one. If we allow that a street does not just have alignments but that it also has connections, both local and global configurational properties may be affected by changes which are introduced at any point within the grid. In an important sense a street does not remain the same if it has a different number of turnings off it, particularly if its intersection with other major routes in the street system are radically disrupted1. The cumulative effects of countless small changes in the alignment and connectivity of the City's streets simply are not known.

A deeper consideration of what lies behind the first assumption: that the street grid of the City is continuous with that of its mediaeval and Saxon past reveals a number of, as yet unanswered, questions. It is not self-evident that a clear answer can be given to the question of what we might mean by 'continuity', nor is it clear whether historical continuity is the same phenomenon as morphological continuity. If the appearance of the City's fabric can change, and yet perpetuate in any sense some underlying principles of form then it is conceivable that the appearance of the street grid can likewise change, and yet perpetuate configurational principles 2. It seems important to know if the street grid is relatively continuous in this deeper sense, or if the cumulative effect of small interventions in the grid is to introduce change. If any changes have taken place in the configuration of the grid, which of these causes might be the most important?

1 as anyone who has experienced at first hand the disruptive effects of transport engineering on a well-known route will vouch
2 this is certainly the view of Aldo Rossi, who argues in The Architecture of the City, Oppositions Books, MIT Press, Cambridge Massachusetts, 1985, p.51, that the street grid is the principal locus of historical 'permanences' within the city.
grid, then it seems important to know what sort of change is entailed. Once the possibility of change is admitted to the argument, then questions of the relation between the local parts of the street grid and its global, overall form are entailed. How much change is required for it to count as a 'real' change, and where does change have its impact; locally at the level of the street or globally at the level of the urban grid?

Continuity in the City's street grid cannot, on reflection, be taken for granted. This is perhaps fortunate, for the assumption of continuity in the form of the City as expressed through the historical continuity of its street grid, raises serious problems for the assumption that the street grid in some sense corresponds to social groupings, for these have clearly changed dramatically over time. The social networks which are characteristic of the modern City are quite unlike those of the past, and those of the past are not as many historians traditionally have thought them to be. To put it in a nutshell, the question is this: if the strategic significance of the mediaeval urban grid was to support and reflect local social groupings in a correspondence to spatial diversity and discreteness, how can the same grid now work to support the global, international commercial interface which is characteristic of the City today? This raises a second set of questions as to what we might mean by the urban grid being in any sense socially relevant. Are the changes noted earlier perhaps more significant than the stabilities?

A powerful contribution has been made to this debate in the work of Keene and Harding, who have undertaken a 'social structural history' of the parishes which abutted Cheapside during the mediaeval period. This work shows that although there were local concentrations of households practising particular trades in this part of the City at the time, this never amounted to more than a statistical tendency which itself changed over time. A local concentration of

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1 and yet if it is not socially relevant, then what is it that society should invest so much effort and energy in either perpetuating or transforming its material form?

2 Keene D., *Cheapside before the Great Fire*, ESRC, London, 1985 - the period covered by the study was from 1100 to 1666, and entailed a house by house reconstruction from parish records and other documentations such as property conveyances. The methodology is reported in Harding V., *Reconstructing London before the Great Fire*, London Topographical Record, Volume XXV, No. 132, 1985.
tanners in contiguous premises to the north of Cheapside in 1300 had reduced in number and dispersed across the area by 1400. Other traders in woollen cloth had moved in. From a single member in 1300, their numbers had swelled to 17 in 1400, but these drapers did not live in adjacent houses, or even in adjacent streets.

One striking feature which emerged about mediaeval urban life was the sheer fluidity of the population\(^1\). The poorer the individual, the more often was he likely to move and the shorter was the spatial compass within which he travelled\(^2\). At the same time, particular locations seemed significant to the life-career events of individual traders. This is particularly noticeable among wealthier citizens, who moved house often and across the global urban landscape. Keene draws the inference that the network of relationships within and between neighbourhoods is intimately bound up with specific sites, houses, and locations within the City\(^3\). He adds that, paradoxically, 'this pattern of movement perhaps reinforced rather than undermined a local sense of community' \(^4\). We do not have adequate ways of characterising this kind of society at a global level, but it is nothing like the static picture of closed social groupings corresponding to distinct, self-contained sub-areas of the City which is entailed in the idea of the inchoate neighbourhood unit or precinct.

The question thus arises as to what the relevance of space might be to a fluid, highly mobile urban society. Continuity and change is as much, or more of an unknown quantity in the case of society and its spatial correlates as it is for space itself. Are the dynamics of mediaeval trade in any sense comparable to those of a modern monetarist economy and how could the urban grid 'work' both for a globalised system of symbolic exchange and for a local market economy. Do changes in

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1 71\% of residents in a typical street moved within 2 years, and the poorest sections of society were the most mobile. Yet many moved only a short distance, often to another house in the same street.

2 In Ironmonger Lane in the City, 71\% of the residents left within two years, with the cheapest properties experiencing the highest turn-over of tenants. Nearly half of these mobile poor relocated themselves within the same street.

3 In one remarkable case he charts a move in 1366 from a large house in Ironmonger Lane to an even larger one in Bow Lane, two parishes away. The move was exactly repeated in the 1530's. Both men were mercers, both made the move six to eight years before attaining the status of alderman, and both then lived in Bow Lane until they died.

4 Keene, op.cit p 17.
configuration of urban space and do changes in the former entail changes in the latter. Clearly, if the street grid is in any sense a significant factor in the construction of social networks, we cannot simultaneously postulate continuity in the former and radical changes in the latter - or can we? The question is completely open.

The first question was about the physical form of the grid, and the second was primarily about its functioning. A third question therefore has to be addressed about the relation between form and function. What do we mean by morphological history (as it were, the immanent law of society and of space) and what is the relation between morphological history and the history of events? In what ways might a reformulated conception of history shed light on present urban problems? These are the specific questions which are addressed in the main body of this thesis.

**Untying the Gordian Knot: Daedalus, encounter fields and 'Seripan' causality.**

To begin to address these questions it is necessary to differentiate three pairs of ideas, each of which is commonly confused in discussions of urban space and structure. The first of these is a confusion between the order which is inherent within a spatial arrangement and the structure of the arrangement. This confusion is well-illustrated in Sterlin's Introduction to the Encyclopedia of World Architecture. Sterlin begins by suggesting that understanding architecture means that, when one looks at a building, (or urban design) however complex it may be, one tries to visualise the relationship between the volumes that comprise it. It means seeking to grasp the way its elements are inter-linked for it is this that determines the structure of every building. Above all it means going back to its origins, to its basic concept - in a word, to the plan ...one's instinct is immediately to start looking for the laws behind it, trying to isolate the principles underlying its formal organisation. One wants to

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1 after the village of Seripe, on the Black Volta in West Africa.
Fig 1:01 - A selection of mazes.
get behind the overall impression to the conscious (or unconscious) order that governs and informs the whole\textsuperscript{1}

Thus far so good. But when Sterlin goes on to suggest that 'the god's eye view of the plan is the key to understanding all architecture'\textsuperscript{2} he raises a serious question in locating the human observer, for as he goes on to argue, this aerial view which is traditionally vouchsafed only to gods and the architect at the drawing board does not guarantee comprehensibility in the experiential reality of the building. Rather, 'a building that one experiences as an incomprehensible maze when walking through it at ground level may suddenly become intelligible when seen from the air...from this point of view, chaos gives way to order'.\textsuperscript{3} Order in the general, overall scheme of things does not it seems guarantee intelligibility for the building user. Rather the opposite. Once the observer is located within the spatial configuration and therefore is able to experience the space structure only as a series of related spatial discontinuities (as individual rooms or streets) geometrical order can confuse and disorientate: geometry, after all, also provides a model for an anti-town, a maze\textsuperscript{4} (Fig. 1.01).

Sterlin's interest is analytic and comparative, so he is content to look down from on high and categorise plans in terms of their geometry: the plan may be entirely free, or it may be governed by a simple repetitive formula. Alternatively it may follow an axial system which imposes symmetry on the whole composition. Equally, the plan may be characterised by double axial symmetry producing a centralised formula. Such a plan may be square, hexagonal, octagonal, or round, embodying various types of symbolism as well as complex ideological functions. Rectangular, hexagonal and octagonal shapes can also be developed into regular patterns...so from the completely random approach to the strictest kind of rectangular or centralised organisation, including between those extremes the organic forms which spring from natural, popular folk or spontaneous architecture.

\textsuperscript{1} Sterlin, op cit. p.7.
\textsuperscript{2} ibid. p.8.
\textsuperscript{3} ibid. p.8.
\textsuperscript{4} this paradox has occupied historians of a philosophical turn of mind. Rykwert, for example, devotes a section of his \textit{Idea of A Town} to a discussion of the relationship between the maze and the city. Rykwert, J. op. cit. Faber and Faber, London, 1976, pp 144-153.
Fig 1:02 - The Algerian Socialist village of Abadla by Bofil.
all types of composition can be traced through the medium of the plan, which reveals the deliberate intentions or subconscious motivations of the architect or builder. He sees the task of the scholar to grasp the essential mystery of all architecture as it is revealed in the order of the plan.

This does not, however, explain how architecture can in principle be intelligible to its users who do not have an 'Ariadne's thread in the labyrinth of perception'. It is argued here that this 'thread' which makes space intelligible to the user is in the structure of configured space and not in its visual order at all. Structure, it is suggested, is different from order. The view from the ground, to an observer moving about within a configuration and experiencing it bit by bit, requires movement to make sense of the layout, and intelligent movement in turn requires the layout to provide information not just about where the viewer is locally at any moment, but also about where he might potentially be located globally within the overall scheme of things. The god's eye view (or the plan) is apprehended all at once, and does not have to provide information about the relation between local and global scales which is constitutive of a configurational structure, because the viewer is required to remain both still and external to the configuration.

This distinction between order and structure is made clear by an example. If we take a plan of the the Algerian socialist village of Abadla by Bofil (Fig 1:02), then the conceptual scheme which gave rise to the layout is immediately clear. Individual dwellings are wrapped around a central, enclosed local space. A set of these is then wrapped around a larger neighbourhood space. Finally a series of local neighbourhoods is wrapped around the central public 'square' of the entire community. However, the clarity which the scheme has conceptually is entirely absent to an inhabitant or visitor on the ground. Here, the layout is unintelligible because all the local elements are the same.

1 Sterlin, ibid. p 14.
2 ibid.p.9.
3 this has indeed been reported by first-hand observers to be the case. Loumi, A., unpublished Ph. D. of the University of London, 1988.
Fig 1:03 - The grid of Milton Keynes.
A more familiar example closer to home is the urban grid of Milton Keynes (Fig 1:03). Again, because all the local elements are identical, the moving observer finds orientation about the urban net extremely difficult. Every road and intersection seems to give identical information about its position within the overall network, and eventually the user has to learn the small visual differences (street names, landscape and topographical features) which identify each local segment of the grid, and then to relate them together in strings of information.

Difference is therefore a key to intelligibility, but it is equally clear that not any difference will do. Unstructured differences would lead to chaos. In a sense it is clear what order is, but what structure is remains to be discovered, both to the user of layouts in everyday life and to the researcher. Provisionally from research, we can say it is the way integration as generalised depth relates to local connectivity, to create a relation between the local and the global as it is progressively experienced. Structure introduces pattern by constructing a relational system of differentiated interior shallownesses to give an overall 'deep structure' to what on the surface appears as disorderly.

Order depends essentially on recognisable similarity of parts in similar relations to each other, to yield an immediately available *gestalt*, whereas structure is the underlying pattern which is picked up by moving about and which depends on an *arrangement* of differences. The relation between local and global is differently constructed in each case. So is the temporal relation. Order is static over time. Deviation is the enemy of order. Structure has continuity under transformation, and its principles embrace both continuity and change. It is not to be found in the regularities which people normally look for in architecture, but the differences which are created within any spatial configuration.

From now on, the term order will be reserved for those aspects of a design which depend on principles of sameness, repetition, geometry, grid, rhythm, symmetry, harmony, and the like. These concepts speak to us directly without mediation, and can be apprehended at once, almost as a *gestalt*. Structure will be reserved for the differences within a configuration from one part to another, which make it intelligible to move about in and experience over time.
Syntax therefore agrees with Sterlin about the significance of the plan, but differs from him in specifying what there is there to be looked for. A syntactic 'explanation' of a plan requires two sets of principles to be brought into play, not one; that is, both structure and order. These may work together to reinforce each other in a design or they may be in opposition to each other, with structure differentiating space in the interests of intelligibility for the user (internal observer) and order tidying it up again in the interests of the planner or critic (external observer) 1. The interplay of these two variables in the evolving layout of the street grid of the City of London is a major preoccupation of this thesis.

A second confusion needs to be clarified at the outset, since this is the most paradigmatic case of where a social idea has been projected onto the past. This is the idea that if space is to play any role at all in constituting social relations it is through some structured correspondences between spatially discrete physical domains and well-defined, closed social groupings. This is taken as axiomatic in the proposition that the role of urban space is to express some form of 'inchoate' neighbourhood grouping, which was outlined in the first section of this chapter. Mumford takes this to be so, and suggests that to question or doubt the existence of these socio-spatial entities is frankly absurd2.

In this sense, the assumed correspondence between society and space is itself an order concept. Again the Bofil example is instructive for the geometry of the composition is not purely self-referential, but intended to express the order inherent in society itself. To many architects and planners it is seen to be natural and obvious that the conceptual clarity which order introduces into layouts initiates, reflects, clarifies and sustains social groupings by projecting them directly and unselfconsciously into space. As a way of moving simultaneously from local to global configuration and from small to large scale social grouping, Hillier suggests that 'the enclosure-

1 those members of the UAS who are consultants on the King's Cross master-plan describe the design process as trapped upon the horns of precisely this dilemma
2 his argument is rehearsed in detail in Chapter Six of this thesis.
repetition-hierarchy method became at some stage in our recent past.....a kind of international style of spatial design'. By reducing social relations to visual order, the illusion is thereby created that it is possible for the designer to maintain control of the local-global socio-spatial relation. Indeed, Alexander has gone so far as to suggest that it is not possible to design in any other way because the human mind is incapable of grasping complex socio-spatial structures.

The literature which surrounds the supposed correspondence of space to society has been discussed in detail elsewhere (and will be raised again in Chapter Six of this thesis). However, the conclusion which emerged from that review is that there is an alternative interpretation of the many empirical studies of the space/society relation, which suggests that the role of space is at least as often to cross-cut, mask, disguise and even systematically to contradict social relations. The 'work' of society, its networks and associations, seems often to be to overcome spatial separation and discreteness. Space assembles the non-homogeneous, and social labels suggest analogies across space which knit together people in entirely different locations. This phenomenon, that space can assemble that which society divides and in an important sense work against the tendency for social categorisation to divide society into physically discrete groups, was therefore termed non-correspondence.

Non-correspondence was itself an attempt to move from the reduction of the relation between society and space to one of order, to the formulation of an - as yet unexplained - structure concept. It was never intended that correspondence and non-correspondence should themselves come to be regarded as polar social types. Rather, it was

2 Alexander, C. A City is not a Tree, in Bell, G. and Tyrwhitt, J., Human Identity in the Urban Environment, Pelican, Harmondsworth, 1972, p.421. The suggestion in this thesis is more optimistic for design, in that it is argued that theory-based descriptions of structure render it accessible to and manipulable by the intellect and subsequently even to intuition.
3 Hanson J. and Hillier B., The Architecture of Community: some new proposals on the social consequences of architectural and planning decisions, Architecture and Behaviour, Vol 3. No. 3 pp 251-273, 1987. The late date of this publication belies its time of writing in 1978. It was, in fact, the original research statement for what has now become this Doctoral thesis.
4 though, inevitably with hindsight, this is what tended to happen
stressed that every society is made up of a multiplicity of both kinds of socio-spatial set-up1.

Naming a phenomenon is not the same as dimensioning complex, infinitely variable realities. The formulation that cultural variation in spatial form is a product of an underlying principle - that the pattern of movement in a town is a function of its pattern of integration2 - is perhaps a first, faltering step towards dimensioning the concept of non-correspondence, for it is now known that the structure of an urban grid creates an encounter field. An encounter field is a natural pattern of background space use and movement which is created by the configuration of the grid and the disposition of the buildings within it3.

The encounter field which the urban grid produces statistically by its very configuration does not, on the whole, lead to obvious social interaction. It is a field of co-presence amongst people who are for the most part strangers to each other: 'cities are not so much mechanisms for generating contact as mechanisms for generating a potential field of probabilistic co-presence and encounter. What happens beyond that is not the direct effect of the city, but an effect of culture. The prevailing culture may however itself be an indirect, evolutionary product of the city. But without this cultural dimension, it would not be possible to use spatial design to achieve a sociological or cultural result. All that may be created is the field of potential encounter - the life - that might lead in the direction of a sociological or cultural result'.

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1 a university for example, is both a localised spatial entity, the set of departments of which it is made up, and a set of transpatial entities, academic disciplines. Any university don is simultaneously a member of both forms of grouping. To turn a university into a correspondence form of organisation would require each to be a single-discipline, campus university: a suggestion which (fortunately) has yet to be made by the powers that be!

2 this is now known to be the case. The research background will be presented in the next chapter.


4 Creating Life, op.cit, p248
Fig 1:04 - A diagramatic typology of integration cores.
It seems that the configuration of an urban grid gives rise to a describable and stable structure of occupation and use, a virtual community\(^1\) which can be sparse or dense, localised or globalised, predictable or unpredictable from the intelligible structure of space and which mixes local inhabitants and strangers in different degrees. It is this which seems to give rise to cultural variation among towns.

In some Algerian towns, the integration core is peripheral, thus limiting the impact of outsiders, while the internal space structure creates an interface between the different clans who occupy regions within the grid\(^2\). In most European towns, the grid is deformed in such a way\(^3\) as to draw strangers into and through the very heart of the town where the main trading functions are located, whilst the interstices of the grid are taken up with quieter, less well-integrated and more residential districts (Fig. 1:04).

It is now conjectured that the possibility of dimensioning the concept of an 'interface' will render the correspondence/non-correspondence formulation otiose. The aim here is to replace the assumed correspondence between space and social groupings which is at the heart of the inchoate neighbourhood formulation with a more precise characterisation of the urban grid as an interface: that is, to substitute for a static order proposition about town layout a dynamic description of the evolving structure of the urban grid of the City of London.

A third confusion which exists in studies of this type is that between historical and morphological 'explanations' of observed events. Again, an example might help to clarify. Fig 1:05 is the result of generating a spatial surface according to a simple local rule of spatial aggregation\(^4\). Whatever the actual sequence of events and provided

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\(^1\) Community because it is a form of group awareness, virtual because it has yet to be realised through interaction among its members.


\(^3\) Known as a deformed wheel, because integration is partly peripheral (round the rim of the wheel) and partly radial in several directions (the spokes) and intersecting in the approximate geometric centre of the town (the hub). Characterising an integration core in this way is, of course, a reduction of structure to order, to make it more intelligible at a conceptual rather than an experiential level.

\(^4\) Square cells are aggregated by means of a full facewise join in a step-by-step process which starts from an initial seed (numbered 1). Objects are added randomly, save that each cell must keep one of its sides free from other cells.
Fig 1:05 - A computer generated spatial surface

Fig 1:06 - The village of Seripe.
that the process is properly randomised, the same generic global form of a 'net with holes' will result. **Fig 1:06** is the roof-entry compound village of Seripe in Africa which exhibits the same generic global form. In this case the form apparently arises from the unfolding of social conventions.

Each compound in Seripe comprises an irregular living courtyard surrounded by rooms for sleeping and storage, which houses a man and his extended family. Rooms lose their roofs and become courtyards: roofs are added to courtyards to make new rooms. New compounds are constructed as domestic arrangements alter. A man with an expanding family can buy a room from his neighbour, close up an existing door and open up a new one into his own compound. The 'rules' are few. Each compound needs its courtyard, and the surrounding rooms must preserve access to this space.

The form of the village is constantly changing as extended families change their social composition, but the overall form of the village survives the innumerable small changes which are necessitated by the exigencies of everyday life. It is perhaps too much to claim that 'nature' acts as a randomiser, although it is indeed the case that no villager can specify his progeny, his fortune or his marital circumstances in advance of events. The most he can do is respond to events by effecting changes in his compound. Ask a villager the reason for the changes he makes, and he will give a historical 'explanation' which details the precise circumstances of his life-career events. The accumulation of these will give one kind of 'explanation of the space structure of the village, but this does not say how the generic shape of the village remains stable over time. A second explanation, which relates the local, circumstantial changes which individuals make to their space to the stable global form of the village has to be sought in the statistical workings of the laws of space itself, and these resemble the law of spatial aggregation entailed in the earlier, computer-generated example.

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1 the difference, of course, is that the 'primitive' computer-modelled example did not admit 'death' in the form of the wiping out of cells and the substitution of others which preserved the same local rule within the growing aggregate (though this could be done), whereas the more 'sophisticated' ethnographic example was capable of internalising change from the outset.
This is not to deny that the social processes by which the village is manufactured and maintained are purposeful, but to suggest that the form which human purposes takes in this instance is related systematically to spatial laws that prescribe the possibility, even the necessity of the form, given the initial conditions and the process or aggregation. In an important sense, an understanding of the 'fitness of purpose' of the lifestyle and architecture of the Seripans is incomplete without knowledge of the 'immanent law' of space, for without this knowledge the many and varied accidents of history which give rise to the village do not make sense. History gives an account of a series of unfolding events which is either fragmentary and lacking in overall coherence, or over-determined. The lesson of Seripe is that we need two kinds of explanation for the form of the village, not one. One 'explanation' is historical, and particular. The other is morphological, and general. Many historical explanations could account for generically similar morphological outcomes, provided that they translate into identical rules of spatial aggregation.

It is suggested here that the distinction between morphological and historical explanation is generalisable. The obvious lessons of history which are given through chronology are perhaps the most deeply deceptive, for the knowledge of the accumulated accidents of history hold out an explanatory power for design which is seldom fulfilled. It is suggested here that it is through a morphological rather than a historical explanation, that the path leads forward from past experience to design. The aim of this thesis is therefore to advance morphological understanding by a consideration of the interplay of history and morphology in the City of London.

The primacy of description and creating the phenomena.

To disentangle these issues requires methodology, and so far as this is concerned primacy is given to the detailed morphological description of the urban grid of the City as revealed through the cartographic record. A major part of the research task is to create the phenomena, in this case a series of transcriptions of configured urban space at different moments in time, captured in such a way that they can be
compared, measured, observed and experimented upon. This last demand of methodology is not an idle one. Hacking reminds us of the philology of the term: 'from the very beginning it (i.e. the term phenomenon) has been used to express philosophical thoughts about appearance and reality. The word is, then, a philosopher's minefield' and he restricts is scientific use to entities which are 'public, regular, possibly law-like but perhaps exceptional' 1. He thus reserves the term for modes of representation which are both theory-orientated and aimed at intervention.

In Hacking's universe, description consists in forms of technology which can be reliably and routinely produced. Not any description will do, and not all descriptions are equivalent2. Description depends on knowing how to isolate a phenomenon, purify it and recreate it. In this sense phenomena, Hacking suggests, are rare. 'There are surely innumerable entities and processes that humans will never know about. Perhaps there are many that in principle we can never know about. Reality is bigger than us. The best kinds of evidence for a reality of a postulated or inferred entity is that we can begin to measure it or otherwise understand its causal powers. The best evidence, in turn, that we have this kind of understanding is that we can set out from scratch to build machines that will work fairly reliably taking advantage of this or that causal nexus. Hence engineering and not theorising is the best proof of scientific realism about entities...Perhaps there are entities which we shall only measure and never use....Long-lived theoretical entities which don't end up being manipulated, commonly turn out to have been wonderful mistakes' 3.

Hacking is of course discussing scientific phenomena, but his preoccupation with the distinction between representations and realities strikes a familiar note, for there are those who object in principle to the possibility an objective description of urban form at

1 Hacking, op.cit. pp.221-2.
2 Most observations, he remarks, are anecdotal. Phenomena like the movement of the planets, stars and tides are rare: 'only the skies afford some phenomena on display, with many more that can be obtained by careful observation and collation. Only the planets and more distant bodies have the right combination of complex regularity against a background of chaos'. ibid. p. 227.
3 Hacking ibid p. 274-5.
any level since the reality presents itself as multivariate and complex. Norburg Schultz, for example, argues that in describing places "we mean a totality made up of concrete things, building materials, substances, shape, environmental character which is the essence of place... a place is therefore a qualitative total phenomenon, which we cannot reduce to any of its properties such as spatial relationships". If Norburg Schultz is right, it follows that we have to give up hope not only of making progress with the questions defined earlier in this thesis, but also of the possibility of making predictive models for design.

The approach adopted here follows Hacking in distinguishing between reality and its representations. The purpose of description here is not to capture every aspect of an urban reality but to isolate and purify a description of the configurational properties of the grid. The 'space syntax' methodology which has been adopted here creates the phenomena only and exactly in this limited sense. The descriptive power of 'space syntax' is taken for granted as a technology with which to approach questions of continuity and change in complex urban objects. Without syntax or an equivalent form of description, there are no urban phenomena about which to theorise. There are only towns, and anecdotes about them.

The structure of the argument.

Having defined the problems which are to be tackled, and having outlined in the most general way the approach which will be adopted in addressing them, it remains to set out the structure of the argument. Little attempt is made to evade the temptation to present the story of the City of London chronologically though it is hoped that in what follows little is of mere anecdotal interest. The early sections of the thesis which deal with the Roman and Saxon periods are based on partial archeological evidence, and as a result these chapters are

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almost wholly experimental\(^1\) in that the argument relies heavily on modelling and manipulating the urban grid which is thought to have existed at these dates. The later sections are occupied almost exclusively with a detailed exploration of the, by now accurate, cartographic record. The whole is prefaced by a chapter which deals with the assumptions and prerequisites of study and a comparison of the set of designs for the rebuilding of London after the Great Fire of 1666 with the mediaeval and Restoration urban fabric, and is concluded by drawing some lessons for design.

Chapter Two therefore attempts first to set the descriptive power of 'space syntax' in context by reviewing a range of configurational studies within urban space and structure, and then to present the assumptions and prerequisites which lie at the foundation of a 'syntactic' approach and which therefore need to be taken as \textit{a priori} in what follows. Intentionally, the range of material which is presented is restricted. No subject matter is included in the literature review unless it has at its foundation some set of descriptive techniques or some physically-orientated classification scheme which enables the shape of urban grids systematically to be compared. Likewise, a full explanation of 'space syntax' will not be presented here since this is readily available elsewhere in published form\(^2\). The account will be restricted to what is pertinent to an understanding of this text.

This is followed by a theoretical excursion into the syntactic properties of pure radial and orthogonal grids. Orthogonal and radial elements seem to be the basic building blocks of all grids, however deformed they eventually become. Even a random pile of sticks can be 'sorted' into its orthogonal and radial components and most real grids including the City of London itself seem to contain elements of both. The aim is to form a benchmark against which to set the real, more deformed, radially and orthogonally mixed cases which are the main focus of the thesis.

\(^1\) in the 'Hacking' sense of the word
The chapter concludes with an account of the findings of syntactic studies of use and movement patterns in the City of London today. The results of this work, together with a pilot study plotting the origins and destinations of journeys by individuals passing through particular streets will be presented in order to go some way to substantiate the proposition that the urban grid is systematically related to patterns of use and movement. The truism that cities are mechanisms for generating contact has, it is suggested, a precise form.

Armed with all this material, Chapter Three returns to the heart of the three main issues raised in this problem definition. The chapter is something of a vignette for it addresses all three issues - of structure and order in urban space, of the relation between history and morphology and of the social logic of the urban grid and even of the significance of urban design - in a limited but precise way. In 1666 the bulk of the mediaeval City was destroyed by fire and the Restoration City which arose from its ashes was completely different in appearance from that presented by the earlier mediaeval fabric. However, the Great Fire presented a challenge and an opportunity to the architects\(^1\) of the day, and several designs were produced in the immediate aftermath of the fire for the 'proper' reconstruction of London.

Five of these early town planning schemes have survived, and taken together they give a clear idea of the preoccupations of the urban theorists and critics of the day. Two, by Evelyn and Wren, are clearly influenced by the geometrical preoccupations of the time amongst planners of both towns and gardens. Hooke's plan is also a regular gridiron, that by Knight is based on his design for an economical, land-efficient urban block, while Newcourt bases his proposals upon the larger social grouping of the parish. This chapter examines the set of proposals in detail, and uses the contrasts which they show with the City which was actually rebuilt to raise general issues of configuration which lie at the interface between analysis and design.

\(^1\) using the word loosely, since these men were surveyors, mathematicians, physicists and the like, whose activity in the sciences had sparked off an interest in town planning, rather than individuals who derived their livelihood from design. This is the case even with Wren, who later went on to design most of the City churches.
Chapter Four returns to the inception of the City of London in the Roman period. At its Roman foundation the 'infant' grid of the City of London is known to have had a more or less orthogonal global form which presents a rather obvious visual contrast with the disorderly, organic and more radial shape which the grid subsequently assumed. This chapter is not just an exploration of the internal dynamics of ideal grids, for the way in which the grid of the City can be shown to deviate from a purely radial or orthogonal configuration is bound up with questions which relate historical events to morphological outcomes.

The first of these questions is one of origins. It is not known whether the City had a military or a civilian foundation. To the extent that civilian and military coloniae exploit different properties of orthogonal grids, a comparison of a range of real, historically authenticated examples of both with experimentally controlled cases might prove instructive in settling the issue in respect of the City's genesis.

A second question concerns the extent to which the Roman foundation of the City has constrained its subsequent growth. Even the boldest of local historians does not go so far as to claim configurational continuity of the modern grid from Roman times, yet it is clear that the period of Roman occupation did exert influences on morphology, not least by defining the limits of the City through its walls and setting the alignment of incoming routes through its gates. Is conservation restricted, as Biddle suggests, to these fixed physical features or is there, as Rossi claims, a more thoroughgoing relation between the general properties of shape, geometry, connectivity and the like, which is so robust as to conserve the broad configurational principles of the entire grid. Here too, the question can only be addressed by comparing what actually took place and is revealed through the archaeological record, with what might otherwise have occurred as demonstrated through experimental modelling. In this way it might be

2 Rossi A. The Architecture of the City, op cit.
possible to go some way towards settling the issue of whether the configurational characteristics of the grid of the City are in any sense inevitable, or whether they are contingent upon the whims\(^1\) of history.

Chapter Five addresses this last question in more detail. Almost nothing is known of the physical order of events in the millennium between the departure of the Romans in AD 410 and the publication of the first accurate survey of the City in 1677. There is a wealth of documentary evidence, and in limited cases it is possible to use this to reconstruct the detail of property boundaries and street frontages\(^2\). For the most part, however, there exists only the sketchiest of outlines of the developing urban grid.

It is now thought that the City was largely unoccupied for several centuries after the departure of the Romans, though a sector in the north-west of the City near the Roman fort may have acted as a royal and ecclesiastical enclave. The systematic reoccupation of London dates from the Alfredian period, c. AD 886. The Saxons seem to have avoided those areas of the City which were occupied by Roman buildings, so one can posit that these had a negative influence on the developing urban grid.

The Saxon reoccupation does, at first sight, represent a complete break with the previous morphology. The shift from a regular orthogonal Roman grid to an organic, apparently unplanned mediaeval street system took place during this period. By the Great Fire of 1666 the City's street layout had evolved in all its fine detail. Yet the influence

\(^1\) using the word here in a technically restricted sense. We know, for example, that particular land grants were made to individuals early in the City's history, and that this seems to have 'fixed' the line of particular streets along the boundary. At the time that the gift was made, the precise spatio-temporal location of the plot probably did not matter all that much either to the donor or to the recipient. There is no record of 'geomancy' ever having been employed to determine the 'most propitious' location for buildings, and the decision was probably made and was certainly recorded by drawing a line on a map. The question is, would a slightly different grant of land, resulting in a slightly different alignment of the street, have made any difference to the morphological outcome. 'Chaos theory' has introduced us to many systems where small differences in initial start conditions lead to widely different eventual outcomes. Are cities in this sense 'chaotic'? There is no obvious reason to think that they should not be, or even to claim that they are not. Because history presents us with a \textit{fait accompli} it is a question which is rarely asked, but it is clearly relevant to the stability or otherwise of urban grids as global space configurations.

\(^2\) as in the work on Cheapside of Keene and Harding, reported earlier.
of the Roman wall and gates, and even of some of the street lines, is apparent. The orientation of the grid in an east-west direction roughly parallel to the river is another feature perpetuated from the Roman era. Are these mere shadows, or is there a more substantial continuity with Rome, and how does this relate to the apparent transformation in other and more order-related aspects of morphology?

This chapter sets out to explore these issues using archeological reconstructions and experimental modelling, supplemented by examples from the map record. Cartography was still in its infancy towards the close of the period, and although several maps were produced after A.D.1500, these were both too inaccurate for analysis to be reliable and too late to be informative about the regeneration of the City’s grid, which had by then become stable.

The issue of the function of the City is, however, also broached in this chapter. This is inevitable, since much more is known about how the City worked than is known about what it was actually like. The puzzling fluidity of local populations reported by Keene dates to this period. The location of street markets and the ubiquitous distribution of tradespeople and artisans suggests that the gross function of the City was to constitute an interface for the production and exchange of goods. A final question which is opened up in this chapter, then, is that of whether there is, in any demonstrable sense, a spatial logic to trade.

Chapters Six and Seven need to be read as a pair, for the Great Rebuilding after the fire was recorded in a detailed and accurate map of the City published in 1677 by Ogilby and Morgan. This map permits historical and documentary evidence to be set alongside a detailed analysis of the fine-structure of the urban grid. This in turn signals a change of emphasis in the mode of enquiry from a speculative, experimental mode to one of defining and testing hypotheses. Most authors agree that the street grid of the City was reduplicated in the Great Rebuilding, so despite its relative modernity Ogilby and Morgan’s map is generally held to give an accurate account of the pre-Fire, mediaeval and early modern space structure of the City. Its existence allows us to establish a description of the urban grid which will act as a benchmark against which to measure the subsequent evolution of the City’s street pattern.
The first hypothesis to be 'put under the microscope' is that which makes general propositions about the configuration of the urban grid in relation to social groupings. This is the set of ideas introduced earlier as one of the three main assumptions about the City, that the street grid itself is functionally 'precinctual' or structured in the image of some kind of 'inchoate neighbourhood unit'. Chapter Six examines the evidence for and against the proposition that the streets, parishes and wards of the City are reflected unselfconsciously into distinctive localities, each of which is a relatively self-referential and self-contained community. Chapter Seven proceeds in the opposite direction, attempting to give a configurational account of the City using 'space syntactic' representations and measures. The purpose is to give both a global configurational account of the urban grid of the City, and also to see if there exist in any sense more localised and spatially differentiated sub-areas within the grid, which permit the decomposition of the intermural grid into spatially defined, morphologically differentiated regions.

Chapter Eight returns to the very first assumption about the City of London, that its street grid is continuous with that of the Saxon and mediaeval plan. The proposition that the City conserves in its modern street grid the morphological principles of its pre-industrial past is pursued through the map record, setting the 'syntactic' description of the 'mediaeval' urban grid at the time of Ogilby and Morgan in 1677 alongside those derived from Rocque's map of 1746, Horwood's map of 1792-9 and the modern Ordnance Survey of the City. The spatial contrasts and continuities which this exercise brings to light are set alongside unfolding historical events and, more particularly, against a summary of the changing nature of market forces which are the very raison d'être of the City of London.

Chapter Nine draws together the various issues which have been raised in this opening Problem Definition, but with 'a sting in the tail'. The history of planned residential districts has in recent years, taken urban design towards the disaggregation of the town into a series of localised, segregated and self-contained urban fragments from which
strangers are largely and deliberately excluded. This is so much an aspect of good planning practice today that it is difficult to challenge without appearing insensitive to the human condition.

However the suspicion which has been voiced by historians like Olsen that the wholesale urban segregation which has been brought about by modern town planning in general and by the 'natural neighbourhood philosophy' in particular is an unnatural child of the last two centuries, does seem to have substance. The design philosophy of modern planning does seem to be socially divisive in a way which bears no relation to the historic functions of towns, for the burden of the main chapters of this thesis is to suggest that the street grid of the City functions above all as a 'movement interface' which brings citizens into contact, and relates their patterns of use and movement about the streets of the City which are so much a part of everyday life, to those of the many strangers who visit the City for pleasure or profit. The story of the City of London suggests that the regeneration of our towns and cities lies in the direction of an increasingly globalised, well-integrated structure which is intelligible to the user and which mixes inhabitants and strangers locally. If this is so, then the lessons of the past teach us that the task for architecture and urban design in conditioning the future shape and form of towns is indeed a significant one.

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1 As will be shown later, the exclusion of strangers from the locality was a specific design aim of Clarence Perry's 'neighbourhood unit formula', and it has been incorporated as an aim into almost every element of influential design guidance in the post-war period.
3 These ideas will be discussed more fully in the prerequisites which follow.
Chapter Two - Literature Review, Prerequisites, Ideal Grids and Encounter Studies

Creating the Phenomena: a review of the literature which describes the configurational properties of urban space and structure.

According to Hacking, 'reality as intervention does not even begin to mesh with reality as representation until modern science. Natural science since the seventeenth century has been the adventure of the interlocking of representing and intervening' 3. In making this point, Hacking attempts to isolate a crucial difference between the physical sciences and the social sciences: for all their speculative endeavour, he argues, the latter do not create stable phenomena which can be the object of theorising and experimentation. What counts as 'real' in science are entities which can be described and theorised about, and which can be manipulated reliably in order to change the world.

In the field of urban morphology, which might be considered as the descriptive branch of town planning and urban design, representing has lagged some way behind intervening. Cities are arguably the most complex, large-scale objects of collective human activity and endeavour. Nonetheless, Benevolo4 prophesies that despite an absolute increase in architectural and planning research in the last few decades, the proportion of urban dwellers for whom research expertise has practical significance is diminishing, whilst at the same time the numbers of people who live in unplanned squatter settlements is now climbing at an alarming rate. We are fast becoming a predominantly urban world, yet despite this prodigious increase in the extent and

1 Readers who are disinclined to follow the methodological detail can omit this chapter and proceed directly to Chapter Three. A slight penalty will be involved in that the derivation of the measures used in the analytic chapters, and the detail of the basis on which towns can be considered as 'movement interfaces' will be lost to the reader, but if s/he is principally interested in the historical material relating to the City this may not matter too much.

2 due to Hacking, I, Representing and Intervening, Cambridge University Press, 1983, who used the phrase to characterise the role of experimentation in the sciences.

3 Hacking ibid. p 146.

scale of urbanisation, few urbanists would claim that urban phenomena are well-understood.

This knowledge gap applies as much to those areas of 'modern' architecture where the majority of research is carried out, as to those areas of spontaneous, unplanned urbanisation about which rather little is known. Lionel March is clear on the point, suggesting not only that 'much of our knowledge in architectural design is vaguely and qualitatively stated' but also warning that 'our intuitive notions about space almost invariably lead us astray'¹. A major reason why this is so, he suggests, because we do not give sufficient attention to the careful description of urban form and structure.

The necessity for objectivity in describing urban space and form as a prerequisite for research is recognised by many scholars. Roberts, for example, argues that to be useful descriptions must be ones of pure spatial form and order, and not also of the particular purposes to which space is put: 'the fact that two settlements have virtually identical forms need not mean that they have a common origin; similar or identical forms need not have similar or identical origins'.² Purposes may relate to spatial attributes, but they may not depend upon them in a mechanistic way³. Anderson takes a similar view that it is only by developing concepts and techniques of analysis of the physical environment itself that we can be liberated from the limitations of subjective discourse 'in favour of a means of describing the physical environment in and for itself, independent of use'⁴. Carter⁵ suggests that it is in this area, of objective spatial description, that the urban geographer can complement the historian by providing a clear account of the identification, interpretation and explanation of spatial patterns in and for themselves.

³ this was theoretically argued in the last chapter as a question of the independence of history and morphology in giving an 'explanation' of phenomena.
⁴ Anderson S ed., On Streets, MIT, Cambridge Massachusetts, p.7
⁵ Carter H, Foreward to An Introduction to Urban Historical Geography, Edward Arnold, London, 1983.
This review takes as its starting point the centrality of description to urban morphology. It is conceded that this is a narrow definition, compared to the many authors who have written extensively on the subject of towns. As Martin and March have (in a similar situation) acknowledged, 'The literature on urbanism is varied by widely conflicting viewpoints: it is also vast. It emanates on a considerable scale from many sources. The urban historians, the urban geographers, the urban sociologists and economists, the physical planners and the architects, the Utopians and the real estate men, the systems analysts and the traffic engineers, the administrators and the politicians have all made their contributions.'

This study makes no attempt to review this vast body of literature and takes as its subject those authors who have attempted to come to grips with the problem of the description of urban space and structure.

The proportion of scholarly endeavour which is expended upon this subject is small. Within geography, Whitehand estimates that only about 12% of papers are devoted to morphological geography. The proportions of historians and architects engaged on research work of this kind are probably similar. The practical consequences of this lack of research activity for the management of the urban landscape are, according to Whitehand, serious. Whitehand points to a specific gap in knowledge here. 'What is particularly needed is a conception of how some parts of the urban landscape have a character distinctive from others that relates to their history and that of the community that created them, and of how individual developments from different historical periods fit together.' Since this is the specific research issue for this thesis, and one which Whitehand highlights as a problem which can be best addressed through the development and use of techniques of space description, the decision to limit this review perhaps needs no further apology.

Three Strands in Spatial Description.

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1 Martin and March, ibid p. 260.
3 Whitehand, op.cit. p. 269.
In what follows, an attempt will therefore be made to set the descriptive power of 'space syntax' in context by reviewing a range of configurational studies within urban space and structure. The literature which is covered falls into three broad groups. Closest in spirit to 'space syntax' research is that which concerns itself with description as an end in itself: that is in order to understand the laws of the object rather than as an aspect of socially or culturally orientated studies. The Cambridge Land Use and Built Form School, particularly the work of Martin and March, Kruger, and Brown will be discussed here alongside the work of scholars from MIT, represented by Stamford Anderson and his colleagues, amongst them Ellis and Caliandro.

A second strand is to be found in English morphological geography and urban and local history. A diverse collection of authors from Smailes, Conzen, Carter, and Roberts to Beresford, Hoskins and Aston and Rowley spring to mind, together with their French counterparts, particularly Lavedin. For these scholars, the description and classification of space is an aspect of the more general task of encapsulating the nature and impact of historical events.

A third group and by far the largest, is that of the urbanists and town planners whose interest is in modelling dimensions of previous entities in order to intervene in present and projected realities. Almost every urban theorist from Alexander to Unwin appeals to the past, and a vast army of scholars including Burnett, Ching, Keeble, Kirschenmann and Muschalek, Krier, Lynch, Schoenaur, Sharp, and Sprereigren each produce a classificatory scheme for urban grids. Representatives of all three strands will be discussed, though the review does not claim to be exhaustive.

The chapter does not cover material which is locational, and orientated to nomenclature rather than to the visual representation of physical properties of the grid (though it notes its existence). There is a large body of material which addresses urban spatial structure in this way, almost all of it aimed at characterising the urban process rather than specifying the dimensions of urban form. This nearly always gives

\[1\] an illustration of the criteria for urban structure which is typical of the approach (Fig 2: 01) is set out by Bourne, LS, *Urban Spatial Structure*, an introductory essay on concepts and criteria, in Bourne LS ed. *Internal
Table 2:01 - Nonrepresentational approaches to urban structure: Bourne and Dunleavy.

<table>
<thead>
<tr>
<th>Level</th>
<th>Course</th>
<th>Description and examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context</td>
<td>1 Timing</td>
<td>Time and stage of development</td>
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<tr>
<td></td>
<td>2 Functional</td>
<td>Functional mode and stage of production (e.g., service center, mining town)</td>
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<td></td>
<td>3 Internal</td>
<td>The socioeconomic and cultural environment in which the city is embedded</td>
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<td></td>
<td>4 Relative</td>
<td>Position within the larger urban context (e.g., core-periphery contrasts)</td>
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<tr>
<td>Macro-form</td>
<td>5 Scale</td>
<td>Size, area, population, economic base, income, etc.</td>
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<tr>
<td></td>
<td>6 Shape</td>
<td>The shape of the area</td>
</tr>
<tr>
<td></td>
<td>7 Site and topo-</td>
<td>The physical landscape on which the city is built</td>
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<td></td>
<td>graphic base</td>
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<td></td>
<td>8 Transport</td>
<td>The type and configuration of transportation system</td>
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<td></td>
<td>9 Density</td>
<td>Average density of development, shape of density gradients (e.g., population density)</td>
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<tr>
<td></td>
<td>10 Homogeneity</td>
<td>The degree of mixing (or segregation) of uses, activities, and social groups</td>
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<td></td>
<td>11 Centrality</td>
<td>The degree to which uses, activities, etc., are organized hierarchically about the city</td>
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<tr>
<td></td>
<td>12 Sectorality</td>
<td>The degree to which uses, activities, etc., are organized sectorally about the city center</td>
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<tr>
<td></td>
<td>13 Connectivity</td>
<td>The degree to which nodes or subareas of the city are connected by networks of transport,</td>
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<td></td>
<td></td>
<td>the physical landscape, social interaction, etc.</td>
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<tr>
<td></td>
<td>14 Diversity</td>
<td>The degree of difference between segments, or between city, service center, residential</td>
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<tr>
<td></td>
<td></td>
<td>space, economic, etc.</td>
</tr>
<tr>
<td></td>
<td>15 Conformity</td>
<td>The degree of correspondence between function and form</td>
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<td></td>
<td>16 Substitutability</td>
<td>The degree to which different urban forms (e.g., buildings, streets, public spaces) can</td>
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<td></td>
<td></td>
<td>be used for one function (e.g., instead of another).</td>
</tr>
<tr>
<td>Organization and behavior</td>
<td>17 Organizational principles</td>
<td>The underlying mechanism of spatial sorting and integration</td>
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<td></td>
<td>18 Cybernetics</td>
<td>The degree of feedback; the sensitivity of form to change</td>
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<td></td>
<td>19 Regulation</td>
<td>Internal review of monitoring and control (e.g., zoning, building controls, financial</td>
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<td></td>
<td></td>
<td>constraints)</td>
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<tr>
<td></td>
<td>20 Goal orientation</td>
<td>The degree to which urban structure evolves toward a priori objectives</td>
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</tbody>
</table>

Fig 2:01 - Nonrepresentational approaches to urban structure: Bourne and Dunleavy.
rise to a problem for morphology in translating from naming the phenomenon to indicating its presence in the world. This work has been reviewed and summarised elsewhere so it will not be covered here.\(^1\) Nor does this chapter cover material relating to the specific history of the City of London. This is consulted where necessary throughout the thesis. A third area which is omitted other than anecdotally, relates to the phenomenal form of towns: matters of construction, environmental design, architectural style and so on. This is not to deny that these aspects of urban form are of interest but to recognise that they are not the central concern of this thesis and to acknowledge that they have been well-documented elsewhere. The aim here is to see if anything can be said beyond giving a description of the physiognomy of the City about the 'deep structure' of urban space.

**Formal descriptions of urban form.**

The research interests of the Centre for Land Use and Built Form at Cambridge\(^2\) are summarised in the Explorations which open March and Martin's book, *Urban Space and Structure*\(^3\). They are concerned primarily with the relation between underlying geometric principles of composition and the mathematics of land use within the street grid which is thereby generated. 'The existing chequerboard of buildings and streets is one pattern. But if the geometry of the pattern is changed then precisely the same amount of space can be accommodated in the same general height of buildings but with a considerable increase in open space. It seemed that in most towns which appear to be overcrowded all the land that is needed is there if

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\(^1\) A summary chart (Fig 2: 01) is offered in Dunleavy P., *Perspectives on Urban Studies*, in Blox, Brook, Dunleavy and McDowell, *Urban Change and Conflict: an interdisciplinary reader*, Harper and Co. London, 1982.

\(^2\) This title is used loosely, as an umbrella to cover work in several other institutions whose scholars passed through Cambridge during the important period when this work was being developed. These include the Centre for Configurational Studies at the Open University and the School of Architecture and Urban Planning at the University of California, Los Angeles.

the right principles are used to find it. 1 They are therefore interested in quantifying the same phenomenon as in 'syntax' - the urban grid - but with one important difference. The research interest here is focused upon the identification of underlying order concepts by which key characteristics of the three-dimensional form of towns can be explored.

March's approach to the grid is dealt with in detail below not only because it illustrates the preoccupations of the group, but also because the concept of 'the grid as generator' has an emotive as well as a rational appeal. The difference is in the account of what is generated. For March and the majority of his colleagues it is a pattern of building stock. For syntax it is a pattern of space use and occupancy. This will be followed by a consideration of the work of Brown et al., who attempt to deal generatively with the urban block structure of non-geometric cities and of Kruger, whose interests are directed in part to the configuration of the urban grid itself.

For 'syntax', geometry is measured by the number of island types, and the order which is apparent in the grid by the extent to which there is identity and repetition in the distribution of RA values; specifically order concepts are dominant where the two are brought together in large measure, and the identity of RA values is not a product of different geometrical relations (as can happen by chance, where two streets with different local connectivity patterns and shape properties can still have identical global depth values) but of similar geometrical alignments (as in two adjacent streets with the same connectivities to cross-cutting streets). For March and Martin, the interest is not quantifying order, but in observing its consequences: especially the potential of different kinds of grid in principle to carry a specified range of uses. This leads to various attempts to describe and model

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1 March and Martin, op cit, p 1.
4 this general research aim leads to its own particular research questions, such as exploring the restrictive effect of building regulations upon the emergent form.
Fig 2:02 − The relation between land use and built form as set out by March.
the gross geometric properties of buildings: pavilions, slabs, towers, courts in terms of their space-containing volumes.

Leslie Martin's paper on The Grid as Generator\(^1\) puts the argument in a nutshell. 'Many towns grew up organically by accretion. Others, and they are numerous and just as flourishing, were established with a preconceived framework as a basis. Both are built up from a range of fairly simple situations: the grid of streets, the plots which this pattern creates and the building arrangements that are placed on these. The whole pattern of social behaviour has been elaborated within a limited number of arrangements of this kind, and this is true of the organic as well as the constructed town......The grid of streets and plots from which the city is composed is like a net placed or thrown upon the ground. This might be called the framework of urbanisation. That framework remains the controlling factor of the way we build, whether it is artificial, regular, preconceived or organic and distorted by historical accident or accretion. And the way in which we build may either limit or open up new possibilities in the way in which we choose to live' \(^2\). According to March, the function of the grid is to receive its loading of buildings and its form affects its capacity to do that efficiently and effectively. This is undoubtedly the case and, this being so, March sets out to show and model the relationship between building density and height and the carrying capacity of the geometry of the grid.

The questions which this approach throws up are almost identical to those which motivate this enquiry into the City of London: how does the framework of a city work, how does the grid operate to generate and control city form, how can it accommodate growth and change? March attempts to answer in a different way, however, by holding the grid steady as a neutral background on which to elaborate particular building geometries. \textbf{Fig 2:02} shows the comparative power of this analysis in tracing the three-dimensional elaboration of the underlying grid under different rules for unfolding buildings across it.

\(^1\) Chapter One of \textit{Urban Space and Structure} op cit, pp 6-27.
\(^2\) ibid pp 9-10.
Fig 2.03 - The range of possible built forms for a 'standard' development on an urban block.
The philosophical aim here is to show that a simple grid does not produce monotony and identity in environments. 'What has been described is a process. It is now possible to extract some principles. Artificial grids of various kinds have been laid down. The choice of grid allows different patterns of living to develop and different choices to be elaborated. The grid, unlike the fixed visual image, can accept and respond to growth and change. It can be developed unimaginatively and monotonously or with great freedom.'¹ This in turn depends on the inter-relationship of quantifiable, specifiable parameters: the size and shape of urban blocks (given by the grid), plot ratio (built space: open space) and building height (together with legislative controls on such factors as daylight, sunlight and overlooking). By varying the parameters, it is possible to generate a range of alternatives for any given urban situation. Fig 2.03 shows how these factors are related together, by holding floor space and site area steady and varying the conditions of access, daylighting, and building geometry.

The conclusion which March arrives at is that if we consider a city and see on the plan an even distribution of sites, and then load it with tower blocks, this would seem to produce a pattern of land use which is full to overcrowding. However, 'if the size of the road net were to be enlarged by omitting some of the cross streets, a new building form is possible. Exactly the same amount of floor space that was contained in the towers can be arranged in another form. If this floor space is placed in buildings around the edges of our enlarged grid, then the same quantity of floor space that was contained in the 21 storey towers needs now only 7-storey buildings. And large open spaces are left at the centre.'² The significance of this approach is in showing the range of possibilities for urban form which satisfy the background conditions in any given situation.

The limitations of the approach for modelling the urban grid in a way which might shed light on growth and change within the street grid of the City of London are equally clear. Despite its centrality to the argument, March's approach omits to quantify and categorise the

¹ ibid. p. 15.
² ibid. p. 21.
changes which are made to the street grid as a result of varying the range of geometries. Because the background, underlying grid on which all the varieties of composition are unfolded is a constant, he has satisfied his conditions of holding the contextual variables, including the gross street pattern steady. However, as soon as we move away from a concern with characterising building form to discussing key properties of the grid itself, this is no longer adequate, particularly in the case of 'organic' towns, where the relation to the background grid is far less clear than in the geometrically regular arrangements which can (in principle at least) be fitted into any rectilinear form simply by changing the scale of the development to suit. It is noteworthy that March does not show any examples of more 'traditional' urban layouts.

There is however a more deep-rooted difficulty in March's approach for the subject matter of this thesis. To reduce function to efficiency in this way is to deny the social significance of urban space as anything more than a system of generalised access to buildings. Uses in March are considered to be a property of buildings and not of streets. The uses of streets are therefore not built in at the outset as a factor to be described and quantified. In the case of the City, much of the activity which today takes place in buildings is known historically to have occupied the streets. The possibility that different geometrical arrangements might bring about different distributions of people on the streets is not discussed though it is entailed in March's premises. The possibility that the grid itself (rather than the buildings) might do this, and therefore that the grid might take one form rather than another in the interests of this movement-orientated variable is not even considered.

Yet there is clearly more of a social significance to be explored within the urban grid than is allowed by the demands of accessibility. March's conclusions give some idea as to the assumptions which lie at the heart of his descriptive universe alongside building functionality. In the final analysis, he acknowledges both that an urban area is more than the sum of the buildings placed within it, and that the urban grid has an upper limit to its spatial scope as well as internal limits to its configurational possibilities. An urban grid, he argues is a locality 'in
Fig 2:04 - March's analysis of the Bloomsbury area of London
which a pattern of related uses holds together’. In arguing this, March assumes a correspondence between segments of urban society and introspective, community-based physical compartments within the local street grid, while through-traffic routes act as limits to the urban grid locally and divide the town globally.

March relies upon Buchanan’s concept of an environmental area2 to justify this viewpoint. One it is adopted, it is possible to consider the logical possibilities for redistributing the building uses locally within the grid. It is with an example of how this might be achieved that March concludes his argument. (Fig 2:04). But suppose the grid locally has other than a self-referential function and contributes either to the local build-up of uses alongside those carried by the building stock, or even to the overall pattern of space use within the town? If this is even conceivable, then the radical reorganisation of the circulation pattern at ground level which is proposed in this example needs to be considered in as much detail as the profiles of the resulting buildings and pattern of open space. March’s descriptions, though quantifiable with respect to the urban blocks, have nothing to contribute to this level of the debate.

The approach to building description which measures of the ‘efficiency’ of building geometries, produces several classifications, all of which treat the urban block as the limit of the field of interest, and the rectangular or square grid as the form by which blocks can be aggregated into larger urban areas. One speculation3 suggests that the pavilion/tower, street and court forms are the three basic ‘types’ which can be generated within a rectilinear universe. The pavilion is a finite plan form, streets extend along a one-dimensional axis and courts extend infinitely in both dimensions.

Another speculation uses the polar concepts of nuclear (thinking of space as blobs: i.e., buildings) or linear (thinking of the spaces between blobs: i.e., the street grid) and concentrated (one entity) or dispersed (many entities) to dimension urban form4. These kinds of classification

1 ibid. p. 23.
2 ibid p. 22.
3 ibid. p. 35
4 ibid p. 49
Fig 2:05 - A typical LUBF activity space distribution diagram
provide a basis for generating different types of grid and modelling their features, such as the percentage of space occupied by buildings set against that allocated to open space. Although it is suggested that all urban space of whatever configuration can be seen as a continuum which varies across all three categories in the first instance, and within these dimensions in the second, it is not made clear by the authors how non-geometric systems like the City of London might be assigned to one 'space type' rather than to another.

A common characteristic of all this work is that it uses stereotypes to model the dimensions of variability of key features of urban layouts in order to see how they vary in relation to a limited range of functional constraints. It is, moreover, a form of building description which is uncommitted on the significance of cultural constraints in the selection of one built form rather than another. These cultural variables are in any event more difficult to quantify than environmental factors, or matters of the 'efficient' use of plots.

A second group of studies within the spirit of enquiry of the LUBF school, however, attempts to approach the issue of social variables more directly by modelling 'real' space use. The general form of these models is to describe activities on the one hand and physical forms on the other, and to assume that these variables are systematically related. In the case of urban spatial structure this leads to a distinction being drawn between two fundamental components: the activities which occur in a town (residence, employment, services) and the stock of physical infrastructure ( % of the floorspace locally available) which accommodates them1. Towns can be 'diagrammed' in terms of the proportional distribution of activities to floorspace, the resulting patterns compared (Fig 2:05) and the flows (journeys) between activities compared. The arterial roads are regarded as channel spaces which carry inter-locality traffic flows.

The aim of the exercise is to distribute activities and flows realistically over a fine mesh square grid overlaid on the town map, in proportions which accord with the percentage of 'real' floor space devoted to each

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1 Echenique M., Crowther D. and Lindsay V., A structural comparison of three generations of New Towns, in March L. and Martin L. eds, Urban Space and Structure, op. cit. p. 222.
activity locally. Evaluation consists in measuring physical characteristics of the overall static distribution pattern. The variable 'social interaction', for example, computes the average distance in kilometres within which all residents can reach a given number of other residents. Towns can then be compared in terms of their performance, the parameters changed and the model re-run to see the possible effect of different planning strategies. Finally social 'weightings' can be applied to variables to give a cost-benefit analysis.

The difficulty with applying this kind of model to the evolving City of London is that these models are not physical but locational. Activities are considered and socio-cultural practices detailed, these are not related to either building geometry or, more importantly, to the configuration the street grid other than in a very diagramatic way. Clearly it is of interest for a resident to know that 12,000 people potentially can be reached in a radius of 1.73 kilometers in Reading travelling 'as the crow flies', while in Milton Keynes it takes a radius of 1.77 kilometers potentially to reach the same number of people. In terms of the shape and parametric properties of the street system which frames the actual distribution and movement potential of people 'on the ground' no equivalent statement or comparison can be made. Models which describe space use in this way are too locationally-orientated and too coarse to deal with the many accumulated small changes which have taken place in the street grid of the City of London. Even the underlying functional categories of the model cannot be used in the mediaeval City of London, where the distinctions of home from work and both of these from services, do not apply.

Having said this, the City of London, and the post-Fire plans of 1666 are the subject of a section on mappings and trasformations in a later book of LUBF studies, The Geometry of Environment, where the plans of Hooke and Wren for rebuilding the devastated city are compared to that of the mediaeval City. The suggestion is made that Hooke used nature as an inspiration. 

1 ibid. p. 226. Four target figures were used in this case 12,000, 24,000, 48,000 and 96,000.
cells of a sponge, the cells which he had discovered under a microscope with their characteristic rectangular structure', whereas Wren drew on abstract man-made geometries 'the ideal of the European Baroque city which he had seen emerging in Parisian works and which had undoubtedly excited his abstract geometrical interest'. The city which was built, it is suggested, was neither of these, but 'one that everyone could grasp'.

The lesson of this for the authors is that pattern, in particular geometrical pattern based on order concepts, is not necessarily informative of social structure. The fact that neither plan was built, they suggest, indicates that the geometries which Wren and Hooke used as sources for design did not capture important aspects of reality. They propose that far more than geometry is involved the description of urban forms. 'We might say that we map the complex environment into separate sheets: one sheet maps the volumes, surfaces and edges of the built environment, another the networks formed by the communication, transportation and service channels, and another the various movements and patterns associated with human activities. It is clear that the various mappings are inter-related, and many would argue that it is precisely the relationship between these mappings that are the most important, and not those within the mappings themselves. (authors' emphasis)' They argue that the three 'sheets' correspond to three separate broad mathematical interests: with the geometry of the plane, with graph theory and with statistics respectively.

In limiting themselves as they do, to the first of these three areas, the authors overtly distance themselves from the kind of questions which are germane to this thesis, particularly those which relate the urban grid or to social and cultural affairs, though they do specify the kinds of techniques and methodologies which would render these aspects of urban reality open to scrutiny. They declare an over-riding interest in characterising the samebesses i.e., the order of things. This is reflected in the chapters which follow. These deal among other matters with the geometric properties of objects such as translation, rotation and

2 ibid, p. 34.
reflection, with the aggregation of arrays through stacking, nesting and fitting, and with theoretical matters like modules, numbers, proportional systems, and arithmetical series. The question of how the separate three fields of inquiry and the three sets of mathematical techniques can themselves be brought into a relation is not discussed by March and Steadman, though it is clearly a question which will have to be addressed in the analysis of the evolution of the street grid of City of London which is the subject of this thesis.

The interest in order and samenesses informs Steadman's overview of the range of the range of architectural research of a descriptive, mathematical nature. His thesis is that 'design is, always has been and always will be concerned at its central core with the manipulation of form, with composition (author's emphasis)'. Ideas like enumeration which are central to Steadman's interest are, despite their apparent concern with diversity; that is, with generating all the possible theoretical versions of some entity; aimed at the samenesses which inhere in objects. 'What we are asking, when we talk of possibility in this context is 'How many other theoretical designs are there, similar in some sense to those which have been actually made?' (my emphasis)'.

According to Steadman, this may be in some way connected with the importance which designers give to the 'ideal', through developing ways of conceiving and manipulating the geometric forms of projected buildings, over the 'real', as represented by architectural history. Many of the techniques which Steadman presents here, whilst affording 'objective' spatial descriptions, are aimed at capturing and modelling aspects of a morphology of the possible and not with the morphology of the real.

One noteworthy exception to the order-related preoccupations of the LUBF school is the work of Brown, which uses the City of London as mapped by Ogilby and Morgan in 1677 as a basis upon which to develop descriptions of the organisation of space at the 'meso-scale'.

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2 Steadman, op.cit. p. 2.
3 ibid. p. 172.
4 showing, perhaps, a similar philosophical attitude to design to the concerns of Alexander about the human mind which were outlined in the Problem Definition.
5 Brown, FE and Johnson JH, op.cit.
Fig 2:06 - Property boundaries in a typical City block according to Brown
the island block - using shape grammars. Brown set out first to discover the apparent principles which governed the arrangement of buildings and plots within a typical insula and then to develop a model which would simulate the observed patterns of development. The research aim was to ‘clarify the mechanisms by which London grew up’.

The first stage of the work was one of historical reconstruction. Brown used a combination of map analysis, house plan analysis and documentary reconstruction to pin down the most probable ‘evolutionary sequence’ of buildings upon typical urban plots. At this stage, it became clear that urban blocks within the City did not take the more usual form of an accumulation of burgage plots, but were divided by the dominant system of land holdings into smaller rectangular areas or segments (Fig 2:06). The segments at the perimeter of the urban block fronting onto the street were found to be wider than a conventional building plot, and frequently contained several properties. The interior segments were once gardens or fields attached to perimeter segments. The boundaries of perimeter and interior segments were, Brown argued, laid down at an early date and influenced the subsequent evolution of plots. The segmental structure of urban blocks was thus taken by him as a priori.

The segmental structure of property boundaries, Brown suggested, was covered by buildings in accordance with two simple rules of aggregation: buildings were always constructed against the segment boundary, and buildings were aggregated into rows of contiguous properties wherever practicable. This led Brown to suggest two typical modes of intensification of development on urban plots. Perimeter segments developed a pattern of narrow, outwards facing properties to maximise the numbers of properties with a street frontage. However, they fell into two sub-types, depending on how their attached interior segment was developed. In the ‘yard’ sub-type, a narrow passage gave access from the street to the backlands, and the interior segment became a courtyard surrounded with properties.

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1 It has to be said that this thesis suggests that the block selected by Brown is not altogether typical but it is rectilinear and therefore it makes for a better approximation to Brown’s computer-generated shape-grammars.
2 Brown et al., op cit p. 377.
Fig 2:07 - A classification of City blocks according to Brown

Fig 2:08 - Simulated urban blocks produced by computer generation under different 'breakthrough' conditions.
which lined the boundary. In the 'burgage' sub-type, the interior segment became a long, narrow private garden. Corner plots were a special case, with a predominance of L-shaped properties enclosing a small square garden. Interior segments which developed separately from a perimeter land holding normally comprised small properties, all of which faced into the yard (Fig 2:07).

From these elementary shape combinations, Brown developed a computer model which attempted to simulate the observed block structure of the mediaeval City by writing a system of aggregation rules in the form of a 'shape grammar'. As Brown explains, 'rules were sought which, separately, could be interpreted as corresponding to real historical actions - the establishment of property boundaries, the maintainence of light, access etc.' The dimensions of the 'frame' provided by the hypothetical rectangular urban block and of all the segments generated within it, were taken from the cartographic record. Brown discovered early in the simulation process, that 'breakthrough' between adjacent property holdings within the urban block was a facet of reality which had to be incorporated into his model.

In his initial simulations, 'breakthrough' to maintain continuity with the street (Fig 2:08) was permitted temporally; that is at particular point in the developmental cycle of the segment. This, Brown discovered, resulted in the depth of interior segments from the street being far greater than in the real City. As a result of this discovery, Brown found it necessary to revise his 'breakthrough' rules spatially rather than temporally: that is to introduce 'breakthrough' at the point at which the interior segment would otherwise become too deep, irrespective of its point in the developmental cycle. A number of small refinements of this type led to an improvement in the performance of the model.

The simulation process and its results led Brown to several conclusions which are pertinent not only to what has gone before, but also the subject matter of this thesis. All Brown's extra rules were orientated to giving greater importance to maintaining contact with the

1 ibid. p. 378.
perimeter streets than seemed apparent from his initial analysis of the growth process. At the same time, he found it necessary to give attention to the construction of a secondary route system through the heart of the urban block to maintain this 'shallowness' to the surrounding street system. That it was necessary to specify this spatially, to forbid the accumulation of depth over time as the plots evolved, led Brown to suggest that the indubitable historical maintainence of a shallow access system must have occurred systematically within the evolutionary process, since the computer simulations demonstrated that it could not have arisen by chance.

The significance of Brown's findings for this thesis are threefold. First, Brown suggests that even in a disadvantaged social group, such as that represented by the occupants of the tenement buildings and hovels which were constructed in interior segments, rights of access were socially so important as to ensure that these were maintained morphologically more or less as specified within the limits of the model. Secondly, Brown's work illustrates the importance of an earlier point of concern here, that of the necessity to look not just at the geometric form of urban blocks, but also at the generative rules which govern the access system which is simultaneously evolved alongside them.

Finally, the shape of Brown's research - his use of the cartographic record to set up hypotheses, his development of simulations to test hypotheses, and his modification of these in the light of experince - suggests that morphological studies do indeed have a part to play in augmenting the kinds of understanding of urban space which can be derived from the direct study of history. The 'spatial laws' which seem to intervene in a temporal process to preserve the shallowness of interior segments to the street illustrate the shape which these morphological constraints might take locally. The question remains as to whether these constraints interact with the global properties of the urban grid of the City, and whether this global historically-evolved

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1 to pursue the point about historical and morphological explanation raised in the Problem Definition, the historical explanation of how this took place is not given by Brown, nor does he find it necessary to speculate. For Brown, a morphological explanation suffices.
Fig 2:09 - Kruger's approach to urban form

Figure 1. Levels of resolution of the urban graph system.

Figure 2. From built-form galaxy to built-form unit.
and changing space structure has additional 'spatial laws' of a similar or novel type which govern its overall growth.

Brown's work was completed too late to appear in Steadman's overview. The only descriptive studies which Steadman considers pertinent to architectural history at the urban level are therefore those of Kruger\(^1\). Kruger used graph theoretic techniques and statistics to make statements about the configuration of buildings in relation to the shape and connectivity of the urban grid. In setting his research aims in this way, Kruger was interested in refining the methods of Echenique et al. which were discussed earlier, to express the actual pattern of connectivity inherent in urban space as opposed to the locational descriptions which underpinned the earlier models. He too, implicitly recognised the inadequacy of the descriptions which were already in existence within LUBF methodology to capture key properties of a complex urban grid.

Kruger's work on the characteristics of urban areas also tended to focus at the level of the urban block - at what he calls the 'built-form constellation' and its 'arrays' or groups of buildings - rather than at the 'built-form galaxy', that is the overall arrangement of urban blocks and its corresponding 'channel network' or street pattern and other transport networks and how these relate to form what he calls the 'urban graph system', the spatial structure of the town (Fig 2.09). The empirical focus for his research was the town of Reading, in Berkshire.

Kruger's approach to an urban surface was to disaggregate it into a series of 'sheets', each of which mapped a different aspect of the reality. His first type of graph recorded the party-wall structure of buildings: that is whether building arrays were terraced, semi-detached, detached, back-to-back etc. His second representation showed the adjacency relationship of the building interior to its surrounding open space through the external walls. The third graph recorded the permeable relation between the interior of each building, and the nearest point in the adjacent main street along paths, drives etc.

\(^1\) Kruger M. op. cit.
Fig 2:10 - Kruger's representations of the street grid of a town.
Further representations were introduced of the main road system. The first of these was a representation of the street grid in the form of a node map in which points represented street intersections and links between nodes represented streets. The inverse pattern of adjacency between faces of the urban blocks - block graphs - was also recorded (Fig 2:10). Kruger's research interest was in plotting the relationships of entailment which hold among variables and to use these changing relationships to characterise different areas of the town.

The main measures which Kruger devised were aimed at the building array. These included a perimeter measure (mean number of external walls per building), a compactness measure (mean number of external walls per building array) a shape measure (ratio of external walls to party walls per array) and a connectivity measure (number of party walls per building array). A division of the town into kilometer squares showed that Reading varied from centre to suburbs on several of these variables. Kruger was then able to simulate probabilistically, the distributions of numbers and types of building arrays which could be observed empirically, thus demonstrating the interdependence of the measures.

Unlike Brown, Kruger did not deal with the system of secondary access and circulation which arose in the heart of his urban blocks, but restricted his analysis of the street grid (channel network) to the main streets. Even here, his work is less fully-developed than at the level of the array of buildings. It is therefore not possible to set Brown's findings for the mediaeval City within a comparative frame. The possibility of doing so is not contained within Kruger's methodology which specifically ignores minor declivities in shape (back extensions to houses, deformities in the orientation of individual streets) in favour of a careful topological description of the gross relations of adjacency.

In the case of the internal structure of urban blocks this is admirable since, at this level, adjacency is the prerequisite for permeability. In the case of the urban grid however, a main analytic problem is that the street system is continuous and so adjacency is not 'natural' to the system in the same way as it is to the built array where discontinuities - boundaries - make the contiguous discrete elements
Fig 2:11 - The limitations of node maps.
of the system identifiable. It is the subdivision of the continuous street space into elements which is a main problem for the description of street systems generally.

Kruger's proposition is that this can be accomplished by a node map, and indeed the node map is a valuable benchmark against which to set 'syntactic' analysis of the grid\(^1\). However, by restricting nodes to intersections of more than one street, rather than allowing parts of a single street to intersect and form a node through a sharp bend or deformity in the building line, his picture preserves the rectangularity of blocks however articulated they actually become (Fig 2:11). This fails to capture an important characteristic of the street space of the City, and ignores what seems to be a key property in the evolution of the grid towards its more regular, modern form.

A second body of research which places considerable emphasis on descriptive techniques is that emanating from MIT under the direction of Stamford Anderson\(^2\). This work is, in an important sense, complementary to that of the LUBF school since it is aimed directly at capturing key properties of streets as opposed to urban blocks\(^3\). Anderson suggests that to describe streets in other than a mundane way is challenging for 'the intermediate position of streets in the environment, intersecting public and private, individual and society, movement and place, built and unbuilt, architecture and planning, demands that simultaneous attention be given to people, the physical environment and their numerous interrelations'\(^4\). He therefore rejects in principle, the proposition that urban space can be represented as a series of 'sheets' each capturing in a separate way a different aspect of the same reality. His aim is to capture the 'ecological wholeness of streets'\(^5\).

Anderson's principal requirement is that, to be useful, a description of

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\(^1\) It is used alongside the 'syntactic' axial map in the section on ideal grids later in this chapter.


\(^3\) Anderson also explicitly rejects the LUBF division of the city into networks or movement channels (streets) and adapted spaces (urban blocks) as too simplistic ibid., p.271.


\(^5\) ibid., p.1
urban form must be both independent of the determination implied by describing it in terms of its existing uses but at the same time capable of being socialised\(^1\), in order to express the potential of the form to accept a range of human activities. This range may be wide, in which case the form is robust. The existing uses may not exploit or exhaust the use-potential afforded by the form, in which case the form has latent potential or resilience.

In applying these ideas to the study of streets, Anderson takes as \textit{a priori} the following two points: firstly, the space of public access which is the street space of towns 'ebbs and flows' \(^2\) in relation to the block structure over time; and secondly that it is not possible to solve the problem of representing street space as a system made up of elements and relations; 'we do not know what the atoms or simples or elements of the city are' \(^3\) so that he assumes that it is necessary to represent the street system as an undifferentiated whole.

This leads him to suggest as a descriptive tool a figure/ground analysis of the physical fabric of the city 'which is relatively physical and complete within its own rules' \(^4\) and to superimpose upon this three further distinctions of a functional type. These are the space of public claim, that is all space which is permeably or visually accessible to everyone in the streets; the space of private (domestic) claim and the space of occupational (nonresidential, work) claim. These, he sees as either overlapping or spatially distinct. His interest is principally in quantifying the degree of 'overlap' which is to be found between the three types of use-defined space under different socio-economic conditions, and in measuring the 'tidal flow' of the different sub-systems across the figure/ground backdrop through time.

Anderson's use of the grid of Savannah to illustrate these ideas is an explicit critique of the LUBF analysis, for he adds to a purely

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\(^1\) Appleyard, who like Anderson recognises the significance of street space, places a far greater emphasis on the individual street and the pattern of use within it, has been consulted but is not reviewed here, Appleyard, D et. al. \textit{Livable Streets}, University of California Press, Berkeley, LA., 1981.

\(^2\) the metaphor of tidal movement through the canals of Venice is used to discuss the 'tidal flow' of people about, into and through the everyday streets and buildings of cities in general.

\(^3\) ibid. p. 268.

\(^4\) ibid p. 271
Fig 2:12 - Anderson's analysis of the Savannah grid set alongside that produced by LUBF Cambridge.
geometric description of the urban blocks an analysis of the internal street grid (Fig 2:12), the main point of which is to show the intricate interaction of abstract geometry and use patterns, each modifying the other. The central east-west axis of the wards, which was a dominant element of the abstract ward geometry, has become the most redundant type of street in the system - it gives neither unique nor primary access to any parcel, and it is not important for movement since it is paralleled by six nearby continuous ways. 1 Anderson therefore argues a similar point to that made earlier here, that an analysis of urban blocks is radically incomplete without a complementary description of the local structure of the street grid.

Anderson's is a view of urban street space which admits ambiguity as an essential feature of description and analysis. It is therefore one which has this feature in common with 'syntax'. Its interest in the relation between visibility and permeability properties is also shared by 'syntax', though in the latter they are not normally represented together but rather in relation to each other, to express differences between the two spatio-temporal fields 2. However, its comparative value is limited to systems which can be directly observed. We can only speculate on the degree of 'overlap' of these realms in the City of London in the past, and propose that this has probably reduced during the evolution of the City 3.

Caliandro 4 uses a similar but more developed set of distinctions to develop a typology of American street systems, again applying such categories as land use (residential, commercial, institutional, mixed), built form (detached, row, appartment, tower etc.), circulation (pedestrian and vehicle, subdivided into light, heavy and in the case of pedestrian movement random activity) activity setting (as individual, group, or private space) and public/private use boundary (the presence or absence of secondary property boundaries to isolate unusable exterior space) as colour-coded patterns on a basic

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1 ibid p. 275.
2 as in an early article Hanson J and Hillier B, Domestic Space Organisation: two contemporary space codes compared, Architecture and Behaviour, Vol.
3 for example, in recent years some ancient public rights of way which passed through buildings have been lost.
Fig 2:13 - Caliandro’s representation of urban space.

Fig 2:14 - Caliandro’s typology of urban space.
figure/ground map of the street and the buildings which line it on either side, and then summarising the major differences between the maps (Fig 2:13). The basic emphasis is upon the quantification of these typological variables, though this seems to be carried out by visual inspection rather than by measurement.

A primary interest is to develop a 'classification of street-oriented or non-street-oriented settings, a question of whether buildings depend directly on the street for accessibility and internal spatial organisation' 1 The typology which Caliandro proposes (Fig. 2:14) is based on the first two variables, land use and built form, together with a third and more impressionistic variable of the orientation of buildings towards or away from the street, which is derived from the amalgamation and descriptive interpretation of the diagrams of circulation patterns, observed activity and the strength and location of public/private use boundaries in the street in question.

Caliandro's work, though more developed than that of Anderson, is (almost as a result) less directly applicable to historical studies. The main distinctions of his typology are for the most part elided in the historically-evolved City of London. Every street within the City is 'mixed use, row, street-orientated'. As a tool to capture local differences and discuss evolution, a different and more detailed set of criteria would have to be evolved and this would make comparison with Caliandro's material impossible. It is probable that his typology is best suited to a sectional analysis and comparison of modern town.

A third contributor to this field, Ellis,2 is also interested in building upon the initial binary figure/ground transcription of streets and urban blocks. Like Caliandro, Ellis is interested in turning this into a typology rather than dealing with street space as a continuum. Ellis proposes two general sub-types of street to block relation: 'a traditional one with its streets in a system of differentiated open spaces and a contemporary one with its streets in a system of undifferentiated open space ' 3. The traditional pattern he terms a 'structure of spaces', by the argument that the street space seems to

1 ibid.p.151.
3 ibid. p. 114.
Fig 2:15 - Ellis's typology of urban space.
have been carved out of a solid building mass so that it is the shape and character of this carving which gives rise to the urban blocks. Modern concepts of space, Ellis argues are by contrast built up from free-standing pavilions set within a landscape, and under these conditions it is the shape of the buildings which dominate the surrounding open space. Space of this type is therefore, Ellis suggests, a 'structure of solids'. (Fig 2:15) Basic differences in the way of positioning the flanking buildings with respect to the street: street wall and street space corresponding roughly to contiguous and non-contiguous modes of building aggregation, are associated by Ellis with these two sub-types of global town form, but not in a one-to-one relationship.

Unlike Caliandro, the burden of Ellis's account of street space is directed towards the characterisation of traditional streets. Here, Ellis proposes two sub-types: continuous development (through streets) and elongated courtyard (cul-de-sac). Ellis points out that in through streets, ambiguity in its terminations is intrinsic. We do not always know where a particular street begins and ends. At its extreme, a through-street may appear as a continuous channel of movement. More usually, the articulation of the street walls which bound it decompose the street into a continuous but differentiated linear segments. Cul-de-sac space is, by contrast, terminally closed, and hence it behaves, Ellis suggests, more like an 'urban room'.

Ellis goes on to observe that, within the street system, some streets are special: 'they tend to produce relative differentiation in the surrounding street system. This structuring function tends to increase a sense of place in the organisation of cities in that it helps to structure them into wholes; it tends to reduce the likelihood of random, limitless organisation.' ¹ This property is, he suggests, a result of one or more characteristics - special size, special configuration, and special position. Special configuration is a property which he reserves for culs-de-sac streets, which are special because of their degree of enclosure. Configuration is therefore seen by Ellis as a local property of urban space. Special size and special position may also occur as a factor which singles out some streets within the generalised street

¹ ibid. p. 123.
system. Size is clearly a local property of the special street. By special position Ellis means a street which serves 'to sector what would otherwise be an unstructured field of buildings or streets'. It is less clear what he means here, but it seems to imply that such a street would be special by virtue of its monumentality and geometric axially, again properties local to the street in question.

The difficulty here is that one characterisation of street space is wholly global, enabling an entire city or urban area to be typed as traditional or modern. The second characterisation isolates individual streets from the general grid according to some wholly local special property. Ellis does not offer a means to type grids or parts of grids, in order to compare them with one another and distinguish their relative contribution to the overall structure of the urban grid of the town. Ellis’ approach in effect raises the question of how it might be possible in principle to divide the through streets of a town into its constituent street segments, since these 'segments' are, he implies, an aspect of the reality of towns which can be recognised, though not quantified. It is precisely this question which is addressed in syntax by axial analysis.

**Descriptive techniques within urban history and morphological geography.**

A second morphological strand which is almost exclusively concerned with the description and typological analysis of traditional towns is that found within urban history and historical geography. This work is distinctive for the interest which is taken in relating theories of urban origins (city as a centre of production and exchange, city as market place, city as strong point, city as temple, and so on) and the topographical and functional differences which can be detected between towns (hill town, riverine town, port, industrial town etc.) to differences in their global form and layout. The main intellectual forces which shaped the field are the subject of a recent review by Whitehand, and current trends have similarly been outlined in a

1 ibid.p.123.
2 and on the fringes of urban anthropology and archeology
recent book by Carter\textsuperscript{1}. Neither of these overviews deals specifically with descriptions of town plans other than to illustrate theoretical innovations in the understanding of social or political processes. This review looks at some of the major contributors to the debate specifically from the point of view of how they deal with the description and classification of urban forms.

Conzen is generally regarded as the founder of English morphological studies. Whitehand credits him with 'first, the establishment of a basic framework of principles for urban morphology; secondly, the adoption for the first time in the geographical literature in the English language of a thorough-going evolutionary approach; thirdly, the recognition of the individual plot as being the fundamental unit of analysis; fourthly, the use of detailed cartographic analysis, employing large-scale plans in conjunction with field survey and documentary evidence; and fifthly, the conceptualisation of developments in the townscape'. He goes on to add that 'the tripartite division of the townscape into town plan, building forms and land use that was recognised has since become widely accepted. The sub-division of the town plan for analytic purposes into streets and their arrangement into a street system, plots and their aggregation into street-blocks, and buildings, or more precisely their block-plans, has become a further standard way of reducing the complexity of reality to manageable proportions'.\textsuperscript{2}

Conzen's best-known works are his studies of Alnwick\textsuperscript{3} and Newcastle-upon-Tyne\textsuperscript{4}. In these Conzen attempts to pin down recurrent morphological cycles which take place at the level of the plot, such as the 'burgage cycle' which he suggests is typical of the historic cores of most English towns. He suggests that on many plots a temporal sequence is established from the 'institutive phase', where

\textsuperscript{1} Carter, H. \textit{An Introduction to Urban Historical Geography}, Edward Arnold, London, 1983.
\textsuperscript{2} Whitehand, op.cit.\textsuperscript{p.254}.
\textsuperscript{3} Conzen MRG, \textit{Alnwick, Northumberland: a study in town plan analysis}, Institute of British Geographers, Pub. No. 27, 1960.
Fig 2:16 - The set of examples for the plan type 'residual burgage complex'.

TYPES OF RESIDUAL BURGAGE COMPLEXES
IN NEWCASTLE UPON TYNE

[Diagram showing various types of residual burgage complexes with legend and symbols]

NOTE NUMBERS ON MAPS OF BURGAGE COMPLEXES ARE THE SAME AS THOSE USED IN FIG. 2:16.
the street lines and boundaries of the plot are first established together with the principal buildings on the plot; through a 'repletive phase', with its expansion of building coverage on the plot; to a 'climax phase', when the density of buildings on the plot reaches saturation point; through a 'recessive phase', where building coverage falls; and finally to 'urban fallow', where the site is cleared, and buildings, plot boundaries and even street lines may be redefined. This is contrasted with two kinds of 'redevelopment cycle' which are characteristic of more modern times; an 'adaptive' form which amalgamates plots within an island but which does not alter street lines, and an 'augmentative cycle' which proceeds as above but entails changes to the street grid though the creation of new streets, a reduction in the number of streets or other alterations to the grid. At the level of the whole town, Conzen uses a similar approach based on a sequence of phased urban growth and stagnation which results in a 'kernel', distinctive lines between periods of growth known as 'fixation lines' and indeterminate areas at the edge of the town which he calls 'fringe belts'.

The problem in applying Conzen's criteria in a new situation is the difficulty of disaggregating the whole town into its constituent elements - what Conzen calls the 'plan units'. As Carter remarks 'a major criticism of plan analysis is that it is essentially subjective and completely reliant upon individual interpretation. Conzen defines a plan division as a geographical group of morphogenetic plan units' and a plan unit as 'any part of a town plan representing an individualised combination of streets, plots and buildings distinct from its neighbours, unique in its site circumstances, and endowed with a measure of morphological unity'. But individualised, distinct, unique and unity are all terms which demand specification.' 1 Conzen has specified a different number of plan-units for each case he has looked at in detail - 12 major and 49 minor types for the small market town of Alnwick and 118 for the central area of Newcastle.

Fig 2:16 illustrates the set for one plan-type, 'the residual burgage complexes' now forming an irregular and disjointed patchwork of

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varied types within the walled town (Newcastle) 

1 This plan type alone accounts for 3 sub-types, which are themselves in a ratio of 1:3:4 sub-sub-types. The accompanying location plan lists 38 separate examples, some of which are an amalgam of a sub-sub-type with urban fallow, which is not numbered separately. Two cases which are not fallow are shown but not separately numbered. In addition, 16 areas of urban fallow are shown. One example of each sub-sub-type (except urban fallow, which is presumably not illustrated since it has no buildings) is shown at two separate time periods. It is left to the reader to make the connection between the group of buildings which is illustrated in each case and the general description of the 'burgage cycle'. Most real configurations within the town are not shown.

Conzen's work is of interest for this thesis because he formulates clearly a major effect from history to the town plan: his hypothesis is that towns do not grow steadily from a core but in phases, with major discontinuities between periods of building. He suggests that this is reflected directly into the plan in the form of 'fixation lines', which register a permanent mark or discontinuity upon the grid. The form which this takes is not specified except in the case of a clear boundary to growth like a town wall. He does however indicate that the relation between history and morphology is one which can in principle be detected in the physical residue which is deposited within the town plan, and he goes some way to specifying the forms which this residue might take.

Subsequent authors in the Conzenian tradition have attempted to quantify salient features of town grids in order to facilitate comparison. Carter2 divides these studies into three types: those which deal with street plan and network analysis3, those which look at plot pattern and shape analysis4, and those which study building styles

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Fig. 1.2. Reduction of a map of a transport network (A) to a graph (B).

Fig. 1.3. Alternative topologic forms for the graph mapped in Fig. 1.2.

Fig 2:17 - A transcription of a road layout from Haggett and Chorley.
and multivariate analysis. For the most part, these authors take the question of spatial description as solved, and concentrate on the adaptation of measures of networks and maps which were evolved as part of 'the new geography' to the analysis of town plans. For the purposes of this thesis, it is not the development of measures which is problematic but the detailed, and non-arbitrary description of the fine structure of the urban grid.

An illustration may prove helpful. Since the subject of this thesis is that of the configuration of the grid, this has been drawn from the first of Carter's types and looks at how networks are defined and measured. Fig. 2:17 reproduces an illustration from Haggett and Chorley which is designed to show how to reduce a map of a simple road network to a graph. Each road intersection is represented as a node, and each road as a connection between nodes. From the point of view of the analysis, much of the information is discarded at the outset, and the authors advise that 'there is no concern with the length or orientation of lines nor whether they are curved or straight.' Once this reduction of reality to a graph has been accomplished, the resulting graph can be classified and measured. Some of the major distinctions between types which are suggested are similar to those in syntax, such as that between branching networks (nondistributed) and circuit networks (distributed), though there is no equivalent measure of integration/segregation.

The difference between the approaches lies in how to map in the first place. In architecture, the shape properties of the design are more important than in geography, and were the road layout to have been a designed one then the difference between the relatively straight

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1 Aktin RH, Mathematical Structure in Human Affairs, Heinemann, London, 1974. would come under this heading, though he is not mentioned by Carter in his overview. Atkin's attempt to use Q-analysis to model the visual impact of Saffron Walden and Lavenham has been consulted but it is not reviewed here because of two methodological difficulties in the work as presented. The first relates to the definition of the spatial units of analysis, the subdivided elements or bits of the plan to which properties were assigned. These 'lozenges' were assumed by Atkin to be arbitrary, and therefore his manner of arriving at them cannot be used as a standard procedure systematically to partition the plan. In addition, of the 100 buildings which formed the components of the visual field, only 50 were shown on the accompanying maps, so this made reconstruction of Atkin's analysis impossible.

2 Haggett and Chorley, op cit. p. 5
sections of road and the highly articulated parts would have been intended, perhaps as a reflection of different kinds of use. In syntax, the nodes and their intersections are directed towards capturing this spatial articulation as well as the property of intersection.

This has two major effects, which have already been discussed earlier with respect to the work of Kruger. The first is to allow the articulation of a road to read as a spatial discontinuity of equal importance to an intersection: the second is to allow the continuation of a line of sight and access across an intersection to read as a spatial continuity. This seems to capture the more accurately than a conventional 'node map' the spatial properties which are of specific interest to the design and use of street space.

Conzen's work was detailed, and was aimed at capturing the idiosyncracy of particular towns. Smailes advocated a comparative approach. He therefore concurred with Conzen on the relationship between morphology and history, but he emphasised the characterisation of present townscape in broad terms...history was important insofar as it left a tangible residue. Smailes takes issue with Conzen on the value of cartographic studies, arguing that the town is not merely a street pattern, or disposition of filled and open space in two dimensions, but is first and foremost an arrangement of structures that rise from the ground in different shapes. Their vertical component is very real and apparent to the senses of being of our stature. Some townscape are homogeneous and simple, others heterogeneous and complex, but all depend upon elevation as well as upon the ground-plan for their essential character. He also saw the town as reducible to a set of simple, recurring elements and relations, and advocated a concern with these rather than with the detail which lent individuality to groups of particular buildings: the features that invest towns with their personality are generally oft-repeated elements or simple associations of elements, together with a few

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1 the theoretical consequences of this will be discussed later in the chapter.
3 Whitehand ibid.p.255
4 Smailes AE, Description and Analysis of Townscapes, op cit. p. 101.
individually significant structures... in very detailed urban surveys it is all too easy to end by failing to see the town for its buildings'\(^1\).

The elements and relations which Smailes identifies are not dissimilar from those of the LUBF school: in modern developments he suggests typical elements are the terrace, villa, and block each of which can be aggregated to give rise to characteristic urban textures like ribbing, studding or clumping. In traditional towns, however, Smailes advocates a more wholistic approach: 'the most significant distinctions to be made on maps, apart from locating individual buildings of special prominence and architectonic quality, would seem to be the recognition of shopping facades and of compact, functionally differentiated quarters, leaving to verbal description and pictorial illustration the rest of the characterisation of a highly individual and complex association of forms'\(^2\). He does offer elsewhere a broad comparative and historical approach to the development of town structure: but here too he finds planned towns less difficult to characterise than organic towns\(^3\) and even here he does not progress beyond the duality of chequerboard (with or without a central square) and spider-web or radio-centric plan\(^4\).

The proposition that the spatial structure of towns can be reduced to some simple set of elements and relations is one which is broadly in sympathy with a 'syntactic' approach. However, Smailes does not make much progress in specifying these for traditional towns, and his significant insights for this thesis lie more at the level of what he observes to be 'regionalisation' in towns. Smailes suggests that any town of a reasonable size possesses an internal geography, which is recognisable as much for 'the physical forms and arrangement of spaces and buildings that compose the urban landscape or townscape' as to the distribution of land uses within the town\(^5\). Smailes therefore hints that towns exhibit a sub-area structure and that the form which this

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\(^1\) ibid. p. 103.
\(^2\) ibid. p. 107.
\(^3\) though he warns against carrying this distinction too far, since it cross-cuts historical development and examples of both types are to be found in all periods and cultures.
\(^5\) Smailes, op.cit.p.84.
Fig 2.18 - Roberts' typology of village plans

Village Forms - Principles of Classification

<table>
<thead>
<tr>
<th>Degree of Regularity</th>
<th>Regular Plans</th>
<th>Irregular Plans</th>
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<tr>
<td>Regular Row Plans</td>
<td>Regular Grid Plans</td>
<td>Irregular Agglomerations Plans</td>
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<td>Irregular Row Plans</td>
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Greens Presence or Absence

<table>
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<th>Without Greens</th>
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<td>Without Greens</td>
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Composite or Political Plans

Analysis of Plan

Members of the Family of Regular one green plans

takes is one of morphological differences between areas rather than a reduplication of some smaller-scale set of similar localities.

More recently, Carter\(^1\) has attempted to quantify Smailes' regions within the central business district of Cardiff by giving ratios of total floor space to ground floor space and plot space, and comparing these with rents and land values. This has led him to postulate a differentiation of areas of the town by specialised function into shopping, a financial area, an office quarter, and administrative area, and a more marginal transition zone. Again, this work has elements in common with the Cambridge LUBF school. It does not offer a way forward for the analysis of the City.

Roberts\(^2\) is concerned more with village morphology than with that of towns, though his approach is to scale-down the set of prerequisites of Conzen, in order to apply them to these smaller, nucleated settlements. 'All villages are made up of an individual, but not necessarily unique, assemblage of public space (the roads, tracks and open spaces) and private space (the houses, gardens and other structures and enclosures). Two basic village shapes can occur: either the assemblage of structures and enclosures can be linear, forming a row, or non-linear, forming an agglomeration. The quality of this overall arrangement can vary enormously, but can broadly be described as regular or irregular'.\(^3\) His village classification is based on entirely on these form properties - shape, regularity, and presence or absence of a green - and divide into ten broad types (Fig 2:15) though Roberts adds that the types grade into each other imperceptibly so that the assignment of an individual to one category rather than another is in some instances a matter of judgement.

Roberts' classification is a clear example of an attempt to reduce morphology to order concepts. His basic shapes or elements are rows

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3 Roberts, Rural Settlement op cit. p. 123.
and clusters (agglomerates) and his basic relations which give rise to
the five main categories in his typology are linear strips and radial
and orthogonal grids as the variations of regular forms, and ribbons
and agglomerates as irregular forms. These five are doubled to ten by
the variable 'presence or absence of a green'. His subsequent work\(^1\) is
all elaborated on these basic distinctions.

Aston and Rowley\(^2\) adopt a classification which draws upon similar
elements as a basis for typing villages. Rowley's main types are street,
green and agglomerated villages, with planned (regular) or unplanned
(irregular). Thorpe\(^3\) produces a similar typology of villages to Rowley,
but with a more detailed set of criteria for 'green' villages: linear plan,
compact green, broad green, street green and indefinite. Dacey\(^4\)
proposes a tripartite classification based on overall village shape:
regular, clustered, random. Brown\(^5\) suggests rectangular, radial, and
topographical informal as main divisions, with combinations such as
radial blended with gridiron, gridiron with superimposed radials,
concentric, irregular mediaeval, combined rectangular and irregular.
In dealing with the town plan, however, no comparable classifications
are offered, and it is more usual for authors to characterise these by
the presence or absence of significant physical features: defences,
castles, market places, and precincts. This makes for a basic
discontinuity in the field between the village studies where form is
used as a typological basis, and that of towns, where function is more
prominent.

Beresford's work on villages and towns is an exception which goes
some way to reversing the tendency to classify towns according to the
presence or absence of fixed physical features like castles or
cathedrals. Initially his studies of English villages and towns led him
to be somewhat dismissive of shape as a basis for classification,

\(^1\) Roberts, Village Plans, Shire, Bucks, 1982, and The Making of the
\(^2\) Aston M. and Rowley T., Landscape Archeology, David and Charles, Newton
1951.
\(^4\) Dacey M.F., Some Questions about Spatial Distributions, in Chorley R.J.
\(^5\) Brown and Sherrard, An Introduction to Town and Country Planning,
Angus and Robertson, Melbourne/London, 1969.
explaining that 'in the early stages...it was hoped that a representative collection of village plans could be assembled and, indeed, that the main grouping of these chapters would be by shape. As the work progressed there was a gradual shift of emphasis...The broader classifications by plan, the street-village, the crossroads village, the bridge-head village, have easily discernable patterns, and the simplicity of the pattern usually brings a ready explanation...yet....when a student goes into the English countryside armed with a system of classification he will either find villages so simple in shape that interpretation comes easily or so complex that he will feel impelled to create yet another category....it would seem more realistic to begin with a statement that villages exhibit a great variety of shapes; and everywhere reflect organic growth and particular local influences, and then to add the rider that certain repeated influences can occasionally and profitably be seen in isolation.'

He goes on to doubt that a useful classification of the phenomena will ever be devised. For the purposes of the survey, he restricts himself to the categories of 'street' village or 'green' village of regular or irregular shape. So far as towns are concerned, he classifies them here in the usual way by major features, into towns with a market place, walled towns, towns with castles and/or cathedrals, towns as ports, and planted towns.

Beresford's major contribution to the field is, however, at the level of planted and therefore planned towns of Europe from the Conquest to the early seventeenth century. Here, Beresford identifies these early planted towns as having in common two features: one to do with form and the other with function. The commonality of cases was that they were laid out on a chequerboard pattern and that the purpose of the foundation was to act as centre of making and dealing, under the jurisdiction of the founding patron. Beresford argues that a gridiron plan has many virtues: 'within the ordained limits of the town site, the simplest way of setting out building plots and streets was in a rectilinear grid, which made no more demands on techniques of measurement than the ability to set out a straight line, to divide it into equal proportions, and to set another line at right angles to it...the

rectilinear street-plan was a flexible one. It could be adapted to a square site as well as to a long, narrow site; rectangles of different size could be laid together to cover such hill sites as Monsegur or Domme where the natural features did not leave a neatly rectangular level space.\footnote{Beresford. M., New Towns of the Middle Ages, Lutterworth, London, 1967, pp.146-147.}

Beresford observes that the prevalence of rectangular planning does not lead to an identity in town form, but rather that it was a pattern capable of accommodating a great deal of individuation\footnote{shades of LUBE, and the line of argument found in 'the grid as generator'.}, and the burden of his thesis is in exploring something of the variety which planted towns show in their urban grid. He differentiates between a 'grid-plan', which was frequently a bastide of nine chequers laid out on a three by three grid, and a 'market-based plan', in which all the burgage plots are concentrated around an open market with, at most, a back lane running behind the burgage plots and, at the extreme, possessing no street grid at all. The overall shape of these non-gridded towns, Beresford suggests, is therefore a function of the shape of the market place - and he elaborates by postulating two principal town shapes, regular and irregular shapes based on rectangular and triangular or fan-shaped markets respectively.

This work helps bridge the gap between the classificatory village studies of Roberts, and the detailed empirical work of Conzen on the evolution of towns. Beresford's work is, however, limited to planted towns at the time of their foundation. Whilst London was undoubtedly a planted, gridiron Roman town, the evolution of the street grid has apparently led to the breakdown of the regular features of the layout and their substitution by a more informal, organic plan. Many authors have commented upon this process in the case of the planted towns which have captured Beresford's imagination, and the difficulty here is in extending his classification of grids and markets to include these irregular developments.

It is in the irregular, organic, agglomeration-like towns that the difficulties of description are greatest. These cases, which do not yield readily to the imposition of a visual order on the plan, are thought by
some authors to be incapable of objective, comparative description. Hoskins, for example, sees the study of the town plan as illuminating only of the particular circumstances in which the town grew up. The individuality of streets is therefore of greater interest to him than any typology.

For Hoskins, street lines are to be explained only in terms of how they might result from the accidents of history: 'a series of kinks in a number of streets running roughly parallel with each other would suggest, for example, that at the point where all the streets make this bend there must have been some considerable obstacle which has now disappeared. The same remark applies to inexplicable bends on many roads or lanes today. Where there is no obvious physical reason for such an abrupt change in direction today the answer must be that when the road, or lane or street was first trampled out there must have been some obstacle which forced people to go round it.' The absence of order is therefore used to diagnose historical discontinuities within the plan. Hoskins is, nonetheless, responsible for much of the urban lore of today. The view that Saxon urban dwellers deliberately avoided the vicinity of ruined Roman buildings is due to Hoskins, as is the assertion that, aside from where a street was directed by some obvious goal like a crossing point or town gate, the urban grid grew up in a 'rather haphazard and accidental way.' Exploring this relation between historical accident and morphological events is a major theme within this thesis.

The majority of urban historians follow Hoskins, and insofar as there is any attempt at the classification of urban form, for many authors it is first and foremost to be accomplished by historical period. For Lavedin history has primacy over morphology. Cases are selected from the record to exemplify in as clear as possible a way the principles of town form in a particular era, and the example is reproduced at that moment in time, without reference to its previous

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2 *Local History in England*, p.96.
form or subsequent evolution. This approach provides us with a record of 'perfect' moments. The assumption that each town is a product of its historical period is so deep-seated that the possibility that the grids of Greek, Roman, neo-classical, colonial and modern towns might be the subject of comparison is excluded from thought. Many authors follow this tradition.

This approach makes the description and analysis of the structure of the urban grid difficult to accomplish in principle, since it reduces the study of space structure to discontinuous fragments, each a frozen moment in time. In the case of a town like London, which has evolved through several of these stages, it is necessary to compare the grids which were produced at different stages in its history. Authors who stress a historical approach to towns seldom deal with the same example in succeeding chapters and so avoid this difficulty.

**Learning from the past: the third strand in the description of urban space.**

The third strand which was mentioned at the outset of this review of urban space descriptions aims directly at the interface of analysis with design. The assumption is that if design is to be intelligent, then it is necessary first to describe the complex urban artifacts which humans have made in such a way as to reveal their essential form and structure, and only then to extrapolate the lessons learnt to design.

A typological approach here normally entails a visual survey, followed by the extraction of some recognisable pattern which is reproduced in the form of a diagram. The aim is to 'purify' descriptions of urban form to a 'least set' of clear solution types. These tend to be presented in the form of diagrams, possibly with a corresponding real example attached. The reader is intended to see a similarity between the real case and the accompanying diagram. Much of the work reviewed below adopts this approach.

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1 By changing the type of space (ie square to linear)

Fig 2:19 - A 'streets and squares' analysis of the space of a town.
The alternative approach aims to set up some organising criteria for looking at all possible cases within the same framework of analysis, rather than by assigning any real example to one of a range of possible pure forms. Here, authors are interested in the relations among what they see as (usually binary) distinctions in the 'basic building blocks' of urban form. Common criteria for dividing up urban space include its representation as a system of streets and squares, or spaces and paths. An example of this approach is presented in An Introduction to Housing Layout produced by the GLC1 (Fig 2:19). In all but the clearest cases, it is difficult to decide on shape grounds which category any particular segment of urban space falls into. A wide street, for example, is difficult to differentiate systematically from a small square. This difficulty in the division of space in a non-arbitrary way and the systematic assignation of the resulting elements of the urban grid to one or other shape category, has already been discussed with respect to the equivalent elements in local history and historical geography - the street and the green. It will be returned to when the 'syntactic' representations of urban space are presented later in the chapter.

A more sophisticated approach within the same general idiom is that adopted by Lynch in his book The Image of the City2. Lynch suggests here that it is possible to reduce the significant spatial structure of the city to five urban elements; namely path, edge, node, district, landmark. Lynch's approach also relies on there being a clarity between elements, say, paths and edges, which does not necessarily occur in practice. A major road can, in some cases, be both a path and an edge. Lynch's concept of a district relies for its diagnosis almost entirely on non-spatial data like function, aesthetics, accoustics, and social composition. Its aim is, moreover, not to capture the relational nature of the space of the city - how the parts fit together within the overall configuration - so much as to arrive at a description of the

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overall form of the city as perceived by its inhabitants. It is based on certain a priori assumptions about how people cognise and use certain aspects of the fabric of the city in 'wayfinding'.

The Lynchian approach to the description of urban form approach has been criticised elsewhere. The difficulty objectively in identifying elements, particularly in capturing those which might have been meaningful for long-dead generations of citizens of the City of London is regarded here as hazardous. It is likely to result only in the redefinition of the spatial structure of the historical city in terms of the assumptions and preoccupations of today. This is a difficulty in all forms of analysis which rely on the interpretation of form, however socialised to groups this interpretation may be. In what follows, discussion will concentrate upon those authors who attempt systematically to classify urban forms, since it is here that the greatest range of contrasts with a 'synatctic' approach are to be found.

The most simple and generally observed typological distinction is one which has been introduced earlier; that between radial plan forms and orthogonal ones. This distinction attempts to capture the global configuration of the city but it does so at the expense of any description of the parts. The distinction in all cases refers to the overall pattern of streets and island blocks. McCulloch, for example, elaborates on this binary distinction by adding a sub-classification of block forms - congested, piecemeal, hollow-square, and open plan - in an attempt to refine the initial distinction and localise descriptions of the city fabric within the overall grid.

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2. As in the work of Lynch, who compared the responses of samples of residents, or of the 'mental maps' approach, which adopts the method of asking respondents to record their personal scheme for an area and then comparing schemata of a sample to identify common physical elements.
Fig 2:20 - Sharp's typology of town grids.

Fig 2:21 - Keeble's typology of town form.

Fig. 2.3  Urban textures. A. Random  B. Segregated  C. Dispersed  D. Buildings centripetal  E. Buildings centrifugal  F. Modified dispersed. As explained in the list of illustrations at the beginning of the book, the notations used in this illustration are used in all the following illustrations where they are applicable.
Sharp, on the other hand, attempts to refine his binary orthogonal/radial analysis of the street grid of the town by introducing two sub-types within the radial category (Fig 2:20). Here he contrasts the urban grid of a simple city centralisation in which 'a diffuse mass of residences around a concentration of industrial and commercial buildings' with a conglomerate sub-centralisation, in which there is 'a series of rationally organised industrial and commercial sub-centres around each of which would be situated the residences of the workers in the sub-centre, all distributed about a very much lessened principal centre, with the whole still forming one great agglomeration'. ¹ Both these are set against the simple unorganised agglomeration. Here, Sharp moves effortlessly between the analysis of existing city plans and the prescription of new layouts, while at the same time he offers a description of physical form and an elaboration of its social consequences. Since one of the aims of this thesis is to disentangle these issues, Sharp’s description of grids is of limited value here.

Keeble (Fig 2:21) offers up a more elaborate typology of possible town forms to house a population of 60,000, which is based on Sharp’s categories. The suggestion is that the set of diagrams which he shows exhausts the possibilities for the gross locational form of a town. Keeble argues that decisions made at the level of these distribution diagrams determine the physical shape which the town eventually takes, 'in terms of appearance and accessibility patterns and hence, often indirectly, the kinds of activities and groupings which will most readily come into being'. ² The ways in which this determination of the grid takes place is not elaborated upon by Keeble, whilst as it stands the type of description he offers of town form is of limited value here since it ignores roads and other communication routes. However, it is a frequently-used mode for the description and comparison of town forms in planning studies.

Schoenaur is one of the few authors who does not refer to radial/orthogonal tendencies in classifying city form. He selects an

¹ Sharp, op cit, p168.
alternative binary distinction which relates to the orientation of the grid towards or away from the street\textsuperscript{1} in his distinction between the oriental city and the occidental city\textsuperscript{2}. Schoenaur is only one of many authors who make a distinction between occidental and oriental urban morphologies. He argues that 'in the Orient, the sensitivity expressed in house design (the inward looking house with a private court-garden) is carried beyond the boundaries of the home into the urban residential environment and manifests itself in a spatial disposition that has a gradual hierarchical order. Just as the oriental urban house has private and public areas, the oriental neighbourhood itself has a similar order that is at least as sophisticated. Accordingly, the blind alleys and narrow local streets giving access to a cluster of private homes are semiprivate areas, while the collector or spine street with the local community facilities of its residential precinct represents the semipublic realms; beyond the gates of the spine street is the public urban domain with thoroughfares, sags and public institutions.'\textsuperscript{3} In the occidental city, by contrast, the house is orientated to the streets, and therefore, 'the difference in orientation accounts for a far greater disparity between the wide boulevards, avenues and streets of the occidental city and the narrow alleyways of the oriental city. Perhaps the Georgian houses built around residential squares highlight best the huge difference between the occidental and the oriental approaches to domestic life. While Georgian homes were orientated towards a large semipublic park used by residents for family recreation in full public view, oriental houses looked upon a small enclosed city court-garden that was hidden from public view. The street orientation of the occidental urban dwelling resulted in the emphasis being placed on the street facade of the buildings...... that the outward orientation of the occidental dwelling corresponded to the segregation of dwellings from commercial functions (and between social classes) is a plausible supposition.'\textsuperscript{4} Schoenaur argues that these types are in antithesis, and form the basis for two modes of urban form and lifestyle.

\textsuperscript{1} a similar preoccupation to that of Caliandro in classifying American cities. The fact that Caliandro suggests the both versions of street/house orientation are characteristic of modern American streets poses problems for Schoenaur's distinction, since he uses it as the basis of distinguishing western cities from oriental cities.


\textsuperscript{3} Schoenaur, op.cit.Vol 3. p. 254.
Schoenaur's opposition between the oriental and the occidental is more of a distillation of a whole complex of assumptions about the relationship between the physical properties of space and social variables than it is a careful description of the variety of urban forms which exist in the Orient and in Europe and America, which are illustrated in the respective volumes of his book. The occidental stereotype which he presents does not mesh at any point with what is known of the urban grid of the City of London as it evolved historically\textsuperscript{1}. Compared with the several hundreds of real examples which Schoenaur draws upon to illustrate each of his polar types, the summation into a stereotype seems to be an impoverishment rather than an illumination of the ethnographic record, though it does provide a starting point for the design of modern court-garden houses by offering up a checklist of spatial, social and environmental principles which can be born in mind in generating new design proposals\textsuperscript{2}.

Kirschenmann and Muschalek also attempt a comparative typology of the form of urban housing and residential districts through history. Their approach to description is more complex than that of Schoenaur. They argue that 'the visible and portrayable results of the architectural and town planning process are manifestations, in the form of buildings and zoning arrangements, of social conditions. By investigating dissimilarities in the housing conditions within a society and analysing the changes in these conditions in relation to successive periods of time, it is possible to pinpoint precisely the difference in living conditions at any one time among different strata of the population.......If the social relevance (function) of urban housing is to be taken into account in the study of housing construction as an architectural phenomenon and as a feature of town planning, there are two aspects at least of the building process, in its social dimensions, that need to be investigated: the location of the dwellings themselves

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\textsuperscript{1} nor with what is known of the oriental cities which have been studied in great detail by Salah-Salah and Loumi, unpublished Ph.D. Theses of the University of London, 1984 and 1988 respectively.

\textsuperscript{2} the proposition that this 'oriental' stereotype has design potential is at least a part of Schoenaur's interest in the study of house form and culture. Its value in contemporary housing design is argued more fully in Schoenaur,N. The Court-garden house, 19
and the location of residential quarters in relation to the layout of a town'. Although their interest in developing a comparative overview of town form is not to discuss urban origins but rather to compare the physical features of the plan, they take for granted the existence of the residential district as an ubiquitous and self-explanatory subdivision of the city. This is one of the main questions to be investigated in this thesis, so it cannot be taken as a priori here.

The typology which the authors evolve is based on four properties of residential districts: type of district (redevelopment, expansion, new building); scale (small, medium, large); type of dwelling (single house; detached, concentrated, garden/atrium, terrace - multi-house; staircase access, internal pathway, external pathway, mixed access); and layout (linear/row, courtyard/block, flat/rectilinear or vertical organisation); together with modifying features such as method of parking and amenities provided. Apart from the value of comparing illustrations, the only 'hard edged', systematic basis for comparing the examples illustrated is by housing density. The way in which districts are related together is not encompassed by the classification, and analysis insofar as it exists is limited to the internal workings of the parts. Moreover, the point of aim of the typology is to classify modern housing prototypes, and since the modern City is poorly served by large-scale residential developments and its basic categories do not apply to office developments, it cannot serve as a model for this thesis.

Alexander uses the broad historical spectrum to postulate an entirely different distinction altogether from that between oriental and occidental cities proposed by Schoenaur. It is also one which brings into question the entire enterprise of Kirschenmann and Muschalek, for this assumes a degree of continuity across urban forms at different historical periods whereas Alexander's distinction between natural and artificial cities indicates that traditional and modern cities are

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2 the Barbican, the only major post-war housing development on the outskirts of the City is not dealt with by the authors, though its neighbour Golden Lane Estate, to the west on the borders with Clerkenwell, is shown in brief. ibid. p.177.
Fig 2:22 - Alexander's representation of trees and semi-lattices.
polar types, at least in terms of the structure of architectural space
and the urban grid in relation to human social purposes.

The distinction is made in Alexander's article A City is not a Tree\(^1\).
Here, Alexander argues that the towns of the past were generated by
an abstract ordering principle which modern designers have yet to
discover and learn to reproduce. He suggests that the ordering
principle of the natural city is that of a semi-lattice while that of the
modern city is that of a tree\(^2\). Alexander goes on to define his terms as
follows. 'A set, in general terms is composed of elements which co-
operate or work together: in terms of urban studies a set is a spatio-
temporal integration of diverse elements like a drugstore, newsrack,
traffic light, bystanders, and customers' \(^3\). The fixed physical parts of
the set are, according to Alexander, the 'unchanging receptacle' for
the changing parts such as the people who pass through it. A city is a
collection of infinitely many such sets, and the concrete, physical
elements are therefore sub-sets of the city.

This collection of sub-sets is not, Alexander proposes, amorphous. It
has a structure. This structure is the entity which Alexander names
when he describes it as either a semi-lattice or a tree: 'a collection of
sets forms a semi-lattice if and only if, when two overlapping sets
belong to the collection, then the set of elements common to both also
belongs to the collection' ...... 'a collection of sets forms a tree if and
only if, for any two sets that belong to a collection, either one is wholly
contained in the other, or else are wholly disjoint' (Fig 2:22) \(^4\). Put in
crude, physical terms, if the spatio-temporal entities of interest are
either nested or physically discrete, a tree-like structure exists. If the
boundaries of spatio-temporal entities overlap, then the city forms a
semi-lattice. Because the elements of the set are diverse entities
associated by statio-temporal integration, the proposition is

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\(^1\) Alexander, C A City is not a Tree, in Bell G and Tyrwhitt J. Human
\(^2\) in the network sense of the word.
\(^3\) in the illustration which Alexander uses, the list of elements in the set could
without difficulty be extended almost infinitely, provided the elements satisfy
the rule of contributing to the spatio-temporal eco-system.
\(^4\) Alexander, op.cit.p.405-6.
Figure 3. Columbia, Maryland.

Figure 4. Greenbelt, Maryland.
uncommitted on the pattern of the urban grid by which the sets may be located and related together as an experiential reality.

Alexander illustrates his argument by reference to some modern conceptions of the city, each of which he regards as a tree (Fig 2:23). He adds that the implication of designing in this way is that 'the physical layout of the plans, and the way they function, suggests a hierarchy of stronger and stronger closed social groups, ranging from the whole city down to the family, each formed by associational ties of different strengths' 1. He suggests that while this may be true of a traditional society, today's social structure is one of open-ended networks: 'the reality of today's social structure is thick with overlap - the systems of friends and acquaintances form a semi-lattice not a tree' 2. Alexander goes on to show that because social groups do not correspond to space on a one-to-one basis, the spatial units which are the residue of the social system also overlap.

The difficulty for Alexander is that while it is relatively easy to show the physical form which a tree-like system might take, it is less easy to demonstrate the physical content of the concept of a semi-lattice. 'I must confess that I cannot yet show you plans or sketches. It is not enough merely to make a demonstration of overlap - the overlap must be the right overlap. This is doubly important, because it is so tempting to make plans in which overlap occurs for its own sake. This is essentially what high density 'life-filled' city plans of recent years do. But overlap alone does not give structure. It can also give chaos' 3. This apparent lack of clarity in being able to diagnose overlap in city plans places a severe restriction on its use as a methodological tool of analysis, particularly since the pattern of the tree or lattice as defined by Alexander has an implied but unclear relation to the urban grid.

Alexander's other published work gives some clue as to the kinds of physical entities are implied in the approach. Notes on the Synthesis of

1 Alexander, ibid.p.412.
2 It is doubtful if they ever did, and this view has been argued in Hanson, J and Hillier B, in The Architecture of Community, op.cit. It will be suggested later that the City of London was not made up of socially closed groups either, though it is a basic tenet of neighbourhood unit planning.
3 ibid.p.425.
Figure 5. Greater London Plan (1943).

Figure 6. Mesa City.

Fig 2:23 - Examples of trees.

Fig 2:24 - Alexander's analysis of the patterns in an Indian village.
Form sets out the proposition that 'every aspect of a form, whether piecelike or patternlike, can be understood as a structure of components. Every object is a hierarchy of components, the large ones specifying the pattern of distribution of the smaller ones, the small ones themselves, though at first sight more clearly piecelike, in fact again patterns specifying the arrangement and distribution of still smaller components' ¹ The relation between this organisational hierarchy specifying the lines of cleavage and vertical relation among components to the semi-lattice which specifies overlap in configured physical space is unclear.

His components are not the usual ones associated with the physical form of towns and villages. In the Appendix, he sets out the components for the design of an Indian village. Some 141 components are listed, divided into 13 sub-headings of religion and caste, social forces, agriculture, animal husbandry, employment, water, material welfare, transportation, forests and soils, education, health, implementation and regional, political and national development. Each component is a design objective: in the case of transportation, for example, component 102 notes that there should be accommodation for processions. This requirement 'interacts' with 11 others in different parts of the list². The 'overlap' between the proposed components of the village in terms of an interaction matrix is clear at this stage.

At this point Alexander suggests that the matrix of the 141 variables with their interactions can be decomposed via lines of association and cleavage into a hierarchy of 4 separate major sub-systems, and then into 12 minor sub-systems. Variable 10 is assigned to pattern C2. This is then associated with another to form major sub-set C, which in turn is a component of the diagram of the entire village. (Fig 2:24) The underlying logic of the shape characteristics of individual patterns is unclear, as is that of the combinatorial process. As a physical description of the village, it is not clear how literal the diagram is intended to be.

¹ Alexander, C. Notes on the Synthesis of Form, Harvard University Press  
² such as number 2, religion and caste, relating to proper disposal of the dead.
Fig 2.25 - The pattern 'promenade'.

Fig 2.26 - Lynch's typology of urban grids.
A later work\textsuperscript{1} generates 253 patterns in greater physical detail, together with a list of linkages for each pattern and a master sequence specifying the hierarchy of associations between patterns from a national regional level, to the incorporation into the finished environment of personal object arrays. Each pattern takes the form of a detailed design prescription. The nearest pattern to the variable 'accommodation for processions' is the pattern 'promenade'. (Fig 2:25) Variables impinging from above, like the catchment area which is though necessary to make the promenade dense with action, and carrying down to more detailed planning levels, like the shape of the space of promenade, are also indicated.

It is not the aim here to criticise the theoretical basis of this work, since this has been done elsewhere\textsuperscript{2}, but rather to suggest that the use of these patterns for the analysis of configured space is severely limited by the fact that their detection would rely heavily on personal interpretation and the use of value judgements. A real city could feasibly be used to test the presence or otherwise of the range, types and content of the particular patterns which Alexander claims are significant in designing to accommodate human social purposes. However, the combinatorial possibilities of patterns are potentially almost limitless and the introduction of new patterns particular to the individual case is always a possibility. The task of decomposing a real city into its constituent least set of generating patterns - that is to give the elementary structure of the semi-lattice as constituted by its objects and relations - is probably impossible.

Searching for patterns and diagramming the grid of a city is a standard approach to the description and classification of architectural and urban form. Lynch has developed the use of diagrams which attempt to sum up pattern in urban space to an artform. One such, which sets out the set of general forms for cities, is shown in Fig 2:26. Lynch goes on to remark that 'the intrinsic formal character of each of these patterns has certain functional implications, such as


\textsuperscript{2} by Hillier, B. in a lecture in the course \textit{Current Issues in Architectural Theory} for undergraduate students in architecture, \textit{Where do architectural ideas come from? or : rationality and intuition in design}.
Fig 2:27 - Lynch’s typology of buildings arrays.

1. Street front
2. Street front - landscaped
3. End on to street
4. Courtyard
5. Cluster.
rigidity or flexibility, dispersed or concentrated communication, specialisation or repetition of parts. Other characteristics appear only when applied to a particular situation. These patterns once applied can be judged on many counts, but most likely two will be crucial: the accessibility provided between units, which is the basic functioning of the whole, and the sense of form and organisation that will be conferred on the final design, which is fundamental to its esthetic quality. ¹

The ability to describe the relation of parts to whole appears to require the most elaboration, for Lynch goes on to argue that 'these general forms may be differentiated according to their characteristics of district pattern (shape of the boundary between development and nondevelopment, or the way the internal parts are arranged in sectors, chequers, stripes, or rings); focal pattern (arrangements of the intensive focal points of use or form); and network pattern (grid, radio-concentric, linear, capillary and so on). We may discuss the density of development, or its grain, (that is the extent to which these activities or forms are differentiated, how finely these differing classes are mixed, and how sharp the transition is between them). If, for example, we are putting together two different kinds of houses, then the grain of that mixture may be fine or coarse, and the transition between groups may be sharp or blurred '. ² Unlike Alexander, whose patterns are the elements of a hierachical organisational system, for Lynch each classification seems to represent a level in an a priori spatial hierarchy. To move from one level to another, say from that of general city form to the arrangement of individual buildings requires the importation of a new classificatory scheme as the focus on the urban tissue becomes more detailed (Fig.2:27). The form which the second typology takes has little in common with the first, though it is entirely conceivable that in the real situation, a street or other urban space might belong simultaneously to both the global and the local city forms.

¹ Lynch, K. A Theory of Good City Form, and Site Planning. MIT, Cambridge Massachusetts, 1961 and 1984 both contain various sets of diagrams of city form, but the one reproduced here is from The Pattern of the Metropolis, in Blowers et al. Urban Change and Conflict, op cit, p.34.
² ibid. p.34.
Fig 2.28 - Spreiregen’s typology of urban grids.

Fig 2.29 - Ching’s typology of urban grids.

**SPATIAL ORGANIZATIONS**

<p>| | | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>CENTRALIZED</td>
<td>A central, dominant space about which a number of secondary spaces are grouped.</td>
</tr>
<tr>
<td>2</td>
<td>LINEAR</td>
<td>A linear sequence of repetitive spaces.</td>
</tr>
<tr>
<td>3</td>
<td>RADIAL</td>
<td>A central space from which linear organizations of space extend in a radial manner.</td>
</tr>
<tr>
<td>4</td>
<td>CLUSTERED</td>
<td>Spaces grouped by proximity or the sharing of a common visible trait or relationship.</td>
</tr>
<tr>
<td>5</td>
<td>GRID</td>
<td>Spaces organized within the field of a structural or other three-dimensional grid.</td>
</tr>
</tbody>
</table>
This tendency appears throughout Lynch's work. His ten 'general patterns' for city form are filled out by modifying factors such as patterns to do with the relation of the 'centre' or 'centres' of the city, giving a further six sub-types; the texture of the grid, yields seven sub-types of which the last category 'housing types' has a further seven sub-sub-types; circulation with five sub-types; open space patterns, with three sub-types including one with six sub-sub-types; and temporal organisation with four sub-types all add to the complexity. In use, some of his categories are mutually exclusive whilst others can clearly co-exist indicating that he is presenting less a theory of possible city forms and more a 'catalog' of the parts of cities. Whilst diagrams of this sort may be a useful heuristic tool they have only limited analytic power. They cannot deal with the problem of the simultaneous existence of real urban spaces at both a local and a global level within the configuration of the urban grid.

'A second difficulty is highlighted by contrasting Lynch's typology of nine terms with Spreiregen's classification1, (Fig 2:28) with its ten. He also qualifies these general shape diagrams with a warning that: 'these classifications of form have definite implications for the city's function. They have advantages and disadvantages relating to circulation, proximity to open space, and articulation of neighbourhoods or districts. Further, these classifications may be appropriate to the city as a whole, or to parts of the city, isolated for study like open spaces or circulation. The open spaces of a city may be linear or branched; or they may form radiocentric patterns. The circulation networks may likewise be described as one or another shape'. These two general shape classifications have only half the possible types in common. By combining the two approaches, fifteen possible stereotypes are acquired. A third author, Ching3, proposes five diagrams for spatial organisation and a further six for paths (Fig 2:29).

The difficulty of dealing with the apparent individuality of towns and urban areas and of an infinite variety in the shape and appearance of

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2 Spreiregen, op. cit. p.54.
ONE INTERSECTING STREET

TWO INTERSECTING-STREETS

THREE INTERSECTING STREETS

FOUR INTERSECTING STREETS

AND SO ON ...

Fig 2:30 - Kier's typology of urban grids.
real streets and squares is illuminating, for it leads to a paradox. Time
and time again, authors suggest that all towns are made up of a
limited vocabulary of urban forms yet, when called upon to specify
the elements of that vocabulary, the temptation to multiply categories
seems to be irresistible.

Krier\textsuperscript{1} is a case in point. He starts from the position that all towns can
be reduced to a combination of street space and squares. These two
space types are each modified by geometry or basic shape, according
to the degree of approximation of the form to a circle, square and
triangle. They are further affected by ‘modulating factors’ some of
which distort space to such an extent that the form is ‘impossible to
define’ or so amorphous that ‘it ceases to bear any relation to the
original’ \textsuperscript{2}. In the case of squares, the enclosure given by the
surrounding streets also has a part to play in sub-dividing form. Krier
eventually ends up by listing twenty four real and invented cases to
illustrate each of his principal categories of urban space\textsuperscript{3} - this being a
convenient number to fit on a page rather than an exhaustive search
for all possible permutations on a theme (Fig.2:30). He gives up
altogether in the case of streets, remarking that ‘the series of street
plans can be infinitely expanded’ \textsuperscript{4}. In other words, ultimately he
deals with local examples purely insofar as, as individuals, they have
interesting shapes. He has little conception of how those shapes relate
to each other or can be organised and fitted together to form the
configuration of the town. This is not to deny that the shape properties
of the City of London at its various historical stages is unimportant,
but that in view of the dominance of the street over articulated open
space a typology of this sort would offer only a localised and partial
description of the street grid of the City.

Types and realities: the unbridgeable gulf.

\textsuperscript{2} Krier, op.cit.p.23.
\textsuperscript{3} these are rectangular and orthogonal squares, orthogonal squares with
central buildings, open squares with buildings introduced, spaces which are
angled, divided, added to and superimposed, circuses, circuses containing
buildings, combinations of circuses, geometrically complex systems, triangular
squares, large scale composite plans and finally inventions.
\textsuperscript{4} Krier, op.cit.p.
In making this review of descriptive techniques one feature has emerged again and again as a difficulty for their deployment in analysing comparing examples. Descriptive typologies are generally speaking either too simple to be useful - radial/orthogonal, street village/green village, and so on, or so detailed as to be idiosyncratic. In some cases, the selection of criteria is so indeterminate as to raise the possibility that the author is simply producing a list of all the variables he can conceive of, rather than setting out a model which shows the internal logic of relations between variables. The search for typology is perhaps doomed to failure because, faced with reality, one is confronted with a morphological continuum, in which moments which are reminiscent of the elements of a typology are set against a background where distinctions merge imperceptibly into one another. In such circumstances one can only proceed by establishing the quantitative dimensions of the continuum.

The Prerequisites of a 'syntactic' approach.

The representational difficulty which this review of the literature on the spatial representation, analysis and typology of grids has highlighted is the problem of how to reduce the continuous space of the public realm to some set of non-arbitrary elements. It is clear that a number of authors from Smailes onwards suggest that it is possible to view the town street grid in this way, and common sense tells us that we no not apprehend the grid of a town all at once, but rather as a series of street pictures. However, whilst there is somewhat of a consensus that it is possible to disaggregate the grid into some relatively finite and simple set of morphological units of analysis, there is no general agreement as to how this should be accomplished or as to what these units might be.

A second, analytic difficulty which has been generally acknowledged in the review, is that of dealing with the continuous variation exhibited by real cases when these are set against the discontinuous account of morphological possibilities which is offered up by any typology of urban form. A degree of interpretation and judgement is

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1 as they did in the eighteenth century in the study of natural history. Typology is eighteenth century classification.
Fig 2:31 - the 'generative' model of space syntax.
necessarily involved in assigning cases other than the purest forms to the most reasonable approximation to the typological pigeon-hole. This is an inevitable product of the foundation of urban typologies on order concepts, which tend to enforce an unnatural degree of tidiness upon what are often messy and disorderly realities.

The early generative syntactic descriptions (Fig 2:31) were beset by this difficulty, and it was largely as a result of the impossibility of non-arbitrarily assigning complex real urban forms to the generative typology which was proposed there, that the methodology was advanced to a point where it became possible to quantify the dimensions of the generative model for real examples of towns and buildings. The methodological aims of syntax were therefore precisely to solve these two problems by the 'objective' representation and quantification of urban space. The analysis of real cases, from the input of cartographic material to the production of a numerical analysis, can now be accomplished by computer-analysis, which suggests that these two criteria which are essential to preserve the comparability of cases, have now been satisfied. A syntactic analysis dimensions all the examples of the City in a comparable way, and at a level which is sensitive to small changes in the alignments of streets and their intersections.

The approach is also capable of being socialised, not just through the direct observation of cases which as we have seen limits any methodology's ability to reconstruct historical material - though empirical studies play a major role in formulating and testing syntactic hypotheses - but through propositions about how the logic of social organisations is intrinsically spatial in its constitution, and hence why a society might unfold spatially in one way rather than another. In what follows the representation and spatial analysis will be taken as a priori, but the social interpretation of syntactic variables will, in

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1 in the sense of non-arbitrary, and therefore reproducible.
2 the theory is set out in full in Hillier B and Hanson J The Social Logic of Space, Cambridge University Press, 1984, Chapter 6-8, but it is also discussed in brief in Hanson J and Hillier B, The Architecture of Community, Architecture and Behaviour, Vol 3 No.3. 1986-7 which was originally the research outline for this thesis.
the absence of supporting documentary evidence, be treated as provisional.

Certain assumptions are made in syntax about the description, testing and interpretation of data which need to be made clear at the outset. 'Space syntax' is a set of descriptive techniques for representing, quantifying and modelling spatial configuration in buildings and settlements. This involves three things:

- the identification and representation of the elements of the entity which is the object of analysis, in this case the urban grid of the City;
- the categorisation and analysis of spatial relations; and
- the modelling of the system and its relational structure.

The main techniques, measures and conjectures which lie within 'space syntax' are set out below.

The analysis of urban grids is based on an axial map. The relation between an axial representation of the grid and a node map which is more usually found in network studies has already been dealt with in principle in the literature review. Formally speaking, an axial map records the least set of longest and straightest lines of sight and access which covers the public system of open space of the city and makes all the street intersections which are present in the urban grid. Every island or urban block is surrounded by axial lines and every street intersection within the urban grid is recorded as an intersection of axial lines.

It is important to note however, that an axial map is not the same as a street map. Where two or more streets are aligned in such a way that a long line of sight and access can be drawn which crosses both, then this is drawn even though it compresses the two named streets into one axial line. Where, on the other hand, a street curves so that it is

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1 again, these are set out fully in the publications referred to above, and the interested reader should consult these for a more detailed account of the methodology.

2 this is one of three main ways of breaking up space which are commonly used in 'syntax'. The other two are 'convex maps and isovists. The axial map is used here because it is the most global representation of space of the three, and it is global urban spatial structure which is the primary concern of this thesis. It is also the representation which has been shown in empirical studies to relate best to observed patterns of use and movement in urban space.
Fig 2:32 - overlapping axial lines and 'trivial' islands.

Fig 2:33 - the relation between an axial map and a node map.
not possible to see and go all the way along it directly, this too is reflected in the transcription.

Each axial line is drawn by aligning a straight-edge along the back of the building line and moving it until the longest possible straight line is arrived at which is end-stopped, however obliquely, by building facades. Where two axial lines 'overlap' and run together, both are drawn and where these intersect with a third to create an apparent 'island' (Fig 2:32) this is disregarded\(^1\). However many individuals make an axial map of an urban system, all should arrive at the same transcription. The technique is in this sense an 'objective' transcription of the structure of the grid. It is also a transcription which aims to cover the essential visual and access information field of a pedestrian user. It is in this sense, a recovery of a 'real' property of urban space. The axial map has been shown to be a powerful predictor of observed use and movement in urban space.

In some chapters, the axial map is complemented by a node map. This represents every intersection of lines in an axial map as a node, and every axial line segment as a connection between nodes (Fig. 2:33). The relation between the node map and the axial map is that the node map is a 'least axial' version of the system with the identical distribution of local line intersections. The axial map specifies the alignment of nodes in the first dimension. It is in this sense more ordered than the node map. The 'distance' between the node map and the axial map captures the amount of additional information which has to be specified in order to arrive at the axially synchronised grid.

The axial map is the basis for deriving measures of properties of the configuration of the grid. The most important measure which is derived from the connectivity matrix\(^2\) is integration (RA). Integration measures the relative depth or shallowness of any spatial system seen from any particular point (in this case an axial line) within it\(^3\). For this

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\(^1\) in fact it is shaded in, so that there is no confusion as to which axial lines surround urban blocks and which are 'trivial' islands entirely within the open space structure.

\(^2\) i.e., the list of all the links to other lines which each axial line in the system possesses.

\(^3\) in this sense it is a measure of spatial 'hierarchy'.
reason it is considered to be a global, static measure. Every axial line is thus assigned a value which characterises its relation to all other lines in the grid, thus providing a global index of relative integration or segregation for that line. The numerical value is a number varying about 1 with low values indicating more integration and high values more segregation or distance. It is calculated by the formula:

\[ \frac{2(MD - 1)}{k - 2} \]

where \( MD \) is the 'mean depth' or mean number of spaces away of all the other spaces in the system from the selected space, and \( k \) is the total number of spaces in the system. A correcting factor is then applied to eliminate the empirical effects of size\(^1\). (RRA) The mean depth (mean RRA) will then represent the average depth or shallowness of the system as a whole.

Integration values are rank ordered from the most integrated to the most segregated axial line in the system of interest. Any chosen percentage\(^2\) of best-integrated (or segregated) spaces can then be highlighted on the axial map. These are the set of streets which draw the urban grid together, and are known collectively as an integration core. An integration core is usually, though not invariably, composed of contiguous axial lines. The shape and spread of the integration core in relation to the grid as a whole, and its mode of growth as expressed by the build-up of axial lines, are all thought to be of interest, since systems differ quite markedly in respect of these variables. It is possible to 'type' urban grids in relation to the shape, spread, coverage and build-up of the integration core. Integration values have been found systematically to correlate with high and low levels of space

\(^1\)For urban space this is done by calculating the value for a diamond with that number of spaces (the diamond distribution gives an even spread of spaces above and below the mean). Another way of looking at it is to say that that the system is relativised with respect to the node-map of a regular orthogonal grid, set on one of its corners.

\(^2\)For large systems with many spaces the 5% of best-integrated spaces is usually sufficient to show a core of covering spaces; in smaller systems, 10% may be needed to give a reasonable shape and spread of core. Most distributions of RA values take up an S-shape, and another possibility to to select the integration values on the steep gradient of the S-curve. This is less satisfactory, because the number of spaces involved will vary from case to case, which inhibits direct visual comparison. 5% and 10% cores are both used here, together with transcriptions of all segregated lines above the mean.
occupancy, use and movement. Segregated spaces tend to be unoccupied for most of the time, or at least to be relatively quiet: well-integrated spaces tend to be busy.

Three other first-order measures (i.e., direct measures of the configuration of the grid) are referred to in this thesis. Choice expresses the extent to which a particular space (axial line) figures as a choice on all shortest routes from all spaces to all other spaces in the system. The more it is an important choice in journeys, the more it might be considered to influence global relations of through-movement. It expresses how much of the total route choice in the whole system each space represents, and it is calculated by taking all axially simplest routes from all spaces to all other spaces and then computing the proportion of shortest routes in the system which pass through every constituent space. Choice is considered to be a global dynamic measure. It is conjectured that choice should indicate which are likely to be the most popular routes in an urban system, but only for those with perfect knowledge of the system, that is, inhabitants rather than strangers. Like integration, choice can be rank ordered from the space which carries the greatest proportion of shortest routes to those that carry the least. Choice cores are more spread than integration cores and are more likely to pick up local area structures than integration, which normally picks out the most global level of structure in the system.

The global static and dynamic measures are paralleled by two local measures. Connectivity is literally the number of axial lines which intersect with each line in the system. It is a local static measure. Local control represents the amount of choice a space represents to its immediate neighbours as somewhere to go. It expresses, again with values varying about 1 (but with high values indicating strong control) how much better or worse connected a space is than its neighbours. It is calculated by summing the reciprocals of the valencies of the neighbours (N) of each space:

\[ \frac{1}{\sum \frac{1}{N}} \]

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\[ ^{1} \] the most recent summary of this material is to be found in Hillier B, Hanson J and Penn A, Natural Movement, paper presented at an international conference on computing and the built environment, Cambridge, Sept. 1989.
Fig 2:34 - the dimensions of 'analytic' syntax.
The more it is an important choice the more it might be considered to control local relations. Control is a local, dynamic measure. Again, chosen % cores can be drawn. It is conjectured that these four direct measures of the spatial configuration are interrelated in the form of a model (Fig 2:34).

Intelligibility, the correlation between RA and connectivity, then expresses the extent to which the axial information which is available to an individual moving through a particular space about how it relates to its neighbours locally, also gives reliable information about the large-scale, global structure of the grid. The conjecture is that integration leads to intelligibility, and intelligibility leads to a stronger movement interface between inhabitants and strangers. In most observed urban layouts the best predictor of observed movement is integration¹.

Integration looks at depth distributions of all the spaces in a configuration from the point of view of each space in turn. Control measures relations locally among neighbouring spaces. Radius three integration is an intermediate measure which gives a value for integration among spaces up to three steps away from the root. It is conjectured that, to the extent that parts of an urban grid are differentially connected within and between themselves, this should be revealed by the rank order of local integration values. Those spaces which draw together local concentrations of streets should be indicated by high values, and lines of cleavage between sub-areas should be indicated by low values. Point depth entropy takes the distribution of depth values provided by integration and calculates the relative entropy of the depth values set against the natural number system. It is conjectured that PDE predicts movement better than integration in systems which are strongly regionalised. Percentage cores can be drawn and inspected for both these measures and visually compared with the shape, coverage, and build-up of the integration core.

¹Choice is hypothesised to be a stronger candidate for predicting movement among inhabitants, who have local knowledge of the layout of the grid, than for strangers who have to rely on 'reading' the layout to move around.
These are the main representations and measures which are used throughout the thesis. Other 'syntactic' measures are occasionally used but these will be explained where they are introduced within the main body of the text. Syntactic studies of the modern City of London which have been carried out in the Unit for Architectural Studies in recent years, together with the relevant use and movement data, will be presented later in this chapter.

From perfect grids to piles of sticks: order versus structure in orthogonal and radial grids and their derivatives.

Almost every author who has made a contribution to the debate about urban form and structure finds it necessary at some point to discuss what seem to be the two polar types of pure grid, the radial and the orthogonal. The texts which were reviewed earlier in the chapter suggest, for example, that a regular orthogonal grid provides a neutral background on which the LUBF school lay out transformations in building geometry and plot ratio. The town and village typologies adopted by local historians and morphological geographers are based on this distinction. Many of the visual patterns offered up by architectural writers and critics use this duality as a starting point for diagramming the properties of the layouts of towns and urban areas.

The radial/orthogonal distinction is also germane to this thesis. The City of London was a Roman foundation and is known to have had a regular orthogonal grid in the east of the City in its initial stages. However, the grid did not fully cover the site and the initial deviations in the skeleton grid of the 'infant' city began to deform the grid locally into a more radial form. The Saxon period reinstated a regular orthogonal grid in the west of the City, parts of which can still be detected today in a shadowy form. However, the overall street grid of the City seems to have undergone a sea-change since Saxon times, for

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1 literally dozens of measures have been devised for quantifying spatial properties over the 15 year period. Those which do not do useful work in capturing something of the 'reality' of urban space eventually 'die'. A number of these 'dead measures' are presented in The Social Logic of Space. Some measures which seem useful in the particular context of this study are used over and above the current 'dependable' ones which are presented here as prerequisites, though even the status of these is liable to change as 'syntax theory' advances.
today it appears to be dominated by a web of radial streets centering on Bank Corner. This makes the City particularly difficult spatially to characterise.

This blending of orthogonal and radial elements is characteristic not only of the City but of many towns, including gridiron towns where relatively homogeneous orthogonal areas clash together radially or, as in the case of New York, where the grid is cross-cut by a single strong diagonal street. The wealth of orthogonally and radially mixed examples in the record does much to undermine the initial clarity which the distinction seems to afford in typing town morphology.

In terms of the order/structure distinction which was raised in the opening Problem Definition, regular radial and orthogonal grids clearly embody order concepts. The spatial structures which these highly ordered cases simultaneously embody is therefore of interest, since in the ideal condition it is possible to control the relations between order and structure by setting them explicitly against one another and measuring the effects of size and of deviations from perfect regularity. Moreover, in what follows it will be suggested that structure and order are opposed in perfect orthogonal grids and piles of sticks; that is in randomly generated sheaves of axial lines. Indeed it was in modelling and contrasting these two 'paradigm' cases that the concepts of order and structure were first fully distinguished from one another. The changing relationship between radial and orthogonal elements in sheaves of axial lines seems to be significant in relating order and structure together.

In order to build a picture of the relationship which exists between 'ideal' and 'real' cases this section of the thesis examines the syntactic features and the growth process\(^2\) of perfect orthogonal grids (an 'ideal type' of Roman grid), radial grids and spiders' webs (an 'ideal type' of organic town) and random sheaves of lines (which seem to be something like the opposite extreme of any real space-time socially generated spatial layout). An exploration is then made of the effects of

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\(^1\)Perhaps the majority of towns

\(^2\)Syntactically speaking, that is in terms of size measured as numbers of constituent parts, rather than historical evolution or metric dimensionality.
Fig 2:35 - a 'Vitruvian' city.

Fig 2:36 - the axial map of the 'Vitruvian' grid.

Fig 2:37 - the integration distribution taking the surrounding road network into account.
'rubbing out' parts of the grid, gradually transforming it into less ordered cases until the relation between structure and order is reversed. The aim is to set a benchmark for comparison with the irregular urban grids which form the bulk of the thesis, where the relation between order and structure is less clear-cut.

The example shown in Fig 2:35, illustrating a walled city laid out according to a chequerboard design and often attributed to Vitruvius¹, is as good a starting point as any from which to begin a consideration of the properties of regular orthogonal grids. From a visual point of view, the plan is remarkably well-ordered. Perfectly square, set on the cardinal points which govern the alignment of the principal streets, particularly the cardo or principal north-south route and the decumanus or principal east-west route, which divide the town into four equal quarters each comprising four insulae, the design of the whole is easily conceptualised and its principles clear.

The axial map of this ideal town is shown in Fig 2:36. From a syntactic point of view the plan possesses a property common to all perfectly regular grids: every street is connected to exactly half the total number in the system (all those running the other way - 5 in this example)². All other syntactic variables are likewise homogenised. Every street has, for example, the same depth (RRA) from all others in the system, although the mean or average depth for every line and for the system as a whole varies with the number of lines which make

¹ careful reading of Vitruvius has uncovered a puzzle, the solution to which would require a major excursion into Renaissance texts. The standard English translation, Morgan, M.H., Vitruvius, the ten books on architecture, Dover, New York, 1960, a reprint of the original 1914 edition, implies that Vitruvius had in mind a circular walled town containing a radial street-grid. If any other form had been intended, then his setting-out instructions are radically incomplete. The illustration more familiar to architects is from a Renaissance text by Joannes de Trigino, first published in 1511. This interpretation shows an orthogonal grid more in line with what is known of historical examples, but to achieve it the grid has been offset from a true north-south axis by 22.5 degrees, which accords neither with Vitruvius nor with the real cases. The invocation of Vitruvius here is immaterial to the argument, which is about the properties of perfect grids, but the question may be of interest to architectural historians.

² this is, of course, provided that the connections to the surrounding main route system is ignored. If priority is given to the global relation of the cardo and the decumanus within the overall transport network, then the resulting values are as shown in Fig. 2:37.
Fig 2:36 - the rank order of RRA for the ideal 'Vitruvian' grid.
up the grid - in this case it is 0.3636. This can be shown by plotting the rank order of integration values\(^1\), a transformation of RRA (Fig 2.38) which yields a flat line at mean RRA in this case. In this sense, the 'Vitruvian' grid lacks structure, although it has order in the visual sense described earlier.

Perfect orthogonal grids are an interesting case to model in their own right. They provide one kind of benchmark against which to look at all real systems with an equivalent number of axial line since they are the most parsimonious grid-like (or ringy) systems in terms of axial lines; so much so that it is tempting to digress into theoretical questions and forget the relevance to real towns. The aim of this brief excursion will be governed by real cases, arising out of the need to examine and compare Roman town plans rather than from any desire to enumerate examples, or 'prove' key properties for sets of grids. What follows will be dictated by an acknowledgement that the representation of grids in this way is attempts to grapple with the properties of built urban space not of pure, abstract networks. What these grids represent is a pattern of continuous open street space surrounding insulae or islands of built-up space.

Considered in terms of insulae rather than of the grid, the representation preserves the rectilinearity of islands. Each block is given its four sides by all or by some part of an axial line. The implications of this will be explored later when 'node maps'\(^2\), radial grids, distortions of orthogonal grids which eliminate parts of the street system by amalgamating and realigning the blocks, and piles of random lines are discussed.\(^3\) The 'syntactic' measure of 'grid axiality' is a primitive exploration of this type, but in its present form it is very

\(^1\)It will be proposed that this representation shows the amount of order which is present in integration cores. In real settlements the curve is characteristically s-shaped, with a steeper slope for the lowest integration values and also for the highest or most segregated spaces, with a flatter slope in the middle range. These changes in slope can be used as an alternative to a % of spaces to mark the extent of cores.

\(^2\)a representation which substitutes a node in a graph for each intersection of axial lines

\(^3\)these experimental distortions go some way to substantiate the claim which was made earlier in the literature review of the LUBF approach to orthogonal grids, by showing the importance for syntactic variables of considering the fine structure of the urban grid.
Fig 2:39 - small orthogonal grids.

Fig 2:40 - a table of values for small orthogonal grids.

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<td>9</td>
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<tr>
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<td>13</td>
<td>0.0026</td>
<td>2500</td>
<td>1.4999</td>
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Fig 2:41 - data table of key syntactic variables for small orthogonal grids.
Fig 2:42 - depth distribution from a line in a minimum four line grid

Fig 2:43 - a plot of RRA against size in small orthogonal grids.
is a primitive exploration of this type, but in its present form it is very strongly affected by size\(^1\) and by not being able to deal adequately with non-ringly systems at all.

Fig 2:39 shows the set of small perfect orthogonal grids up to 10 x10 axial lines (represented linearly rather than in two dimensions) and a case 20 x 20 and 40 x 40 for comparison. Fig 2:40 gives a table of values and Fig 2:41 plots key variables for the set. The Vitruvian example looked at earlier is number 4 in the series. At the minimum grid, which has four lines, the distribution of axial depth is as shown in Fig 2:42, which is identical to the representation of the minimum distributed asymmetry relation. The mean depth of this system is 1.333.

As more lines are added to the grid, then there are always \(k/2\) lines at depth one from the root space and \(k/2 - 1\) at depth two from the root. As the numbers become very large, then the difference this makes is very small indeed, so much so as to be almost negligible (Fig 2:43). By 80 spaces, the mean depth is 1.4937, and at 1000 spaces is 1.4995, and for 5000 spaces it is 1.4999 so is mean depth is always approaching but never quite reaching 1.5. Size is significant in that the 'two level depth' property of perfectly regular orthogonal grids makes more difference in small systems than in large ones.

The mean RA (uncorrected for size) approaches but never reaches zero as does that for mean RRA\(^2\). This is not really relevant for real cases in the sense that the majority of real towns tend to possess between 80 and 1000 axial lines (nearly all the real and designed examples looked at in this thesis fall within this range) so the RRA

\[\text{grid axiality} = \frac{\sqrt{I \times 2}}{L} = \frac{2}{L} \] where \(I\) is the number of islands and \(L\) the number of axial lines. It gives a number between 0 and 1, with high values indicating an approximation to a grid and low values a greater degree of axial deformation. The aim of the measure was to compare any case to a regular orthogonal grid with the same number of islands. However, since extremely large straight line grids are improbably, the measure requires relativising if grids of very different sizes are to be compared. A second difficulty is that, as it stands, the measure is tied very closely to the 'ringiness' measure.

\(^2\) a proof of this is contained in Kruger M., On Node and Axial Grid Maps: Distance Measures and Related Topics, UAS, July, 1989.
Fig 2:44 - the rank order of RRA distributions in small orthogonal grids.
Fig 2.45 - the rank order of RRA distribution for the modern City showing a characteristic s-shape
Fig 2.46 - the rank order of RRA distribution for a geometric composition.

Fig 2.47 - the rank order of RRA for a sheaf of random long lines.
values for comparable perfect orthogonal grids would be between 0.1288 and 0.0099 which is a relatively large range of values.

So far the distribution of measures is concerned, however, all perfect orthogonal grids share the property noted earlier in the 'Vitruvian' example that all lines have the same RRA, all have the same connectivity (1/2 k) and all systems have the same intelligibility (zero). In other words, there is no information content\(^1\) in the distribution of values - in any perfect orthogonal grid as all points are exactly the same. Despite the degree of order which is apparent in the orthogonal grid, formally speaking, it is syntactically unstructured. The computer working on the basis of a connectivity matrix and interrogating a perfect grid as a system of connectivities rather than as a visual pattern, cannot distinguish between the components which make it up. This captures something of the experiential reality of gridiron plans: moving about in them, orientation is difficult since each part of the grid is the same as all others.

In each case, a plot of the RA distribution is flat (Fig 2:44). In any real case, by contrast, plot makes an s-shaped curve where every space has a unique RA value. Fig 2:45 shows an example, the rank order of RA with the order from integration to segregation along the x-axis, for the modern City of London which has 511 spaces. For highly ordered cases where an identity in the geometric composition leads to identity in the distribution of RA, the plot shows a rising flight of steps, with the precise shape of the steps and the slope of the overall flight indicating the degree of order, the number of differences and the number of spaces for which each step holds good (Fig. 2:46). For completely random sheaves of long lines the plot appears to give a straight line (Fig 2:47).

It makes no difference from the point of view of the structure of the grid expressed as an absence of difference in RA, if a line is considered at the edge of the grid or in the middle, although it does from the point of view of order where the centre/periphery relation is visually

Fig 2:48 - the node map transformation of small orthogonal grids.

Fig 2:49 - an axially continuous but geometrically distorted grid with its node map.

Fig 2:50 - the grid of Milton Keynes with its node map.

Fig 2:51 - Alexander's illustrations of semi-lattices.

Fig 2:52 - a plot of mean RRA against size for the series of node maps.

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<th>Mean RRA</th>
<th>Intelligibility</th>
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<td>8</td>
<td>3.5556</td>
<td>1.2987</td>
</tr>
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</table>
clear. If we consider the 'node maps'\(^1\) for the corresponding series of grids already shown in Fig 2:39 transformed into 'node maps' (Fig 2:48), then the centre/periphery distinction is of importance in all cases larger than the minimal four line grid. This transformation of the regular grids looked at earlier preserves rectangularity of islands but no longer specifies the axial continuity of lines. Rather the opposite, the transformation yields in each case a grid with the same number of islands but with the maximum axial break-up compatible with preserving the squareness of individual islands. In this sense, a node map is one of the possible least-ordered versions\(^2\) of a comparably connected rectilinear system. This should be compared with the alternative least-ordered grid which preserves axiality but distorts geometry and which is shown in Fig. 2:49. It is not completely idle to consider systems with the 'node map' manifestation of a reduction in order, since this is precisely the form of the Milton Keynes grid which will be considered later (Fig 2:50).

If regular orthogonal grids seem to model something like homogeneity, then their comparable node maps seem to capture something like the property of grid-like hierarchy\(^3\). The first sign of this is given by the rapid increase in the number of elements which arises as soon as regular grids are transformed into their dual 'node maps'\(^4\). The second indication is in the mean RRA of the set of transformations as compared with the original grids (Fig.2:52) which shows that the means for the two types of grid are diverging, with that for orthogonal grids becoming increasingly integrated and that of the comparable 'node maps' becoming more segregated.

\(^1\) in which every intersection of axial lines is considered as a node in a comparable grid.

\(^2\) in the geometrical sense in that the lengths of lines representing 'streets' and the angles formed by the intersection of 'streets' at each node or 'road junction' can each be different.

\(^3\) as opposed to tree-like or non-distributed hierarchy which was highlighted in Alexander's work reviewed earlier in the chapter. The diagrams which Alexander uses to illustrate his concept of a semi-lattice (Fig 2:51) are similar to the node maps illustrated here, suggesting that his concept of a semi-lattice, though it introduces rings in the connectivity graph of the elements of the system, is still hierarchical in that it preserves the indirect relations or levels of depth between the elements of his hypothetical sets.

\(^4\) the number of nodes for any case is given by the square of the axial connectivity.
Fig 2.53 - rank ordered plots of RRA against size for the node maps of regular orthogonal grids.
More important however, is the distribution of RRA values in the set of 'node maps'. Whereas this is completely homogenised in the case of regular grids, 'node maps' produce a characteristic centre-periphery distribution at every size above the minimum (which, having only one island, does not have a centre-periphery visual or syntactic dimension in its 'street' space). In 'node maps' - which represent here the axially broken street network for the same number of urban blocks - the most integrated point or minimal four-node ring is at the centre. Integration then spreads out ring-wise to the centre point of the next square of nodes, then expanding horizontally to in both directions to the corner of the square then outwards to the centre of the next encircling ring of nodes until the perimeter is reached. The four outside corners of the grid are the most segregated of all. The the proportions of RRA for examples 22-8 in Fig 2:48 are shown in Fig 2:53. It can therefore be said that in principle axiality works against this tendency towards centrality and hierarchy in urban layouts which are growing in size and spreading in scope in order to keep them shallow from the centre to the periphery and well-integrated overall.

There are, it seems two further properties of interest here. The first is the geometrical regularity of the example, which can be detected visually and which results in step-distribution of RRA values. The second is the degree of differentiation of the grid as expressed through the numbers of lines in each step (the 'going') and the distance between RRA bands (the 'riser'). Together these provide an indication of the order inherent in the grid.

The step pattern in the transformation is indicative of a regular, ordered, rhythmical pattern of RRA distribution. But 'node maps' are also intelligible as a system. Relative intelligibility, not computable for regular grids, is computable here, and reduces as the system gets bigger. This makes intuitive sense. As more and more fine

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1 depending on whether the nodes are even or odd in number. Odd numbers of nodes (2,4,6,8) yield even numbers of blocks, even numbers of nodes yield odd numbers of blocks with a central island surrounded by a most integrated ring of 'streets' (3,5,7,9).
2 in case 1, RRA is the same for each node.
3 The values for examples 3-8 are as follows: 0.1374, 0.1311, 0.1185, 0.1049, 0.0920, 0.0804.
Fig 2.54 - A set of small radial grids.

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<th>Grid</th>
<th>Diagram</th>
<th>Note</th>
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discriminations are made in the step-values for integration, then for an individual moving about within the grid there is a comparable lessening of the ability to know where any point is in relation to the system as a whole.

The 'node map' version of the regular orthogonal grid makes it directly comparable with, though not identical to, a radial arrangement of islands. Radial grids provide us with a point of comparison not only because, as it has already been observed, they are frequently offered up as the polar opposite to orthogonal grids but also because recognisable traces of radiating routes appear so often, albeit in a deformed version, in 'organic' towns that a town centre is occasionally viewed as little more than the intersection of radiating routes. Finally, it should not be forgotten that a radial plan is the alternative interpretation of the better-known orthogonal Vitruvian town plan, nor that radial grids are of a more general interest in the study of 'ideal' towns, since these crop up from the Renaissance onwards at least as often as orthogonal grids.

A comparable selection of perfect\(^1\) radial grids with small numbers of axial lines is given in Fig 2:54. The least grid - number 3 - is given by three lines, surrounding a single island. For this trivial case, all values are homogenised: RA is again zero\(^2\), and connectivity is 2. At six axial lines - number 6 - the system has two versions which illustrate the fundamental possibilities for radial grids. The first has two radials which are diameters of the system, and four laterals joining them. The alternative is less ordered, in that the radials are actually radiae which intersect in the heart of the grid but do not cross it in one step. This alternative is composed of three radials and three laterals.

The 'diameter-radial' version at six lines give the 'seed' for the mode of growth of grids of this type. The two diameters are better-connected than the four laterals: 5 as opposed to 4 connected. They

\(^{1}\) only in the 'topological' sense of having radials which meet in the centre and laterals which meet at each intersection with radials and not, as yet, in terms of having a governing geometry to guarantee the similarity of parts, which would be a more ordered case of each version given here.

\(^{2}\) the distribution of RA cannot be drawn, or rather it runs along the horizontal axis.
<table>
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<th>Rel Int</th>
<th>RRA int</th>
<th>RR seg</th>
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Fig 2.55 - RRA distributions in small radial grids

Fig 2.56 - higher order webs in radial grids.
share equal zero integration compared with the set of laterals which all have the same lower value of 0.2865, giving a mean RRA of 0.1910 and a mean connectivity of 4.333. In short, the grid falls into two unequal parts, a small number of integrating diameters and a rather larger set of segregated laterals. The 'radius-radial' version at six lines has a connectivity of 4 for all components and a mean RRA of 0.2865, with all spaces having the same value but producing a more segregated system overall, as one might expect.

The next possibility - number 8 - is a 'radius-radial' with four radials and four laterals. At this point the radials and laterals for this version of a radial grid acquire different values by virtue of their meeting in the centre, since laterals cannot progress beyond 4 connectivity whereas radials gain by $1^2$ each time the web expands. It follows that this grid now also falls into two equal clumps of identical size but differentiating more integrated radials from more segregated laterals. The connectivity slowly climbs as the web expands radially, the differences between radials and laterals becoming measurably greater as enhanced connectivity at the centre begins to tell, as do the mean RRA and the relative intelligibility of the system. For the set of 'diameter-radials' the story is almost identical. The ratio of diameters to laterals is a more dramatic 1:2. Hence connectivity and RRA measures spread the two parts of the system apart more quickly and mean RRA values are lower than for the comparable 'radius-radial' web. All RA distributions (Fig.2:55) show two steps (and not the multi-step pattern of the 'node map' transformation of an orthogonal grid) in 'radius-radials' the 'going' of the two steps is equal and in 'diameter-radials' it is unequal.

The effect of adding higher order webs is shown in Fig 2:56. The radials remain equal and integrating, and values for all the laterals are homogenised and share the same numerical values for all measures

---

1 of course, all first order webs with one ring of laterals have equal numbers of radials and laterals however large they grow, and second and higher order webs have $2k$, $3k$, $4k$, etc where $k$ is the number of radials.

2 each radial is connected at the edge to 2 laterals and at the centre to all the other radials, so the connectivity of any radial is one more than the number of radials/laterals in the web.

3 again, for each radial 4 connections are acquired from the laterals at each end and the remainder from the other radials, to give a stable rate of increase.
Fig 2:57 - node maps for simple radial grids

Fig 2:58 - node maps for higher order webs
Fig 2:59 - a long line random sheaf of 96 lines
independent of the centre/periphery distinction, a demonstration that this is a feature of visual order which the computer does not recognise from the connectivity matrix. This principle is clear by the fourth ring.

'Node maps' (Figs. 2:57, 2:58) bear a different relation to radial grids than to their orthogonal counterparts. Unlike in the orthogonal case, the number of nodes does not expand dramatically with the number of lines for the reason that axial continuity is in any event maintained only along the diameters or radiae of the web and not at intersections with laterals. For a single ring it is always the number of radials plus 1 for the centre. All 'diameter-radial' cases degenerate to a larger 'radius-radial' version, as the demand for axial continuity across the centre of the web is lifted. As levels are added to expand the web ring-wise from the centre, then the number of nodes in the network is given by: the number of radials x the number of lateral rings plus 1 for the centre.

The ordered but unstructured orthogonal grid is an extreme case. To arrive at its opposite it is necessary to imagine that a set of regular, gridiron streets is picked up and thrown down again in a random pile. Piles of random lines do not yield anything like the shape of what would be the building blocks of a town as defined by the axial grid interpreted as streets. However their place here is to do with what they have to show us about structure in constellations of radial and orthogonal tendencies governed by compactness, which is the result of random placements.

Fig 2:59 is a long line example with 96 lines. By definition, this arrangement is lacking in many of the aspects of visual order which are present in regular grids since it is a random aggregation. It does not, however, lack syntactic structure. The example shown shares some properties with a perfectly regular grid of the same number of lines. The mean connectivity of lines in the system is exactly half the total number in the system, and the mean RRA for the pile of random

---

1 due to Professor Bill Hillier and Alan Penn, who have conducted the research reported here on random line experiments.

2 though even here, it is not entirely absent, since it is possible to draw random long line maps, random short line maps and maps of mixed line length. The structure properties are, in each case, different.
Fig 2:60 - rank ordered RRA and intelligibility for the sheaf of 96 random lines

Fig 2:61 - an 80 line random long line sheaf with 10% integration and 10% segregation shown
lines equal to that of a perfect grid with the same number of lines - in this case a mean RRA of 0.1213.

However, the distribution is different. Some lines are poorly connected, others are very well-connected, the distribution being dependent on the length of the lines which make up the pile (the longer the lines the more probable that they will intersect many others if the pile is cast down compactly) and the precise way in which the pile of lines happens to fall on any particular occasion (the probability being that each time a pile is cast down it will form a unique arrangement which is nonetheless one of very large equivalence class of similar piles). From the point of view of the structure/order distinction this leads to a situation where the distribution of RRA likewise varies according to the position of each line within the configuration as a whole. This is unlike the previous case of the perfect grid, where all values were identical. These differences from one component in the configuration to another give a pile of random lines structure\textsuperscript{1}, although by definition the pile lacks visual order since it is arrived at randomly. If a plot is taken of intelligibility\textsuperscript{2} (Fig 2:60) then there is an almost perfect correlation. A pile of random lines, it seems is perfectly disordered but perfectly structured - the opposite of a regular orthogonal grid.

A standardised 60 long line random\textsuperscript{3} example (Fig 2:61) is shown here for comparison with the 60 line regular orthogonal grid discussed earlier, with 10\% (6 line) integration/10 \% segregation shown. This figure makes it clear that not all integration values are homogenised, but that there exists a structure of best-integrated spaces which

\textsuperscript{1} the reader will recall that syntactic structure was defined earlier as inhering in the differences between integration values, which is indicative of differences in the layout as a system of interior shallownesses.

\textsuperscript{2} i.e., RRA against connectivity.

\textsuperscript{3} absolutely random piles are extremely difficult to generate manually, and deviations from pure randomness which, it is suspected, might even result from the 'interference' of the hand and eye of the observer in the generation process. Even the intention to locate the pile compactly, within a bounded universe, is a restriction on randomness, as is the rectangular shape of the frame, which introduces directionality into the pile - the important effects here being that of having diagonal lines which cross the pile, and relatively free-flying lines at the edge which begin to 'escape' the pile, just like midges at the edge of a swarm.
Fig 2:62 - the rank ordered RRA distribution for the 80 line random line sheaf.

Observations

Fig 2:63 - RRA plotted against connectivity for the 80 line random sheaf.

- $r = 0.9382$ rel Int = 0.2297
- mean RRA = 0.1063  CONN = 46.8250

Fig 2:64 - the rank ordered RRA distribution for a well-randomised sheaf of long axial lines.
corresponds to the longest lines which cross-cut the geometric centre of the grid\textsuperscript{1}. These are the lines at greater than average 'slope', marked \( a \) in the RA distribution (Fig 2:62). At the other extreme the most segregated lines are those right at the perimeter which do not connect to all lines which cross at right angles, marked \( b \) in Fig 2:62. Between these cases the curve is smooth, but not a completely regular slope due to the clustering of groups of lines with identical values, particularly at the lower end of the range, marked \( c \). These are not a product of regularisation, as in a grid, but of the probability that adjacent or similarly-orientated lines will share identical values in a long line system. This example illustrates something of the complexity of the relation between structure and order, and of the influence of radial and orthogonal tendencies in an 'almost random' aggregation.

Fig 2:63, plotting RRA against connectivity, shows 'bunching' in the curve at the extremes where lines share values or perform better or worse than their connectivity would warrant. The connectivity overall is higher than for a regular grid, and the introduction of the differences in the distribution of connectivity and RRA (the system is more integrated than a grid with the same number of lines, 0.1063 as opposed to 0.1288) discussed earlier give the system a high level of intelligibility.

Random line experiments by Professor Bill Hillier and Alan Penn have demonstrated that these properties vary with such factors as the length of axial lines and the density or compactness of the pile. Short random line piles are found to be relatively unintelligible and long random line piles are correspondingly more intelligible, because the longer the lines the more concentrated the relation becomes between connectivity and integration which is the basis of the measure of intelligibility. For random piles of lines of the same length and perfectly randomly distributed, the rank-ordered RA transformation appears to be a more or less a perfect slope (Fig 2:64).

\textsuperscript{1} thus acting exactly like the diameters in the web or radial grids looked at earlier. Core lines in this random pile gain in integration by virtue of picking up added connectivity over and above the K/2 (40) which is the case in orthogonal grids, just as a diagonal line crossing an orthogonal layout is connected to K-1 lines. The best-connected line here is 61-connected and the worst-connected is 20-connected, so the spread of values for individual lines is from 1/2 to 3/4 the mean connectivity of the system.
Fig. 2.65 - a 'brickwork' grid

Fig. 2.66 - main syntactic values for the brickwork grid.

\[ r = 0.8660 \quad \text{rel Int} = 0.0369 \]
\[ \text{mean RRA} = 0.7197 \quad \text{CONN} = 3.5556 \]
Fig 2.67 - a system with 'blocked' interior lines

r = 0.9332  rel Int = 0.1193
mean RRA = 0.6121  CONN = 4.3636
Fig 2:68 - a 'tatami mat' version of a grid.
Fig 2:69 - a pinwheel offset grid.
Few real towns are perfect grids; probably none are generated completely at random. 'Rubbing out' or 'deforming' the grid therefore permits a 'primitive' exploration of the relationship between order and structure over and above the obvious, completely regular examples. 'Brickwork' patterns\(^1\), a highly ordered case but one where the principles are of a rather different kind in that the regularity of the brick joints is 'read' by continuing grid lines across intervening blocks, yield results which are slightly counter-intuitive until stated (Fig 2.65). The vertical edges are most integrating, followed by the four inner horizontals, then the horizontal edges, the inner brick joints and then the brick joints at the edge. The main values for the system are considerably distorted from a regular grid with the same number of axial lines (Fig 2.66).

'Rubbing out' portions of the grid in both directions is the next logical step. Fig 2.67 illustrates a case where no internal lines traverse the system, except for a 'decumanus' and a 'cardo' which intersect at the geometric centre and divide the grid into quarters. Again, the order in the system is implied\(^2\), and can be 'read' by continuing grid lines in both directions. Fig 2.68 shows what happens when no internal line crosses the system and the interior, although packed in an orderly way which is reminiscent of tatami mats\(^3\) is nonetheless labyrinthine to traverse. In this case, the integration core is largely peripheral\(^4\).

Fig 2.69 takes the next logical step of offsetting parts of the grid, so that lines no longer align themselves with reference to an underlying system of dimensional co-ordination. This not only reproduces the 'brickwork' effects noted earlier but also introduces 'pinwheel' effects where lines intersect in the open space between blocks\(^5\). This is about

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\(^1\) offsetting axial lines in one direction.
\(^2\) through 'improbable' alignments between spatially discontinuous objects
\(^3\) rectangular tatami mats of a proportion of 2:1, the compact packing of which governed the size and layout of rooms in traditional Japanese houses.
\(^4\) it is this anti-axiality which results from 'rubbing out' portions of the grid, regularised here in this more ordered grid, which gives rise to disorientating and segregated internal layouts and a peripheral integration core in many modern estate layouts.
\(^5\) an effect which was noted and advocated by Camillo Sitte in his \textit{Art of Building Towns}, as being the correct method of constructing road intersections in newly designed towns.
Fig 2:70 - a more complex offset grid.

\[ r = 0.9361 \quad \text{rel Int} = 0.1408 \]

mean RRR = 0.6546  CONN = 3.7857
Fig 2.71 - an identically structured version of Fig 2.70 which lacks visual order.
Fig 2:72 - a comparison of a connectivity matrix entry with the node adjacency for a typical axial line (modern Cheapside)
as complex a set of ideas as can be easily be maintained within a strict adherence to a regular grid.

Fig 2:70 shows how, locally, combinations of 'rubbing out' parts of the grid, offsetting some intersections and introducing 'pinwheel' junctions in others, effect can be brought together with a global cross-cutting pair of central axes, to reintroduce something like the 'quarters' of Fig 2:67. Finally, Fig 2:71 shows that the properties of order and structure which have been explored in this sequence are relatively independent in that the two cases share an identical structure\(^1\), but the former is visually more ordered than the latter.

This formal independence of structure and order is generalisable to axial maps, and it is important to realise some of the properties of axial maps as spatial representations. Syntactic analysis specifies only a set of connections which have (frequently) been derived from reality, but which in itself is a reality the computer does not recognise. In order to move from a matrix of connections, which is what the computer recognises and operates upon to a layout, it is necessary to specify more than is contained in the connectivity matrix. Otherwise, there potentially exists an equivalence class (probably infinite) of real cases, each of which will differ in shape. In order to reconstruct a layout from its matrix of connectivities it is necessary to specify line lengths, the angles of junctions between lines, and the order in which intersections are sequenced along the line\(^2\) in order to give the actual shape and dimensions of the net (Fig.2:72). The computer is even blind to the visual properties of centre-periphery distinctions and to the shape and spread of integration cores. The full significance of this will be discussed in a later chapter, but for now it is necessary merely to note that order has a part to play in moving from equivalence classes of possible nets to any real net; of which the example given by these regular grids is located towards the pole of highly ordered systems.

The relation between order and structure is not completely reversible. Clearly identical orders with different structures can be conceived of

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1 literally, the same matrix of connections.
2 that is, the node adjacency.
Fig 2:73 - four 'Palladian' plans with the permeability altered in each case to model the dimensions of space syntax.

Fig 2:74 - an order motif applied in contrasting global configurations.
and represented. Four identical 'Palladian' plans with identical geometries and adjacencies but with different permeability patterns\(^1\) would account for one (Fig 2:73). For urban space which is normally continuous, the difficulty of deciding the criteria by which two cases might be considered to have an identical degree of order without this affecting the structure of the two cases at all, is not at all obvious. To arrive at identical orders with different structures may only be possible where the order concept is a local one, applied recursively to give different global outcomes. Fig 2:74 illustrates what is meant by this. Here, the order motif is a 'court-type' enclosure and in each case four 'motifs' have been assembled into a higher-order enclosure, but in a handed and mirrored relation. There is the same amount of order present, but the two resulting structures are different as demonstrated in the two maps (Fig 2:75) showing integration/segregation, and in the accompanying table of values (Fig 2:76). The first has a central core and the second a peripheral one. The resulting structures could not be more different.

**The sub-area structure of the modern City, use and movement studies and the criticality of the concept of the 'movement interface'.**

Most real towns are not pure radial or orthogonal grids but grids which are geometrically axially deformed in some way. The implication of what has gone before is that they lose in order but gain in structure as a result. The question immediately arises as to whether or not this observation is meaningful in terms of the 'sociology' of towns. Is a well-structured layout to be preferred to a geometrically-ordered but less visually-regular one in some way, because it is relevant to the way in which towns work? If so, then the distinction which Alexander has drawn between natural and artificial cities\(^2\) may indeed be significant and, moreover, the tendency which he observes for a preference for deformed grids in naturally-evolved cities may not be fortuitous. To pursue the argument a little in advance of the evidence, if this line of reasoning holds then it is necessary for designers to understand how towns are structured at least as well as

\(^2\) see pp 74-76 of the literature review.
Fig 2:75 - the axial map of each arrangement showing integration and segregation in each case.

Fig 2:76 - a table of key syntactic values for the two cases.

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they currently understand and recognise principles of geometric composition.

It was suggested in the Problem Definition that order and structure construct different kinds of intelligibility for the user. It was suggested there that highly-ordered layouts are more easily intelligible from outside, even from above the layout. Structure creates both overall and local differences which make the layout intelligible to the internal user moving about the configuration. If this is so, then in the relatively deformed grids of real towns, there ought to be a detectable relation between spatial configuration and space use and movement.

A number of authors who write about the social significance of city form and who are concerned with the extent to which the city is rendered intelligible to its occupants, imply that an orientation of the grid towards use and movement might be the case. For example, Pred observes that 'the form of the city has always been governed by the manner in which man considers he will move about in it' 1, while for Mumford, 'the city is a place which multiplies the "accidents" of human contact' 2 and Bourne states that 'the successful street is the one that is much used because it connects vital parts, and the more it fulfills this function of liaison, the more interesting and lively it will be as a place in its own right.' This ability to connect the parts and direct the movements of its occupants has led Rasmussen to question the 'townscape' approach to urban form, since most citizens use a town for practical purposes. Thus he argues that a direct experience of the urban grid has the result that 'instead of a street picture, you get an impression of the whole town and its atmosphere'...therefore ......' you are no longer dependent on the angle from which the picture is

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1 Pred, A., On the spatial structure of organisations and the complexity of metropolitan interdependence, in Blower set al., Urban Change and Conflict, op cit.
Fig 2.77 - A map of the modern City.

Fig 2.78 - An axial representation of the modern City with observation routes highlighted.
made'. ....... and are able to .......... 'see ahead, laterally and remember those streets you have passed.'

It has already been suggested in the methodological prerequisites that a range of syntactic studies conducted in the Unit for Architectural Studies in recent years shows that differential integration which, as we have seen, is brought about by axially deforming a regular orthogonal or radial grid is indeed a powerful predictor of observed use and movement in towns. One element of this research took place in the City of London, so it is doubly relevant to this thesis in that it provides information about how the urban grid of the City works today.

In 1984, as part of the preparations for giving evidence at the Mansion House Square Public Inquiry, a study of the pattern of public space in the City, together with its patterns of use and occupancy was carried out. The study included i) a detailed spatial analysis of the whole of the City area, roughly within the walls; ii) a systematic observational study of space use and movement in the public space of the City, with particular attention to the use and non-use of public squares and open spaces; and iii) a statistical analysis of the relations between spatial and observed patterns of use and occupancy. The aim of the study, according to its authors, was to identify the 'the spatial culture' of the City, defining this both in terms of both the distinctive spatial structure of the City and the characteristic ways in which it is used.

The spatial structure of the modern City will be dealt with at length in Chapter Eight of this thesis. It should be assumed here that the calculation of integration values on the basis of an axial transcription of the street space of the City (Fig 2:77, 2:78) was carried out, and each line assigned its integration value in the normal way.

1 Rasmussen, SE, Towns and Buildings, University of Liverpool Press, Liverpool, 1951.
2 for details of this work see Hillier, B. et al. Creating Life: or, does architecture determine anything, in Architecture and Behaviour, Vol. 3 No. 3., 1986-7.
4 see pp. 84-87 for the detail of the methodology
Fig 2:79 - the routes with numbers of static and moving people in the morning and afternoon.

Fig 2:80 - the routes with numbers of static and moving people observed at lunchtime
Observation routes which covered the range of integration values were then selected from within the central area of the City. The observation technique employed involved a pedestrian walking the route at a constant speed and noting the numbers of both moving and static people that s/he passed in each space on the pre-selected route. Each space was observed 30 times during five time periods in order to give statistical reliability to the observational data. The totals were then broken down to give an encounter rate for the axial line of people per 100m/minute.

Figs 2.79 and 2.80 show two routes within the central part of the City annotated with the observed numbers of static and moving people during the periods of morning/afternoon work and at lunchtime. Fig. 2.81 is a scattergram plotting integration values for all the spaces on the observed routes against the numbers of moving people using those spaces during the three time periods.

The correlation of 0.539 between integration and moving people shows that space use and movement about the modern City is strongly and significantly associated with configurational differences. The correlation, however, is weaker than the .75 (or so) that is usually found in urban areas. The correlation confirms that in the City as elsewhere, knowledge of the overall configuration of the grid as given through its integration distribution will give a fairly reliable indication of the relative quietness or business of individual streets within the urban grid, but also suggests that the City has distinctive properties which render the correlation weaker than elsewhere.

What these distinctive properties are, is strongly suggested by disaggregating the scattergram into sub-areas. For example, taking just the routes around the heart of the City south of Gresham Street,

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1 8.00 a.m. to 10.00 a.m., 10.00 a.m. to 12.00 noon, 12.00 noon to 2.00 p.m., 2.00 p.m. to 4.00 p.m. and 4.00 p.m. to 6.00 p.m.
2 conveniently this is an approximate steady walking speed so the 100m/minute rate captures a significant aspect of how people actually experience the presence of others whilst moving through an urban area.
3 that is, avoiding the morning and evening rush hours where movement is very intensively directed away from/towards the main line railway stations and the underground.
4 significance 0.0001.
Fig 2:81 - scattergram plotting integration against moving people for the three time periods.

Fig 2:82 - scattergram for the area south of Gresham Street.
Fig 2.63 - scattergram for the Guildhall area

Fig 2.64 - scattergram for the Austin Friars area
that is the integrated streets in the commercial heart of the City, (Fig 2:82) the correlation improves strikingly to 0.740¹, close to the urban norm. Figs 2:83 – 2:87 show the sub-plots for each of five further sectors: the area around the Guildhall, Austin Friars, the whole of the second route, and the two areas of this route either side of Cornhill; that is, the area north of Cornhill and Leadenhall Market, holding the range constant so that the sub-plots can immediately be visually compared with the scattergram for the whole.

Looked at separately, not only do most of the correlations improve to 0.928, 0.559, 0.707, 0.910, and 0.842 respectively², but it can be seen that the spaces involved are clustered within the main scattergram and lead to different regression lines in each sub-plot. It can also be seen that the two areas north of Gresham Street over-perform in terms of through-movement for their degree of integration. The regression lines for each sub-area can be held to characterise the distinctive relations between space pattern and function in that area, and give a a certain morphological meaning to the idea of an urban sub-area.

These results suggest that the idea that the City today has within it more regionalised sub-areas. It seems that these do exist within the modern City, but that the sub-area structure is not so much to do with visually clear 'natural neighbourhoods' as with regions which are differentiated by space and by function. This lends force to the interest which this thesis has in conducting a morphological investigation into the existence or otherwise of 'natural neighbourhood units' within the historic City of London.

One further result of of interest. If the choice measure is substituted for integration this does not beneficially affect the results for the sub-areas taken separately, but it does improve the overall correlation between the space pattern and observed use and movement to 0.698³ (Fig. 2:88). This suggests that choice, while less good at predicting movement within each area, gives a better account of the relations

¹ significance 0.0001.
² significances 0.0075, 0.2487, 0.0101, .0017, .0355
³ significance 0.0001.
Fig 2.89 - the six spaces of the origin/destination study.
among the areas, and how they combine to form the overall system. Following the current state of theory about the various measures of spatial pattern, this might also be held to indicate that the space structure of the City is used in the main by people with a fair degree of local knowledge of the street layout, well able to use the more localised areas in construct routes around the City.\footnote{see p.87-88}

These arguments suggest that the modern City is configured to construct an intelligible pattern of space use and movement which is both locally regionalised and systematically related to the overall configuration of the urban grid. However, these 'syntactic' studies of use and movement do not look at the origins and destinations of journeys which cumulatively construct the space occupancy of any particular street at a point in time. They simply record the numbers of people moving through the street grid without any indication of the direction of movement, let alone the origin and destination of the journeys.

If the sub-areas of the City correspond to 'natural neighbourhoods' in a sociological sense, then it is to be expected that this will be reflected in the domination of the grid by people moving about locally. It was therefore decided to expand the work already carried out in the UAS\footnote{Unit for Architectural Studies at the Bartlett School of Architecture and Planning, University College London.} by carrying out a short test study into the origin and destination of journeys within the modern City. Assuming that strangers could be defined as those on longer journeys and inhabitants as those on shorter journeys, the hope was to achieve a better understanding of the interface between inhabitants and strangers in different types of City street by relating journey-lengths to spaces. The six spaces in the heart of the modern City which were selected for the origin and destination study are shown in \textbf{Fig 2:89}. These cover a spread of integration values from relatively segregated to well-integrated streets.

It was considered important to devise a methodology which involved the minimum of interruption in the journeys of subjects. Questioning
was limited to the origin address of the particular journey which has been interrupted, and its eventual destination. The observer simultaneously noted the direction of travel, the gender of the respondent and the size of group of which s/he was a member. Fifty subjects were questioned for each space: half travelling in each direction. Observation was limited to the morning and afternoon periods to isolate the background movement interface of the grid during the normal working day, avoiding rush-hours and mid-day peaks. Initial thoughts on the use of City streets by moving pedestrians were that these features would extend to the use of street space, and that the spatial property of integration would correlate with longer journeys. Both integrated and segregated streets would have a mix of long and short journeys, but segregated locations might contain a higher proportion of short journeys about the area and perhaps more journeys with the observation space featuring as the origin or destination for the journey. Integrated spaces, on the other hand, might contain a greater proportion of long journeys and journeys where the observation space was neither the origin nor the destination.

First impressions of the pattern of recorded movement was slightly puzzling. It seemed as if each street was behaving idiosyncratically. In all, 30 of the 50 observations in Love Lane (marked A on Fig 2:69) originated or ended there. These were, for the most part, relatively extended trips emanating from or aiming at streets outside the City to

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1 only one respondent per group was recorded.
2 10.00 a.m. to 12.00 noon and 2.00 p.m. to 4.00 p.m., thus avoiding the rush hour and lunchtime periods.
3 A parallel study was simultaneously conducted within the UAS into the origin and destination of the static occupants of the City's squares and public open spaces. Here it was found that the more strategic the location of the square as a well-integrated space with good lines of sight and access to other parts of the City, the better it was used and the further people travelled to come to it. Well-used spaces like Broadgate, for example, drew a majority of people in from outside the surrounding office blocks which fronted immediately onto the square. The average travel distance to sit in this square was over 400 metres. By contrast, a less strategically important, more localised and more segregated squares like that behind the Guildhall were found both to be more sparsely occupied and to draw people in from nearby, from within an average range of about 200 metres.

1 Hatton Garden, Aldersgate Street, Finsbury Circus.
Fig 2:90 - the distribution of recorded journeys through Love Lane.

Fig 2:91 - the distribution of recorded journeys through Cheapside.
the north and west\textsuperscript{1}, or in the south-west sector of the City\textsuperscript{2}. The remaining journeys which were using Love Lane for through-movement were emanating from or aiming at the immediate locality\textsuperscript{3}. Several of these were short trips entirely within the immediate neighbourhood. A small proportion of journeys were 'improbable', in the sense that the subject could not have been taking the shortest route from his reported origin to his intended destination\textsuperscript{4}. It became obvious that some people 'waste time' by taking a more tortuous route than is strictly necessary. Some half dozen of these were 'repeat journeys'; that is, journeys where both the origin and destination were in the same street, though not necessarily at the same premises or using the same direction of travel\textsuperscript{5}. The remainder were trips of greater duration but these were still generated by origins and destinations immediately around Love Lane. All the recorded trips began and ended west of Bank Corner. No long trips at all were recorded in which Love Lane featured in the central portion of the route. No journeys were confined to the street. The spread of recorded journeys is shown in Fig 2:90.

In Cheapside, (marked B on Fig 2:89) 28 of the 50 journeys had the street as the origin or destination point (Fig 2:91). However, unlike Love Lane, 11 of these 28 were journeys which were confined to Cheapside; that is, the subject was moving between different premises in the same street. Several subjects reported themselves as being engaged on a round trip\textsuperscript{6}. Again, there were some 'improbable' journeys. These were rather obviously people on local trips who had an axially more direct route at their disposal but who were selecting to walk to their destination by way of Cheapside\textsuperscript{7}. A majority of the remaining journeys were long cross-City journeys on which Cheapside

\textsuperscript{1} Hatton Garden, Aldersgate Street, Finsbury Circus.
\textsuperscript{2} New Change, St Paul's Station.
\textsuperscript{3} the Guildhall, Aldermanbury, Gresham Street.
\textsuperscript{4} Queen Street/Basinghall Street.
\textsuperscript{5} Gresham Street/Love Lane.
\textsuperscript{6} Monument/Monument; Queen Victoria Street/Queen Victoria Street.
\textsuperscript{7} like Milk Street to Watling Street which was walked in an S-bend via Cheapside rather than as a U-bend, avoiding Cheapside.
Fig 2:92 - the distribution of recorded journeys through Bow Lane.

Fig 2:93 - the distribution of recorded journeys through Watling Street.

Fig 2:94 - the distribution of recorded journeys through Royal Exchange Buildings.
featured as a central portion of the route. There were a few direct local journeys, all of which were 'repeated' several times.

In the case of Bow Lane (Fig 2:92 and marked C on Fig 2:89) both these features, of 'repeat' local journeys and 'improbable' journeys were present in the sample of respondents. Some routes were clearly axially more tortuous than that afforded by the shortest path from the origin to the destination. Maybe the respondent had used his knowledge of the City to select an indirect and longer, but more interesting route. Many of the journeys gave a nearby street as either the origin or the destination for the trip, but only 15 actually began or ended there. Only two long cross-City trips were observed to pass through the street. The impression is that Bow Lane is a more localised street for people moving through the area but without itself being a magnet for significant numbers of either local or long distance trips.

By contrast Watling Street (Fig 2:93 and D on Fig 2:89) generated a great deal of activity as an origin or destination for pedestrian movement. A total of 33 out of the 50 journeys began or ended there and, like Cheapside, several trips were internal to the street. People coming and going were traversing the entire City in all directions as well as making local trips. No recorded journeys were 'improbable'.

The vast majority of people questioned who were using Royal Exchange Buildings as a route (Fig 2:94 and E on Fig 2:89) were making 'repeat' local journeys. The same few streets tended to crop up as origins and destinations for those on through-routes and for those trips which either began or ended in the street, of which there

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1 only one was an obvious tourist route (St.Paul's to the Tower). The remainder were from business destinations, Smithfield Market/Queen Victoria Street, Fenchurch Street/Fleet Street, Upper Thames Street/Fore Street.
2 e.g., Cheapside to Bow Lane.
3 such as Watling Street to Cheapside.
4 one respondent travelling from Queen Street to Queen Victoria Street by way of Bow Lane took 5 axial steps in preference to the obvious direct link.
5 from the Barbican to Watling Street and from Newgate to Queen Victoria Street.
6 15 trips were between Cornhill and Threadneedle Street, Cheapside and Bartholomew Lane by the Stock Exchange were also popular origins or destinations.
Fig 2:95 - the distribution of recorded journeys through King Street.
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Fig 2.96 - Table of key variables for the origin/destination study.
Fig 2: The correlation between syntactic variables and mean journey length for the sample of spaces.

Regression equation: 

\[ y = -761.584x + 408.893, \text{R-squared: .927} \]

\[ R = 0.963 \]
\[ P = 0.009 \]

Regression equation: 

\[ y = 25.254x + 43.039, \text{R-squared: .95} \]

\[ R = 0.975 \]
\[ P = 0.005 \]
\[ y = 206.382x + 69.575, \text{ R-squared: } 0.738 \]

\[ y = -61.547x + 130.399, \text{ R-squared: } 0.032 \]

\[ y = 22.089x + 55.574, \text{ R-squared: } 0.734 \]
were 20. This localisation was balanced by a few long journeys\(^1\), all of which were to the street itself. Only one or two journeys were 'improbable' and these took the form of people whose route took them naturally near the street but who must have diverted to take in Royal Exchange Buildings on the way.

Finally King Street (Fig 2:95 and shown as F in Fig 2:89) was mainly used by people moving through, particularly towards or away from the area around the Guildhall. Only 13 out of the 50 recorded journeys began or ended in the street. Journeys were long, and crossed the City in all directions. Several journeys were from a long way away, and/or from or towards axially complex areas\(^2\), where the portion of the route which took in King Street made the whole trip axially simple. There were no recorded 'improbable' journeys.

In spite of the idiosyncracies of particular spaces, however, analysis of the data numerically against the distribution of spatial measures showed remarkably strong results. Fig 2:96 records the metric variables, the length of each axial line and the number of buildings fronting each street, key syntactic variables including the measures of integration, control, connectivity, and choice, and the observational variables of mean journey length and mean number of axial steps of journeys passing through the street and the proportion of journeys which have the street as either the origin or the destination of the trip, together with the standard deviation, maximum and minimum values.

As Fig 2:97 shows, all first order spatial measures correlate strongly with the mean length of journeys: the stronger the space, locally and globally, then the greater the mean journey length of those passing through the space. One space - Love Lane - is slightly at odds with the overall pattern, but this space is of course on its own, well to the north of the other 5 spaces. If Love Lane is ommitted, all correlations between spatial measures and mean journey length are above .96. With all the caveats that must be made for such a small scale study,

\(^1\) From the Barbican, Newgate Street and London Wall. These well recorded well outside the rush hour periods so were likely to have been 'genuine' journeys produced by \textit{work} as opposed to journeys into or from \textit{work}.

\(^2\) St Bartholomew's, Bush Lane near Cannon Street
this result does suggest that spaces do vary in their tendency to create mixes of longer and shorter journeys, and therefore different degrees of interface between inhabitants and strangers, and that these difference arise, as do the movement densities themselves, largely from spatial properties.

It is notable that this result is not reproduced when considering the spatial complexity of journeys, that is the number of axial steps making up the journey, rather than its metric length. There is little correlation between spatial variables and journey complexity. This is as it should be. Journey complexity ought to even itself out, since any tendency for longer journeys to be axially more complex would be compensated by the tendency for segregated spaces to be accessible through other segregated spaces, thus requiring more axial steps.

Coupled to the basic fact that the data shows that at least two thirds of the people questioned in the City streets are passing through the street in question, rather than using it as an origin or destination, and that even the more segregated streets have a preponderance of strangers, these results suggest that the presence of strangers and the interface between strangers and inhabitants, is a key dimension of the spatial structure and functioning of urban layouts.

A Summary and Findings of the Chapter.

A great deal of material of a rather disparate nature has been covered in the proceeding pages. It has been suggested that much of the methodology for the description and analysis of urban grids which is available to students of morphology is not sufficiently rigorous to approach in principle the kinds of questions which are central to this thesis, particularly since this study ranges comparatively across cases which are not clear-cut and simple, and involves historical material which cannot be directly observed.

In terms of the structure-order distinction which was introduced in the opening Problem Definition, many of the descriptive typologies of urban space which have been reviewed here are aimed at order concepts. Because typological statements tend to be either too simple
to be useful or so detailed as to be indiosyncratic, they fail to deal with the morphological continuum which reality presents to the student of urban space and structure. It has been suggested that the space syntax method for the description and analysis of urban space is aimed directly at the identification of structure in urban grids, and is therefore an appropriate methodology with which to approach the historical study of the morphology of public space in the City of London.

An analysis of regular orthogonal and radial grids was conducted in order to study heuristically the relation between order and structure. These present configurational characteristics in a pure form which is a product of their geometry and growth processes. Real grids, it was argued, are deformed in terms of the degree of order which they display but this creates differences in the overall spatial configuration which lead in some cases to the grid being well-structured.

It was then shown that syntactic variables, particularly the measure of integration (which, it has been argued, is in a limited sense a measure of structure in that it captures the way in which the pattern of streets constitutes a system of differentiated interior shallownesses) predicts the observed pattern of use and movement about the urban grid. Analysis and observation of the modern City has revealed that it seems to work today as a structure of morphologically and functionally differentiated but related sub-areas.

Finally, a pilot study of the origin and destination of journeys about the City suggested that the movement interface as recorded in terms of the mix of people who are co-present in particular City streets is dominated by strangers. The pattern of space use not only predicts the numbers of people who are to be found in different parts of the grid, but also the degree to which these are dominated by journeys which are on average long or short. In other words, if we allow that journeys which originate or are destined for a particular street are indicative that the respondent is more like a local inhabitant, then syntactic spatial variables are informative about the inhabitants-strangers interface. These ideas will be carried forwards into the main body of the thesis.
Chapter Three: Order and Structure in Urban Design; the lesson of the Post Fire Plans for the Rebuilding of London after the Great Fire of 1666.

The structure of the architectural imagination.

The period following immediately upon the Great Fire of London in 1666 was significant not only for the history of the City but also for the emergence of a new design philosophy in English town planning. This revealed itself when, scarcely before the fire had ceased raging, a series of proposals by eminent amateur architects was submitted to Charles II for the redesign of the City upon more salubrious and aesthetically pleasing lines.

In the final analysis, none of these ideal town plans was adopted, and the City was reconstructed upon the previous ground plan. To be sure, amendments to the street grid were incorporated in the Restoration City and several streets were widened and straightened to ease traffic congestion. However, compared with the impact which the new geometric compositions were having on the layouts of the great estates which were springing up in the suburbs to the west of the City, the failure of the City Fathers to incorporate these new ideas in the town plan of what was at the time Europe's most prosperous capital city is striking.

By contrast with the irregular, deformed grid of the Restoration City, almost all the proposals for its redesign show a strong influence of geometry upon the plan. The street grids of the contenders in this first 'competition design' are all highly ordered. Two are almost pure gridiron plans. Another distorts the grid locally by introducing interruptions and discontinuities which make it directly comparable
with the series of transformations of a pure grid which were looked at in the previous chapter. The final two schemes which have survived 'play' with the overlay of radial elements upon an orthogonal grid to create unusual geometries in the shape of urban blocks and street intersections. Again, the interests of these amateur designers seem intimately bound up with an exploration of the theoretical possibilities of conjecturing possible town forms.

It is this apparent and common interest in the visual configuration of the grid which makes these designs relevant today, for the proposals seem curiously contemporary when set alongside current proposals for urban regeneration. Whenever we design today, whether it be a building, an urban area, or an entire town, we tend to use order concepts to organise the plan: order, in the sense introduced earlier of principles based on some generally accepted notion of sameness, repetition, geometry, grid, rhythm, symmetry, harmony and the like. These concepts speak to us directly without mediation, and can be apprehended at once, almost as a gestalt. Because order concepts are formal, they appear logical. Order concepts are one of the principal means by which we recognise the architectural imagination at work both in the designs of today and in these early town planning schemes.

There is a tendency amongst designers today to assume that order yields structure in the experiential reality of the buildings and places we create through architectural means: structure, in the sense of making places intelligible through creating local differences which give both a sense of identity and a grasp of the of relation between the parts and the whole, such that we are able reliably to infer the global form from any position within it. However, the argument has already been advanced in this thesis that order and structure are not the same thing at all. A plan or a bird's eye view represents buildings and places with a conceptual unity which cannot be duplicated on the ground because we do not experience architecture this way. Moving about a building or place fragments our experience. We learn to read structure over time. Hence, an apparently disorderly layout may turn
out to be well-structured and intelligible to its users, whereas a highly-ordered architectural composition may in fact be unstructured when we experience it as a built form. However much we may appreciate order concepts when criticising architecture on the drawing board, well-structured realities seem to be what matter most on the ground, not least by generating and controlling patterns of everyday use and movement.

This view will be argued by exploring the relationship between order and structure in these early town planning examples and by setting them against the pre-Fire City and its Restoration counterpart. In so doing, a move will be effected from the mathematics of the ideal grids and piles of sticks which were the subject of the last chapter, to an exploration of the structure of the architectural imagination. For whilst no one has seriously suggested that it is necessary or pleasing to use the examples which were examined in the previous chapter as a model for street grids and urban layouts, the set of cases which will be presented in this chapter are all either real or putative plans of the City of London.

The five surviving post-fire plans seem to differ in terms of their ordering principles. While this is undoubtedly the case, the structure differences which emerge through analysis seem to be far more profound and far-reaching than can be understood through any comparison in terms of visual order. It turns out that structure and order can reinforce each other, but it is equally clear that by ignoring structure it is possible to arrive at an order proposition which frustrates its own design intentions.

The lesson which these early examples seems to carry for modern urban design is that we need to take both order and structure into account when we design; perhaps never more so than today, when geometric principles seem to be invoked as a guarantee of continuity with our architectural heritage. If order concepts have any place in
the architecture of the cities of the future, perhaps it is to confirm structure and not to disguise its absence.

London, the great emporium.

The City of London on the eve of the Great Fire of 1666 is generally held to be the archtypical organic city, moulded directly by social and economic processes without the imprint of conscious design. All the accounts describe it as disordered, overcrowded and insanitary. Few houses were constructed from stone or brick, and the majority were of timber-framed construction built according to regulations first laid down in the twelfth century. Streets throughout the City were narrow, overhung by tall jettied buildings and blocked by open markets. The conditions in the interiors of the urban blocks were terrible, produced by a combination of dirt, open sewers, overcrowding and a maximum coverage of sites by buildings. The main thoroughfares were lined by the more prestigious houses of the merchants and traders from whose activities the City derived its wealth and power. In this way rich and poor lived side by side, but wealth was precisely indexed through proximity and adjacency to the main theatres of public life.

This apparent disorder does not mean that the City was in a state of decay. On the contrary, continental visitors of the time found it a stimulating, vital and even awe-inspiring place which embodied the best of contemporary urban life\(^1\). The shops and selds\(^2\) of Cheapside, the main shopping street of the City, were thronged by customers and were renowned throughout Europe for their concentration of luxury goods. Cheapside was flanked by buildings rising to a height of six

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\(^1\) At this time London had a population of some 200,000 residents which made it the largest city in Europe, and in the western world.

\(^2\) Private bazaars within which many traders each occupied a small retail outlet, some only little larger than would contain a chest. The selds dealt in leather goods, gloves, rare textiles, spices, jewellery, clothing, and imported luxury goods.
Fig. 3.01. Cheapside in 1638, showing the processional entry of Marie de Medici into the City.

Fig. 3.02. John Leake's plan of the City after the Great Fire of 1666.
Fig. 3:03. The open space of the City as shown in Leake’s map of the City after the Great Fire of 1666.
storeys along much of its length, and was lined by elaborate facades which were emblazoned with the names and signs of retail traders. It was the most important place of open air public display and spectacle within the City, (Fig. 3:01) but much of the everyday life of the City took place out of doors in the dense grid of streets confined within the square mile of the Roman walls. The entire City functioned as a great trading emporium, with an economy dependent on the maintenance of a dense pattern of everyday interaction and encounter in the public space of the streets.

All the contemporary accounts paint a picture of a City which was disordered but well-structured. While this is difficult to ascertain from the map record1 the first true ground plan of the mediaeval City, that of the devastated area produced immediately after the Great Fire by Leake, (Fig. 3:02) corroborates verbal accounts of an intelligible working city. Analysis cannot be relied on in the detail, but the general shape of the main street grid yields a picture of public space which is both broadly in line with historical accounts and is also comparable in terms of scale and attention to detail with the set of proposals for the reconstruction of the City. Leake’s plan therefore provides a benchmark for looking at the design proposals for the reconstruction of London after the Great Fire2.

A glance at the ground plan (Fig. 3:03) of the City abstracted from Leake’s map picks out immediately the principal streets of mediaeval London. In the approximate mid-point of the north-south axis run the

1 all the printed maps of London published before 1666 are ‘map views’ which combine a linear ground plan in which every building is seen from a theoretically vertical viewpoint, with a bird’s eye view in which the town is drawn pictorially and obliquely from an elevated position. This technique exaggerates scale, so that details of alleys and yards are obscured and it is impossible to gauge accurately the true width of streets. In short, precision of measurement is sacrificed to visual impact.

2 Leake’s plan was commissioned by those responsible for the rebuilding as a basis for ascertaining the extent of the damage, and as a means of providing an accurate record of land ownership and the extent of building plots at the time of the fire. It does not record every alleyway, but the main street grid is shown accurately and to scale. The unburned area is portrayed as a more conventional map view.
Fig. 3: 04. Axial map of the City in 1666.

Fig. 3: 05. Integration core of the City in 1666.
major market streets of Newgate Street and Cheapside, fanning out in the heart of the City towards the north and east. The road from Bishopsgate, the main road into London from the north to the lowest crossing point of the Thames at London Bridge\(^1\) can be seen clearly a little further to the east. The southern half of the plan is cross-cut by a dense lattice of small streets and lanes. The longest and straightest of these run in an east-west direction, parallel to the river. The riverfront itself is close-packed with wharves. North of Cheapside, development is relatively sparse and fragmented\(^2\). The only large open spaces in the street network surround the dominant buildings of St. Paul's and the Tower. Both are ancient public gathering places. The remaining public buildings, the parish churches and the guild buildings\(^3\) are, with the exception of the Guildhall complex to the north of Cheapside, completely embedded in the building fabric and form a random scatter throughout the plan. Some of the more prestigious houses can be picked out as large courtyard formations since the majority were located in the north east quarter of the City, and hence within the unburned area of Leake's map. The plan transcribes into the axial map\(^4\) shown in Fig 3:04.

The integration core\(^5\) of the City (Fig 3:05) is concentrated in the heart of the commercial centre, linking together the two major open general food markets which are known to date back to the Anglo-Saxon period, the western market which runs the whole length of the thoroughfare from Newgate to the Walbrook with a main focus on Cheapside and the eastern market, which covers a wider network of

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1 the fact that this was the lowest bridging point of the Thames was the reason for the siting of Roman London in this location.
2 this was a marshy area which could only be negotiated by boat at certain times of year.
3 the City had 109 churches shown hatched on Leake’s map, each the focus of a small spatially defined parish community, and about the same number of guilds or trade associations, shown as shields on Leake’s map, which drew members together from all over the City.
4 an axial map shows the fewest and longest lines of sight and access which cover the public open space of the plan. It does not necessarily correspond to named streets. The axial map does not include the large number of wharves leading down to the Thames.
5 integration is a mathematical measure which expresses the extent to which a street or axial line draws all other streets to itself and renders them shallow as destinations from that point. A 5% integration core is shown here.
Fig. 3:06. 10% integration core of the City in 1666.

Fig. 3:07. The core of 5% most integrated lines in the City in 1666 at a radius of three axial steps.

Fig. 3:08. 50% of segregated lines in Leake's map of the City.
streets including Eastcheap, Bridge Street, and Gracechurch Street and runs along Cornhill to Leadenhall. These markets are located on or near the principal east-west and north-south through routes by way of the main City gates. The ancient dividing line of the City along the Walbrook features early within the integration core, as does the street leading up to the medieval Guildhall, the administrative and government centre. Bow Lane is also picked up in the south-west, pointing in the direction of the more recently established and more specialised food and produce markets centred around Old Fish Street and Queenhythe.

Raising the core to 10% (Fig 3:06) merely adds the streets adjacent to Cheapside to draw the area of the selds and specialist shops selling luxury goods into the core. Radius three integration (Fig 3:07) confirms the 5% city-wide integration core, but there is an interesting shift away from the north and east, and hence away from the Guildhall and the principal residential streets of the wealthiest of the merchants and traders, towards the south-west markets in the area around Fish Street and Queenhythe. Local integration picks out the streets of the everyday marketing system, whereas global integration links the original market areas with the centre of power at the Guildhall and the houses of the ruling class of merchant traders.

Segregation (Fig 3:08) is concentrated around the outskirts of the City, picking up the area around the Tower in the east and the sites of Baynard’s and Montfitchet’s castles to the south-west of St Paul’s and then consolidating them into two large continuously segregated areas. These were the places where the monarch established strongpoints in the free-trading city after the Norman Conquest of 1066, and it would be tempting to associate these ‘alien’ implants with the distortion of the grid away from those areas of the City. The northern fringe of the City

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1 The banqueting hall of the Guildhall was used for great feasts at which the magnificence of the Lord Mayor and the twelve great Companies of the City were displayed.

2 A more local measure which computes integration up to three spaces around every root space. It shows which spaces are strategic locally in drawing the street network together.
is also relatively segregated, but there is not the same amalgamation of lines into segregated zones. The largest zone of segregated lines in the extreme north west of the City, on the site of the Roman fort. Segregation elsewhere is largely confined to the hinterland of some of the largest of the urban blocks which even at this time of intensive development, were laid out as orchards and gardens.

There is, however, a second possible account of this distribution of segregation. Within the centre of the City, there is very little segregated space indeed. The most consistent feature is produced by the freestanding parish churches. Typically, these front onto a main street but are surrounded by more segregated alleyways whose purpose is to disassociate the church from its profane neighbours and to set it slightly apart. The peripheral segregation matches closely the distribution of monastic foundations within the City, and it is tempting to think that the monks and friars initially selected those locations for their houses which offered them relative seclusion from the hubub of everyday life.

Insofar as integration is a precise index of the degree of space occupation and use, it is clear that the integration core of the City renders the commercial streets shallow and accessible both to the citizens to strangers from the outside. It constructs a dense and continuous trading interface within the heart of the city which is the mediaeval equivalent of a department store. The apparent visual

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1 when the first Jewish colonies were founded in London in Norman times, providing the only source of ready capital to the inhabitants at the exorbitant interest rates of 40%-60%, they settled in this area and in the vicinity of the Tower.

2 St Paul's began as a monastic foundation, and the monasteries and friaries which arrived in London during the thirteenth century were offered sites by wealthy patrons, including those previously occupied by the Norman castles in the south west. The south western area thus became a place of sanctuary where criminals could not be arrested and brought to trial, and as a result it acquired the reputation of being one of the most vicious and depraved area of the City until that right was revoked in 1697.

3 which has been demonstrated by empirical observational studies in the modern City of London, as well as in numerous other examples.
Fig. 3.09. Wren’s plan for the rebuilding of London.

Fig. 3.10. Evelyn’s plan for the rebuilding of London.
disorder of the street grid is not symptomatic of an absence of spatial structure.

**The first competition designs.**

The story of the Great Fire of 1666 is a familiar one which will not be rehearsed here. What is less well-known is that as a result of the devastation, a number of designs were prepared for the rebuilding of London which, taken together, represent the earliest and possibly the most significant proposals for the rebuilding of a major English town which exist. Furthermore, a comparison of the proposals reveals striking differences in the conceptions of a town held by the various authors, concepts which can still be found today in urban design discourse.

Two of the plans, those by Wren and Evelyn, (Figs 3:09, 3:10) are generally held to be a product of an architectural imagination whilst the remainder of those which survive\(^1\), by Hooke, Knight and particularly by Newcourt, (Figs 3:11-3:13) are ascribed to the domain of planning. This partition is made on the basis that the former appear to be more concerned with built form, aesthetics, composition, shape and motif whereas the latter are a product of functional requirements, the analysis of social processes, density, economics, and workability. In terms of the structure-order distinction outlined above, it is clear that all the plans are derived from order concepts, but that they differ in the degree of complexity involved. The ascription of the designs reflects the extent of the bias towards order in the plans, singling out those which use a more complex set of order concepts as belonging to architecture and those which use a single generating idea as the precursors of modern town planning. This consensus on the origin and locus of the concepts used to generate these town forms co-exists with vociferous disagreement.

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\(^{1}\) there was at least one other plan prepared by Peter Mills, the Surveyor of the City, which is unfortunately no longer in existence.
Fig. 3:11. Hooke's plan for the rebuilding of London.

Fig. 3:12. Knight's plan for the rebuilding of London.

Fig. 3:13. Newcourt's plan for the rebuilding of London.
amongst scholars as to the merits or deficiencies of the various plans proposed for the rebuilding of London, as compared with the mediaeval City and the City as it was rebuilt and recorded in 1676 by Ogilby and Morgan.

A transcription of the five plans into public open space maps is given in Figs 3:14-18 and into axial maps in Figs 3:19-23. For convenience, they will be dealt with in ascending order of size, measured in terms of the number of axial lines contained in each plan; that is, Hooke¹, Knight², Evelyn³, Wren⁴ and Newcourt⁵ respectively. Each the plans except those of Newcourt and Hooke, which greatly enlarge the City area and ignore existing topographical features, will

¹ Robert Hooke was Curator of Experiments at the Royal Society and Professor of Geometry at Gresham College at the time of the Great Fire. His plan was submitted to the Royal Society on 19th September 1666 and met with their approval. The original has not survived but the version reproduced here, shown in Doornick's view of the Thames in 1666 has been attributed to Hooke. Hooke was nominated as one of the six Commissioners for the Rebuilding, along with Peter Mills, and Edward Jerman, the architect of the Royal Exchange.

² Little is known of Valentine Knight except that he was an army officer, whose submission took the form of a printed broadsheet dated 20th September 1666 with a written description of how the City was to be parcelled up, and an accompanying freehand drawing. His design is rudimentary and incomplete and his representation of the plan is hurried and inaccurate. He suggested that the King might raise revenues for the military by rebuilding the City upon his more economical lines, and as a result was imprisoned for his temerity in suggesting that the King should derive profit from the disaster.

³ John Evelyn was a wealthy, educated nobleman who lived for his hobbies and divided his time between aesthetics and practical matters. He is best known as a diarist, courtier, and confidante of King Charles II. He first submitted his design to the King on September 17th and was received favorably. Evelyn drew on contemporary architectural theory, and was more knowledgeable than his contemporaries about European architectural tastes, having travelled extensively on the Continent.

⁴ Sir Christopher Wren's design was the first to be received by Charles II, on September 10th 1666, scarcely after the fire had ceased raging. He was a scientist of some reputation and had 'taken up' architecture four years previously. Wren had visited Paris the previous year where it is known that he studied architecture including the Louvre, then under construction. He was Deputy Surveyor of the King's Works at the time of the Fire and had been commissioned to produce a plan for the restoration of Old St. Paul's which was in a state of disrepair. After the Fire, he was the architect to the new St. Paul's and many of the City Churches.

⁵ Little is known of Richard Newcourt, except that he was a surveyor of some repute who had been one of the authors of a map of the City produced eight years before the Fire. He had extensive experience of the mediaeval City, and his design should be viewed as a critique of the human misery and overcrowded housing conditions which he recorded while making his earlier survey.
Fig. 3:14 - Hooke's open space map

Fig. 3:15 - Knight's open space map

Fig. 3:16 - Evelyn's open space map
Fig 3:17 - Wren's open space map

Fig 3:18 - Newcourt's open space map.
Fig. 3:19 - Axial map of Hooke's plan

Fig. 3:20 - Axial map of Knight's plan

Fig. 3:21 - Axial map of Evelyn's plan
be discussed in two stages: first in terms of the area of the design lying within the City walls in order to facilitate comparisons with the City as it evolved historically, and then in its entirety\(^1\). The plans will first be introduced and compared in terms of their respective patterns of open space and then analysed syntactically.

Hooke’s plan shows a square orthogonal gridiron punctuated by four major squares in which markets or fountains were to be placed. The large open space adjacent to the Tower is retained, as is the mediaeval street grid outside the fire-damaged area (shown hatched). The new streets are connected to the old by slight changes of alignment wherever possible. Sites for fifteen churches are indicated in the plan (as opposed to a hundred or more before the Fire) all facing onto the east-west cross routes so that all roads except one, in the north, has at least one church giving onto it at some point along its length. The actual disposition of churches seems random in the sense that they are not located at intersections or in major public spaces. St Paul’s Cathedral and the Guildhall are each located within the interior of two parallel blocks amalgamated to form larger rectangular islands in the heart of the City. St Paul’s, relocated to the north of its actual site, is approached by way of four roads leading from the mid-points of the block to an inner ring of streets surrounding the Cathedral, and the Guildhall, a little to the east of its actual site, is accessed by a similar configuration of routes but with the addition of a small fourcourt on the side facing the River.

A major feature of the plan is a wide quay along the entire length of the Thames, although this is clearly notional since it takes no account of the actual curvature of the Thames at this point. The line of the old walls is equally notional, although Hooke seems to have intended to perpetuate the line of the wall in the form of a new ring road. To the west of this road, the grid continues unabated across the Fleet River

\(^1\) The Great Fire extended westwards well beyond the Roman walls, to engulf the extra-mural suburb where the lawyers had established their Inns of Court in the early thirteenth century. All the schemes included proposals for rebuilding this suburb.
Fig 3:22 - Axial map of Wren's plan

Fig 3:23 - Axial map of Newcourt's plan
covering the remaining area of devastation, so that the western extremity of the old City is all but obliterated in the new design.

The sheer size of the proposed market squares and the new quay is striking, particularly when compared with the scale of the building blocks or the apron to the Guildhall. The square grid is pursued relentlessly save where Hooke makes use of the geometric device of 'biting into' the corners of four adjacent blocks to accommodate the market squares and major public buildings. This device ensures that, apart from at the centre where the through-routes intersect, the squares appear relatively enclosed. In the case of St Paul's and the Guildhall, the east-west views from the facades are also terminated by the adjacent island blocks so that the only long vista is from the centres of the long sides of the two building facades in a southerly direction down to the River Thames¹.

Knight's plan is rudimentary and incomplete and most of his roads are drawn notionally rather than to scale. However, it is possible to reconstruct something of what Knight intended by comparing his text with the accompanying drawing. Knight intended to have six streets, each 50 feet wide and a further five streets 30 feet wide, all running north-south. Crossing these in an east-west direction he proposed two major 50 feet wide routes and another twenty streets 30 feet wide, all roughly following the curve of the River. St Paul's is indicated by Knight as standing in an open piazza between two of his new minor roads, with the southern major road, roughly on a line with the old Fleet Street and Ludgate Hill, striking the west front of St Paul's and then continuing from the east window as far as the Tower. Unlike Evelyn and Wren, who started from the street grid and let the block structure emerge as a by-product, in Knight's case the entire layout was derived by first designing a prototype urban block 500 feet long by 70 feet across and composed of two parallel terraces separated by a narrow open yard. The pavements at ground level were to be arcaded with access to commercial facilities at street level and houses

¹ a major traffic artery at the time, particularly from Westminster.
Evelyn's design for the rebuilding of London shows a gridiron plan overlaid with a kite-shape in the east and an octagon of streets in the west between the Fleet and the Temple. This suburb appears quite distinct from the City within the walls, and is separated from it by the River Fleet which has roads on both banks and is bridged at three points roughly on the lines of Newgate, Ludgate and Upper Thames Street. His plan for the new City retains the existing walls and gates and constructs within these an entirely new pattern of major routes. Chief of these is a new river route lined by major public buildings fronting onto the Thames, including the Royal Exchange, the Custom's House and Admiralty Buildings as well as several landing stages, wharves and outdoor markets. A second important east-west route lies in the centre of the City and runs from Ludgate to East Smithfield. This is marked by four large public spaces containing St Paul's, the Mayor's House, a major food market and St Dunstan's Church. This northern route is, in addition, lined with parish churches and public buildings as well as the guild and livery halls of the ancient Companies of London. Four further routes are shown running east-west. The next most southerly of these, roughly on a line with Upper and Lower Thames Streets has few major buildings and only one open space, a piazza marking the approach to London Bridge, associated with it. A little to the north again is a straight street crossing the City lined with guild buildings, churches and naval buildings, as well as linking three open market squares in the east where major routes converge. Finally two more streets in the north of the City cross from east to west, and are lined with churches, and other public buildings which are interspersed with open piazzas. The most important of these is the Guildhall.

Crossing at right angles are nine north-south streets; to the west are two routes with churches and public buildings at strategic locations where they intersect with the east-west cross routes, then the route blocked by the major bulk of St Paul's and by a new market building on the riverfront, and one parallel with the smaller piazzas at the
major intersections containing more churches and other public buildings. The two routes from Moorfields to the River and from Bishopsgate to London Bridge are both highly elaborated with large-scale piazzas at the intersections. The first contains the Guildhall, the Mayor’s house, an open piazza and the Royal Exchange, all representing wealth and luxury, and the second links the produce market and the fish market emphasising the importance of these items in the staple diet of the day. The north-easterly north-south routes again have a mixture open spaces and intersections blocked by buildings.

The initial impression of Evelyn’s plan is one of an attempt to make each road intersection a unique combination of plan geometry and facades, not just by lining his routes and articulating the space of the plan, but rather by blocking the most important road intersections with prominent public buildings such that through-views are obscured. Moving about the City, one would be aware of moving from one important building to another. This picture is confirmed by the open space map, which highlights the concentration of public buildings at and in the intersections of the streets. As Evelyn himself remarks, it should not be possible to pass through the City ‘all in one tenor without varieties, usefull breakings and enlargements into piazzas at compatant distances, which ought to be built exactly uniform and strong and with beautiful fronts. Nor should these be all of the square, but some of the oblong, circular and oval figures, for their better grace and capacity. I would allow none of the principal streets to be less than a hundred feet in breadth nor any of the narrowest than thirty.’ Within the island blocks Evelyn envisaged further developments taking place, including a system of lanes and alleys, but he did not consider the specification of these necessary to the proper execution of his design. So here, as before, the plan is incomplete, but this time it is the interstices of the ‘grand design’ which are missing.

Compared with the plans of Hooke and Knight, Evelyn’s plan is striking for two reasons. It shows both a basic rectilinearity in the layout of the principal streets, but adds a kite-shaped formation of streets
cross-cutting the grid. It shares with Hooke (but not with Knight) an interest in articulating the streets into a system of narrower and wider public streets and squares, but adds a further distinction - the inverse of Hooke's internally elaborated blocks which separate public buildings from the principal streets - the elaborated, blocked intersection.

Evelyn's design is, in this respect at least, in complete contrast to that of Wren. Wren's priorities lay in creating unimpeded vistas along major thoroughfares driving across the city to link together the 'several remote quarters of the City'. These streets were intended to be the principal trading streets with the churches and other public buildings related at key intersections in such a way as not to disturb the line of sight and access from one part of the City to another. Like Evelyn, Wren includes an octagonal arrangement of streets between the Fleet and the Temple 1. Unlike Evelyn, Wren purposely links his octagonal design to the surrounding network of streets to give precisely those views which Evelyn blocks off.

As in the previous cases, Wren's plan for the western half of the City takes a form more or less regular grid, but with a v-shaped formation continuing the line of Ludgate Hill and splitting either side of St Paul's to drive eastwards past the Royal Exchange to Aldgate, and south-eastwards through a series of piazzas to the Tower. In contrast, the eastern half of the City is organised around intersecting groups of streets radiating from a number of foci, notably the Royal Exchange in the north, the two piazzas on the route from Ludgate to the Tower previously mentioned, and the approach to London Bridge. With the sole exception of the Royal Exchange, which acts both as an organising focus for, and as a block to north-south views through the heart of the City 2, all the major public buildings are offset so as not to obscure long vistas along the major thoroughfares.

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1 they were almost certainly aware of each other's designs at the 'drawing board' stage.

2 in contrast to the other plans, Wren elevates the position of the Royal Exchange - an instrumental and practical trading centre - and diminishes that
It is this east-west orthogonal-radial duality which visually sets Wren's plan apart from the previous cases. He shares with his contemporaries the retention of the existing line of the city walls and gates, the creation of a new quay along the River Thames (like Hooke, this is largely notional and does not take into account the bends in the river). Compared to Hooke and Evelyn, Wren invests rather little in developing the piazza as a form of public space apart from those which form the foci of radial arangements of streets in the eastern half of the city. His buildings sit in irregular 'beads' of space rather than in geometrically composed configurations. Compared with Knight and Evelyn, Wren appears geometrically to differentiate the City without fragmenting it.

The manuscript accompanying Newcourt's rebuilding scheme contains a vivid if somewhat depressing account of living conditions in mid-seventeenth century London. It is unsurprising therefore, that of all the five plans Newcourt's pays least regard to the existing city fabric. His plan is square and walled but doubles the area within the city limits. Within the walled area, the City is divided into almost square blocks, approximately 285 x 260 yards in size, eight in an east-west direction, and six in a north-south direction. The four central blocks are amalgamated to form a major public square and four further blocks are taken into the public realm to give minor squares in the quarters of the plan. The extreme south-eastern block is incomplete, and possibly may have been intended to remain as an open space because of the obstructing bulk of the Tower of London.

Within each block, four roads lead to an inner square of streets surrounding a church (an arrangement identical to Hooke's embedding of St Pauls in the centre of an island block mentioned earlier.) In Newcourt's plan, this has been raised to a general principle for the...
design of urban blocks. Thus the plan divides itself into a grid of thoroughfares running in both directions right across the city, a secondary system of end-stopped roads running from church to church, and a tertiary system of short roads in the heart of each block surrounding the church with no long vistas to the outside of the block. Like his contemporaries, Newcourt intended the river frontage to have been a new quay running the whole length of the City, although he parted company with them in intending this not to be ornamented by major public buildings. These were to be grouped in the central square. St Paul's was the exception, being sited in the south-west square.

Apart from its almost perfect geometry (save for the location of St Paul's and the Tower) the most striking feature of Newcourt's plan is the sheer scale of his open spaces. Each block, Newcourt intended, was to house the population of a parish, each minor square was to be the meeting place of its surrounding parishes, and the central square the focus of the public life of the entire City.

To summarise the argument to date, a visual inspection of the post-fire plans reveals the following points of comparison and contrast. The commonality of the plans lies in their dependence on order concepts to guarantee their conceptual clarity. However, the way in which order is projected into the plan is markedly different in each of the five cases.

Hooke's plan is of a geometrically unified City over the whole of the devastated area, based on a regular orthogonal grid. It displays a combination of long vistas right across the plan from north to south and east to west in the thoroughfare streets, and convexly articulated squares which are traversed by the thoroughfares but are relatively 'enclosed' by buildings. The major public buildings, St Paul's and the Guildhall, are located within the islands and are not associated with  

1 the central square alone measures 570x520 yards.
the major public spaces. Likewise, the more locally-orientated public buildings, the parish churches, are associated with almost all the east-west cross-routes, but are not placed at intersections, nor are they marked by any increase in the size of the spaces onto which they front. The emphasis here seems to be on a disjunction between the global orientation of the thoroughfare grid and the localisation of piazzas and public buildings.

Knight's plan appears geometrically to be a unified design based on a 'tartan' orthogonal grid over the whole of the devastated area, but the retention of the Walls in the west and the positioning of St. Paul's, fragment the City into two, although this is not reflected by any difference in geometrical composition. The thoroughfares form a slightly deformed grid in both directions. It is not possible to see and pass directly from one side of the City to the other, but the deformation is slight, following the curve of the River. There is no attempt to locate public buildings with the exception of St Paul's within the plan. Other major buildings are located outside the built-up area, in the unbuilt space between the new compact street grid and the Roman walls. The location of St. Paul's is such as to further block the line of sight and access along the central major east-west thoroughfare, although this is not attended by any attempt to form a major public space. Rather, St. Paul's is rather simply accommodated by taking up the two adjacent blocks to the north and south of this line and amalgamating them into a larger site. The emphasis here seems to be on an economical disposition of densely packed blocks.

Evelyn's plan differentiates the City within and outside the walls both by retaining the City wall and connecting through only at three points and by reflecting this geometrically in an orthogonal-radial/orthogonal-kite distinction without and within the walls. Vistas are short, running from public building to public building, these being sited so as to block the intersections of the principal routes and to interrupt the grid. Where this is not done, intersections are convexly enlarged to form major public piazzas at the junction of principal
routes. The emphasis here seems to be on producing a unique combination of plan geometry and facade at each major intersection.

Wren's plan differentiates the devastated area into three geometrically distinct areas, outside the walls by a radial-orthogonal composition, and inside the walls by a regular orthogonal grid in the west and a series of radial clusters in the east; but these are connected by a grid of long thoroughfare routes giving vistas across the entire city in all directions. There is little attempt at formal composition in the public piazzas. Rather, the major public buildings are, with the exception of the Exchange, located asymmetrically or off-centre in irregular 'beads' of public space, so that they do not obstruct the view. Parish churches are the exception to this rule, and a number of these are located in such a way that their principal facades end-stop minor routes. The conception here seems to be that of maximising the potential for long thoroughfares linking the geometrically distinct local parts of the city together, and constituting these by major public buildings set informally on small aprons so as not to obscure the view.

Finally, Newcourt's plan appears to be unified not by geometry but by a more abstract concept; that of hierarchy, applied to every aspect of the plan. It displays a hierarchy in the size, length and global penetration of routes which is paralleled by a hierarchy of size of public squares, which in turn relates to a hierarchy of public buildings. Those used by the entire population of the city are located in the main square where the penetration of major thoroughfares coincides with a grossly enlarged space, while the parish churches are located in the heart of each block without any investment in convex articulation. The levels of the social organisation of the city - parish, neighbourhood, community - are clarified by reflecting them directly in the plan and

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1 this was not the case in the mediaeval city where the boundaries of the wards and parishes were unclear. Sometimes they ran along the line of party walls while on other occasions they followed the line of the streets. The 'shapes' formed by these civic and religious units resemble the pieces of a jigsaw rather than the units of a repeating pattern.
Fig. 3.24. Table of measures for the seven plans of the City.

<table>
<thead>
<tr>
<th>plan name</th>
<th>axial lines</th>
<th>three-dial end</th>
<th>no. islands</th>
<th>gross an.</th>
<th>mean depth</th>
<th>plan name</th>
</tr>
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<tbody>
<tr>
<td>Lake</td>
<td>374</td>
<td>-</td>
<td>105</td>
<td>0.970</td>
<td>0.9752</td>
<td>Lake</td>
</tr>
<tr>
<td>Gq. + Mgr.</td>
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<td>0.653</td>
<td>469</td>
<td>0.0569</td>
<td>0.7501</td>
<td>Gq. + Mgr.</td>
</tr>
<tr>
<td>Hook</td>
<td>61</td>
<td>-</td>
<td>120</td>
<td>0.3920</td>
<td>0.4600</td>
<td>Hook</td>
</tr>
<tr>
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<td>94</td>
<td>11.75</td>
<td>169</td>
<td>0.2980</td>
<td>0.3756</td>
<td>Knight-City</td>
</tr>
<tr>
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<td>7.263</td>
<td>210</td>
<td>0.2250</td>
<td>0.5037</td>
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</tr>
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<td>Evelyn-City</td>
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<td>-</td>
<td>56</td>
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<td>0.7070</td>
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<td>-</td>
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<td>0.1630</td>
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</tr>
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</tr>
<tr>
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<td>-</td>
<td>227</td>
<td>0.1220</td>
<td>0.5900</td>
<td>Nevcourt</td>
</tr>
</tbody>
</table>
making them correspond to the hierarchy of identifiable spatial domains.

The question immediately arises as to whether this general shift towards order concepts is accompanied by changes in the way in which the City is structured, and hence might be expected to perform as an intelligible working entity. Even those plans which appear at first sight to use a similar repertoire of geometrical motifs differ in the way in which these are assembled into an overall configuration. Each one is an individual with a distinctive order-related identity but can the same be said of their structure-related properties?

**Structure and Order Revealed.**

Before embarking on an analysis of the distribution of integration and segregation in each of the individual designs a number of common features of the set of plans should be discussed, which give some idea of the radical nature of the changes envisaged. These features are summarised in Fig. 3:24.

First, the sheer number of streets proposed in the new designs drops dramatically in all cases as compared with the street grid identified by Leake and as recorded after the rebuilding by Ogilby and Morgan. Newcourt's design which comes closest in numerical terms, more than doubles the built-up area while Knight's which halves the built-up area would still need to contain twice the number of streets to approximate even the crude main street grid plotted on the Leake plan.
A second feature which differentiates the post-fire plans from their mediaeval predecessor is that all but one of the post-fire plans contain no dead end spaces or culs-de-sac. This cannot be because the authors of the various plans were unaware of the possibility - as Brown has shown (1985) the 'court' form of development in particular was widespread in the City during this period, as indeed it was generally in urban areas at that time. The Ogilby and Morgan map of the City as rebuilt is striking for its large numbers of dead end alleys and courts, accounting for 937 axial lines and giving a positive dead end : thoroughfare ratio of 1: 0.853.

The number of islands or urban blocks is also of interest. In the Leake map, which showed only the major blocks, there are 185 insulae. The value for Ogilby and Morgan's map is 469, showing just how important is the development of lanes and alleys in splitting up the visually identifiable large-scale blocks confronting the major street grid into smaller constituent parts. All the post-fire plans with the exception of Evelyn's have about the same number of islands as the mediaeval City map. However Knight's plan takes up roughly half the area previously occupied by the City, and Newcourt approximately doubles the size of the City in his design so of all the designers, Wren seems to be the most sensitive to the existing scale of the City and Evelyn's the least.

The deformation of the grid which shapes the islands is equally significant. The main grid can be more or less deformed, irregularly as in the mediaeval City or in an ordered way through geometry, into polygonal blocks while secondary development within the insulae can reduce rectilinearity almost as dramatically as deforming the main grid but without appearing to do so visually. As might be expected,

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1 the exception, that of Knight, leaves dead ends in the vicinity of the Roman wall, but this was clearly not a product of the design so much as a constraint provided by the existing physical features.

grid axiality\(^1\) increases markedly for all the post-fire designs, when compared with the mediaeval and restored City. The values for Leake's and Ogilby and Morgan's plans, both below 0.1, indicate that grid-like order is almost non-existent in the City. As a crude measure of increased rectilinearity, the values for the five plans confirm a clear increase in regularity overall, but the differences are equally revealing. Newcourt's design has the lowest value of all the plans despite its extreme regularity and apparent similarity to Hooke's, which has the greatest, due entirely to the break-up of the large-scale blocks defined by the supergrid.

Finally, if the mean depth\(^2\) of the system from all points is compared to that for the City as it evolved historically, with one notable exception, Evelyn's plan, these are noticeably more integrated overall. But whereas in the case of the historically-evolved City, much of the depth is accounted for at the periphery and by the less 'griddy' development in the 'backland' areas of blocks, in Evelyn it is accounted for in the geometric heart of the City by the contorted morphology of the major street grid. The increase in mean integration in the remainder of the designs is a reflection of the imposition overall of a more regular orthogonal grid in the designs\(^3\). The varied distribution of segregation above this mean shows the independence of order, geometry, gridiness and integration. It seems that there are two principal ways of raising the overall degree of asymmetry within a plan - the first might be considered more a global feature of the plan since it results in its partition into an integrated core and large areas of contiguous segregated lines, either surrounding or surrounded by

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\(^1\) this compares each example to a perfectly regular orthogonal grid with the same number of islands by the formula: grid axiality = \(\frac{1}{2} L \times 2\) where I is the number of islands and L is the number of axial lines in the system. The result varies between 0 and 1 with high values approximating to a grid and low values to an axially deformed system.

\(^2\) mean integration from all lines, looking in all cases just at the set of thoroughfare streets and ignoring the deepening effect of dead ends.

\(^3\) the limiting case is a perfectly regular square orthogonal grid, in which each line is connected to exactly half the others, rendering all values the same and the whole maximally shallow from each line to every other, although the actual value varies with the number of lines.
Fig. 3:25. 10% integration core for Hooke's design.
the core spaces. The second might be considered a more local feature of the plan, in that small clusters of segregated lines are distributed throughout the plan so that they do not cohere among themselves. Another way of looking at it might be to consider the first as being *segregation* in relation to the core, and the second as *atomisation*. These differences will be given substance in the next section of the paper, where the shape of cores is looked at in more detail.

**The geometry of cores.**

The next step compares the organisation of the integration cores and segregated areas\(^1\) for the five designs. The integration core of the Hooke map (Fig 3:25) is composed of seven lines. The first of these is the major cross-City route from Holborn to Aldgate, and the second is the next most southerly east-west route. Between them these contain the two major buildings in the plan, St.Paul's and the Guildhall, and in the latter case the apron in front of the Guildhall is actually traversed by the second most integrating axial line. The third line is that corresponding to what is today the line of Upper and Lower Thames Streets, which traverses the three major open squares adjacent to the river front, and the fourth line is that running from the Strand which links the City and Westminster, to the public open space at Tower Hill. The new river frontage completes the east-west links in the core. The final two lines of the core run and in a north-south direction. Strikingly, these do not correspond to any major cross-City routes, unlike those running in the east-west direction, but rather run from the inside of the City wall to a new landing stage on the River, passing *en route* either side of the new Guildhall building and thus completely encircling it with integrating lines. The shape of the integrated core as a whole is, therefore, asymmetric in the geometric sense, and is directed more to the east of the City and the river front than to the north and west. This is despite the fact that the most integrating line is the most northerly. The spread of the core is large, completely

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\(^1\) integration is 10% of lines in all cases and segregation is 50% of lines in all cases except where otherwise stated.
Fig. 3.26. 50% of segregated lines in Hooke's plan.
traversing the City in both directions, although the dominant emphasis here is westwards in the direction of Westminster. All the east west lines spread through to the adjacent streets, and the design ignores the line of the old walls in the west and incorporates the entire western suburb into the new City.

The map of 50% of segregated lines (Fig 3.26) shows that these are heavily biased at the periphery in the north of the City, running round almost the entire ring street immediately inside the Walls and radiating from the Tower. These segregated areas correspond to that part of the City which was undamaged by the Great Fire. It appears that, despite Hooke's attempts to connect his routes to the existing streets of the City, the misalignments which introduced in relating the old and the new are such as to render the older parts of the City inaccessible as destinations for spaces within the new design, particularly since the new grid makes all potential routes within the new scheme relatively direct. By contrast, none of the area outside the City in a westerly direction appears in the segregated map and the new is more continuous with the pre-existing city fabric.

Even more striking are the lines picked out in the interior of the new City. These segregated lines pick out in the west, the ring of spaces encircling St. Paul’s, together with the approaches to the west front and the east window, and the route leading from the south front to the new quay. In the east, a comparable ring of segregated lines encircles the Guildhall, together with its approaches on three sides. Thus, although the integrated core sweeps across the front of the forecourt to the Guildhall, the bulk of this apron, convexly defined, is relatively segregated. It seems then that the effect of singling out these two buildings for more elaborate geometrical treatment is to distance or ‘deepen’ them from the surrounding shallow grid and literally to set them ‘apart’ as special buildings. The major buildings literally turn their back to the most integrated street.\(^1\)

\(^1\) Integration/Segregation is the best index of the relative business or quietness of streets as they are actually used. Studies of a large number of towns from all parts of the world show that use patterns and densities of occupation and
As an experiential reality, geometry and structure appear to function differently within Hooke's design itself from how the design as a whole relates to its surroundings. The order concept which generates the regular orthogonal grid renders Hooke's plan indifferent to its surroundings, particularly in the east of the City, despite the lip service paid to 'integrating' it with the surrounding area. To achieve integration requires more than simply joining streets together but rather some recognition of street alignments has to be made, as is the case in the west of Hooke's design. Within the design, the deformation of the major grid roads is slight. There are differences in the way in which the framework of streets constructs channels of use and movement, which the visual order in the grid serves only to conceal. Hooke's streets are more differentiated than they appear.

The relative segregation of St. Paul's and the Guildhall, whether intentional or not, recognises the important ceremonial functions of these major spiritual and civic buildings by differentiating them, and if there is any structure-level interpretation of the proposition that 'greater space means more formality' then 'more segregation' is arguably one way of achieving it. In the mediaeval City St. Paul's is clearly distanced in this way, although Guildhall is not and the integration core strikes the main entrance to the building head-on. However, it is not the way in which either of these buildings are incorporated into the post-fire City. In the City as rebuilt, St. Paul's is almost completely surrounded by well-integrated lines, and the roads from the Thames to the Guildhall are actually widened and straightened to make it more integrated than before the Great Fire. The Restoration City does not, it seems, experience any discontinuity between the space of everyday life and that of ceremony which we recognise in Hooke's design.

through movement are largely determined by this variable, which indexes the accessibility of a space as a destination for all other spaces in the system.

1 a proposition made by Mary Douglas, in Rules and Meanings, Penguin, 1973
Fig. 3:27. 10% integration core for Knight's design within the walls.

Fig. 3:28. 50% of segregation in Knight's design within the walls.
Moving on to Valentine Knight’s plan, this might be expected to display the same kind of east-west emphasis as Hooke judging from a purely visual comparison of the two plans and this is, to a very limited extent, shown to be the case. However, the build-up of the core and the disposition of segregation is strongly affected by the incorporation of the Roman walls into the design, which will therefore be examined in two stages looking first at the inter-mural City and then at the plan for the whole of the devastated area.

The build-up of integration values in the area within the walls (Fig 3:27) yields a very compact integration core indeed in the geometric centre of the City. The first line in the core runs in a north-south direction, roughly on a line which is a continuation of the relatively insignificant entry at Cripplegate and which stretches down to the River. The second is a more important north-south line connecting Bishopsgate in a southerly direction towards London Bridge, which the core eventually reaches with line 6. Two neighbouring horizontal routes link these two vertices in an east-west direction and a third, a continuation of the axial line which passes to the north of St Paul’s, also joins the core at this point with the same value. Lines 7, 8 and 10 consolidate the east-west core in the heart of the City. Equal 8th value is shared by a north-south line from Smithfield1.

This density of integration is bought at the expense of extensive segregated zones at the periphery (Fig 3:28), which include almost all the area to the east of the Bishopsgate to London Bridge route where the majority of the longest axial lines in the design are concentrated, as well as a zone close to the River in the south west at Blackfriars and a third large contiguous group wrapping around the north-western perimeter and extending into the undeveloped areas within Knight’s map. Whilst all these areas were relatively segregated historically, this effect has been greatly exaggerated in the case of Knight’s design. Moreover, the integrating core completely fails to reach the perimeter

1 the cattle-market and slaughterhouse of the City which was located just to the north of the walled area.
Fig. 3:29 10% integration core for the complete Knight plan.

Fig. 3:30 50% segregation for the complete Knight plan.
at any point in an east-west direction, despite the apparent east-west orientation of the design.

The effect of adding the area of Knight's plan outside the Walls is to introduce 'holes' between groups of integrated streets (Fig 3:29) and to spread the integration core over a wider area of the City¹. The area traversed by the core shifts westwards away from the Bishopsgate to London Bridge route to include the line passing across the west front of St.Paul's and three streets immediately to the south of St.Paul's, so that the cathedral is drawn into the centre of the grid of shallow and accessible lines. Moreover, part of the river front is also drawn into the core. If one were to envisage the north-south routes compressed to the same distance apart as those running east-west, i.e., a dimensionless drawing of the core, then the core forms an irregular S-bend of well-integrated routes which contain St Paul's at their centre but which fail to reach the periphery of the City in any direction.

The 50% segregation map (Fig 3:30) is even more striking. Despite the move by the integration core in a westerly direction, this has very little effect in integrating the area of the design outside the walls to the west of the City. The area added in the west is all segregated. The effect is to produce two extensive segregated zones on either side of the geometric centre of the plan.

So far as rendering spaces accessible as destinations for all other spaces in the system is concerned the principal effect of Knight's layout seems to be that the City is divided into three clear areas; a central relatively accessible area with eastern and western fringes which are completely inaccessible. More than any other, Knight's plan illustrates the falacy of confusing order principles with those of structure. The geometric nature of his street grid actually serves to conceal the profound differences he introduces in the way in which individual streets are related together to form a street system - a

¹ although this is not always the case as will be seen later.
structure of public space. This is particularly the case in the north-south axis, where slight changes of alignment are introduced for no apparent reason, so that at no point can the Thames be seen directly from the northern boundary of the built-up area of City, but it is also true in the east-west dimension where the idea that the streets follow the curve of the River does not explain the precise way in which this is achieved by realigning streets in small groups at several points along their length. The effect on the way space is structured means that streets are arbitrarily privileged or disadvantaged with respect to the configuration as a whole: arbitrariness because this makes sense neither in terms of the generating concept of the block, which is uniform throughout the City, nor in terms of any attempt to acknowledge and organise relations between incoming routes and important destinations within the City.

Three concentrations in the points where streets change direction are worth noting however, because they suggest that Knight may not have been completely indifferent to the historically-evolved City, but rather that his understanding was emphasising a representational rather than an experiential level of reality. The whole of the eastern area beyond the route from Bishopsgate to the Bridge is segregated because Knight consistently breaks the east-west street grid at this point, perhaps articulating some half-formed notion that the areas to the east were becoming less important and maybe less socially desirable. A second concentration of breaks in axiality occurs along Walbrook, the ancient dividing line of the City. The third group is different to the previous two in character because the axial shift in east-west emphasis does not coincide with the line of a north-south street. Street alignments in the block adjacent to Roman wall are shifted to acknowledge the direction of streets on the far side of the City walls but without any attempt to create access. This suggests that the relation between the inter-mural City and the western suburb is at

1 the Bishopsgate area was beginning to decline in importance as a residential area for wealthy merchants who were increasingly looking to the West End of London or the high ground outside the City as a desirable place to live, while the area to the east of the Tower was by this time an overcrowded and industrial suburb. This shift forewarned of the split between the West End and the East End of London.
Fig. 3:31. 10% integration core for Evelyn's design within the walls.
best half-hearted. Whereas integration seems arbitrary and unrelated to use and movement within the City, segregation may reflect some deeper level of structure which belies the apparent east-west order which gives visual unity to Knight's design.

Evelyn's plan for London will also be examined in two stages. The design for the area within the walls contrasts with the previous two cases in that the 10% integration core (Fig 3.31) hugs the river frontage and the perimeter of the City rather than penetrating deep into the geometric heart of the built-up area of the design. The first line passes through an internal route which runs straight from the Fleet to the Tower through two large squares, but it does not pass any major buildings, of which there are many in the plan, 'en route'. The second line runs parallel to this, close to the River, again avoiding any major public buildings and crossing only one major space, marking the approach to London Bridge. The third line runs north from Billingsgate on the River front to Bishopsgate in the northern Wall, crossing these two routes as it does so. The next two lines branch from the major open intersection in front of London Bridge to strike St. Paul's in the west and St. Dunstan's in the east. The 6th line also runs north-south parallel to the Fleet River, just inside the western walls, to breach the northern boundary of the City at Smithfield. The 7th step adds a line just north of the River frontage which links across the Fleet into the devastated area outside the walls, and 8 is a second north-south line running clear along the bank of the Fleet to mark the western boundary of the City. The U-shape on the periphery begins to fill in on the fourth side of the square with line 9 which pushes west from Bishopsgate to reach Christ's Hospital and church which are located in a major intersection close to the western walls. The final line in the integration core links the Royal Exchange on the waterfront with the Mayor's house in the centre of the City. Thus at 10% of lines, the integration core almost completely encircles the City close to the periphery, and at the same time relates this encircling band to most of the most significant religious and civic buildings. However, it does not perform as a normal city core nor; indeed, as do the cores of historic London in that it completely fails to penetrate to and cross the heart of the City with strong integrating lines. Thus Evelyn has created a
Fig. 3.32. 50% of segregation in Evelyn’s plan within the walls.
situation which is difficult to envisage from a common-sense point of view. His design is one in which the edges of the City are shallower to all other places in the plan than the centre, despite its relatively compact shape. This kind of core is the defining feature of many 'estate' forms today.

This is confirmed by the 50% segregation map (Fig 3:32). This map shows that, despite its proximity to the most integrating line in the core, the whole of the riverfront containing important public buildings and markets is segregated within the City fabric. A second major group of segregated spaces forms two almost complete rings in the geometric heart of the City between St. Paul’s and Gracechurch Market, almost completely encircling all the major public buildings in this part of the City. Further groups of segregated lines outline St.Paul’s and St.Dunstan’s, which are integrated in the direction of the river front but segregated to the north-west and north-east respectively. This effect is produced entirely as a result of situating the major buildings in the interstices of routes rather than within the City blocks, and is an exacerbated form of the phenomenon already noted in Hooke - of separating out and distancing the public buildings as destinations within the City fabric - what we might call the 'Barbican effect'.

The routes which 'work' best are those which are unimpeded by public buildings. Whether intentionally or not Evelyn has, by his decision to elaborate the intersections of his grid by endowing them with free-standing public buildings which block the vistas, produced a City which works 'inside-out' with a shallow, peripheral ring of long thoroughfares surrounding a more segregated heart in which views run direct from building to building, but movement is indirect and diverted around and away from them.

1 the opposite direction to Hooke's plan
2 the Barbican is a recently-built cultural complex just outside the City which is notoriously difficult to find and negotiate as a stranger to the area.
Fig. 3:33. 10% integration core for the complete Evelyn plan.

Fig. 3:34. 50% segregation for the complete Evelyn plan.
This effect is so powerful that it is very little altered by extending the scope of the analysis to include the devastated area outside the Walls. The effect on the integration core (Fig 3:33) is to introduce one integrating line in the area outside the walls, striking into the centre of the octagon from a position west of the Fleet at Smithfield and to reverse the directionality of the integrated periphery from east to west towards the Guildhall, with a heavy concentration of integration in the area of the Fleet River around Blackfriars - historically segregated. Apart from this line, nearly all the remainder of the large octagon to the west of the City is segregated (Fig 3:34). The sheer weight of numbers of the segregated lines in this area has the effect of reducing those within the City itself. The major public buildings on the river front remain segregated but less continuously so and St. Paul's leaves the segregated zone entirely. Nevertheless, the group of major public buildings including the Guildhall, Christ's Hospital, St.Dunstan's in the East, a number of parish churches, and many of the markets, large public fountains and the Mayor's House are still all strongly segregated.

Adding the octagonal suburb to the west of the City walls therefore modifies Evelyn's design rather than transforms it. Indeed, it modifies it rather little when it is considered that the plan is thereby enlarged by about 25%. This is because the area added is so strongly cut off from the remainder of the City and is a larger and more extensive version of the 'blocked intersection' device used by Evelyn throughout the central area of the City. The extra-mural suburb seems to work more as yet another blocking feature in the plan than as a major modifying force within the design.

The order concepts which make Evelyn's design so visually attractive are in an important sense self-defeating. The blockages and deformities they introduce into the system which Evelyn intended to function as a nexus of well-integrated, busy streets actually impedes their use as a working town centre. Rather than reinforcing structure to give it added clarity, visual order conflicts with the spatial structure at every point. Deformity of the grid, like regularity, is not an absolute
Fig. 3:35. 10% integration core for Wren's design within the walls.
value but a principle which can only be understood relationally as it constructs the global framework of streets and urban blocks.

Wren’s design, like Evelyn’s, will be examined in two stages, first without and then with the extra-mural suburb. The first two lines of Wren’s integration core (Fig 3:35) originate at Ludgate, in front of the piazza on which St. Paul’s is situated, and bifurcate to contain St. Paul’s between them, the northerly one passing right across the City across the forecourt of the Royal Exchange to Aldgate and the southerly one through two large piazzas to the Tower. A third east-west line from Blackfriars to the Tower is the next line to join the core. The fourth line runs north-south bisecting the City on a line from London Wall to the new quay roughly on a line with Walbrook. The fifth line runs from the piazza at the approach to London Bridge through a second large piazza to meet the most integrating line in the core roughly at the geometrical centre of the City where the grid changes from an orthogonal to a radial form. The sixth line crosses in the opposite direction from the Thames to the Royal Exchange. The next three lines to be added to the core run more or less north-south. The first of these stretches from the western section of the quay where Wren intended the guild buildings of the livery companies of London to be situated to the City walls at Aldersgate, passing behind the eastern facade of St. Paul’s. The second, line 8, runs to the east of this, from Queenhythe to Cripplegate, and the third, slightly more oblique line 9, runs north-south from the piazza at London Bridge to Bishopsgate. Of equal value is a line running from the Customs House on the eastern quay to the Royal Exchange. Further integrated lines add a major route from Newgate to the rear of the Royal Exchange building and fill in the orthogonal grid between the east front of St. Paul’s and Walbrook. Two lines are added to the grid in the vicinity of the Royal Exchange, one to link it directly to London Bridge and a second to give a second north-south integrated through-route to the west of the Exchange.

Wren’s plan, therefore, differs markedly from Evelyn’s in its coverage and density of integrated lines in the area within the Walls. The
Fig 3:36. 50% of segregation in Wren's plan within the walls.
integration core strikes right through the heart of the City in all directions with long cross-City thoroughfares. All of these pass by major buildings or through large piazzas. At the same time, shorter lines integrate the Royal Exchange building - 'the nave of the town' - with key commercial facilities on the river front. Wren uses the trick of using the buildings to 'bounce' axial lines, but unlike Evelyn his design links these buildings directly to the bridgehead, the gates and the major cross-routes. At the same time, he produces a strong concentrated grid of integrating lines in the commercial heart of the City, but again directly linked to the gates and the bridgehead, unlike Knight, who produced a similar though more compact concentration at the expense of creating large segregated zones at the periphery of the City.

Wren's plan contains few such segregated lines (Fig 3:36). Most of the segregated lines, particularly in the central areas, are segregated 'singletons' - isolated, short, secluded streets running between the longer and axially shallower grid lines. In making his churches free-standing within the blocks, Wren also creates, at intervals, a U-shape of more secluded streets which runs round these 'embedded' facades to the sides and rear1.

Only in one place do these lines of 'rear access' begin to aggregate together with those passing across the principal facade to form a more extensive zone of segregated lines. This occurs to the south of the Royal Exchange. Here, whereas the radials are all strong integrators, the laterals ringing the Royal Exchange are segregated. A second wedge of segregated lines is to be found to the rear of the Royal Exchange running northwards to London Wall. Thus, the Royal Exchange is well-integrated with the City as a whole, but it is segregated with respect to its immediate neighbourhood. Its global orientation is not accompanied by local prominence. There is a slight build-up of segregated lines towards the western boundary of the City, but this is not pronounced compared with the other designs, nor indeed with the

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1 thus replicating the phenomenon already noted in the mediaeval City
Fig. 3.37. 10% of integration for the complete Wren plan.

Fig. 3.38. 50% segregation for the complete Wren plan.
City as it evolved historically.

The addition of the spaces in the fire-damaged area outside the walls results in a shift in the concentration of integrated streets (Fig 3:37) towards the west, becoming particularly dense in the area west of St Paul's piazza. The waterfront enters the core, as do the streets on both banks of the Fleet. A line drives right through the heart of the octagonal suburb to meet this nexus of lines and strike the west front of St. Paul's. Thus, in terms of the entire plan, the emphasis placed on particular buildings seems to change, linking the new forms of commercial activity centred upon the Royal Exchange with the older culture of street trading which is located around the spiritual focus of St.Paul's.

This shift towards St.Paul's is reflected in the comparable map of segregation (Fig 3:38). The segregated lines previously found on the western boundary of the City all but disappear and the 'singletons' in the remainder of the City remain almost unchanged, but two large new segregated zones are found on either side of the route from St.Paul's to Temple Bar in the newly-added suburb. In this, at least, Wren's plan shows something in common with that of Evelyn.

Looking at the shape of the cores, it can be said that while Evelyn and Wren share a common idea of what constitutes order in design, a common motif in the use of an octagonal suburb to the west of the Fleet, a common interest in radial/orthogonal dualities and even a common preoccupation, with the relationship between the major public buildings and the organisation of the street grid, from the point of view of structure this is where all similarity ends. Both in terms of the organisation of their respective plans within the walled area, and in the way in which the extra-mural suburb is related to the design of the walled City, the two could not be more different. Wren's plan takes the principal features of the mediaeval City and transforms them into a reality which is both well-ordered and well-structured.
Fig. 3:39. 10% integration core for Newcourt's design.
The changes which he makes with respect to the mediaeval plan may not, therefore, be completely innocent of meaning and deliberate intention, notably the relegation of the Guildhall to a minor role and the elevation of the Royal Exchange to replace it as a prominent feature of the design, both from the point of view of order and that of structure. It is conceivable that he may have detected the gradual shift in the locus of economic and political power from the Mayor and Common Councillors of the City, the tradesmen and merchants of the street-orientated market economy, to the bankers and traders who frequented the Exchange and on whose activities the City's wealth was in the ensuing centuries increasingly to depend.

The final design, by Newcourt, is similar to that of Hooke in that it covers a larger - in this case a far larger - area than the old walled City. As with Hooke, the plan will be examined in its entirety. At 10% of best integrated lines (Fig 3:39) Newcourt's plan clearly picks out the major grid of through-streets. The effect of the extreme regularity of the design is also reflected in the values in that, unlike the other cases looked at so far, groups of lines share a common value. Only the effect of retaining the Tower, which 'bites out' the south-eastern corner of the plan thus skewing the whole of the integrated core away from that corner towards the north-west, saves Newcourt's scheme from reproducing the hierarchy of spatial domains referred to earlier, as a syntactic hierarchy of banded values from relative integration to relative segregation.

The development of a repetitive geometry at the level of order produces tendency to homogeneity in the structure of overall design. By 10% of integrated lines the core picks up all the large open spaces, including all the lines which intersect in the large central square and the two smaller western squares and the vertical lines in the two eastern squares, the skewness of the distribution again reflecting the non-completion of the regular grid in the vicinity of the Tower.
Fig. 3: 50% of segregation in Newcourt's plan.
The map of 50% segregation (Fig 3:40) then picks out the local squares in which the parish churches are situated. Most of these are completely encircled by segregated lines, but in the vicinity of the most integrated through-routes these are only partially encircled by segregated lines. Unlike the other plans looked at so far, where secluded spaces are found directly connected to lines within the integration core - as is exemplified by Wren's radials and laterals - the segregated lines do not, on the whole, connect to integrated lines but are mediated by lines which are neither particularly shallow nor deeper than the mean. This distribution of relative accessibility appears to confirm the intuitive description of the description of the plan offered earlier, in that the major grid roads are shallow with respect to all spaces in the system, the lines running from parish church to parish church between the major grid squares are neither shallow nor deep, and the streets surrounding the local parish churches are relatively inaccessible as destinations for all spaces in the system. Newcourt's plan, in other words, does seem to display a hierarchy of accessibility - the imperfection in the realisation being entirely due to the non-completion of the grid.

Insofar as structure exists, it does so simply to differentiate the various levels in the hierarchy, but without structuring space within any particular level. This identity, in the parts makes spatial recognition and orientation difficult, since all streets are alike in their relatedness to the whole. More seriously, it makes space unintelligible in that it is difficult to gain useful information about the configuration of the whole from any of its constituent parts, particularly in the segregated areas.

Taken as a set, the designs illuminate many of the preoccupations of town planning discourse and practice today. Hooke's twin assumptions

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1 again, an artifact of the non-completion of the grid which introduces more structure, though a decrease in order, into what would otherwise be a highly repetitive design.
Fig. 3:41. Ogilby and Morgan’s map of London,
that his concerns stop at the boundary of the site while within the site
the grid guarantees a degree of order, are reminiscent of a generation
of post-war planners. Evelyn's preoccupations with lending
individuality to the local intersections of streets while ignoring the
way in which these are configured globally reminds us of Krier. Wren
is a syntacticist in the Hillier mould, Newcourt articulates an identical
social philosophy to that which produced the 'neighbourhood unit' of
Perry and Stein, while Knight chases the illusive idea of generating
urban form from the design of the perfect, ubiquitous and self-
contained urban block. That this is the case suggests that there are
fewer strategic alternatives to the design of urban space than there
are realisations of it and that these are generated by the logical
possibilities for design at least as much as by the particularities of
historical circumstances.

The phoenix arises.

The process by which the City was reconstructed in the decade after
the Great Fire has been well-documented elsewhere1. From the point
of view of the public space structure which resulted from the
rebuilding a visual inspection suggests continuity with the pre-fire
period (Fig 3:41). The Roman walls still present an obstacle to
movement in and out of the City by channelling traffic through the
City gates. The disorderly appearance of the urban blocks which make
up the fabric within the walls remains, and the island blocks
perpetuate the variety in shape and size and composition which was a
feature of the pre-fire City. With the improvements in surveying
techniques and the adoption of a true ground plan after the Fire this
has actually become more pronounced as the level of resolution and
detail in the plan has risen.

1Reddaway T F, The Rebuilding of London after the Great Fire, Arnold, London,
1940, and Milne G, The Great Fire of London, Historical Publications Ltd.,
Fig. 3:42. the open space map of the City as rebuilt after the Great Fire.

Fig. 3:43. the complete axial break up of the City as rebuilt after the Great Fire.

Fig. 3:44. axial map of the through streets of the City as rebuilt after the Great Fire.
The street grid shown in the open space map (Fig 3:42) is highly deformed and irregular. The clearance of markets from the major thoroughfares is achieved by the post-fire reconstruction and the City is rebuilt in accordance with a road widening and straightening programme. All this is achieved without any major dislocation in the complex network of land and property ownership which had shaped the physical form of the mediaeval plan. Thus, although some streets which were designated as major thoroughfares are substantially widened and minor lanes are made at least 14 feet wide¹, there is no attempt in the rebuilding to geometrize the City in line with the principles of town planning exemplified by the set of ideal plans looked at earlier and the plan of the City published a decade after the Great Fire by Ogilby and Morgan displays a remarkable continuity with the Leake map.

The complete axial break up of the City at the time of Ogilby and Morgan is shown in Fig 3:43 and the sub-set of thoroughfare streets is shown in Fig 3:44. This map, roughly speaking, picks out the structure of streets, lanes and alleys from that of closed courts and yards and presents a realistic picture of the complexity of the public street network of the City of London at the time of the Restoration². The addition of a new strip of wharving down to the River can be picked out³ and the hinterland of the blocks to the north of Cheapside is much more fully developed, but the preservation of a family likeness with the mediaeval City is striking, particularly when the longest and straightest axial lines are compared.

¹ before the Great Fire, major streets had been encroached upon by buildings and some had shrunk to as little as 11 feet in width.
² Charles II had returned from exile on the Continent in 1660 to take the throne which his father lost to Cromwell. His time abroad had exposed him to Renaissance architecture and planning and he was initially sympathetic to the idea that the City might be redesigned along Continental principles. However, the City Fathers had supported Cromwell in the Civil War and were undoubtedly sensitive to the fact that several of the post-fire plans bore the imprint of aristocratic and courtly values.
³ built on the consolidated rubble of the mediaeval buildings which were removed and deposited at the waterfront before rebuilding commenced.
Fig. 3.45. Integration core of the 36 line map of the City as rebuilt after the Great Fire.

Fig. 3.46. 10% integration core in the City as rebuilt after the Great Fire.

Fig. 3.47. 50% of segregated lines in the Ogilby and Morgan plan.
However, identity in general shape does not necessarily guarantee a reproduction of the precise connections of streets, so any differences in configuration brought about by the post-fire reconstruction are best considered in relation to the build-up and the overall shape of the integration core. **Fig 3:45** is the integration core of the Restoration City at 36 lines, the same number as shown in the Leake core (**Fig 3:06**) and just short of 5% of the total number of axial lines in the plan. As a result of its straightening Cheapside has moved into the most integrated position, and the new street connecting the Guildhall to the river is the second most integrated space, entering the core before the fan of streets radiating from Cornhill. The significance of Eastcheap and the north-south link from Bishopsgate to the Bridge are reduced, the line of the Walbrook maintains its prominence while that of the east-west route along Thames Street is increased by the concentration of new wharves leading down to the river. Otherwise, the shape and coverage of the two cores is almost identical. Raising the core to 10% of lines (**Fig 3:46**) first increses the density of lines in the vicinity of Cheapside, and then expands the scope and coverage of the core around Eastcheap and in the area to the south east of the cathedral.

The integration core of the City in 1676 is relatively restricted in its size and scope. It reaches the edge of the City at only one point, London Bridge. The mode of growth of the core is through a series of waves of expansion, where long axial lines push the coverage of the core out from the centre, followed by consolidation where lines are added to fill out the density within its established coverage. The thrust of the core is excentric, loaded towards the south and east. Compared with its mediaeval counterpart it is more ringy and more evenly distributed through the centre of the City. St Paul's in the west, the Guildhall in the north and the Woolchurch Market at Cornhill all acquire concentrations of well-integrated axial lines. The siting of the Royal Exchange on Cornhill ensures its accesibility.

The 50% segregated map of the 1676 City (**Fig 3:47**) is equally revealing. First, there are still almost no segregated spaces in the heart
Fig. 3:48. Early 18th. century view of the City as rebuilt, by T. Bowles after J. Donowell.
of the City between St Paul's and the north-south route from Bishopsgate to London Bridge in the area south of the Guildhall. Those which exist are isolated singletons or small groups distributed across the surface rather than forming clusters of segregated lines. In the area close to the walls, the converse remains the case. There are no lines which are more integrated than average and those which exist are singletons rather than clusters of connected shallow and accessible streets. Blackfriars, the Cripplegate area, the streets to the rear of the Guildhall, the north-east corner of the City and the vicinity of the Tower are all strongly segregated, as is the new market at Newgate to the immediate west of St. Paul's. The effects of the pre-fire plan are exactly reproduced.

It might appear from this that little changed with the Great Rebuilding. This is an understandable inference from looking at the structure of the street grid of the City. The urban grid seems merely to have been fine-tuned, and the opportunity taken to increase the prominence of major buildings both syntactically and visually. However, this view does not survive inspection of the built form of Restoration London and morphological continuity is accompanied by a radical transformation in the appearance of the City both in public and in everyday buildings. Order concepts found a place not in plan but in elevation, and the City of Restoration London presented a face which was, for the first time, not merely urban but urbane (Fig 3:48).

Conclusion. Natural and artificial cities.

It is customary today to discuss the morphological properties of organic, vernacular or 'natural' cities as if they are a completely different, and therefore incommensurable phenomenon from planned

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1 the exception is still the area around the main wharves at Queenhythe.
1 these terms are due to Christopher Alexander. A city is not a tree. Design magazine, Feb. 1966
or 'artificial' cities. As we have seen, it has even been argued that this is the case because the mind operating reflexively is incapable of conceptualising complex overlapping socio-spatial realities like cities and has therefore to clarify them by reducing them to simple organising principles in order to design.

If little headway appears to have been made in this debate, it is perhaps because it is predicated upon a fundamental confusion of order concepts with structure concepts. In the absence of tools to investigate structure in natural cities, there is no way to approach the framework of urbanisation which is given by the pattern of streets and urban blocks other than by addressing those features which are immediately available to visual inspection. For the most part this results in a negative discourse: one which identifies and focuses upon what is absent in organic cities - lack of order - rather than what might be present. This is no less true with visually well-ordered designs where the very transparency of the visual order renders geometrically designed, planned cities opaque in terms of how they actually structure space. Here, the struggle to appear profound all too often seems to state the obvious at the level of order in the plan, and yet to miss the point. This is becoming increasingly clear in the 'postmodern' period where geometricity holds sway in urban design and yet many proposals appear curiously unrealistic. Discourse does not provide the tools to criticize, yet scepticism increases in the face of architectural striving for greater and more elaborate visual arrays.

Cities like the City of London which grew up by accretion may look different because they have few readily identifiable ordering principles but they may be well-structured. Planned cities may be more obviously ordered but order does not guarantee structure any

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1 these terms are due to Christopher Alexander, *A city is not a tree*. Design magazine, Feb. 1966
more than its absence is indicative of chaos. An understanding of both, looked at separately and together, is a necessary first step to unify the field of urban morphological studies. Looking at cities in this way may even make the terminology of the ‘natural/artificial’ debate obsolete.

It is suggested here that both order and structure are present to some degree in all urban configurations. The problem is not to classify them in terms of ‘either/or’ but to capture the degree to which either or both are necessary to make a working, pleasing town. Because they are different dimensions of the morphological field, rather than opposite poles of a one-dimensional reality, order and structure can work hand in hand or in opposition, to create different kinds of town. Wren’s plan reproduced much of the structure of mediaeval London, but it was visually more order-rich. Newcourt’s plan, although highly visually ordered, concentrated all structural differences between levels in the socio-spatial hierarchy thus leaving each layer relatively unstructured and homogeneous. Hooke’s design displayed a correspondence between structure and order in that the remnants of the naturally-evolved City and the more differentiated and individuated public buildings were both segregated in relation to the highly ordered, but internally homogenised grid. Knight’s design related visual order to spatial structure almost arbitrarily so that, had it been built, the working life of the town would have undoubtedly proved a puzzle to its residents. In Evelyn’s design the effects of the two were actually opposed, so that the very places where he envisaged that the public life of the town would be concentrated were the most inaccessible to the natural pattern of use and movement.

These reflections on the relative impact of structure and order in design are entirely consistent with an understanding of how organic cities both order and structure public space to different degrees. The Restoration City gains in order at the global level, but loses it at the local level when set alongside its mediaeval counterpart. Its structure, however, is largely unaffected. It is feasible to set both alongside the proposals for rebuilding and compare them all in terms of structure, and to reflect on the source and nature of differences which lie below
those surface appearances which are captured and represented in the plans.

A more complex view which attempts to isolate the impact of order and structure in generating and controlling the framework of a city leads not just to a more informed debate about the relationship between history and morphology, but also to a more liberating view of design. Architecture may not be doomed to a perpetual inadequacy resulting from an assumed inability to grasp complex overlapping realities. There is another way. Raising structure to a level of conscious investigation alongside order may lead to a situation where claims made at the drawing board are capable of translation into well-structured and therefore liveable urban places.
Chapter Four: modelling the effects of the grid of Roman London on the subsequent morphological development of the City.

**Introduction: Structure and Order in Roman London.**

It was suggested in Chapter Two that structure and order are opposed in perfect grids and piles of sticks – that is, randomly generated axial lines. Indeed it was in modelling and contrasting these that the concepts were first distinguished from each other. That this is so, is of considerable relevance for the study of London because the City was a Roman foundation and is known to have had a regular orthogonal grid in its initial stages. However, the grid did not fully cover the site and, as will be shown, the initial deviations in the skeleton grid of the 'infant' city laid down a powerful structure which has been almost indestructible throughout its subsequent morphological development. At the level of appearances however, the City seems to have undergone a sea-change since Roman times, since it now appears to be a disorderly organic town which historically has lacked any sense of planning or exogenous order. Order and structure in the City of London seem to have decayed at different rates, so that a transformation in visual order can happily co-exist with a conservation in structural principles.

This chapter sets to investigate the relationship between structure and order as revealed through the archeological record of Roman London. The opening sections of the chapter look at the growth of London during the Roman period and raise two key issues which puzzle historians working on the basis of the archeological record. The first reflects upon the origin of the town plan as a military or a civilian settlement. The second queries the extent to which the
Roman era can be considered to have influenced the subsequent evolution of the street grid of London.

In order to approach the first of these issues, reconstructions of the grid of Roman London will be compared with that of Roman colonial towns whose street plans have survived intact, and whose functional origins are known. This exercise goes some way to suggest how military and civilian influences may be diagnosed in the working structure of the plan.

The argument then returns to the case of London, to tackle the second issue; that of its subsequent growth and change. Here, it is suggested that the wandering east-west cross-City routes which arose outside the area occupied by the regular orthogonal grid have left an indelible imprint on the structure of the City. Experiments on random 'overdrawings' of the remaining, but partial, Roman grid show how hard the pattern is to destroy. A comparison of an 'ideal' and a 'reconstructed' version of a grid which covers the walled city are used to model key features of the Roman plan.

The chapter concludes by attempting to answer the questions posed for history at the outset, by reviewing the relationship between historical events and morphological constraints, and by reformulating Biddle's concept of the conservation of morphology through the ossifying effect of key physical features like city walls and gates. This view is contrasted to a syntactic approach, which sees the very structure of the grid as conserving the structural properties of towns. Finally some speculations are made on the theoretical significance of structure and order as principles for understanding spatial layouts, and on the effects of radial and orthogonal tendencies on real cases.
Recent archeological work has confirmed that there was no substantial occupation of the site of the City of London before the arrival of the Romans. Iron Age sites are thought to have existed to the west of the City and the Roman road network may have been based, in part, on older prehistoric trackways. The first fords were upstream in the vicinity of Westminster, and the Thames was impassable in the area of the City although it has yielded several rich finds, indicative of its use for local water-borne trade and travel.

Upon their arrival, the Romans were presented with what was, to all intents and purposes, a greenfield site. The significance of this lies in the fact that the ground plan of the Roman City of London appears to have departed from normal Roman town planning practices in two key respects: firstly, unlike other Roman towns in Britain, Gaul and Germany, London appears to have a regular orthogonal grid only in the restricted area immediately south of the forum whilst elsewhere the streets and city gateways seem to have followed the lie of the land; secondly, the main street of the settlement was orientated east-west as opposed to the more usual north-south.

These departures had a marked effect, not only upon the morphology and functioning of Roman London, but in addition they have left a legacy which has had a profound influence on the evolution of the City. Commenting on the Roman legacy in London, Biddle points out that lengths of the two most important streets of the Roman town have remained in use, while along intervening stretches of the same streets, the mediaeval and modern courses have wandered away from

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2 some scholars suggest that there may even have been a trading post, tribal headquarters, or primitive town associated with this crossing point, but there is no hard archeological evidence to support the view.
3 the number of Roman cities founded between 300 B.C. and A.D. 150 runs into hundreds.
4 the site on the North bank of the Thames was marked by two low hills separated by a small river valley, the Walbrook. Occupation appears to have hugged the flat portion of the high ground, with routes extending away to the north-west and north-east along the ridges. Care seems to have been taken to site the gates on high ground.
the earlier lines. It is remarkable that the great street markets of mediæval London - Westcheap (Cheapside) and Eastcheap - both occupy approximately the lines of Roman streets'. ¹ although he adds a note of caution against assuming this to be proof positive that London is the exception to the more general rule in dealing with towns founded under Roman occupation where there is, more often than not, no demonstrable continuity of streets as built-up routes. However, the possibility undoubtedly exists that some sections of London streets survived in continuous use, with the street line perpetuated by the properties which lined them. What is known and able to be reconstructed from the period certainly seems to illustrate what Biddle describes as the 'passive' conservation of morphological principles in later urban patterns², since traces of Roman features remain today in the street grid of the City of London.

For historians, the anomalies which these traces reveal represent a puzzle in the origins of the Roman town, particularly in attribution of the plan either to a civil or a military origin. Marsden³ illustrates this difficulty in interpreting historical events in his discussion of the origin of the main east-west street in the immediate vicinity of the forum. Here, it seems quite likely that the main street of Plautius' military encampment was retained when the civil administration moved onto the site, but it was equally plausible that the street was purpose-built for the new town⁴.

Any investigation of the influence of the Roman grid on London has therefore to address a twofold puzzle into the origins (civil or military) and the effects (morphological continuity or discontinuity) of planning decisions taken some 2,000 years ago and buried 6-9 metres below the space-time reference of the modern City of London.

² Biddle M., ibid, p107.
⁴ Marsden's thesis is that London is 'a carefully planned civil trading settlement of Roman merchants', and not a military foundation as most historians believe, op cit. p.9.
Fig 4.01 - the Marsden/Brown interpretation of Roman London.

Fig 4.02 - the Hobley/Hall/Merrifield interpretation of Roman London.
The Roman Legacy.

Before 1973 little was known of the period of Roman occupation within the City of London. Despite the large numbers of excavations which have been carried out in recent years\(^1\), knowledge of the plan of the Roman town is still imperfect and piecemeal; so much so, that attempts to reconstruct the appearance of the City as a whole\(^2\) cannot be relied upon for morphological analysis. Reconstructed partial plans\(^3\) have been used as the basis for the descriptive and analytic work which follows, since these have been arrived at purely as a result of archeological investigation.

Two partial plans have been adopted for the purposes of modelling the Roman grid (Figs 4:01-4:02). Both incorporate recent archeological findings from within the last decade, but Fig 4:01 is based on the Marsden/Brown\(^4\) sequence and Fig 4:02 on that of Hobley, Hall and Merrifield\(^5\). Together they illustrate something of the difficulty in interpreting archeological data since, although they appear to differ only marginally, the discrepancies affect analysis. The major points of difference are in the west, in the layout of the roads in the vicinity of the Roman fort and in the east, in the alignment of the road leading north from the forum to Bishopsgate. These discrepancies arise from the interpretation of events which took place during the most prolific period of the Roman building sequence in the 2nd century AD. The record left by the earliest developments within the City is clearer on the ground, but it is perhaps the most difficult to

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1 with the founding of Urban Archeology Unit, which has carried out over 125 excavations in City since its inception.
2 the best-known of these are by Alan and Richard Sorrell and are reproduced in Hall J. and Merrifield R., eds., Roman London, H.M.S.O., London, 1986.
3 such as those produced by the Urban Archeology Unit of the Museum of London.
interpret since it is at this point that the break with more usual town planning practices occurred.

The role that the City played in the invasion of AD43 is not clear. It is not known whether the Roman invaders crossed at the site of the City or upstream. However, the location of a bridge at the lowest crossing point of the Thames and the subsequent construction of a network of roads radiating from the bridgehead\(^1\) had an essential strategic role in the subsequent development of the City of London as a centre of communications and as the junction of sea-borne and overland trade.

London began as a planned layout north of this bridgehead. It used to be thought that the Roman settlement began on Cornhill and spread westwards. More recent evidence suggests that the plan of the entire settlement was present in a skeleton form from the first, including the alignment of the principal roads and the line of the civic boundary\(^2\).

The site chosen by the Romans for the City\(^3\) centred upon two low hills, Cornhill and Ludgate Hill, separated by the Walbrook, a stream which drained from the area north of the City, later known as

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\(^1\) South-east England fell immediately under Roman rule and Colchester, the most important pre-Roman settlement was designated the capital of the new Roman province early in the campaign. London Bridge was the key crossing point in the overland route from the Kentish channel ports to the provincial headquarters in Essex, and out to the war zone to the north and east of London. This strategic location was later crystallised in a road network centred on London. A major route, Ermine Street, ran from Bishopsgate north to York; from London Bridge, Stane Street led south to Chichester, intersecting with Watling Street which ran from Canterbury to St. Albans skirting the City; from Newgate and Ludgate, two (unamed) major roads led west to Silchester, and from Aldgate, a further (unamed) road ran east to Colchester.

\(^2\) Confirmation of this is given by the discovery of three major cemetery sites immediately outside the City walls and alongside the major roads at Aldgate, Bishopsgate and Newgate. The practise of interring the dead outside the city boundary was reinforced by Roman law.

\(^3\) The plan is sufficiently rigorous to suggest military planning, but the City may have been laid out by civilians under military supervision. The character of the first buildings suggest that wealthy property developers were present in the early colony building speculative shops for rent. London was not yet a chartered town, but it was nonetheless a thriving commercial centre.
Fig 4:03 - London A.D.60; Marsden and Hobley
Moorfields, into the Thames at Dowgate. Its course was short, broad and shallow. Alluvial mud spread by its passage made the lower reaches fertile but the ground in the upper reaches was so boggy that it was uninhabitable until late mediaeval times. West of Cornhill, the longer, stronger Fleet River formed a natural boundary as it ran down to the Thames at Blackfriars.

The first settlement, AD50-60, occupied the high ground of both hills (Fig 4:03) either side of a principal 9.0 m. wide east-west road roughly along the lines of modern day Fenchurch Street, Lombard Street, Cheapside and Newgate Street. The construction of this street suggests that it was intended to be the principal street of the township and the locus of all the important buildings. Reconstructions of this early period show the principal east-west street reaching the line of the later wall at Newgate in the west and bending in a north-easterly direction to strike the line of the wall at Aldgate. A second road was constructed east of the Walbrook parallel and closer to the river, roughly along the line of modern Cannon Street. The road north from the bridge intersected these at right angles and, immediately to the north, on the high ground of Cornhill, were located the earliest civic buildings including the open market square which pre-dated the first forum. Widely scattered, though clearly planned, these early buildings were destroyed in a fire of AD60 during the rebellion led by Boudica. Only some of the streets and buildings had been erected by this time, but their destruction was a major disaster and a profound shock to the newly-emerging economy. Recovery was slow, and was led by a major rebuilding programme.

The post-Boudican plan (Fig 4:04) was an ambitious one, according with London's status as an increasingly powerful administrative

2 remains of an early military ditch suggests that this curve was a very early 'fix' within the plan.
3 Tacitus tells of a massive evacuation of the unfortified City before the Icini arrived. Buildings were left bare. The slaughter of those who remained was recorded by Tacitus, but there is little archeological evidence of any fighting other than fire damage.
Fig 4.04 - London in the early 2nd century; Marsden and Hobley.
centre and seat of government. Two roughly parallel east-west roads were laid out along the same lines as before between Cornhill and the Fleet, and the major civic buildings were once more located at the intersection of the more northerly of these with the road leading up from the bridge to Cornhill; these were the City’s first forum and basilica, set around an open courtyard and surrounded by shops. These buildings were again replaced in the 2nd century AD by an even larger complex, four times the size of the previous buildings and occupying a complete block or insula surrounded by streets. One interpretation of the street grid around the forum and basilica shows a road passing along the eastern extremity of this block to meet the City boundary at Bishopsgate as in Fig 4:01. The alternative alignment is recorded in Fig 4:02.

The roads passing to the east and west of the forum are presumed by some scholars to have extended down to the waterfront, where quays were built in the 1st century AD and improved in the 2nd century AD. The land immediately to the west, between Cannon Street and the River, is known to have been occupied by the governor’s palace. This was constructed in the late 1st century AD, possibly during the governorship of Agricola (AD78-84-5).

The major period of building took place in the 1st and 2nd centuries after occupation. Domestic buildings have been excavated on three

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1 the basilica alone was 150m. long, greater than that of any other Roman city north of the Alps.
2 Brown, F.E., The Spatial Development of the City of London, op.cit., p2 Fig 1.1 Roman London. The length of these roads does not affect initial syntactic analysis since their physical extent does not alter the connectivity of the system.
3 from AD 50 this land had been occupied by a large, timber-framed building possibly serving military functions and gold workshops are known to have existed between this and the River. This suggests that the land was possibly already owned by the central authorities.
4 the hillside was terraced for the construction of a grand official residence containing state rooms within a garden court with a large pool, surrounded by ranges of rooms and a small bath suite. To the east lay a second courtyard surrounded by rooms. The palace was heated by hypercaust, and had tessellated floors. The waterfront was revetted, and there are remains of a possible colonnade.
Fig 4.05 - the walled City; Brown and Hobley.
large-scale sites, Milk Street, Watling Court and the GPO site in Newgate Street\(^1\). While knowledge of the building sequence on these sites is extensive and gives the line of several of the roads in the west of the City, it does not contribute to a picture of the street pattern as a whole.

During the 2nd century AD, a stone-walled fort was built at the north-west corner of City, probably for the staff and bodyguard of the governor. At its Cheapside end the principal east-west road deviated slightly to accommodate the road running south from the Cripplegate fort which met it at right angles. Wood Street preserves the line north to the fort to this day. A previously-existing bath house one block to the east of this intersection is known to have been adapted for military use at the time, giving the beginnings of a second road striking north of Cheapside towards the eastern extremity of the fort.\(^2\) The roads in this area present a puzzle. Fig.4:01 shows the alignments which are most often reproduced\(^3\). Fig 4:02 shows the alternative and more recent interpretation.

When the City was later walled, early in the 3rd century AD (Fig.4:05) gates were placed at the points where the principal roads intersected with the line of the walls at Ludgate and Newgate in the west, Bishopsgate in the north and Aldgate in the east. The entry by way of the fort at Cripplegate formed a fifth gateway to the city, but it did not lie on a major route. Nor did the gate at Aldersgate, south-west of the fort, which was cut rather later, perhaps to bypass the fort\(^4\). The wall appears to have replaced an earlier ditch along similar lines which suggests that the military builders followed the established civic boundary. The barbarian invasion of AD367-8 may have led to

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1 for details of the excavations see Marsden P, Roman London, op.cit. pp.111-112.
2 two other locations for Roman baths are known; at Huggin Hill in the west and Billingsgate in the east, both immediately adjacent to the River.
3 a composite of several plans of the area.
4 although the line of the road through Aldersgate is known, it is not included in the first analysis because it is not known how it was connected into the intermural street grid but is consistently shown as a 'free-floating' line.
Fig 4.06 - Florence.

1. Capitol
2. Baths
3. Theatre
the strengthening of the wall with bastions to provide flanking fire. A wall was also known to have been built along the riverfront about this time, although this was subsequently destroyed by river erosion.

These fortifications took place in a period marked otherwise by economic decline and they have been interpreted by historians as demonstrating that London's position was uneasy, struggling to retain its importance in commercial and strategic terms but seeing itself increasingly as a fearful outpost in a beleaguered empire. Efforts to revitalise the old city failed to restore the levels of trade previously enjoyed. The population declined and the western part of the City in

From the point of view of the relationship between historical events, social dynamics and morphological possibilities, the partial view produced by these remains is tantalising. The line of the waterfront and the alignment of the city boundary wall and its permeabilities - the gates - are persistent archeological features whose precise positions are known. Within this can be identified a partial street grid, some buildings which suggest further streets, and a tendency to development which locates the denser areas of the Roman City, mainly south of the Cheapside line, with outlying building in the west up to the fort and in the east between Bishopsgate and Aldgate thus avoiding the boggy area around the headwaters of the Walbrook. Nothing of what remains fits easily into the highly ordered picture of the 'Vitruvian' grid which was analysed in Chapter Two, and which is frequently cited as embodying the principles of Roman town planning.

**Solving a historical puzzle in the origin of real Roman towns.**

Of course, few real Roman towns are perfectly regular 'Vitruvian' orthogonal grids like those discussed in Chapter Two, although many approximate it closely. Florence, Ostia\(^1\) and Slichester\(^2\) (Figs 4:06-
Fig 4:07 - Ostia

Fig 4:08 - Silchester
Fig 4:09 - open space map of Florence
Fig 4.10 - Axial map of Florence

Fig 4.11 - Integration/segregation in Florence; internal and with a 'carrier' space.
4:06) are frequently cited as towns laid out on an archtypical Roman grid, although even here there are departures from the 'Vitruvian' ideal. In Florence, for example, (Fig 4:09) the arrangement of blocks within each quarter of the town is not a 2 x 2 form, but 3 x 4, and in two places blocks have been amalgamated to give larger islands, the one around the forum being of open public space and that in the north east corner one of built-up space. The line of the *decumanus* locally takes the form of a crescent in the eastern quarter, breaking the grid at that point.

All of these departures make a difference to the visual order principles present in the grid whilst only one, the breaking of the axiality of the decumanus, makes a difference from the point of view both of order and of structure. The reason for this becomes clear as soon as the plan is transformed into an axial map (Fig 4:10). The impact on integration is to render the east-west streets excluding the *decumanus* equal and best integrators. The two north-south lines either side of the chicane in the *decumanus* follow. Next in value is a batch of streets comprising the remainder of north-south lines including the *cardo* and the western portion of the *decumanus*. The remainder of the *decumanus* forms a 'tail' of segregated lines. (Fig 4:11) Mean RRA is .5643, connectivity is 5.00 and relative intelligibility is .0818 as compared with this not being computable for a regular grid with 16 lines. What seems to defy intuition, and therefore to make structure concepts so much less apparent than order principles, is that a local change in the conditions of the grid has

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subdivided, it is not known how this was achieved, so it cannot be used as a basis for syntactic investigation.

1 at Silchester, the original unvealed layout was transformed by the later addition of an irregular wall. A visual inspection of the plan shows that the grid was deformed, particularly in the centre around the forum, but the plan is difficult to interpret from the point of view of carrying out instructive analysis.

2 this example, and the set of Roman grids that follow show that step-by-step integration is more valuable than the delineation of a core in these cases - so many spaces share an identical value that it is necessary to show the order of integration values for the entire system, to build a clear picture of what is occurring. The confirmation is shown in the departure from an *s*-distribution in the ranked RRA transformation, see below, which indicates that integration is not normally distributed.

2 precisely mirroring an effect to be found later in Hooke's plan for the rebuilding of London after the Great Fire.
Bar Chart for column: X1 Column 6

Fig 4:12 - the rank order of RRA in Florence.
global ramifications far more significant than the apparent similarity of streets at the level of order would suggest (the differences brought about in the set of north-south streets being a clear case of this disjunction between visual order and structure). The rank order of RRA (Fig 4:12) shows flight of steps with the long 'going* in the centre resulting from the homogenisation of the grid west of the cardo ¹

In the real cases which will be examined below, only a small number of roads lead out of the town. These tend to follow the direction of the compass points, but in some cases they are not aligned upon the *decumanus* or the *cardo* but, as in the case of London, follow the lie of the land. Some of the examples used are walled. Most are large. It is highly improbable that movement took place in the open, and often farmed landscape around the perimeter of the town. In a very real sense, the connection of the approach roads by a notional 'carrier*, while of formal interest in respect of how it affects the measures and distributions of syntactic values, is not life-like. In what follows analysis will be restricted to a comparison of the internal workings of real Roman towns.

Roman town planning has produced a distinctive group of urban forms which are characterised by being immediately recognisable yet which are difficult to differentiate from one another as individuals. The uniqueness of each street layout is rarely remarked upon, and commentary on the plan as a whole is usually focuses upon the degree to which the plan observes cardinality of orientation, and the extent to which the intersection of the *cardo* and the *decumanus* is at the geometric centre of the town to give identical quarters, or offset to give a unequal quadrants - where this is the case in a civilian settlement it is normal, though not inevitable, for the *cardines* to be

₁ As in the case of the Vitruvian example which was examined in Chapter Two, adding a 'carrier' of surrounding roads makes a difference to the distribution of RRA as compared with the internal structure of the town grid, notably in bringing the *cardo* into the integration core as a main integrator alongside the *decumani*, but the principle that small differences in visual and geometric characteristics yield significant differences in the structure of the grid remains inviolate (Fig 4:11).
shorter than the *decumanus* leading to integration bias in an east-west direction. In other words, the dominance of order concepts in real cases is mirrored in an inability to describe untidy reality as anything other than imperfect: a deviation from some abstract but perfect and probably unrealised ideal town in which, as Rykwert so poetically puts it, 'the Roman who walked along the cardo knew that his walk was the axis round which the sun turned and if he followed the *decumanus* he was following the sun's course. The whole universe and its meaning could be spelt out of his civic institutions.' a description which is clearly based on order concepts. Comment on the unique features of each real town layout tends to be directed at the design of the public buildings rather than at the structure of the grid. The case of Florence gives some idea of why this should be so: the ways in which changes individuate the street grid, particularly with respect to the structure of the grid, are in an important sense counter-intuitive, and therefore difficult to discuss without adequate descriptive and analytic techniques.

According to Carter, for example, Roman towns were characterised by five morphological principals: orthogonality, a regular division of the city into four quarters by means of a primary north-south street (the *cardo*) which was cross-cut by a secondary east-west street (the *decumanus*); rectangularity in the setting out of the defensive walls and the laying out of a street grid within them; focality in the location of civic buildings at, or in the immediate vicinity of, the intersection of the two principal axes; militarism in their similarity to Roman military camp layout which had twin north-south axes, a feature which was adopted in many colonial cities; and variation, or more

2 Florence is therefore normal in a general sense, but the particular role of the *decumanus* itself is unusual.
3 The best candidate is Ostia, but even here there is doubt as to the design of the blocks locally. This seems rather like the case of the 'panopticon' in buildings, where an abstract model of great theoretical power has had a greater influence of the idea of what constitutes an institutional building than the actual number of examples built would warrant.
Fig 4:13 - Turin

Fig 4:14 - Integration/segregation in Turin
properly lack of variation in the uniformity displayed by Roman towns, particularly their inflexibility in response to local topographies or natural features. The description which Carter offers is again one which is based on order concepts. It is not difficult to see why this should be so for, in a sense, so are Roman towns.

Turin\(^1\) (Fig 4:13) is a case in point, and shows an example so close to a perfect orthogonal grid that it is relatively trivial and uninteresting to analyse syntactically since its structure properties are immediately apparent. The plan shows a rectangular grid offset from the cardinal points by 45 degrees, with the *cardo* clearly offset to the east in a 6 x 4 : 3 x 4 ratio. Structure, of course, takes no account of this offset, or in differences in the width of streets (both order effects). The significant event for structure is the 'bite' taken out of the grid in the northern corner\(^2\), which turns the grid from a normal two-value *decumani*-biased grid (given by a regular, rectangular composition of blocks) to a four-value grid (Figs 4:14, 4:15), with the incomplete areas appearing as more segregated than the majority of streets.

The example of Verbonia\(^3\), still an 'ideal' case close to the 'Vitruvian' pole and based on Florence, which was designed to illustrate the principles of coloniae. The plan here is one which has equal quarters organised around the *cardo* and the *decumanus*, but with differences in the way in which buildings disrupt the grid locally within each of the quarters. (Figs 4:16 to 4:20) In a system of 21 lines, one is 11-connected, 6 are 10-connected, a further 9 are 9-connected, one is 8-connected, one is 7-connected, 2 are 5-connected and 1 is 3 connected. The most integrated space is the east-west line 14 which runs to the east of the amphitheatre. This is followed by the set of east-west lines east of the *decumanus* together with line 12, on the western extremity of the town. Eight of the 9-connected lines, numbers 4-11

\(^1\) taken from Carter, op cit, p 31.

\(^2\) an event comparable with the 'bite' taken out of Newcourt's design for London after the Great Fire by the (retained) Tower of London, which was shown and analysed in Chapter Three.

Fig 4:15 - the rank order of RRA in Turin

Fig 4:16 - Verbonia
Fig 4:17 - open space map of Verbonia

Fig 4:18 - integration in Verbonia
Fig 4.19 - segregation in Verbonia

Fig 4.20 - the rank order of RRA in Verbonia
running north-south and including the *cardo* are equal third in terms of integration, but line 13, 9 connected north-south is less integrated, demonstrating the independence of RRA and connectivity. The north-south blockage in the system caused by the *forum* is reflected in the relative segregation of lines 15 and 16. Worst of all is line 3 to the south of the ampitheatre.

Verbonia still has a high degree of homogenisation in its values and bias towards integration by way of the *decumani*, particularly in the middle range of integration. It is the pattern of distribution of integration which is affected by the deformation of the grid by breaking some lines and privileging others. The rank ordered RRA transformation (Fig 4:20) picks this up clearly as a series of broad steps in integration rather than a smooth curve. The mean RRA is low, 0.3242 and the connectivity high 6.5714 (for a perfect grid with this number of lines it would be 10.50). The intelligibility is low, 0.1554.

Trier and Timgad1 (Figs 4:21 and 4:22), two of the best-known and most complete Roman towns whose plans remain, show a comparable degree of homogeneity to Verbonia, although they serve also to show that Roman grids are far from a 'perfect' realisation of order concepts. In these real cases also the grid is interrupted by major discontinuities where public buildings block routes. The effects from the point of view of structure, are firstly, to shift the integration core of the towns away from the cardinal points of the *decumanus* and the *cardo* at the geometric centre of the town into better-related but less-obviously significant streets - normally those of east-west orientation - from a visual or geometric point of view and, secondly, to produce more variation at the extremes of segregation and integration in the structure of the street network. As in Verbonia, this is brought about by breaking order principles either by enhancing or by rupturing the grid locally.

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1 Trier and Timgad are both taken from Benevolo, *The City in History* op cit.
Fig 4.21 - Trier

Fig 4.22 - Timgad
Fig 4:23 - open space map of Trier

Fig 4:24 - axial map of Trier
Fig 4:25 - integration in Trier

Fig 4:26 - segregation in Trier
Trier clearly illustrates how these effects are brought about. The open space and axial maps of the town (Fig 4:23-4:24) shows that although the orientation of the grid is approximately on the cardinal points, the grid is elongated (unusually) along the axis of the cardo. There is, in any event, more than one candidate for the cardo. The first is the line passing between the forum and the palace, which is in the centre of Trier but not on any principal route. The second, immediately to the east and equally central in a geometric sense, reaches the wall in the south, and the third is the adjacent street which carries the principal route northwards to Frankfurt. The line of the decumanus is shifted south of the geometric centre of the town and opened into an enlarged public square which acts as a focus for the palace, the forum and the Imperial Baths, which completely block the grid to the east of the forum. Other important buildings also disrupt the grid, particularly in the south and east.

The effects of these departures from visual order are picked up in the integration core (Fig 4:25). The two most integrated lines are the first and third candidates for the cardo. Three lines share second place in the table: the main route leading from Trier to the south, the western boundary and the road which passes immediately in front of the palace. At the other extreme, segregation (Fig 4:26) is concentrated first in the ragged southern and eastern boundaries of the town, and then on some of the more poorly connected east-west streets where the ragged boundary creates an imbalance in the overall network of streets.

Trier illustrates a tension which exists in Roman town planning between preserving global order in the street plan and creating more localised order-effects by the positioning of major public buildings. If public buildings are used architecturally to good effect to end-stop

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1 a 75% core
2 an 18.5% core
3 the first core shows 25% and the second shows 40%, adding the next value, shared by 11 spaces, would show 70% segregation.
4 and in highly ordered systems generally. This effect is particularly marked in Evelyn's design for London after the Great Fire, analysed in Chapter Three.
Fig 4:27 - the rank order of RRA in Trier

Fig 4:28 - open space map of Timgad
principal routes, then they create blockage in the street system as a whole. Where public buildings are larger in area than a conventional insula permits, the amalgamation of islands and a consequential disruption of the grid are unavoidable. If large buildings are confined to the perimeter where these disruptions are less noticeable from the point of view of visual order, as is the tendency in Trier, then the segregating tendency for urban structure is exacerbated.

Between these extremes, a over one third of the grid shares integration values which are either identical\(^1\) or differ in value by less than 0.1. These streets are those parts of Trier which conform more closely to a conventional Roman grid. The rank order RRA transformation shows this as a flattened portion in the middle of the curve. (Fig 4:27) Mean RRA for Trier is 0.3955, mean connectivity is 7.7037 and relative intelligibility is 0.1572.

The town of Timgad illustrates a rather different case. The open space map (Fig 4:28) shows that there is more convex irregularity in the size and shape of open spaces than is the norm. In addition to the main routes into the town, there are additional entry points along the northern boundary. Suburban development is widespread around the gridded area, with some areas adhering to and others deviating from the lines of the main urban grid. Finally although the grid is everywhere clearly implied, in several areas blocks have been amalgamated to give space in which to accommodate much larger buildings within the heart of the town.

In the town of Timgad the principal through street is the decumanus and the cardo is end-stopped against the forum in the geometric centre of the grid (Fig 4:29). A through-route bypasses the heart of the town to the west and another route rear the eastern perimeter leads directly to a large bath house. The end-stopping of the cardo is an identical arrangement to that found in Londiniumn except that it

\(^1\) the same integration value is shared by 9 of the remaining 11 spaces.
Fig 4:29 - axial map of Timgad

Fig 4:30 - integration in Timgad
approaches from the north in Timgad and from the south in Londinium\(^1\). The town is a square grid, with 12 streets (but 13 blocks) running north-south and 13 east-west streets.

In Timgad, the *decumanus* and all but one (blocked by the baths) of the east-west streets in the grid to the south are equal and best-integrated (Fig 4:30), sharing the same value with an internal street running west of the forum and theatre and forming a 20% integration core\(^2\). The pattern of segregation (Fig 4:31) in the system includes the *cardo* and its neighbouring streets, and is entirely brought about by the 'holes' created in the network of streets by the forum, the theatre and the baths. The mean RRA for Timgad is 0.4262, the connectivity is 7.9412 and the relative intelligibility is 0.1811. The rank ordered RRA transformation, (Fig 4:32) in complete contrast to the remainder of cases\(^3\), shows a bias towards segregation, which is compensated for by the set of very strong best-integrated lines. The curve almost falls into two slopes, above and below the mean integration.

The result for Timgad suggests that real Roman towns may differ quite markedly in the way in which public buildings disrupt the grid, whilst appearing to preserve geometric identity. In particular the distribution of segregation in Timgad is notable for introducing a centralised radial pattern around a central, large-scale blockage in the system. This is in complete contrast to the cases examined so far, where segregation is largely preserved in a relatively flat central portion of the s-curve. Some light may be shed on this by looking at the design of military encampments, which provide an alternative model to the 'Vitruvian' plan for the design of towns. Fig 4:33 illustrates a Roman military encampment as described by Polybius and Fig 4:34 translates this

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\(^1\) and in London there is only one route from the south, over the bridge.

\(^2\) though in this instance the term 'core' is something of a misnomer since it is not a continuous system of streets.

\(^3\) where bias is either towards numerically emphasising the best-integrated lines in a long 'going' or in placing the emphasis on a relatively flat central portion of the s-curve.
Fig 4.31 - segregation in Timgad

Fig 4.32 - the rank order of RRA in Timgad
Fig 4.33 - a Roman camp according to Polybius

Fig 4.34 - axial map of a Roman camp
Fig 4:35 - integration segregation in a Roman camp.

Fig 4:36 - the rank order of RRA in a Roman camp.
into an axial map. According to Carter\textsuperscript{1} the main difference in towns
generated from a military base is that they have two dominant street
lines, the \textit{via principalis} and the \textit{via quintana}, each leading to gates
in the defensive walls. Carter suggests that these twin axes run north-
south, but Rykwert\textsuperscript{2} disagrees, arguing that the commanding officer
set out the encampment by planting his \textit{vexillum} on the site of his
encampment, placing the \textit{groma} at other end and thus setting up the
\textit{cardo} either on the north-south axis or, in where attack was iminent,
faceing the enemy. This would imply that the two principal \textit{via} were
orientated east-west. Polybius' diagram shows only four gates, and the
naming of those at either end of the \textit{via principalis} as \textit{sinister} and
\textit{dextra} (left and right) suggests that the entire camp was set up facing
south with respect to the \textit{praetorium}, or commanding officer's
headquarters.

The three equally most integrated lines in Polybius' plan are the \textit{via
principalis}/\textit{decumanus}, the \textit{via quintana} and the northern boundary
of the encampment. The secondary north-south routes, 6,7,10,11 are
next to enter the core, followed by the two lines to the rear of the
commander's headquarters. The \textit{cardo} and adjacent routes leading up
to the headquarters share equal value, followed by the most
segregated line of all, that leading out of the camp through the \textit{porta
decumana}\textsuperscript{3} to the north from the rear of the commander's position
(Fig 4:35). This space structure makes complete sense in terms of
military strategy, making it maximally difficult to penetrate from the
enemy position, although it is not at all obvious that this should be the
case when the visual order apparent in the camp is stressed. At the
same time it introduces a radial element into the space structure, and

\begin{flushleft}
\textsuperscript{1} Carter, op.cit. p 31.
\textsuperscript{2} Rykwert op cit p. This agrees with the orientation and planning of one of the
only clear military encampments to survive almost in its entirety, the camp of
Lambaesis in Africa. The headquarters here faces south, with the \textit{cardo} end-
stopped by the main entrance, and a considably widened \textit{decumanus}; \textit{via
principalis} clearly takes priority over the alternative east-west route.
\textsuperscript{3} the root \textit{decuman} simply means large or powerful, and does not in itself
specify orientation, so it is unremarkable that the main gate to the rear of a
military encampment should be given this name although it is not on the east-
west axis.
\end{flushleft}
brings about a greater emphasis on segregation in the ranked RRA transformation (Fig 4:36).

Returning to Timgad, it is clear that the relative segregation of the cardo in this case is brought about by placing the forum and theatre in a position identical to that of the headquarters in a military encampment. The number of cases is too small to be conclusive, but for the few examples which have been analysed here the results look suggestive. Diagnosis of the differences between towns with a civilian and those of a military character may conceivably be aided by a consideration of the apparent differences this brings about in the distribution and pattern of segregation between civilian and military examples. Civilian towns, integrated by the cardines or the decumani, with major buildings at periphery and a pattern of segregation which confirms the orthogonal grid, appear to have a different structure to military towns. In towns of a military type, the cardo is segregated and buildings are central and end-stop the cardo, while the area behind is also segregated because of the axial blockage created in the system, leading to a radial pattern of segregation which counterposes the apparent orthogonality of the plan. This may not be an effect which arises only from some deep-rooted symbolic consideration, like a specification that important buildings should end-stop important axes to emphasise their monumental significance, but also from the practical effects this spatial gesture has on working structure of space: that the layout becomes more difficult to penetrate and overrun by an external enemy.

Interpreting the Roman Grid of London.

Public discussion of the impact of the Roman grid on the evolution of the City of London has, up to now, been completely dominated by the

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1 Florence and Turin are known to have been civilian settlements, Verbonia was designed to illustrate an 'ideal' civilian town plan. Trier was a provincial capital and seat of government and Timgad is known to have been a military colony planted to protect important routes.
search for some form of order amongst the disparate fragments of the grid which can be identified today. The method has been to piece the jigsaw together to see if the lines of streets, lengths of roads, proportions and angles of hypothetical urban blocks and the position of major buildings can offer some clue to the reconstruction of a visually recognisable pattern of streets. The main 'research tool' is to compare the layout of London with the visual characteristics of other Roman grids. The expectation is that it will be thus possible to infer military or civilian influences by showing the similarity of London to other Roman coloniae of known historical origin. It is this kind of detective work which permits the speculative reconstructions of the Sorrells, but these are impressionistic sketches which, as they stand, cannot form the basis for configurational analysis.

This analysis is forced to concede at the outset that we may never know about the nature and extent of the visual order which was present in the Roman plan of London, but that it is possible to initiate an investigation of structure, which, though imperfect, seems robust. The investigation of structure seeks for tendencies where order demands perfection. In what follows, it is proposed to offer a description of the partial plans which it has been possible to reconstruct through excavation, to propose a 'most ordered' layout as a benchmark for comparison and to experiment with the fragments which remain to see how these may have played a structuring role in Roman London, and in its subsequent morphological development.

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1 a particularly clear example of this is given in Marsden P, *Roman London*, op cit p 47, where he discusses at some length the implications of the Roman planning module of the actus in deducing the positions of urban blocks in various parts of the city.

2 confirmed in conversation with John Schofield of the Museum of London's Department of Urban Archaeology.

3 small errors in the connectivity matrix normally have a negligible effect on the analysis of a spatial pattern since it is a statistical account which is being rendered, though large discrepancies in the connectivity matrix of a net can produce a dramatic difference in the results.
Returning, therefore, to the two reconstructions of Roman London (Figs 4.01, 4.02), it is proposed to use modelling and comparison with real cases to begin to speculate about the two principal questions which lie at the heart of this chapter: the first on the origin of the town as either a civilian or a military foundation; the second on the consequences for the relationship between history and morphology of the decision to lay out the early settlement in this way.

So far as the question of the origin and attribution of the plan of early Roman London is concerned, the east-west orientation of the grid which so concerned London local historians is, it seems, to be encountered in real cases with both a civilian and a military origin, if the term 'orientation' is taken to mean practical experiential emphasis. The military encampment model arrives at this by blocking the cardo with the headquarters building and emphasising the via principalis (and the remaining internal streets, particularly the via quintana) onto which this fronts. For civilian settlements, the syntactic emphasis through integration depends on whether the mode of growth: whether the growing colonia preserves a square pattern, or develops a preference in one dimension by adding only to the cardines or to the decumani. Adding cardines results in decumani integration and vice versa so visual emphasis is confirmed syntactically. London is not, after all, unusual in this respect.

However, the way in which the east-west orientation is expressed, by end-stopping the cardo on the face of the forum and placing two parallel streets between this building complex and the river, points to military influences on the early plan of Roman London even if it does not confirm that London grew out of a military encampment. Both representations agree about this feature. Having said this, the visual similarities of the axial maps locally in the area around the forum, marked a, and the northern fort, marked b, seem striking.

It is not sensible to analyse Figs 4.01 and 4.02 in their entirety when considering the morphology of London before 100 AD since most of the 'weighting' in the map of what remains is in the area around the
Fig 4:37 - early Roman London, interpretation based on Fig 4:01

Fig 4:38 - early Roman London, interpretation based on Fig 4:02
fort, which was not constructed until early in the following century. In both representations of the built-up area in the initial period of growth, shown here axially and numbered from the most integrated to the most segregated line, (Figs 4:37, 4:38) the east-west line of Lombard Street/Fenchurch Street is the most integrated space. In both versions, the most segregated spaces of all are the routes radiating from the square of streets which enclose the forum.

However, in the first interpretation, the main route to the north is a very well-integrated space (joint second in the rank order after Lombard Street/Fenchurch Street) while the street to the rear of the forum is segregated, whereas in the more recent interpretation, incoming routes in four all directions are segregated. In terms of a relation between order and structure, the more recent interpretation, with its intergated orthogonal elements and its segregated radial elements, seems to contain a 'seed' of the orthogonal/radial duality noted earlier in Timgad, and certainly tips the balance in favour of symmetrical order concepts as a prime generator of the early layout.1

Returning to the mature Roman city of Figs 4:01 and 4:02, an analysis just of the connected parts of the remains (that is, excluding parts of streets which are isolated and therefore form separate subsystems) (Figs 4:39, 4:40) shows that in both interpretations the Newgate Street/Cheapside line is most integrating2, followed in the axial interpretation of Fig 4:01 by the street leading up to the fort along the line of modern Wood Street and then by Lombard Street/Fenchurch Street, and in the interpretation of Fig 4:02 by Lombard Street/Fenchurch Street and then by the street leading to the fort. The shape of the core is constant: the order of integration is different. The bias is to the west in Fig 4:01 and to the east in Fig 4:02. Since it is known that the Roman settlement straggled along the high ground along the entire east-west axis, the second and more

1 though it has to be said that with so few spaces to analyse and such a large room for interpretation, this speculation is rather self-indulgent!
2 10% integration cores and segregation above the mean are shown in both cases
Fig 4:39 - integration/segregation in the partial reconstruction of London based on Fig 4:01

Fig 4:40 - integration/segregation in the partial reconstruction of London based on Fig 4:02
recent interpretation seems to give a reading which is supported by the general picture given by the excavations. This initial bias in integration is supported in both cases by the remainder of the analysis.

The importance of the Wood Street line is an artefact of its being the main access to the large, segregated clump of streets in the area around the fort. This may not be totally out of line with the situation which actually obtained on the ground. The free-floating street to the east of the fort suggests that some filling out of the grid in this region must have taken place. It is unlikely that any significant building took place in the headwaters of the Walbrook, so the archaeological picture of the north-west quarter as we have it today may be more or less complete in skeleton form. The evidence suggests that this part of the city was relatively segregated from its inception.

Both reconstructions agree that the line taken by modern day Cannon Street to Ludgate in the west was segregated. Fig 4:01 shows a hint of a street grid in this area, known to be the location of a public baths. The Sorrells deals with this area in their reconstructions by showing four sparsely developed blocks between Cheapside and Cannon Street in the area west of the Walbrook. The last of these was bounded by a known north-south street running on the high ground west of the Walbrook. This street is the next to enter the core in both reconstructions, just at the point where the Cannon Street line swings southwards down the contours of the valley to cross the Walbrook and align itself with the eastern extension of the road below the forum.

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1 since the most recent volumes on Roman London have been published the position of the amphitheatre, the only important building of Roman London whose location was a complete mystery, has been identified in the vicinity of the Guildhall. This would have acted as another large blockage in the street grid in the north-west quarter of the Roman city, probably contributing to its relative segregation.

2 the Sorrells' reconstructions show a few partially completed insulae, but not a complete street system in this sector.

3 at Huggin Hill

4 modern Lombard Street/Fenchurch Street, which appears to have corresponded to the via quintana of a military encampment.
The relative segregation of the Cannon Street line is not likely to have been decreased by filling out the grid in this area.

The remaining integration above the mean is concentrated in the west of the city around the fort in the axial map Fig 4:39 which is based on Fig 4:01. All the streets in the east, the area of the forum, are above mean segregation. However, the north-south roads passing either side of the forum are actually the next to be integrated in the alternative axial representation Fig 4:40 which is based on Fig 4:02, with the remaining integration above the mean filling in the grid of streets close to the main east-west core line. It is at this point that the discrepancies in interpreting archeological remains which were discussed earlier in the chapter have a major impact on morphological analysis.

Looking at the distribution of artifact remains, the location of important buildings and the Sorrells’ interpretations of Roman London, occupation of the north-east sector seems to have been concentrated in the area immediately to the north of the forum and to the west of the main route out to Aldgate. This sector would most likely have been relatively segregated from its foundation, particularly according to the account given by Fig 4:40.

Archeological evidence suggests that the main occupation area of Roman London seems to have been east of the Walbrook and south of the forum. The governor’s palace took up the area east of the Walbrook between the Cannon Street line and the river. In the area immediately to the north, it is known from the excavation of the insula bounded by Bow Lane, Cannon Street, Cheapside and the Walbrook that a typical residential block in the heart of Roman London was subdivided into long narrow house plots running east west, each building being separated from its neighbours by narrow streets. Sorrel shows this type of dense development for almost the

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1 on the basis of computer simulation, described later in the chapter.
Fig 4.41 - the rank order of RRA in Fig 4.39

Fig 4.42 - the rank order of RRA in Fig 4.40
whole of the south-east quarter, centered on the northerly approach over the bridge but petering out where the remains of the Lombard Street/Fenchurch Street main road stop. Few archeological remains have been found east of this line in the vicinity of the Tower, other than an early cemetry site. Everything points to this sector as having been well-integrated, in line with the interpretation shown in Fig 4.40.

It is unlikely that this account gives an accurate picture of the structure of Roman London. The material is too partial and sketchy to hope this might be the case, but what it does suggest is that integration graded away stepwise from the straggling east-west line of the extended decumanus (London seems in this liminted sense possibly to have been a 'one-street town') and that the four quarters of the city were morphologically differentiated one from another, a feature atypical of the generality of Roman towns and one which is later to emerge as a major structuring feature of the City of London. The analysis of the partial reconstructions of Roman London suggest that these tendencies were already present in embryonic form in Roman London.

A second feature of the partial reconstructions which differentiates London from the generality of Roman coloniae is the amount of variety to be found in the integration of those streets which remain. The rank ordered RRA transformations show not a series of broad steps which hitherto have been associated with Roman grids, but a smooth s-curve (Figs 4.41,4.42). This seems a 'real' property of Roman London and not an artefact of partial mapping. In neither case is there a sign of the numerical bias towards segregation encoutered in the transformation for military coloniae. Both versions are also characterised by a high mean RRA, 1.0769 and 1.2379 respectively,

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1 as mentioned earlier, burial took place outside areas of habitation, which would also point ot this area as one which may have been sparsely populated.

2 the property is retained when the grid is filled out in a later experimental modelling, and since it is the principal roads in the grid which are deformed from the orthogonal, it follows logically that this would be the case.
low connectivity, 2.8462 in both cases, and a low, but positive, relative intelligibility, 0.1107 and 0.0491 respectively. These results are a product of the partial mapping, and it might be expected that the complete grid would have shown an improvement in all these variables.

A feature of the analysis which has already been pointed out is the importance of the Newgate Street/Cheapside line as the main integrator of the city. This is a permanent feature throughout the subsequent evolution of the City, and it seems that the early planning decisions taken at the foundation of the city, namely: the east-west orientation of the plan; that of restricting the regular grid to the area immediately around the bridgehead; breaking the line of the two main east-west streets, particularly the lines of Cannon Street and Aldgate, set such a strong stamp upon the physionomy of the City that despite the numerous alterations which occurred to the network of streets in the ensuing centuries the general shape of the grid was more or less indestructible.

This is no less true of the distribution of relative segregation. The initial 'seed' of a compressed, relatively orthogonal core with a dominant east-west emphasis, surrounded by a large 'rim' of relative segregation seems to have been present from the outset, and to have set the city on a spatial trajectory from which innumerable small changes in alignment and even relatively major modifications could not easily deflect it.

A series of experiments in 'overdrawing' the partial Roman remains give some idea of the strength of the tendencies revealed through analysis. The 'overdrawings' were conceived of as depositing over the initial structure, a random pile of lines of more or less equal size.

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1 which would automatically produce decuman i integration in a regular grid.
2 a feature again confirmed by modelling, reported below.
3 about 15 were carried out altogether, but not all the results were printed.
4 Fig 2 was used as the basis for experimentation.
Fig 4:43 - short random overdrawing of the grid of Roman London

Fig 4:44 - long random line overdrawing of the grid of Roman London
firstly, in order to investigate the strength of the structure of the grid and secondly, to see if it could be completely destroyed. Random 'overdrawings' confirmed the strength of the 'real' Newgate Street/Cheapside and Lombard Street/Fenchurch Street lines. These came out time and time again as the two best-integrated streets, particularly where the effect the loss of axial continuity at the headwaters of the Walbrook stream is taken into account (Fig. 4:43).

However, long random lines with similar characteristics to 'real' integrators tended to drive the 'real' lines out of the remainder of the core. In Fig.4:44 random line 3 replaces the Wood Street line up to the fort (just detectable amongst the segregated clump of lines in this sector) and random line 4 replaces the street west of the Walbrook, just detectable in the middle range of values, while random line 5 duplicates many of the characteristics of the Fenchurch Street/Lombard Street line. The segregated characteristics of the reconstructed partial plan are also largely confirmed by 'overdrawing'. In the example shown, only the western end of the Cannon Street line benefits, and this result is also typical of the experiment as a whole.

To test the structure to destruction, it was necessary to overlay a series of long random lines east-west (Fig 4:45) right across the system. These then became the principal integrators. Long north-south random lines (Fig 4:46) did not produce this result and the 'real' integrators survived. These long lines, of course, duplicate the integration-segregation structure of the cardo-decumanus effects which were remarked upon earlier in the chapter when the set of Roman street plans was examined, and which were found to result from the geometrical shape of the grid and its resultant loadings.

This suggests that there may be a more fundamental definition of Biddle's concept of the 'passive conservation of morphological principles' through morphological permanences, i.e., individual physical objects of a large mass like walls, gateways, and monumental buildings, which guide and constrain the subsequent development of the street grid. The very grid itself may constitute an accumulation of
Fig 4:45 - east-west bias in overdrawing
Fig 4:46 - north-south bias in overdrawing
Fig 4:47 - a regular orthogonal overlay on the outline of the City
strong morphological events which, taken together, produce a globally strong structure which is highly inertial and difficult to erase or destroy by local changes. In this limited sense, historical events are perhaps less significant than we have hitherto acknowledged. The historical continuity of particular streets lined by building facades may be morphologically speaking, contingent rather than necessary to our understanding of the growth of towns\(^1\), since the contribution of an infinite number of differently located but similarly connected streets could have produced an identical street system\(^2\).

In order to provide some independent check on what is, after all, a rather large claim raised upon relatively insubstantial data, two experimental models of Roman London were investigated, and compared with the partial reconstructions which have prompted this proposition. The first extrapolates the layout of Roman London to an extreme form of order, to provide a benchmark similar to the perfect grids looked at earlier in the chapter. The second attempts to work forward from the partial remains by completing the grid along the lines suggested by the archeological evidence, to produce a robust and relatively complete hypothetical reconstruction which avoids the difficulties created for analysis of working with partially reconstituted plans.

The first version (Fig 4:47) takes the shape provided by the 'real' city gates, walls and river front as the defining boundary for a regular orthogonal grid, which is laid across the site without reference to topography but which uses those parts of the Roman streets system which remain as a 'first fix' for unfolding the grid. The basic island

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\(^1\) though historically speaking, it is of great interest to trace these continuities, and it is perhaps of even greater psychological value to feel some that the view of earth and sky is identical to that experienced by humankind from time immemorial.

\(^2\) the feature noted earlier about large equivalence classes of grids with identical structures but different shape characteristics and even differing degrees of order.
block size is based on the *actus*\(^1\). Buildings such as the forum, the palace and the fort are inserted into the locations they occupy in the 'real' grid of Roman London. The aim of this reconstruction is to transform the 'imperfect' grid which was Roman London into a more 'perfect', axially ordered form which is compatible with the set of Roman plans looked at earlier in the chapter. The result is rather like Trier\(^2\) in shape and outline, but mirrored, and rotated by 90 degrees with reference to the compass.

The result is, of course, nothing like Roman London, but it is the first of many representations in this thesis of 'London as it might have been'\(^3\). In fact, the degree of agreement between the 'ideal' and the 'real' forms is rather striking. The lines of Fenchurch Street/Lombard Street and Cannon Street fit the ideal grid precisely, but both the *forum* and the fort are larger in the 'ideal' case than the reconstruction from partial remains. The positions of Newgate and Ludgate strike grid lines exactly; those of Bishopsgate and Aldgate are slightly misaligned with respect to the ideal grid, particularly in the case of Aldgate which is located exactly on the corner of a grid square. The governor's palace is inserted in the ideal grid in its known location close to the river, thus amalgamating two neighbouring blocks. The precision with which the 'ideal' grid pinpoints the location of key physical objects raises the speculation that the gateways\(^4\) were initially set out by military surveyors, but that their influence was short lived and did not extend into the post-Boudican reconstructions.

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\(^1\) 35.5 m., the common land division used in planning Roman street grids in the *colonise*. Marsden, op.cit. argues that the size of grid used in London was a 35 *actus* module, so it this this module which has been used to cover the site.

\(^2\) and in this case the overall plan is 6 blocks by 13, whereas in Trier is was 11 x 7.

\(^3\) it is strikingly like the Hooke plan for the reconstruction of London after the Great Fire of 1666 which was discussed in Chapter Three.

\(^4\) though not of course the actual gates.
Fig 4.48 - integration/segregation in the ideal plan of Roman London.

Fig 4.49 - the rank order of RRA in the ideal plan.
The analysis of this 'ideal' plan (Fig 4:48) shows the two streets between the forum and the river as equal and best integrated\footnote{these correspond exactly to the two main east-west routes of Fenchurch Street/Lombard Street and Cannon Street in the restricted area south of the forum.}. Next to enter the core is the street to the north of the forum, followed by a homogenised U-shaped grid of 7 streets round the north of the forum and crossing the Walbrook to take in the long north-south streets on the western bank. The last line above mean integration is that leading down to the governor's palace. The radial pattern of segregation noted in towns with a military origin holds for this 'idealised' plan of London, despite its visual similarity to Trier (where this is not the case). The river front is segregated, as are the streets in the west of the city, the northern boundary, and the north-south streets close to the eastern boundary.

That this is the outcome in the 'idealised' highly regular layout suggests that the shape of the Roman walls, which make a ragged edge to the city\footnote{like that at Trier and Turin, where a similar 'segregation effect' also resulted.} and so prevent the completion of the grid around the perimeter, have a profound influence at the level of 'morphological tendencies' discussed earlier. Again though, the tendency is one which applies to the entire street system, and not just in dictating the point of aim of individual streets towards the gates. Seen this way, the compressed core and rim of segregation identified in Roman London, a feature which persisted throughout the historical evolution of the City and remains today in the modern plan, may indeed be a product of the early planning decisions taken almost 2000 years ago.

Mean RRA is slightly higher than is usual for Roman grids 0.4104 although the mean connectivity of 7.00 is what would be expected for Roman grids. Relative intelligibility is 0.868. The rank ordered RRA transformation (Fig 4:49) shows a typical pattern for Roman grids, with individuated ends and a flat, homogenised central portion corresponding to the homogenised grid of streets around the forum. The steep rise in the curve, particularly at the segregated end of the
Fig 4:50 - node map of the ideal plan of Roman London showing integration/segregation

Fig 4:51 - the rank order of RRA in the node map
range, places it in a gradient which is comparable to the class of real military-style settlements.

The 'node map'\(^1\) (Fig 4:50) shows a highly centralised group of nodes in the precise geographical area of the Walbrook. In the degenerate anti-axial extreme of the 'ideal' grid from order, the natural centre of gravity turns out to be the one place where building is impossible. The degree of axial continuity of the 'real' Newgate Street/Cheapside line is, it seems, a vital ingredient in making this route a communications artery which holds the structure of the Roman City together. Integration then radiates outwards in a 'deformed' version of pattern noted earlier in the regular cases examined in Chapter Two, but with imbalances in the stepped and ordered geometric pattern produced in regular systems which are brought about by the 'holes' created in the net by major buildings. In the rank ordered RRA (Fig 4:51) steps in integration no longer rise in graded proportions as in the comparable output for a square grid but describe a smoothly inclined slope. If axial continuity across adjacent nodes emphasises and individuates strong core lines within the grid, axial discontinuities also bring about enhanced individuation between streets in an irregular net with holes. These two contradictory 'pulls' on the shape of axial grids show how deforming the grid axially brings about the range of structured differences which can be observed in real examples of town plans.

The second version, which extrapolates from what is known, is shown in (Fig 4:52). It differs from the 'ideal' version in having fewer north-south blocks. The Walbrook in particular affords a serious disruption in the continuity of the grid, and close to the centre the grid is only two blocks wide\(^2\). Even where streets traverse the city, they tend to

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\(^1\) showing 10% integration and 50% segregation

\(^2\) apart from the difficulty already noted, of building in the north of the city where the headwaters made the ground boggy, there was at the time fully a 10.0m drop in level down the slope from ridge to stream level making a continuous building line impossible and straight roads particularly difficult to negotiate.
Fig 4:52 - an extrapolation from the known grid of Roman London.

Fig 4:53. - integration/segregation in the extrapolation of the grid of Roman London.
be axially chicained. In particular, north-south streets do not form crossroads outside the immediate area of the *forum*.

As expected, the Newgate Street/Cheapside line and the Fenchurch Street/Lombard Street line appear as best integrated lines in the integration core (Fig 4.53) with priority given to the eastern sector of the city. The remainder of the 10% core marks the divide between the east and west sectors of the city at the Walbrook. These two short lines link the governor's palace, the site of the amphitheatre and the rear of the *forum/basilica* complex. The main contrast with the 'ideal' orthogonal grid is to be found here. The T-shape of long, strong grid lines which knit the northern and western quarters of the 'idealised' orthogonal layout into the integration core have shrunk in the 'reconstruction' to this tiny T-shaped relic.

The next group to be integrated are the streets in the eastern sector of the city in the orthogonal grid around the forum, duplicating the morphological outcome of the 'ideal' plan. Segregation is confined to the area around the fort, to the western part of Cannon Street and the roads leading down to the river in the west, to the north-east routes out of the city and to the eastern river frontage and the *cardo*. Given the dramatic drop in order compared with the 'ideal' version the effect on structure is far less than might have been anticipated. From the point of view of structure the 'ideal' and the real cases have a remarkable degree of agreement, and both are broadly in line with the results of the 'partial reconstruction'.

The rank ordered RRA transformation is individuated, and takes a form close to an s-curve (Fig 4.54) which is associated with well-structured towns. The mean RRA of 1.65 suggests that the relatively

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1 although the system loses visual order as a result, it does gain in other ways. Axially speaking, only one precise connectivity can satisfy the requirement to maintain axial continuity across the Newgate Street/Cheapside line. Once connectivity is released from this constraint, streets can follow local constraints and the results of axial analysis hold for many more putative street lines.

2 as occurred in the random line experiments.
Fig 4.54 - the rank order of RRA for Fig 4.52
Fig 4.55 - a node map of Fig 4.52 with integration/segregation shown
Fig 4.56 - the rank order of RRA for Fig 4.55
high value for the partial reconstruction of Roman London noted earlier does indeed identify a clear difference between this and other Roman towns.

Transforming this version of Roman London to a 'node map' (Fig 4:55) shows how this version of the City falls into two square node-areas joined by relatively compact core containing few nodes, which consequently integrate the system. Integration spreads away from this central area in a stepwise manner first encircling the palace, the fora and the amphitheatre and then grading out towards the perimeter as in radial and orthogonal node graphs examined earlier, with segregation clumped in three distinct areas corresponding to the Roman fort, and the areas which were later to be occupied by Blackfriars and the Tower. This is an exaggerated version of the pattern produced by the 'ideal' node-map. The ranked RRA transformation (Fig 4:56) again has a smoothly inclined slope as opposed to an s-curve, indicating that the ironing out of the differentiated extremes of integration and segregation which are indicative of well-structured urban grids may be the general relationship which holds between rank ordered integration in 'node map' and 'axial map' representations of the same street grid.

Empirical Findings and Theoretical Speculations.

This chapter was originally prompted by a puzzle in the archeological record of Roman London. It set out to address two questions: the one on the origin of the Roman plan and its attribution to either military or civilian town planning practices; the other on the impact which the Roman plan had on the evolution of the street grid of the City. The first could not be answered without some exploration of the characteristics of Roman plans. The second could not be tackled without modelling the syntactic properties of the fragmentary remains revealed by archeological investigation and comparing these to hypothetical reconstructions which describe the street system of the Roman City in its entirety. Neither could be interpreted without the
benchmark provided by Chapter Two, which gave an understanding of how the structural properties of regular orthogonal and radial grids change with size and under deformation, and how these regular forms may be related to the deformed grids found in reality.

On the way to answering these questions, empirical findings have emerged which seem to have a general as well as a specific importance. It has become clear, for example, that Roman planned towns are very much individuals at the level of the structure of the street grid, though this is often disguised by the degree of homogeneity they share at the level of appearances. The grid pattern is so immediate and striking that there seems little more to be said, other than to discuss examples in terms of resemblance to a stereotype, where deviations are taken as evidence of degeneration from order rather than as a demonstration of individuality.

The findings here, though based on a limited body of data, do suggest that there is more to be said. Roman planned towns are more like individuals sharing a ‘family likeness’ rather than ‘clones’. Moreover, two basic types of Roman grid have emerged at the level of the syntactic structure which results from configuration. The first is one in which the layout of the street grid and the positioning of public buildings are such as to reinforce through syntactic structure the apparent orthogonal order of the plan. This type of plan has well-integrated spatial structure based, perhaps rather arbitrarily, on the *decumanus* or the *cardo* depending on the direction of expansion of the town, with segregation largely confined to the shorter streets at the perimeter. In the second case order and structure tell contradictory stories. Order stresses the geometric centrality of the plan, while structure denies it through a striking radial pattern of segregation pointing to the geometric heart of the town, which is brought about by a major rupturing of the street grid by major public buildings. The first seems typical of civilian *coloniae*; the second of military foundations. Syntactic analysis, it seems, may prove a useful tool to diagnose differences in the ways in which samples of town
plans are structured, particularly in difficult cases where the visual characteristics give few clues and historical accounts are vague.

Looked at in this light, Roman London does seem to bear the hallmark of military town planning, at least in its initial stages of occupation before the Boudican fire. However, the influence is slight, and in its subsequent period of expansion early in the first century AD the street pattern seems to have been dominated by the practical concerns of maintaining access and circulation in the teeth of what must have been very difficult site conditions.

So far as the second question; that of the continuity of the street pattern is concerned, the answer is given here in an unfamiliar form. ‘Continuity’ is normally taken to mean historical continuity, in that the positions of particular real streets and the buildings that line them are known to have been the same throughout their history. The thesis here is that another kind of continuity may be just as significant a feature in conserving the physical fabric of towns; that of morphological continuity. Morphological continuity does not depend on the fixing of particular street lines for all time, but on individual streets maintaining a broadly similar relationship to the grid as a whole, and thus continuing to play the same role in structuring space. This is a more permissive concept of continuity that that which is normally adopted by historians and archeologists, since it admits that an incomplete knowledge of historical circumstance, particularly where plot sizes and building lines change over time in ways which can never be reconstructed, does not rule out informed speculation about the historical structure and functioning of a town and the part that individual streets may have played in it.

A second point to emerge from this study is the difference which seems to hold between Biddle’s concept of the ‘passive’ conservation of physical features and a syntactic concept of a more ‘active’ form of conservation of the structural principles of the global morphology. The very grid itself is a large accumulation of syntactic events which has a
greater or lesser inertia depending on the form it takes. A perfect grid is unstable, and requires only one non-conforming act to subvert or destroy its previous logic. A deformed grid is more robust, and can accommodate a considerable measure of minor, local change without there being a significant effect on structure.

In the case of London, it is argued that the characteristic features of a compressed core and segregated rim centred on the Newgate Street/Cheapside line take this second form. Passive features like the city walls and gates also seem to have consequences for the overall structure of the grid, and not just for those streets which lie on the main routes into the city as has hitherto been thought. Moreover, the differentiation of the city into four distinct and syntactically different quarters during this period seems to have set the 'infant' town on a spatial trajectory which will be developed in later chapters as a major factor which shaped the City of London.

Properly speaking, historical circumstances and morphological constraints should be seen separately, and their importance should not be confused. We shall probably never be able to 'explain' why the grid of London deviated from orthogonality, particularly in the west. That it did so, and thus constructed a deformed urban grid with well-formed global properties which remained stable under transformation, has a logical 'explanation' as well as an historical one. Roman London provides us with an illustration of Hillier's general proposition\(^1\) that it is necessary to know the laws and the consequences of what is logically constructable, as well as the particular circumstances and events which motivate the act of building.

One possibility for urban archeology to consider, is that morphological precision is needed in only two areas: firstly, in correctly identifying

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street intersections in order establish whether streets construct a
crossroads or a T-junction and thus to derive an accurate local picture
of connectivity and forms the basis of a 'node map'; and secondly, to
establish the relationship between this first order local picture of
connectivities and the more parsimonious and more highly ordered
'axial map', which is the basis of the connectivity matrix. This takes
account of the set of connections which are made by each individual
line and hence provides a global picture of the street system on which
syntactic analysis is founded.

However, this suggestion has theoretical as well as empirical
implications, for it raises a question as to the relationships which
might hold between three kinds of object: real and idealised grids,
their spatial attributes and properties, and the methods used to
represent and measure them. To approach this question some
clarification of order and structure as principles for understanding
spatial configurations visually and experientially, and the radial and
orthogonal tendencies as opposing forces in building different kinds of
order/structure relationship are required.

At the heart of this syntactic investigation lie two representations of
the same physical reality (including any orthogonal grid or pile of
random lines): the 'axial map' and the 'node map'. These capture
different structure/order aspects of that physical reality. A 'node map'
is a least ordered version of any physical reality, in the sense that it
requires nothing more than that a connection be recorded at each
intersection in the network of streets. The representation is blind to
orthogonality. It does not require any knowledge of the alignment of
streets above the level of the individual island blocks. It is a 'true'
representation of local connectivity, but in nearly all cases it is not a
'true' representation of the street network. Rather it is a degenerate
version which takes no account of the degree of visual order present
in the grid.
An axial map is the most ordered version of the same physical reality. To the extent that a street continues on the same trajectory across intersections it requires several or many island blocks to fall into alignment. The extreme form of this is the regular orthogonal grid where the location of every island is pre-ordained according to proportional system governing the size and shape of streets and urban blocks. Again, most real examples are not orthogonal grids, but individual streets do maintain the property of obeying a greater or lesser axial alignment, depending on the 'rules' by which the town was generated. It is this higher order alignment which is recorded in the connectivity matrix.

Node maps and axial maps give a 'least' and 'most' recording of the order present in any plan. The axial map is an accurate recording and a node map is an abstraction from it, a degenerate, minimal version of the same basic network. Both maps also record structure properties. Axial maps show the syntactic structure of the grid, and give the most global picture of the street system. In most real cases, analysis yields a core of well-integrated streets.

Node maps have degenerate structure which always takes a radial form, working from the centre of the net to the perimeter in a stepwise manner. The least-order is related to an organising centre/periphery distinction which gives a hierarchical syntactic structure from the most integrated core at the heart of the node map to the segregated edge. In regular systems the pattern of integration is also regular and produces steps in integration value. In deformed nets each node in the pattern has a slightly different value which is dependent on the number, shape, size and location of any 'holes' in the node network. The net is structured, but it is a structure made up of innumerable small gradations in value among elements which are almost identical, apart from in terms of proximity to the centre. If the 'least distance' between a node map and an axial map is given by the example of the Milton Keynes grid shown in Chapter Two, then all radial grids minimise the distinction between the two forms.
Orthogonal grids have a degenerate axial structure which is produced by the opposite property: a total homogenisation of the values of all the streets in the system which obliterates geometric distinctions like centre/periphery, though it is perfectly obvious to an observer from above that the regular orthogonal grid is a perfect ordered form and its node map visually is regular. Piles of random lines, considered axially, lack any sense of the visual order which is the hallmark of a perfect grid but paradoxically they seem to possess something like a 'perfect' structure. The structure seems to be brought about by that selfsame centre/periphery distinction which is obliterated at a visual level. The 'fall' of the pile structures lines according to how many each intersects with, in which case well-centred long lines pick up a much greater degree of connectivity than on average while those running orthogonally on the outskirts of the pile encounter relatively few lines and lose connectivity compared with the mean. So here too, integration is well-centred and segregation at the edge.

Real cases seem a product of these logical properties, laws of the field as it were, to balance visual and structural features and radial and orthogonal tendencies. Some deformed street grids, which characterise the vast majority of real towns, have a high degree of visual order like the Roman grids examined here, and are well-structured in a working experiential sense as well. Others appear to have little visual order, but they must have enough to structure space in the interests of axial continuity in at least some parts to prevent a collapse to a simple radial arrangement. The determining feature seems to be that of maintaining access from the perimeter to the working heart of the town, whether this be geometrically located or eccentric, and this seems to have been the intervening variable in the case of Roman London.
Chapter Five: Historical Events and Morphological Constraints: the evolution of the urban grid in the Saxon and Mediaeval City of London.

Introduction: the uncharted millennium.

The period between the departure of the Romans in AD 410 and the production of the first true ground plan by Leake after the Great Fire of 1666 was marked by a prodigious growth and change in the physical morphology of the City. Much of the street plan is thought to have been laid down during the Saxon period, of which little which is tangible is known. Its relationship to the modern plan is held to be one of continuity but, as it was argued in the Problem Definition, it is by no means clear what this might mean in the physical detail of the urban grid as it was then, and is now. Throughout the Middle Ages there was a filling-out of the street grid as London became the fastest-growing city in Europe, but the configurational changes which were thus wrought upon the urban grid are as obscure as are its Saxon origins. This chapter sets out to investigate the interplay of history and morphology during this important, but largely uncharted historical period.

In what follows, it is suggested that during this key period the spatial structure of the City exhibits both morphological, structural continuities - notably, the dominant east-west orientation of the overall structure of the grid, the special significance of the Newgate Street/Cheapside line in unifying the City spatially, the differentiation of the four quarters of the City and the characteristic pattern of peripheral segregation, and significant changes at both a global and a local level in the plan - there is a shift in the focus of the integration core from the east to the west of the City, a strengthening of the focus on Cheapside and about a fan of new streets radiating from the Stocks Market at its eastern end, and a pronounced local shift of the core into the waterfront area in the west of the City.
The geometric properties of the City are likewise transformed. There is an 'absolute' loss of visual order as compared with the Roman grid, so much so that from this point onward the City is cited as an organic City par excellence, resulting from the accumulation of small and insignificant physical gestures which can in no sense be regarded as an expression of the power of a ruling individual or group. The City as recorded in 1666 also displays an orthogonal/radial duality, with the west more rectilinear and the east, which was the locus of regularity in Roman times, apparently more radial and curvilinear. However, it will be suggested that the City appears to be well-structured in relation to its main function, trade.

This raises a more general speculation for the questions of morphological continuity and change which formed part of the Problem Definition, for it is suggested here that the influence of Rome is not dead and (literally) buried, but submerged in the later evolution of the urban grid. It is possible to recall it by transforming the urban grid in a systematic way. Thus, it is possible to pinpoint the logical constraints on the physical, morphological events which bring about change. The 'responsibility' for change thus acquires two 'causes' not one: the first can be ascribed to the 'laws of the field' which, in this case, are laws of spatial combination\(^1\), and the second is to known historical events and social processes. This view implies that spatial transformation is a rational social process which takes advantage of key properties of the urban grid, particularly those which relate to the construction of use and movement patterns.

Thus, for historians to talk about the 'mediaeval city plan' and to present it as entirely different from the Saxon or Roman plans which preceded it or from the Restoration and modern plans which supercede it, is disingenuous. Firstly, the idea that there exists such an entity as 'the mediaeval plan' seems to deny the influence which the past may exert upon the present. Secondly, the term gives an appearance of unity\(^2\) to a phenomenon which entails both historical events and morphological constraints: the historical events providing a

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\(^1\) this concept was introduced and explored in the Problem Definition.

\(^2\) which is both typological and atemporal
particularistic but fragmentary account of how the plan came to acquire its physical form and the morphological constraints providing a logic for the potential unfoldings of an urban layout.

The view is put forward here that the City is a set of historically and morphologically differentiated parts (differentiated morphologically because differentiated historically) - the Saxon town, the Romano-British town, the Tower and Roman fort regions, the areas defined by religious houses, and so on - whose morphological combination makes the City unique. History provides one 'explanation' of this process of growth and change, but the process cannot be fully understood without reference to the 'laws of field' within which historical events are unfolded.

A Historical Digresion.

Any picture of the historical evolution of the City from Saxon to early modern times is necessarily based mainly on documents, but where excavations have located the sites of important buildings and distributions of artefact remains, this is an important aid to interpretation, particularly in allowing some conjecture to be made as to the density of occupation in a particular region of the City at any point in time. This chapter also requires some knowledge of history in order to interpret the structure urban grid as recorded by archeological excavations, drawings, plans and buildings, but the account which is presented below will be restricted to what is necessary to an understanding of the dynamics if space in the Saxon and mediaeval City. Since much of life is said to have taken place in the open air, this will necessarily involve some discussion of the dominant social institutions, and the place of economic, religious and political activity in generating and maintaining a characteristic pattern
Fig 5:01 - Saxon London, showing the artifact distribution in the 7th to 9th centuries and after the ninth century.
of public open space. The period covered is from the departure of the Romans to the eve of the Great Fire of 1666.

Saxon London.

The decline of London was such in the late fourth century AD that it has been suggested that living conditions in the capital were more characteristic of the Saxon and early mediaeval periods than of the Roman heyday. Repeated raiding by Saxon pirates had diminished overseas trade to a trickle. It is difficult to reconstruct what happened to the City in the period after Roman withdrawal in AD 410. The built fabric is presumed gradually to have fallen into a state of decay.

No firm archeological evidence has been discovered to confirm Anglo-Saxon occupation of the City prior to the ninth century AD. A mid-Saxon settlement (Fig 5:01) is known to have existed upstream of the City at the modern day Strand, between Whitehall and the Fleet. Saxon occupation debris from the seventh to the ninth centuries is concentrated here, whereas after the ninth century it is nearly all located within the walled City. It is now thought that the Strand settlement is the one to which Bede must have been referring in his description of London as an emporium of many nations coming to it by land and sea. However, the walled city may not have been entirely deserted. Its continued occupation was almost certain after

1 thus giving the supporting evidence for the difficulty which was acknowledged earlier in the Literature Review of Chapter Two in using LUBF type typologies of urban form, which do not regard street space as anything more than a channel of communication between buildings.


3 it is known that the Saxons were suspicious of cities and preferred a dispersed mode of existence in circular walled homesteads.

4 the landing points for which Saxon boats were designed, were gently shelving muddy and sandy shores, and they had no need for the deep water anchorages and quaysides which they found in the City.

the eighth century at least as an enclave for the Church\textsuperscript{1} and as a place of royal residence\textsuperscript{2}. Certainly, the Roman road system which converged upon the City must have guaranteed its role as a regional communications centre.

The Strand settlement, undefended by walls and gates, was sacked by Viking raiders in AD 841, AD 851 and AD 871. This may have resulted in a reoccupation of the Roman site during the reign of King Alfred in AD 866. At the time of reoccupation many Roman buildings would have been standing ruins, and in several locations\textsuperscript{3} the Saxons used Roman streets as a solid foundation. Parts of the Roman street grid were thus obscured and a new minor street grid established. It can be inferred from the curving arcs of the main roads that through-movement was maintained across the City but 'the straight lines and corners of the planned Roman street system seem to have been disregarded as irrelevant'\textsuperscript{4} Moreover, all the early occupation debris comes from the west, and not from the Cornhill region favoured by the Romans,\textsuperscript{5} and it is likely that the early settlers avoided those parts of

\textsuperscript{1} Hereford, Thanet, Rochester and Barking were all bishoprics to be granted lands in the City during the seventh century. The early establishment of St Paul's in the City in AD 604 by Mellitus, a Bishop sent direct from the Pope in Rome, suggests that it was important, but not so vital as to merit an archbishopric.

\textsuperscript{2} remains of a Saxon palace have recently been found at Aldermanbury (the name means the fortified residence of an earldoman or royal official) in an area close to the east gate of the Roman fort which had been favoured as the most probable site for many years. The palace is ascribed by some to King Etherbert of Kent (AD 560-616) and by others to Offa of Mercia (AD 757-796). In late Saxon times the area was a soke which meant that the landowner there had private jurisdiction over his tenants and probably throughout the parish. It is feasible that the internal south and east walls of the Roman fort accommodated some form of royal residence up to the middle of the 11th century when the new palace was built at Westminster. Thereafter, part of area may still have been reserved for a palace official or aderman who could represent the king's interests in the City. When the City government was undertaken by the wards, and the sheriff represented their interests to the king, more extensive premises were built at Guildhall a short distance to the south-east.

\textsuperscript{3} such as Milk Street and Ironmonger Lane

\textsuperscript{4} UAU op cit. p 32.

\textsuperscript{5} Grey goes so far as to argue from the naming of the stream the Walbrook (stream of the British) that when the Saxons began living in the west, the British were still occupying the Roman remains on Cornhill. Grey, R., \textit{A History of London}, Hutchinson, London, 1978.
the City which were renderd unsuitable for building by dense concentrations of ruins.

London thus became one of a number of Alfredian townships or *burghs* ¹ founded by the king principally as strong points in the landscape in order to resist Viking incursions. Most occupied the sites of Roman towns and relatively few were newly-planted for the purpose². In the case of London there is no evidence of systematic replanning on a global scale though the quays were restored, the bridge seems to have been rebuilt and a new intermural road was created. Typically, *burghs* contained the residences of the local earldorman and bishop, houses for reeves and clergy and a grid of little streets for houses. A major function of these newly-constructed and reoccupied towns, over and above their obvious defensive value in acting as a locus from which to resisting Viking raids, was to regularise trading in market-places.³ Most did not really become towns proper, as opposed to market enclosures, until after the Norman conquest. London’s strategic trading position, as in the Roman period, soon outstripped its defensive value and it was trade which fuelled the growth of the town in the late Saxon period⁴.

The Thames was at its furthest north in the late Saxon period and subsequent waterfront developments gradually reclaimed land from the river. Alfred established three pre-conquest harbours at Queenhythe, Dowgate and Billingsgate. Queenhythe served local trade, Dowgate was the landing point for imported goods and Billingsgate

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¹ few early Saxon documents refer to houses as such, but rather to *hagas* and *burgs*. *Hagas* were hedged plots of land. The term seems to have been used for grants of town property to the owners of large rural estates in the shires, where the town property was used as a retail outlet for farm produce. *Burgo* were defensive holdings, in which an overlord was granted land, private jurisdiction over his tenants and the rights to a private chapel in return for military assistance.

² Chichester, Exeter, Rochester and Winchester are examples of the former, and Oxford and Shaftesbury of the latter.


Fig 5.02 - a reconstruction of the early Saxon grid above Queenhythe.
was used by both local and international merchants. Queenhythe and Billingsgate were also public landing stages. The harbours had raised banks on which to beach boats, and trading is thought to have taken place directly from the moored vessels. Although waterfront trading had ceased by the twelfth century, the lines of these Saxon 'beach markets' remained fixed while the banks on either side were encroached by tenement blocks, so their locations are marked in later maps by sharp indentations in the banks.

It is probable that these waterfront activities were directly or indirectly responsible for the growth of a small grid of streets in the west of the City between the Walbrook and the Roman wall as far north as Cheapside (Fig 5:02). According to Schofield, these date from about AD 889-899. He suggests that a similar grid of streets seems to have developed between Fenchurch Street and Thames Street (around the market of Eastcheap which may have been developing above Billingsgate) but few of these streets can be traced back archeologically beyond their first mention in post-Conquest documents. The east and north-east sectors of the City are thought to have revived more slowly than the west and south.

The pattern of city streets which gradually emerged during the Saxon period seems at first sight to bear only an incidental relation to the Roman street pattern, even though the walls and gates were fixed by Roman foundations. There are three places where Rome clearly influenced the City street pattern: in the north-west at the Cripplegate fort, in the location of the late Saxon east and west chepe markets, which follow Roman roads; and in the line of Upper Thames Street, which conforms to the Roman waterfront line.

The Danes offered a constant threat to London throughout the ensuing century. It is during the Alfredian reoccupation that it is presumed

1 Hobley B., op cit, p 19.
Fig 5:03 - the ward structure of London as it was in Ogilby and Morgan's map of 1677.
that the City was divided into wards (Fig 5:03) to safeguard local rights and encourage mutual assistance, particularly in resisting Viking attack. Householders amalgamated to provide the men and materials necessary to repulse attack. The boundary of each ward probably related to the landholding of a prominent local landlord who would have been the leader within each ward. Sales and gifts of property to loyal subjects were haphazard with respect to the grid of public streets. Most early land holdings were Aagas, and at the outset these hedged or walled enclosures contained little more than a patch of land for vegetables, linked together by paths that were public rights of way. The names of these early landholdings indicate the origin of the overlord.

The wards vary greatly in size, which suggests to historians that the City must have been very unevenly settled at their formation in the late 10th and early 11th centuries. It is possible to infer the density of occupation in the early 11th century City directly from the size and shape of wards. The smaller the unit of land and the more jagged the boundary, then the more fully-settled the ward, with the boundary given by property rights which were already established and respected. These occur mainly in the south and west of the City. The largest wards are on the sparsely-populated edge and, as the maintainence of the walls was a part of their duty, their boundaries cross the walls to take in land outside the City. The ward structure shown here is taken from Ogilby and Morgan’s map of 1677, but historians agree that the boundaries do not seem to differ greatly from those established in Saxon times.

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1 The 24 wards are still the basic administrative units of the City today. They may have helped the City repulse Canute in AD 1016, though he gained control peacefully almost immediately.
2 Schofield, op. cit. p. 29
3 For example, Basinghaw Ward and Basinghall Street refer to the Aaga of the men of Basingstoke.
Fig 5:04 - the parish structure of London as it was in Ogilby and Morgan's map of 1677.
The jagged shapes of the ward boundaries crystallised when houses were built\(^1\) although during the 9th and 10th centuries it is thought that many plots were completely free of buildings. In due course, the *hagas* became bundles of houses and gardens, rents were bought and sold so that the property of a landowner became scattered over the face of the town, and the outlying manor failed to keep a hold on its tenants. The occupants of the wards became more diverse in origin, and local neighbourliness gradually replaced the bonds of shared allegiance to a provincial overlord. City life was emancipated from its country background\(^2\). The distribution of wards requires accurate cartographic material, and will therefore be examined in Chapter Six.

Saxon London was predominantly a secular city\(^3\). The *parishes*\(^4\) (Fig. 5:04) grew up later than the wards and and took a longer time to become established\(^5\). Church building was sponsored by close groups of neighbours as a place of common worship, by members of a specific trade or by wealthy patrons\(^6\) for their own private worship and for the benefit of their tenants. Parish boundaries, like those of the wards, were thus related to property boundaries but the founding group rarely coincided with ward membership so parish boundaries bear very little relation to ward boundaries. In every case, a major thoroughfare runs through the middle of the parish and sometimes there is an important cross-roads at the centre. At almost every point where the City wall impinged on a parish it formed the boundary, unlike the wards which always crossed the walls\(^7\). Because the City's parishes grew from these relatively democratic roots, the distribution of endowed churches was both dense and spread throughout the City\(^8\). By the end of the Saxon period in 1066 there were 107 churches in

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1. In west, the jagged boundaries of wards suggest that small plots of land, houses and tenements were in place and that these fixed the precise lines of the boundaries - in the east, the lines are smoother, suggesting that the settlement was less complete when the boundaries were finalised.

2. Cathcart Borer, ibid. p. 58

3. There were no monastic houses within the City before the Conquest.

4. The locus of rights to be baptized and to be buried, and of the obligation to pay tithes.


6. In which case their personal name tended to appear in the title of the church.


8. Unlike in continental cities, where the small churches of the period were tiny oratories clustering round a great cathedral.
the City, making London the largest concentration of parishes in Western Europe. The map shown here is based on Ogilby and Morgan's map of 1677, and as with that of the wards, the parish structure will be dealt with in more detail in Chapter Six.

In early Saxon times politics was conducted in public at an assembly (folk moot) of the entire male population which took place at the north-east corner of St. Paul's's three times a year. As trade grew and commercial disputes became the most frequent cause of litigation, this function was taken over by a special court, the Hustings. Each ward also had its own court presided over by an alderman and, by the time of the Conquest, the institutionalisation of legislative and political control was well under way.

Thus, on the eve of the Conquest London was an expanding, international port and the main English mint for coinage. There were colonies of Flanders cloth merchants at Dowgate, wine merchants from Rouen lived in the Vintry, and goldsmiths from Ghent and Ponthieu in Eastcheap. Despite its status as a great commercial centre, London was still a rural town with large green areas of orchard and garden within the confines of the wall. Moreover King Edward the Confessor, by choosing to locate his centre of government outside the City, had already created the powerful magnet of Westminster which was to draw the urban grid of London westwards in the ensuing centuries (Fig 5:05).

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1 Cathcart Borer, op cit. pp 61 and 79
2 hustings is a Viking word which suggests that Scandinavian traders were an early and peaceful foreign influence upon the affairs of the City, even before its short period of Danish rule under Canute (1016-1042), although there is no hard physical evidence to support this view.
Mediaeval London.

The remnants of Harold's defeated army fled to the City after the Battle of Hastings. However, the defences appeared impregnable and William of Normandy did not attempt to take it by force. He elected rather to ravage the surrounding countryside until the population, numbering some 10,000 at the time, was faced with starvation and forced to surrender. Outside London, the Normans transformed the environment as a political act to subdue the provinces in a programme of planted towns. Most had a castle, but some had a monastery as the dominant building making the overlord religious rather than secular. The houses and even the very street grid of the previous regime were obliterated.

William announced his presence in the City immediately by building the dominating stone edifices of the Tower in the east and Baynard's and Montfitchet's castles in the west. However, he acted with political skill and restraint towards the citizenry and granted them the freedom to conduct their own affairs, particularly affairs of trade. The citizens of London were thus uniquely privileged, and for the most part social and economic life continued on the course established by the Saxons for about a century after the Conquest.

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1 Cathcart Borer, op.cit. p. 47.
2 Schofield, op.cit. p. 37.
3 Other important Norman buildings included the first stone bridge (1176) and a new stone cathedral to replace the earlier timber one which was destroyed by fire in 1207. The Norman building was larger than the present St. Paul's, 585 feet long and with a spire 450 feet high. This burnt down in a storm of 1561. True to earlier form, the cathedral was more of this world than the next, and the dean and 30 cannons were little more than privileged royal officials who derived a lucrative income from their bakehouse and brewery. Trading took place in the cathedral, which was in a continual state of neglect and disrepair up to the time of the Great Fire. However, the site of the old folk moot was still a place of public meeting until the 17th century. The Normans were also responsible for several large monastic houses, and many hospitals, priories and nunneries.
4 Cathcart Borer, op.cit. pp. 47 and 49.
During early middle ages there was little suburban growth. Within the walled City, the area around the Tower was also sparsely occupied\(^1\) although the new fortress may have stimulated waterfront development. Moorfields remained boggy and uninhabitable\(^2\). The allocation of land to incoming religious foundations made still more unavailable for building, particularly at the perimeter where large areas were ossified by these closed and bounded precinctual communities until the Dissolution. In a period marked nationally by relative impoverishment the resident population rose to 35,000 by 1300, but there was still room within the walls to absorb the increase.

Throughout the mediaeval period, the City lay tight within the Roman walls. The only noticeable suburb was along the Strand but some land was taken into the City in the south-west corner near the Fleet, where the arrival of the Blackfriars in AD1275 caused the walls to be breached at that point. There were seven gates, and several small posterns for pedestrian traffic.\(^3\) The gates and basitons were let out to a variety of uses including prisons, chapels and private houses.

Very little is known about the shape of streets, and this situation will not improve since it is these levels which have been most disturbed by subsequent building works\(^4\). The densest concentrations of streets and buildings jostled for proximity to the river.\(^5\) Waterfront traffic centred on the four quays of Queenhythe and the Steelyard above the bridge, and Billingsgate and the Customs House below it. The main landing points for local and international trade, Queenhythe and Billingsgate, each had an inland market: Queenhythe trade centred on Old Fish Street and Cheapside; Billingsgate goods were sold in

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1 there is some speculation that the existing population may have been ejected at the time that the Tower was built.
2 the area provided rushes, reed and thatch for City buildings, and it is recorded that the Bishop of London, who owned land in the area, had to inspect it by boat.
3 the walls were kept in good repair throughout the Saxon period and were strong enough to discourage William from a protracted seige in 1066. Murage was levied from time to time throughout the Middle Ages to repair the walls.
4 Schofield, J. op.cit.p.77
5 1/3 of the country's trade passed through London during this period.
Eastcheap. The whole of the riverfront was revetted in the 14th century, but the redevelopment of riverfront sites was so rapid that this too obliterated traces of previous building, and what is known dates mainly from the 16th century.

By 1300 most of the streets and lanes were recorded in contemporary legal documents. Streets were more important than lanes and tended to lead to the gates or important City buildings. Lanes were far more numerous, and seem to have related to individual landowners. The term 'row' seems to have been used to denote a public way occupied by a particular trade\(^1,2\). This period saw the beginnings of building control, and the number of city officials increased fourfold.\(^3\)

By AD 1200 the parish map is thought to have been more or less complete\(^4\). The wards had become the primary military, judicial and administrative units of the City. Their principal role was no longer that of resisting an external enemy so much as keeping an intermural peace by policing the thoroughfares and providing a watch at the City gates\(^5\). Churches were the centre of neighbourhood life, a place where the ward authorities could meet, justice be handed out, debates held and plays enacted\(^6\). According to Schofield, there was a parish church on almost every street corner: one hundred and seven all told. A person walking across the city from Newgate to Aldgate, a distance of about a mile and a quarter, would pass sixteen of them. The churches

\(^1\) about 1/3 of lanes and less than 1/3 of streets bore trade names, which may reflect that a degree of specialisation was emerging at this time. In only a few cases (Vintners, Mercers) do guild buildings seem to have been purposefully located in the same area as a concentration of specialist traders.


\(^3\) regulations governed such matters as the thickness of party and boundary walls, rainwater and foul waste disposal, encroachment into the streets, and fire protection.

\(^4\) Cathcart Borer, op.cit.p.82.

\(^5\) ibid. p.58.

\(^6\) Schofield, J. op cit.p.115
Fig 5:06 - the major mediaeval monastic foundations within the City of London
are worth study because they took up much of the attention of the contemporary mind.  

The first friars arrived in London in the 13th century with a mission to the urban masses so wherever possible they settled within the walls, usually just inside where there was still building land available (Fig 5:06). Religious buildings of all kinds proliferated. The friaries provided an alternative to parish preaching which underwent reforms, perhaps as a direct result of the competition. There was a greater emphasis on preaching, altars were introduced and churches were decorated with stained glass, painting and sculpture showing incidents in life of Christ and the saints.

City trade was dominated and regulated by the guilds; first the merchant guilds and then the trade guilds or craft associations. In 1215, King John gave political independence to mayor and a new concept of citizenship began to emerge. The aldermen of the 24 wards elected the mayor and they in turn were (theoretically) elected by the citizens of each ward. In practice, political control rested in the hands of a merchant elite, whose wealth was based on overseas trade in key commodities like wool, cloth and wine. In the 13th century only

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1 ibid., p 4.
2 the Dominicans (Blackfriars) settled first in Holborn (1221) and then (1275) in the south-west of the City near the Fleet in an area which was later to become Alsatia, a sanctuary for thieves and murderers. The Franciscans (Greyfriars) had a chapel near Newgate (1239) had gardens near Stinking Lane (1319) and expanded into the area of Christ's Hospital (1337). The Carmelites (Whitefriars/Crutched Friars) were south of Fleet Street (1241) and the Augustinian Friars were in Broad Street (1253).
3 Schofield op.cit.p.70-73.
4 every guild required a charter from the monarch, granting members a ‘closed shop’ on some aspect of the production and sale of consumer goods. To enter a guild an individual had to serve a seven year apprenticeship in a master craftsman’s house, after which he became a journeyman and then a master craftsman in his own right. Guild rules regulated every aspect of the manufacture and sale of goods from quality control to wages and prices.
5 Cathcart Borer, op.cit. p.71-73.
6 privileges of citizenship included exemption from tolls and the right to be tried only in the City. Foreigners, small traders, apprentices, labourers, and servants were all excluded.
one in three Londoners qualified\(^1\) for citizenship. The activities of foreign and provincial merchants were severely curtailed.\(^2\)

Throughout the Middle Ages, Londoners met together for festive purposes in clubs and secret societies\(^3\), and the practitioners of particular skills and trades were no exception. In the second half of the thirteenth century, the *craft associations* began to gain the political upper hand over the great families, and the basis of power gradually shifted from an oligarchy to these new institutional forms\(^4\). The building of the Guildhall in 1439 mirrors this shift in the locus of City politics. By 1500 there were about 30 craft halls, often bequeathed by a prominent member.\(^5\) Membership gradually became disassociated from the work of the craft\(^6\).

Despite the stranglehold that the guilds and crafts had over rights to reside and trade in the City, mediaeval London was cosmopolitan. The emphasis changed as the City became less an outpost of Viking trade than the centre of Flemish trade. The first Jewry was established on William's arrival at Old Jewry and St. Lawrence Jewry.\(^7\) where,

\(^1\) privileges of citizenship included exemption from tolls and the right to be tried only in the City. Foreigners, small traders, apprentices, labourers, and servants were all excluded.

\(^2\) they had a maximum right to stay of 40 days, and could not own shops or trade direct.

\(^3\) Grey, op. cit., lists love of the female form and football among the more light-hearted!

\(^4\) membership of a craft association became the basis of citizenship.

\(^5\) crafts needed a Royal Charter enabling them to hold assets in perpetuity in order to acquire a hall, a fact which enabled the monarch to engage in City politics.

\(^6\) by the 1400s individuals could inherit membership without serving an apprenticeship in the craft specialism, and the artisans who formed the backbone of production gradually began to lose power to a new elite of *liverymen* whose claim to office was political skill rather than craft mastery. The new officials concerned themselves with the 'pomp and circumstance' of membership, with administering the regulations of the craft, and with property management. The craft associations became more the outward expression of the fortunes of a particular trading group and did not have to be guided by the requirements of their chosen trade or industry.

\(^7\) this first wave, 2% of the population at most, was expelled in 1290.
Fig 5:07 - the growth of mediaeval London, 1485 and 1666.
together with the Knights Templars they controlled the 12th century money market\textsuperscript{1}. From time to time, groups of foreign merchants were granted royal exemption from the general regulations restricting rights to trade\textsuperscript{2}. As with the religious houses, there was a tendency for foreign merchants to congregate in spatially distinct enclaves, like the Steelyard\textsuperscript{3, 4}.

**Early Modern London.**

There were only 12 houses in Bishopsgate in the fifteenth century, all owned by wealthy merchants\textsuperscript{5, 6}. However, the sixteenth century saw a population explosion in the City on an unprecedented scale. In 1500, the City had a population of between 50,000 and 75,000, by 1600 this had grown to 225,000 and by 1650 it was 450,000, making London one of largest cities in Europe (Fig 5:07). The intermural City still housed over 200,000 after the great plague of 1666\textsuperscript{7}.

This remarkable growth, which far outstripped that of other European capitals\textsuperscript{8}, was brought about entirely by migration to London, which was a centre of conspicuous consumption. The new migrants, mainly young, single, male apprentices, settled first in the suburbs and aspired to become a citizen with rights to live and trade within the walls (the reverse of later trends) while the population of City itself

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\textsuperscript{1} Cathcart Borer, op.cit.p.83
\textsuperscript{2} usually in return for loans as a result of which their position was insecure, as the monarch could always cancel the loan by expelling his creditors.
\textsuperscript{3} from *steephof*, a courtyard where samples of merchandise were stored or exhibited. This was a colony of German traders, who were granted special privileges. They were exempt from English law, and could deal with other foreign merchants. They were expelled in 1579.
\textsuperscript{4} Cathcart Borer, op.cit p.89.
\textsuperscript{5} one of the largest, Dukes Place, was a Jewry at the time of Cromwell.
\textsuperscript{6} Cathcart Borer, op.cit. p. 126
\textsuperscript{7} the estimated population of Roman London is 30,000.
remained constant. Migration was accompanied by immense poverty and disease.  

The Dissolution of the monasteries in the 1530's released land into the housing market, permitting large scale building activity within and outside the City. The fate of the large monastic complexes within the City varied. A few became large private houses for the nobility; others attracted small-scale tenement building for immigrants. Outside the City, church land was laid out in new upper class 'estates' but this third possibility did not happen within the City. Beier and Finlay argue that this had a long term significance in changing London from a mediaeval city to a modern metropolis, since 'whole areas could now be laid out as streets and squares, both for those who could afford houses of quality...and for artisan housing, later to be slums. This distinction encouraged the separation of people into stratified groups in society...' Throughout the mediaeval period rich and poor lived side by side. Proximity to the main streets was an accurate gauge of wealth and social standing. From this time, new streets and houses began increasingly to reflect the wealth and social status of separate income groups. Where people lived became less tied to production, trade and professional standing.

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1 apprentices, often little more than children, were frequently abandoned on arrival at the capital. There were four major plague epidemics in the period 1563-1625, each of which killed about 20% of the population, and in each case the locus of infection was the crowded alleys and tenement blocks of the poor. Casual labour and seasonal employment added to the misery.

2 the detail cited in this paragraph is all drawn from Beier and Finlay, op.cit.

3 Schofield, op.cit.p.131-141

4 the obvious example being Inigo Jones' Covent Garden.

5 Schofield, op.cit, p 157.

6 in the new 'estates' the form of dwellings also changed and took on a new relationship to the street, substituting a direct, shallow, open front court for the ranges of outbuildings and deep, internal couryards which, in City traditional merchants' houses, shielded the dwelling from the street.
Fig 5:08 - Major London markets in the early modern period.
These changes did not at first appear to affect the City. The density of development within the City responded to population pressures so that, by the beginning of the seventeenth century the gardens and green spaces were built over, street lines had been narrowed by encroachments and even the frontages of churches were let out for buildings. The 'decanting' of wealthy landowners to the suburbs is even regarded by Cathcart Borer as beneficial in the short term: 'by Elizabethan times, London belonged entirely to its merchants and citizens for there was no royal palace left within its precincts and the nobility had all left for their new mansions on the Strand nearer to Westminster' The short term threat the City seemed to be to the locus of production itself, where suburban expansion offered a much more obvious and direct challenge. Suburban tradesmen were not bound by the regulations which restricted City trading. Throughout the sixteenth and seventeenth centuries, the mayor and aldermen of the City were engaged in a constant and wholly ineffective struggle to limit suburban growth and keep the majority of citizens within their jurisdiction.

The wealth of the City was based on its complete domination of both production and exchange. In effect, the whole of the City was a place of sale, but there were locations where food and other goods were habitually sold (Fig 5:08). The markets of London had areas where citizens could open shops and stalls to deal in food or commodities, and street markets where country traders could sell their wares. These rights were jealously guarded, and were enshrined in regulations.

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1 Schofield, op.cit.p.145.
2 Cathcart Borer, op.cit.p.156.
3 In 1580 Elizabeth I passed a law decreeing that no house should be erected within three miles of the City walls unless there had been another house there within living memory. She exempted some noblemen from the legislation and the Stuarts blatantly used the law to raise revenue by selling exemptions.
4 Schofield, op.cit. p 145
5 At this time, all imported goods which attracted duty had to enter the country through London; that is, on the short stretch of quayside between London Bridge and the Tower.
governing fair trading and limiting the times and places where trading could take place. Most rules were designed to protect the distinction between *market trading* and *street trading*, which gave rise to a range of buildings which encompassed temporary standings in the street markets, removable stalls in front of shops, true shops, *seids* and permanent stalls, and covered market buildings like Leadenhall. By the beginning of the seventeenth century, direct trading by producers was becoming increasingly unrealistic as the production of goods, particularly of food, became organised on a national basis.

Most of the specialist food markets had been in existence since the mid 13th century. Cheapside was the customary location of country traders. Meat was sold in the Newgate shambles and in Eastcheap, Cheapside, Cornhill and Gracechurch Street were general markets, fish was sold from Bridge Street, grain at Billingsgate and Queenhythe on the waterfront, and in Newgate Street and Gracechurch Street. Many commodities transported by water were still sold directly at the quayside. There had been a covered market for meat and fish at Woolchurch since 1283. This became the Stocks Market, let out to stallholders long term. Even after the new buildings opened, trade spilled over into the surrounding streets. Leadenhall, once a private house, became a food market after it was bought by the City in 1411. Trade moved inside in 1455, and the market soon carried a range of goods other than food, including cloth, wool and leather. The first true Exchange building grew out of these early covered markets as a place where commodities could be displayed for sale after the manner...

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1 legislation prevented the various forms of buying up of all stocks of a particular commodity and reselling it. The overriding principal was that producers should market direct without middle men or dealers. Rules dictated which kinds of goods could be hawked (sold walking), and prohibited the sale of faulty goods and bad food. Some staple foods had fixed prices.

2 private bazaars, within which many traders each had chests, cupboards and benches where they stored and displayed their wares. A typical seld had twenty to thirty traders selling luxury items like gloves, leather goods, textiles, and clothing, all crammed within the space normally occupied by a shop.

3 this progress towards a national food economy is detailed in Charteres JA, *Food Consumption and Internal Trade*, in Beier and Finlay op.cit.
of continental merchants. The 1570 Exchange building housed some hundred shops.

Throughout the period Cheapside was the most important open space in the City for public display and the expression of authority. Shops were the dominant feature of Cheapside and the surrounding streets. Most were very small, with frontages of about two metres and with a depth of between three and four metres. This street was the main interface of imported goods, locally produced items and provincial imports which were traded in the open street market. Citizens traded out of secure, weatherproof shops and cellars which were necessary to store the valuable artifacts which characterised Cheapside trading by this time. One estimate of the Cheapside area suggests that in its heyday it might have had 400 shops and 4000 retail outlets in cellars, although many traders would have had more than one outlet.

London was as much a centre for production as it was of exchange. Production was small-scale, diverse and domestic in its nature. There were about 180 separate crafts and trades in the City in the early modern period. Whilst there may have been a tendency for groups of craftsmen to be concentrated more densely in particular localities, this never amounted to exclusivity. Small parishes each had two to three dozen different specialist tradespeople, large ones upwards of six dozen. In London as a whole, the clothing trade employed the largest single group, about 1/5 of the total workforce. Other major employers were the wine trade, merchants, and transportation. The building trades and workers in leather and metals employed significant numbers of workers.

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1 Cathcart Borer, op.cit.p.149-150.
2 again, the detail here is mainly drawn from Hugh Alley's Caveat, op.cit.
4 the detail for this paragraph is drawn from Keene, D., op.cit.
5 3/5 were employed in production, and only 1/4 in trade and only 1/5 in service occupations and the professions.
6 Beier A L, Engine of manufacture: the trades of London in Beier A L and Finlay R eds., op cit.
7 the detail for this paragraph is drawn from Beier, AL op.cit., in Beier and Finlay, op cit.
Within the walled city, merchants, masters and gentlemen were present in unusually large numbers. The hold maintained over production by the guilds, and the small scale nature of parish life made controls difficult to avoid. However, formal apprenticeship was in a decline in the second half the seventeenth century because of the relative freedom to trade unlicenced in the suburbs. This affected the organisation of production itself, with a move to the putting-out system in the suburbs, which in turn became a contributory factor to a more general reorganisation of metropolitan society: 'gone was the security of gild membership, which had included the defense of one's employment, a measure of community solidarity, and assistance in old age and other family crises. In its place grew up a system of casual labour in which security was minimal...and in which solidarity was slow to develop because of the fragmentation of the work-force.'  

These demographic changes seem to have had a stultifying effect on the City, which became more and more a bastion of conservatism in production and exchange.

However, these effects were not pronounced in the early modern era, and the City functioned on the eve of the Great Fire very much as it had throughout the Middle Ages. Stow's 1598 survey  suggests that the pace of residential development was speeding-up: he credits the substitution of timber for stone as the principal building material to the ease with which timber framed houses could be subsequently divided up, and thus become more responsive to population pressures. Wheeled traffic was on the increase, and the potential for the wealthy to make long distance journeys across the metropolis improved as a direct consequence. The distribution of trades, never static, was subject to increasing flux. However, all these were matters of degree and not of kind, and the space structure which is recorded in

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1 ibid. p.162.
3 coaches were introduced from Germany in the 1560's and were numerous by 1600.
Leake can be set against a historical background which, though long, is free of any major historical discontinuities.

**The Uncharted Millennium: an analytic account.**

History tells a story which is one of growth through continuity in London's social and institutional structures from well before the Conquest to the eve of the Great Fire. For many of its citizens everyday life, based as it was throughout the period on the production and exchange of luxury goods, foreign imports and services, may even have been recognisably continuous with life in Roman London. The spatial record however, is marked by an apparent radical discontinuity at the time of reoccupation of the walled city, and the City plan recorded by Leake at the culmination of the many and varied events which constitute the historical account of the City, is very different from that of Roman London which was the subject of the previous chapter. The question arises as to whether anything survived in the physical record from that earlier Roman era, in the early modern street grid which was surveyed by Leake among the ashes of the Great Fire of London.

In the previous chapter, morphological tendencies were revealed in the fragmentary Roman grid which can be detected from the archeological record of the City. Reconstructions and modelling the grid suggested that the dominant axis of Roman London was east-west, along the route now occupied by Newgate Street/Cheapside and Lombard Street/Fenchurch Street. The build-up of integration showed that there may have been an eastward bias in the Roman grid which placed the syntactic weight of the grid on that part of the settlement which grew up around the *forum* and *basilica* on Cornhill. Wood Street and the Walbrook line were strategically important spaces. Wood Street pointed to a dense collection of segregated lines, while the Walbrook connection tied the east-west cross routes together in the geometric centre of the City at the point where the settlement
almost fell into two discrete halves. Segregation was peripherally concentrated along the riverfront, in the area of the fort and to the rear (north) of the forum on the lines of Aldgate and Bishopsgate. The four quarters were morphologically differentiated from one another. Random line overdrawings confirmed that these properties were structural features of the grid. The snapshot given by integration/segregation was of a compressed, relatively orthogonal integration core with a dominant east-west emphasis, a local easterly concentration and a large 'rim' of segregation.

What is known of the Roman plan, though partial, does at least take a physical form; that of archeological data. The next snapshot of the City which can be regarded as 'hard' evidence is Leake's 1666 map of the City after the Great Fire, over a thousand years later. Although the intervening period is rich in documentary evidence, it is very poor indeed in 'hard' physical data. Archeological material from this period is rare, since the levels at which Saxon and mediaeval remains lie, coincides with the deep basements of modern City buildings. The cartographic record for the period in question is equally unreliable. The first map records of the City were not made until 1553-9, long after the medieval City had taken its final shape. All the early maps which have survived take the form of the 'map view', and are therefore marred by scale distortions and obscuring of detail. Almost

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1 In December 1666, the City Corporation commissioned a team of six surveyors headed by Leake to draw up a six sheet (one each) skeleton survey of the devastated area. This survey was drawn on manuscript and has not survived, but Leake himself made a single sheet reduction of the entire manuscript. This formed the basis of Hollar's engraving of 1667, which was issued for administrative purposes. Only the main streets are shown.

2 a technique in which buildings are drawn pictorially from an elevated position, but the scale is established to reproduce the linear ground plan. It is frequently to judge the true width of streets and the exact pattern of connectivity on maps of this type, particularly in the interstices of the blocks, where fine detail is often sacrificed in order to show the buildings fronting the main streets at an exaggerated scale.

3 one of the most accurate complete 'map views' is Braun and Hogenburg's map of 1572 at a scale of 6 1/2" to the mile. According to Fisher, the accuracy of this map is surprisingly good, and scale distortions minimal. The other is that made by Fairthorne (engraver) and Newcourt (surveyor) in 1658 at a scale of 12" to the mile. The basic survey of this map is sound. Fisher, J., Early Maps of London, c. 1553-1667, H. Margaray, Lympne Castle, Kent, 1981
Fig 5.09 - plan and open space map of Leake.

Fig 5.10 - axial map of Leake, 1667.
nothing is known about the visual appearance of London's street grid in the formative period after the City was reoccupied by the Saxons in AD 886.

A visual comparison of Leake's map (Figs. 5.08-5.10) and the filled-out version of the Roman grid (Fig 5.11) reveals the nature and extent of the morphological transformation which the City has undergone during this uncharted millennium. The Newgate Street/Cheapside line and the Lombard Street/Fenchurch Street lines can be clearly picked out on Leake's map, as can the continuation to Aldgate but this route, which once took 3 axial steps to cross the City, now requires 10. By contrast, the line from Bishopsgate to the bridge has become more direct than in the Roman era. The circuitous Roman north-south through route of 7 axial steps, from Bishopsgate to the rear of the Forum (3 steps), round the forum (3 steps) and down to the bridge (1 step) has been reduced to 2. The lower east-west Roman road is clearly 'remembered' in the route from St. Paul's along Watling Street, Budge Row, Cannon Street and Eastcheap, and this route s-bends abruptly at about the same point at which the known extent of the Roman grid peters out.

In the minor grid, Philpot and Botolph Lanes seem visually to agree with the eastern road linking the forum/basilica with the quayside. The western road must fall in the area of St Clement's and St Michael's Lanes, but there has clearly been some 'drift' here away from the Roman grid. In the north-west corner, the road network describes a contorted shape which bears only a vague resemblance to that of the fort. Lothbury and the northern portion of Coleman Street may describe a similar course to the Roman roads which are known to have existed in that sector of the City. Bow Lane looks like the approximate locus of the key Roman street which linked the two principal east-west routes. These features are summarised in sketch form in Fig 5.12.
Fig 5:11 - a filled out version of the Roman grid

Fig 5:12 - streets shared by the Roman grid of London and Leake's map of London.
It is, however, extremely difficult visually to detect identities between the remains of the Roman plan and the open space map of the Leake plan for the differences spring more readily to attention. The Newgate Street/Cheapside line culminates in the Leake plan in two curving streets which describe a shape much like the 'bowl' of a gigantic spoon. To the south, between Cheapside and the river between the bulk of St Paul's and the Tower, Cannon Street and Eastcheap form the handle of a system of streets which resemble a three-pronged fork. Further south still runs Thames Street, with the wharves bristling from it like the teeth of a comb.

No comparable graphic images spring to mind when considering the area north of Cheapside. The line of the walls is clearly marked by an intermural road. In the north-west the islands are strikingly large and irregular, and form a funnel of streets laid diagonally across the City from south-west to north-east along Lothbury, Throgmorton Street and Broad Street, and Walbrook, Threadneedle Street, and the northern end of Bishopsgate. The route down Bishopsgate to the bridge reads clearly. These new curvilinear shapes are sketched roughly in Fig.5:13.

These abstract curvilinear and evocative representational forms cannot be conjured out of the more ordered Roman grid. However, an analysis of the axial map of the City as recorded by Leake suggests that the transformation is one which is structural as well as visual, at least in part. This plan has already been discussed in the opening sections of Chapter Three, but it is worth rehearsing the detail once more in the context of the Saxon reoccupation of the City and its subsequent development, particularly since the picture of integration in the map of through streets begins to suggest the underlying dynamics of the space structure of the mediaeval City.

The first line to enter the integration core (Fig 5:14) is Cornhill, followed by Cheapside. There is a marked axial discontinuity between these two strongly integrating streets by the curve of Poultry (3rd to
Fig 5:13 - the major new 'shape features' of Leake's plan.

Fig 5:14 - a 5% integration core of Leake's map.
enter the core) and by the blockage created at their junction by the Stocks Market building. Cheapside is represented by two axial lines which pass either side of the Standard and the Eleanor Cross. The second, more northerly axial line is relatively trivial, but its inclusion does not affect analysis since it merely duplicates some of the full set of connections carried by the main southern line\(^1\). Cornhill runs between the Stocks Market and Leadenhall Market pasing the Exchange *en route*. These were the three main covered markets in the mediaeval City. Cheapside was the locus of street trading, and of shops selling luxury items.

The street leading to the bridge from Bishopsgate is next to enter the core, confirming the visual impression that direct north-south movement across the City, which was so markedly absent in the Roman plan, is of considerable strategic importance in the mediaeval town. Walbrook and Broad Street, both at the Stocks Market intersection follow, together with the short spur of Bucklersbury. With the next two lines, the continuation of Cornhill eastwards towards Aldgate and the continuation of Bishopsgate down to the bridge, the City is more or less traversed in both directions by streets entering by way of the principal gates.

The next street to enter the core is Oldbury, at the Poultry end of Cheapside, followed by the remainder of Bucklersbury, Eastcheap (the more southerly of the two Roman streets below the *forum*) and Bow Lane (the tie at the centre of the Roman grid). The northern end of Threadneedle Street and Lombard Street spread the core eastwards to Bishopsgate. The 5% best integrated lines show a core which is concentrated on the principal cross-routes and on the set of island blocks at the Stocks Market intersection. All but one of these blocks is completely encircled by well integrated streets, whilst no other significant rings of globally shallow streets are made anywhere else in the system.

\(^1\) it is less well-connected than its southern counterpart and enters the grid in 15th place.
Fig 5.15 - a 10% integration core of Leake's map
The integration core at this stage is concentrated in the heart of the commercial centre, linking together the two major open general food markets which date back to the Saxon period, the western market which runs the whole length of the thoroughfare from Newgate to the Walbrook with a main focus on Cheapside and the eastern market, which covers a wider network of streets including Eastcheap, Bridge Street and Gracechurch Street and runs along Cornhill to Leadenhall. These markets, the origins and functioning of which will be discussed in more detail below, are located on or near the principal east-west and north-south routes by way of the main City gates. The ancient dividing line of the City along Walbrook features early within the integration core as does the street leading up to the mediaeval Guildhall, the administrative and government centre. Bow Lane is picked up in the south west, pointing in the direction of the more recently established and more specialised food and produce markets centred around Old Fish Street and Queenhythe.

Over half the streets added by raising the core to 10% (Fig. 5:15) intersect with Cheapside. Strikingly, only one intersection crosses Cheapside, Bread Street (18) but it chicanes almost immediately. This suggests that the intention visually and axially to divorce the northern half of the City from the south in this area was not just a matter of chance. The intersection at the Stocks Market also gains integration strength. The remaining lines spread the core, down the Walbrook to Dowgate Dock, and westwards along Trinity Lane, along Fenchurch Street (along the Roman decumanus, the only line to be added east of the bridge), and edging out around the intermural street at Bishopsgate.

1 the banqueting hall of the Guildhall was used for great feasts at which the magnificence of the Lord Mayor and the twelve great Companies of the City were displayed.
Fig 5:16 - radius 3 integration at 5%.

Fig 5:17 - segregation above the mean in Leake.
Radius 3 or local integration\(^1\) at 5\(\%\) (Fig 5:16) changes both the order of integration and the shape and spread of the core. Cheapside becomes the principal integrator. Threadneedle Street in the north-east sector is now absent from the core. There is no longer a concentration of integration at the Stocks Market. There is a marked westward shift in the core both north and south of Cheapside. In the north-west Foster Lane, leading up to the area of the Roman fort, is locally well-integrated. South of Cheapside a whole new system of well integrated streets is introduced on the hill west of St. Paul's between Cheapside and the river. This ring of locally well-integrated streets centres on Queenhythe\(^2\). The more localised picture seems to pick out the streets of the everyday marketing system, whereas global integration links the original market areas with the centre of power at the Guildhall and the houses of the ruling class of merchant traders.

The global picture of segregation is concentrated around the rim of the City. The entire area south of Fenchurch Street and east of the bridge is segregated (Fig 5:17). A similar large concentration is to be found south and west of St Paul's, including the Ludgate approach to St Paul's and stretching eastwards as far as St. Bennets Hill and St Paul's wharf. A third, more patchy scatter of segregation is in the north of the City. In the west, this picks out the area once occupied by the Roman fort and the streets behind the Guildhall. The area between Coleman Street and Broad Street where the headwaters of the Walbrook rise, is completely developed and covered with buildings\(^3\), but segregated. The interstices of the blocks between Leadenhall Street and the wall are also segregated. Within the main body of the City, there is very little segregated space at all. Small alleys to the rear of churches and short winding paths in the heart of major blocks are picked out. Queenhythe and Billingsgate are both segregated\(^4\).

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\(^1\) the measure which looks at integration of streets locally, up to three steps away from the origin (see the methodological prerequisites in Chapter Two for the detail).

\(^2\) and includes Thames Street and Trinity Lane running east-west and Bow Lane and Bread Street running north-south.

\(^3\) this area was not completely engulfed by flames, so the density can be estimated from the 'map view' portion of Leake's survey.

\(^4\) although the 10\(\%\) integration core reaches Dowgate Dock.
The picture painted by integration/segregation shows both continuities with and transformations on that of the Roman grid. The dominant east-west axis remains, but is shifted northwards in the east of the City, away from Lombard Street/Fenchurch Street towards Cornhill. The segregated 'rim' which, it has been argued relates to the non-convex shape of the Roman wall clearly remains to a surprising degree, as does the property of morphological differentiation in the four quarters east and west of the Walbrook and north and south of Cheapside. A striking difference is found in the shape and spread of the integration core, which has shifted from the east of the City

This is a radical departure from the Roman grid, though one which was presaged by the experimental overdrawings on the Roman grid of the previous chapter. To tease out the relationship between historical events and morphological constraints, the former represented by the development of the City as a major centre of production and exchange and the latter by the laws of the field within which strategies in relation to the urban grid requires some detective work. In what follows, an attempt will be made to reconstruct events from historical accounts and the evidence provided by the grid of the City itself. The aim here will be to investigate more closely the issue first raised in the Problem Definition as to the relationship between morphological and historical events.

The Great Emporium\(^1\).

From its Saxon re-establishment as a fortified strong point, the development of the City was ruled by trade, and the structure of its evolving street system might be expected to 'oil the wheels of commerce' by permitting easy and direct access from the main gates

\(^1\) Bede's description of the Saxon settlement has been used here, despite the subsequent change in location, since it seems to capture something of the trading spirit of London throughout this entire period.
Fig 5.18 - plan and axial reconstruction based on Brooke and Keir’s version of Saxon London.
to the centres of market activity. Moreover, it might be expected that those areas where trading took place would be well-integrated within the space structure of the City, particularly since the production and exchange of commodities was relatively place-specific and, as a result the acquisition of even the most basic necessities of life would require access to several locations within the square mile of the Roman walls. This seems to have been the case in Leake’s London.

The apparent organic shape characteristics of the urban blocks yield an open space pattern which is well-structured in relation to the trading interface of the City, and to what is recorded in contemporary accounts of its patterns of use and movement. The question thus arises as to whether this kind of ‘spatial logic to growth’ played a role in the early ‘engineering’ of the Saxon plan.

Reconstructions of Saxon London in 1066 by Brooke and Keir¹ and Schofield² (Fig 5:18, 5:19) attempt to grapple with the problems of giving the Saxon City a physical form. The version by Brooke and Keir is clearly notional, erring on the side of generosity in assigning the street system a curvilinear form. This shows in the translation to an axial map, which is considerably articulated as a result of following the sinuous form of streets. Lothbury, for example, translates into 13 axial steps, probably an exaggeration. Schofield’s representation, appears more lifelike, but this is likely to be a result of his building on his knowledge of the modern City in making his reconstruction. Lothbury in Schofield’s version takes a mere 7 axial steps. In Leake, the same path requires 10 steps, the increase being brought about by offset street intersections. Clearly, neither Saxon reconstruction can be regarded as accurate in the detail, and as with the Roman City can only be expected to reveal trends, particularly in identifying the focus of the core.

Brooke and Keir’s map appears visually more ordered than that of Schofield, despite its curvilinear form, particularly in the area of the

¹ Brooke and Keir, op. cit.
² Schofield, op. cit. p.35
Fig 5:19 - plan and axial reconstruction based on Schofield's version of Saxon London.
orthogonal grid in the west. The focus of the City is clearly restricted
to a square grid of streets between St. Paul's and Walbrook, and
Cheapside and the River. The remaining streets are apparently
approach roads rather than an integral part of the township.
Schofield's version fills more of the walled area, but in an apparently
disorderly way. The grid of streets in the south west quarter of the
City is not dissimilar from that shown in Brook and Keir, but it is
simply overwhelmed when set in the larger 'frame' of the grid of the
entire City. The two streets identified by local integration in Leake's
map of 1666, Bread Street and Bow Lane, can readily be picked out by
visual inspection, particularly in the representation by Brooke and
Keir.

Since this south-west quarter is thought to have been the locus of the
early Saxon township, it is worth examining this sector of the town in
more detail. Taking just the south west quarter in each case, and
assuming a waterfront quayside to complete the grid\footnote{shown
dotted in both versions, indicating a degree of uncertainty as to
whether this feature actually existed.} the apparent
degree of agreement between the two maps is considerable (Figs
5:20, 5:21). Brooke and Keir's version has 23 islands surrounded by
43 axial lines. Schofield's version has the same number of islands, but
differently distributed and surrounded by 29 axial lines, which
suggests that it is in fact more regular than its embedded form makes
it appear.

The difference between the two grids has to do with the relationship
between connectivity and connectivity matrix as expressed through
the node map and the axial map, which was explored Chapter Two
with reference to the Roman grid. Brook and Keir's version appears
rectilinear to the eye, but the 'node map' is more developed than the
anti-axial 'Milton Keynes' grid for that number of islands (Fig 5:22)
(44 as opposed to 34 nodes) because axial continuity is broken not just
at intersections but also along the faces of the blocks. In this sense the
reconstruction is less ordered than Schofield's map which, for the most
Fig 5:20 - Brooke and Keir's version of the Saxon township above Queenhythe.

Fig 5:21 - Schofield's version of the Saxon township above Queenhythe.
Fig 5:22 - the node map of Brooke and Keir's interpretation.

Fig 5:23 - the node map of Schofield's interpretation.
**Fig 5:24** - 10% integration, 50% segregation in Brooke and Keir's restricted square grid.

**Fig 5:25** - 10% integration, 50% segregation in Schofield's restricted square grid.
part has axial continuity for two or more adjacent blocks. Schofield’s reconstruction (Fig 5:23) suffers in visual comparisons because of its complete departure from rectilinearity in the north west corner, but overall it is slightly more ordered (with 41 nodes and nearly 1/3 fewer axial lines) ¹.

Despite the apparent visual similarity of the two local Saxon ‘township’ grids, so far as structure is concerned the two reconstructions could not be more different for the integration cores of the two grids (Fig 5:24, 5:25) build in diametrically opposite ways. Schofield’s reconstruction has a perimeter and asymmetric core while that of Brooke and Keir has a centralised and relatively symmetrical one. The first line to enter the integration core of Brooke and Keir’s reconstruction is the waterfront ², but then the focus shifts immediately to the geometric centre of the street system, where the next three lines describe an H-shape (at 10% of lines) centred on Bread Street. Line 5 is at the perimeter, along the street leading from the river to St.Paul’s, but from that point on the core begins to build a square of integrated streets by completing the original H-shape, and by adding radials to connect this square ‘hub’ first to St.Paul’s and then eastwards in the direction of the Walbrook, up to Cheapside and down to the river. Segregation picks out parts of the perimeter, notably the northern approach to St.Paul’s, Cheapside and the northern end of Walbrook. Some, but by no means all of the radials which point into the centre from the edge of the township are also segregated. This pattern of integration/segregation is similar to that of the node maps of regular orthogonal grids looked at earlier, and confirms the apparent anti-axial tendency of this reconstruction.

The street abutting St.Paul’s is the first to enter the core in the local grid of Schofield’s reconstruction, followed by the waterfront and

¹ using order here in the particular sense of requiring the alignment of adjacent blocks to be specified in advance - the criterion which, applied ubiquitously, leads to a perfectly regular orthogonal grid.

² the only long axial line in the system, and a dubious one at that. Were it to be chicaned, the tendency reported here would be considerably strengthened.
Fig 5:26 - 10% integration, 50% segregation in Brooke and Keir's complete map of Saxon London.
Cheapside (10% of lines). The core then shifts to the south west corner of the grid along Trinity Lane, the southern end of Bow Lane, the central portion of Watling Street, and streets roughly on a line with College Hill and Distaff Lane. The bulk of the remaining streets above mean integration complete key north-south between Cheapside and the river in the west of the grid. Segregation above the mean is concentrated in the non-rectilinear area in the north east corner of the local grid.

In both cases, sections of the important streets which link Queenhythe with Cheapside appear shallow in the street system as a whole. Brooke and Keir's reconstruction, looked at locally in this way, picks up Bread Street as a key link between the integrated waterfront and segregated Cheapside, and suggests that the blocks immediately above Queenhythe are significant in drawing the entire street grid together, but these results could well be an artifact of the decision by these archeologists to 'opt' for a curvilinear interpretation of the Saxon plan. Schofield's version 'prefers' Bow Lane as the link between Cheapside and the river but his interpretation also picks up the entire length of Bread Street above mean integration, while the asymmetric loading of the grid in the south west encloses the important site of Hwaetmundes Stan with a shallow grid of streets close to the waterfront. Hwaetmundes Stan1 and Queenhythe or Aetheredes Hythe2 are land grants known to have been given by Alfred to prominent church leaders in an attempt to establish a 'mercantile shore' in London, so Schofield's reconstruction seems more in line with historical events.

Embedding both versions in the intermural street system amplifies the picture presented by considering just the local grid where the Saxon town is believed originally to have been planted. The integration focus of Brooke and Kier's reconstruction (Fig 5:26) shifts north to Cheapside3 and the western grid of the City. Bread Street

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1 dated to AD 889.
2 after Ethelred, Governor of Mercia and Alfred's son-in-law.
3 which shifts from being segregated in the local township grid to being the number one integrator within the intermural city.
Fig 5.27 - 10% integration, 50% segregation in Schofield's interpretation of Saxon London.
enters the core early, as the second most integrated street in the City, followed by the western extremity of Cheapside as it bends north to accommodate the site of the folk moot. Milk Street, a northward continuation of Bread Street, is fourth, and Bow Lane is fifth. The next batch of short but integrated streets all centre on Cornhill but the 10% core of best integrated streets takes Bread Street southwards to the river at Queenhythe. Segregation is concentrated in the west around St. Paul's, an area which is also segregated in the local map, north of Cheapside along the meandering roads which skirt the marshy ground of the headwaters of the Walbrook, and on the approach roads from Aldgate.

In Schofield's representation, (Fig 5:27) the western emphasis of the system as picked out by integration is both reduced and redirected. Cheapside is still the number one integrator, but the cluster of lines radiating from Cornhill enter the core next. In sixth place is the section of north-south through-route which lies between Lombard Street and Cornhill, making the only shallow ring in the system. Most of the remaining lines 'hang off' Cheapside, particularly at the western end. Four point north, all to the area of the fort, and three south. These are evenly distributed to either end of Cheapside, and to the centre down Bow Lane, a block east of Hwaetmundes Stan. Two streets are added to the second best integrated space, Lombard Street, one an eastward continuation down Fenchurch Street and the other roughly on a line with St. Swithin's Lane. The local grid appears as a large 'neutral' area in the full intermural reconstruction.

The distribution of segregation in Schofield's representation is similar to that in Brooke and Keir allowing, of course, for the greater degree of development in infilling within the intermural grid. The area of the Roman fort is strongly segregated, as is the area west of St. Paul's and the vicinity of the Tower. Parts of the waterfront are segregated,

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1 as opposed to number 3 locally.
2 no rings of integrated space are formed in the Brook and Keir version.
3 on the shallow side of mean integration
including the streets above Billingsgate, although the site of Eastcheap market is in the integrated half of the distribution. The intermural street is segregated, but the north east quarter is far less segregated than in Brooke and Keir's version because of its higher degree of axiality.

Comparing both reconstructions with the Leake plan shown in Figs 5:14-5:17, the changes which seem likely to have taken place in the structural features of the City in the mediaeval period become clear. The straightening of the axial line to the bridge brings this route into the integration core where, in both less axial versions of the Saxon grid, the northern end at Bishopsgate was segregated. Similarly the straightening of the streets radiating from Cornhill to Aldgate brings about an improvement in the spread of integration, particularly when compared with Brooke and Keir's version, which is axially more discontinuous and the easternly extension of the integration core correspondingly minimal. The Walbrook line, three axial steps and a key early integrator at its northern end in all three versions, gains considerably in significance in Leake's plan as do Eastcheap and Cannon Street, which move from a 'neutral' position to one within the 10% integration core. This is due to the formation of Thames Street and the completion of the grid in the large, irregular block immediately south-west of Cheapside which was such a striking feature in both local versions of the Saxon plan. The infilling of the grid in Leake and Schofield brings in its wake a more balanced distribution of the core either side of Cheapside. Of the two reconstructions, Schofield's shows more direct morphological continuity with Leake.

A comparison of the pattern of segregation in all three plans also reveals clear morphological tendencies. The areas of the Tower and Blackfriars form much more concentrated chunks than in either of the Saxon plans. The straightening and simplification of the main through streets in these areas has been accompanied by a build up of shorter and less axially continuous streets in the backlands. The same
Fig 5:28 - Braun and Hogenberg's map of London in 1572.

Fig 5:29 - the open space map of the 1572 plan
is true in the area of the fort, where the major grid has improved in axially while the minor grid has lost axial extension. The formation of Thames Street eliminates segregation almost entirely from the waterfront area in the centre of the grid, and the improved axial extension of the major grid city-wide lifts the intermural street above mean integration. Here too, segregation is confined to the backland areas of urban blocks. Finally, local RA in the Leake plan seems to pick up the dominant lines of the grid in the restricted area where the original Saxon township is believed to have been located and the site of the early inland market at Eastcheap.

In the period between the Norman invasion and the production of Leake’s skeleton survey, the City clearly infilled, considerably, if Brooke and Keir’s estimate of the spread of the Saxon township is the more accurate one. Map views of this period are notoriously unreliable. All the early versions consulted agree with the historical accounts presented earlier that the centre, south and west of the City was more densely developed than the north and east. Thames Street provided a relatively direct east-west cross-City route on the line of the Saxon waterfront, and below this on land reclaimed from the river new streets led down to the river. These were for the most part culs de sac except at Three Cranes Wharf, Queenhythe and Billingsgate where there was more space. Fairthorne and Newcourt’s map of 1658, although very notional, shows all the land within the walls to have been developed apart from Drapers’ Garden in the north-east. This reinforces the suspicion, voiced earlier, that Schofield’s view of the extent and density of the network of streets in the late Saxon City may have been conditioned to some extent by his knowledge of subsequent developments.

Analysis of the most accurate of these early map views, Braun and Hogenberg’s map of 1572, (Fig 5:28) has been carried out not in the

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1 where a comparison can only be made with Schofield’s map because of the lesser degree of development in Brooke and Keir’s reconstruction.

2 all those mentioned earlier in the opening section of the chapter, and the Hollar Panorama of the City in 1647.
Fig 5:30 - the axial map of the 1572 plan

Fig 5:31 - 5% integration in the 1572 plan
hope of achieving accuracy\(^1\) but to look for tendencies. The open space map of this version (Fig. 5:29) is cruder and less convexly differentiated than Leake's. Whilst convex break-up of space is not the main analytic focus in this exercise, this does suggest that the representation might be expected to transcribe into a relatively coarse and inaccurate axial map. The area of the folk moot north of St. Paul's is clearly preserved, and it is known to have been in use for outdoor popular assemblies and religious events. The map shows the City to have been more complete in the south than the north. There is a noticeable concentration of small blocks and shambles along Cheapside and parts of the grid of streets in the south-west seem to have been 'eroded' in order to make the street grid 'read' within the limitations of the oblique elevated projection.

The axial map to which this pattern of open space gives rise (Fig. 5:30) bears a 'family likeness' to Leake's plan, but its shape is clearly distorted. The angles produced by the blocks are almost everywhere exaggerated and made more acute (anti-axial). As a result the map appears visually less ordered than Leake's version, which is something entirely to be expected from a representation which is based on survey techniques which are themselves less able to take account of large scale geometric regularities encountered in reality.

Given this loss in order, it is interesting to note that the structure effects are more robust under this deformation, and the shape and spread of the 5% integration core (Fig 5:31) is broadly in line with that of Leake. The main integrator is Cheapside, with the longest axis passing to the north of the Standard and reaching all the way to the Stocks Market at Cornhill. This is probably a scaling error, since other map views show a clear curve as Cheapside enters Poultry. Cornhill and Throgmorton Street share equal second place, followed by Lombard Street and the Walbrook, all the way to the river. Eastcheap is the 8th most integrated space in Braun and Hogenberg's map, and Watling Street is the 9th. Again, this incompatibility with Leake seems

\(^1\) though this version is the most reliable of the pre-Fire maps.
Fig 5:32 - 10% integration in the 1572 plan

Fig 5:33 - segregation above the mean in the 1572 plan.
to result from a scale compression in accommodating the large number of small urban blocks which are to be found in this part of the City which, if rectified, would take integration further south to Cannon Street where it is in Leake. The line from Bishopsgate to the bridge is far more anti-axial than it ought to be, worse even than in Brooke and Keir. Only the central part which intersects with the fan of streets radiating from Cornhill is in the core at 5% of lines.

Raising the core to 10% (Fig 5:32) brings the Fenchurch Street decumanus line into the core in 12th place. The 13th place is taken up by the portion of Thames Street between Queenhythe and Billingsgate. This does not appear in Leake's 10% core but its occurrence here shows how important this new east-west street was in maintaining the orientation of the integration core of the mediaeval City towards the river at a time when almost all new street development was being carried out in the north. Lines 11, 14, and 19 all cross Cheapside in centre but should, according to Leake, be staggered apart from the approach to the Guildhall. There generally less integration emphasis here than in Leake, particularly in the streets adjacent to Cheapside, and a new emphasis is to be found, centred about the area of the original Roman grid either side of the bridge in the north-south lines 15, 17 and 18. Again, the fact that marginal regularisations on the part of the mapmaker can alter the balance within the street structure to pick out traces of the previous order indicates how subtle and deliberate some of the deformations which go to yield the integration structure of the City as depicted in Leake's plan must have been. it seems that after all, only a slight re-orientation of the street grid is required to re-establish traces of the former Roman street grid.

Segregation in the Braun and Hogenberg plan is shown in Fig 5:33. There is not the concentration of segregation around the Tower that the Leake plan would predict, mainly because of the increase in integration around bridgehead. The degree of segregation west of St Paul's and in the area of the Roman fort are as expected, and the

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1 both social and spatial on this occasion
distribution of segregation in the north-east is more like that of the Brooke and Keir version of the Saxon city. Again, this shows the subtlety with which the open space of the City seems to have been fine-tuned by the building lines, since axial chicaining as well as rectifying the grid brings about predictable changes in the distribution of integration. In this case the picture reverts to one more in keeping with the Saxon period.

Historical evolution and morphological constraints: a reflection.

Two events seem to have dictated the trajectory of the Saxon and mediaeval city, both of which were brought about by historical circumstances but which have had a clear morphological outcome. The first is the spread of the approach roads to Cheapside from the north and east, avoiding the area of the Roman *forum* which was possibly made dangerous, or at least difficult to negotiate, by the presence of a large concentration of ruined buildings. The second is the siting of the Saxon township in the west above Queenhythe. We shall never know why Queenhythe was selected as the favoured location for the early mercantile shore, perhaps because local bankside conditions afforded an easier landing stage for shallow-draught boats, perhaps again because it was more or less a greenfield site. The reason 'why' may be less significant than the 'fact' of the event, for these tendencies, reacting to and interacting with the older ones established by the previous Roman grid, set the City on a new trajectory which was already well-established by the Norman invasion.

The distribution of key activities within the early Saxon grid seems to have preserved the morphological integrity of the four quarters of the City noted earlier in the Roman era, though in a novel form. The area selected for the Saxon palace near the Roman fort remained segregated in character. The establishment of a new trading focus in the south-west changes its role to a prime focus of integration,
particularly local integration while the south-east became more segregated. The slow pace of development in the north-east, and the meandering nature of the approach roads in that part of the intermural grid preserved its morphological identity.

From then on, the story is one of continuing interaction between historical events and morphological constraints. The constraining nature of the irregular boundary in creating a 'rim' of segregation had gradually to be corrected at least for the incoming routes, as the City began to rely more and more on its hinterland and as it became increasingly important to access people and goods into its very heart. The increasing dominance of trade in the economy seems gradually to have brought everywhere in its wake axial rectifications of the major street grid in the interests of improved communications and accessibility, thus rendering the markets shallow in the system of streets both internally, and in relation to incomers.

This in turn seems to have begun to alter the balance between integration and segregation, particularly within the centre of the City. Here, a two-level effect is detectable between street widening and straightening improvements in the major grid, coupled to backland elaboration in the interstices of the blocks leading to the former improving in integration and the latter acquiring more segregated characteristics. William's implants at the eastern and western extremities of the City, and subsequent monastic development in the Blackfriars area seems considerably to have strengthened the tendency to segregation already there in principle.

Thus, the spatial logic of trade may well have fine-tuned and transformed the shape characteristics of adjacent blocks until it took the form portrayed by Leake. Insofar as integration is a formal index of the degree of space occupation and use\(^1\), it is clear that the

\(^{1}\) which has been demonstrated by empirical observational studies in the modern City of London, as well as in numerous other examples.
integration core of the City renders the commercial streets shallow and accessible both to the citizens and to strangers from outside the gates. It constructs a dense and continuous trading interface within the heart of the City which is the mediaeval equivalent of a department store. The apparent visual disorder of the street grid is not symptomatic of an absence of spatial structure.

However, the apparent rupture with Rome does not, in the final analysis, render the street grids incomparable. The analysis of the older, and potentially less accurate map by Braun and Hogenberg shows that the bias in integration towards the south-west of the City which is characteristic of Leake's map is subtly achieved and in a sense even provisional in nature. The slight distortions and axial approximations which the 'map view' introduces as compared with the 'true ground plan' are sufficient to reveal the shadow of the regular, orthogonal Roman grid in the mediaeval City. A romantic would argue that this is not just a result of representation. Perhaps the City at the time of Braun and Hogenberg really did carry a stronger, clearer imprint of the Roman grid within its physical, spatial form. The reconstructions of Saxon London by Brooke and Keir and by Schofield suggest otherwise, but since the map record is so sparse and inaccurate, the issue may never be settled beyond reasonable doubt.

The Ogilby and Morgan map of 1677 gives a much more complete picture of the City which arose from the ashes of the Fire. It is the point of departure for all students of mediaeval London but, as Schofield ironically puts it, the map records the mediaeval City 'at the moment of its extinction'\(^1\) at least in appearance. The new buildings were brick built, but despite the changed facades the structure of streets, alleys, blocks and property boundaries in 1677 are those of the mediaeval City. Many of these boundaries were only obliterated in the second half of this century. This map, which is the subject of analysis in the next chapter, is the proper place to examine these tendencies in the detail.

\(^1\) Schofield J., p. 176.

Introduction.

This is the first of a pair of linked chapters which sets out to explore the morphology of the Restoration City of London through an analysis of the Ogilby and Morgan Map of 1677. This map marks an important milestone in the study of London history, since it is the first detailed and accurate record of the built fabric and open space structure of the City. Thanks to its existence, it is possible to move from the realm of speculation about the urban structure of the City to one of defining and testing hypotheses.

It is unfortunate for historians that the map was produced after the Great Fire of 1666 so that it does not, strictly speaking, record the mediaeval building fabric. However, it is widely acknowledged that although the appearance of the City was greatly altered in the post-Fire rebuilding, the property boundaries and the street system were preserved almost completely intact. It is reasonably safe to assume that the Restoration City, in this sense at least, is continuous with its mediaeval predecessor despite the relative modernity of the map.

From the point of view of urban design, the Restoration period is one of considerable interest. The City of London is by this time a small part of the growing metropolis. By comparison with the new estates of the West End, the physical appearance of the City plan appears antiquated and out of step with contemporary tastes and lifestyles. The architects of the ‘great estates’ placed a greater emphasis on order in assembling the sub-areas of the plan into an overall design than did their mediaeval counterparts: a change which is reflected in the post-Fire plans for the reconstruction of London after the Great Fire of 1666.

By contrast, the ‘phoenix’ which arose from the ashes of the Great Fire appeared to hark back to a more intimate lifestyle, a small scale closed
world in which community life was to the fore and where family privacy and the division of home and work were minimally developed. This has led some historians to view the City in terms of correspondences between social groupings (trades, artisans, craftsmen and shopkeepers) and particular localities (streets, districts, parishes). At its most extreme, the claim is advanced that *gemeinschaft* is reflected directly and unselfconsciously into space in a physically defined, natural or inchoate neighbourhood.

The neighbourhood unit has been a recurring theme of modern town planning, and appeal to the precedent afforded by the 'mediaeval' past has been a key feature of the debate. This chapter sets out to examine the City as it was first recorded accurately and in detail to see if such an entity as a natural neighbourhood can be identified within what is widely regarded as the organic city *par excellence*.

The suggestion is made here that, whilst the concept of a natural neighbourhood as articulated within neighbourhood unit philosophy cannot be supported by analysis, the City does exhibit physical features which have a bearing upon the neighbourhood unit debate. More precisely, it seems that through a close analysis of the structure of the urban grid in relation to the configuration of wards, parishes, guild associations and the like, a precise formulation can be made of the spatial correlates of Alexander's concept of 'a semi-lattice'.

**London Survey'd.**

The Great Fire of 1666 destroyed 13,200 houses, the Royal Exchange, the Customs House and many other civic buildings, the Guildhall and 44 Company Halls, and St. Paul's Cathedral and 87 parish churches. Two thirds of the City lay in smoking ruins. However, by early February of the following year Royal assent had been obtained for a new building act to reconstruct the City on a modified ground plan. This, and subsequent acts 'strive to create a city that would be more habitable and more beautiful, built in such a manner as to render

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2. *An Act for the Rebuilding of the City of London, 08.02.1667*. 
Fig 6.01 - the extent of eighteenth century London
another Great Fire impossible. John Ogilby is thought to have begun work on recording the new City as it began to take shape early in 1672, but he died before the final version was ready for publication so the final stages of the task were overseen by his step-grandson, William Morgan.

Ogilby and Morgan's major large-scale survey of the City of London was published in 1677, eleven years after the Great Fire. By this time, London had nearly doubled in size with most new development taking place west of the intermural City (Fig 6:01). This process of westward expansion had accelerated with the Restoration. The incoming Royalists were suspicious of the City, which had supported Cromwell, and the aristocracy preferred to reside in the more pleasant open suburbs between the City and the Court at Westminster. At the time of publication, London was already seen to be a 'metropolis', for the word occurs in the opening paragraph of the printed 'Explanation' which accompanies the map. Nonetheless, although it was contiguously built-up, in Ogilby and Morgan's map London was still subdivided into the Cities of London and Westminster, and the Borough of Southwark, according to earlier conventions.

By the time the map was published in 1677 the City had been almost completely rebuilt except for occasional gaps where a site lay vacant. The City's streets were lined with rows of regulation houses, constructed in brick as specified by the Act for Rebuilding. The main streets were rebuilt straighter and wider than before, and were

2 Ogilby commissioned William Leybourn, a mathematician with extensive practical knowledge of surveying who had also been involved in Leake's post-fire survey, to take charge of the survey.
3 the map was offered for sale on 25.01.1677.
4 one inch to one mile
5 The full title of which is London Survey'd, or an explanation of the large map of London, giving particular account of the streets and lanes in the City and Liberties, with the courts, yards and alleys churches, halls and houses of note in every street and lane, and directions to find them in the map, with the names and marks of the wards, parishes and precincts therein described.
consequently axially less deformed\(^1\), and entirely new streets supplemented the pre-Fire grid\(^2\). The pre-Fire tendency for trading to be removed from the main streets into specially-constructed market buildings was maintained in the new City, and several new market areas were designated in the hope of preventing congestion on through-routes\(^3\).

Temporary churches had been set up at thirty or so sites within the City after the Great Fire. Rebuilding of the City’s churches began in 1670, with the Second Rebuilding Act. Only half the new Wren churches were on site by the survey date. Some were not reconstructed until the 1690’s. The old cathedral of Saint Paul’s had been destroyed in the Great Fire, but by the time of the map, reconstruction was well under-way \(^4\). Of the 44 livery company halls destroyed in the Great Fire, 41 rebuilt with new halls whilst the others repaired their existing buildings. By 1677 most were in use.

Progress on the City Corporation’s own building programme was much slower, but is recorded in the map. The Guildhall was begun in 1667 and by 1671 was used for banqueting once again. The year 1671 saw the Sessions House completed, and a start had been made on the two Compters\(^5\). Of the City gates damaged by fire, Ludgate was almost complete and the rebuilding of Newgate was well under way. The City’s other major institutions did not fare so well. Syon House was not rebuilt until 1670, Blackwell Hall and the Customs House by 1671, the North Block of the College of Arms by 1673, and enough of Christ’s Hospital to accommodate pupils by 1674. The Monument (to the Fire) was completed in 1675.

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\(^1\) Notorious bottlenecks such as Thames Street and Threadneedle Street were widened. The approaches to the bridge down Gracechurch Street and Fish Street Hill were widened to 35 feet and the west entry through Ludgate to St. Paul’s to 40 feet. Lanes and side streets were set at 14 feet, sufficient to permit two carts to pass.

\(^2\) notably the Queen Street approach to the Guildhall, with a new public landing stage to relieve pressure on Dowgate and Queenhythe.

\(^3\) Cheapside Market was moved to Honey Lane, a new square was created for Newgate Market, the Stocks Market was erected and new ground acquired for Leadenhall Market.

\(^4\) the detail with which the ground plan is shown has led to speculation that Ogilby consulted Wren himself about his intentions for the design.

\(^5\) debtors’ prisons.
The map also records two projected projects which eventually failed to come to fruition. The first is the New Quay, which was intended to provide London with a river frontage to rival Continental cities and which was a recurring theme in the post-Fire plans for the redesign of the City. The second is the designation of the Fleet River as a new canal flanked by 30 foot wharves with underground storage. A start was made here, but the river gradually declined into its former state as an open sewer. The 'Explanation' which accompanies Ogilby and Morgan's map includes a full list of all these physical features.

At the time the map was made, the intermural City comprised 96 parishes and 25 wards, each still largely self-regulating under the jurisdiction of an alderman and a deputy. The civil government of the City was by the Mayor with the Court of Aldermen and Common Council, as in the pre-fire period. The law requiring aldermen to live within the City was once more in force, although it had been relaxed for a short time immediately after the Fire. The city's ecclesiastical government was by a Bishop, with a dean and chapter, a treasurer and thirty prebendaries, in a diocese which extended to Middlesex, Essex and part of Herfordshire. Trade continued to be organised in Companies or Corporations, and it was still from the twelve principal companies that the Lord Mayor was chosen. More recent on the scene were the merchant trading companies. The business of these companies was transacted at the Royal Exchange, first built by Sir Thomas Gresham in 1566 but rebuilt after the Fire by the City and Company of Mercers. Land use continued to be dominated by the

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1 The extent to which this is an accurate representation is disputed by scholars. Perks suggests that it was intended but never built. Reddaway is more inclined to view the map as an idealised representation.
2 The list includes 25 wards, 96 parishes, 189 streets, 153 lanes, 522 alleys, 458 courts, 210 yards. The City wall is identified as a broad black line, the line of freedom is represented by a chain. The ward boundaries are shown as a hollow dotted line and the parishes, liberties and precincts by a dotted line. The extent of fire damage is marked by a wavy line. Churches and important public buildings were double-hatched. Public space is left white. Gardens were lightly dotted.
3 Of the 36 houses specifically mentioned by name in Ogilby and Morgan, 14 were the houses of aldermen, including the private residences of the Committee which inspected and officially endorsed the plates.
4 These were the mercers, grocers, drapers, fishmongers, goldsmiths, skinners, merchant-tailors, haberdashers, salters, ironmongers, vintners and cloth workers.
Fig 6.02 - Ogilby and Morgan's map of the City in 1677 (a large scale version of this map is to be found in the pocket at the end of the volume - bound copies only.)
production and merchandising of goods. The reference to the City as a 'celebrated emporium' \(^1\) comes from Ogilby and Morgan's text.

Ogilby and Morgan's map is the first multi-sheet plan of a major British town and very nearly the first linear ground plan to be executed\(^2\). Checks made with other documents, notably with manuscript surveys, suggest that ground plans generally conform but that there are some minor discrepancies at the backs of buildings. Not every alley and court is shown, and some small buildings in the backlands were omitted.

The general impression given by the map is one of disorder (Fig 6:02)\(^3\). Indeed the impression of chaos seems to have increased when the map is compared with the earlier map views of the City, particularly in the backlands where a process of infilling has almost completely obliterated yards and private gardens in favour of a dense system of ramshackle tenements, accessed by a network of courts and alleys.

**Newcourt and the Genesis of Modern Town Planning.**

Compared with the disorderly City portrayed by Ogilby and Morgan, the plans for the reconstruction of London after the Great Fire which were the subject of Chapter Three contain two strikingly different propositions about the relationship between the parts of a City and its overall global configuration. Those of Wren and Evelyn appear to have been conceived of top-down. The designer in these cases seems to have worked principally at the global level, and the characteristics of each space are subordinated to some relational conception of a city as a unified or integrated phenomenon. By contrast, those of Knight and - more contentiously - Hooke, proceed in the opposite direction; that is, bottom-up from the design of a local element or elements, which are

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\(^1\) Ogilby and Morgan, op.cit. p.5.

\(^2\) Leybourn inserted a new section in the second edition of his 'Compleat Surveyor' as a result of his experience in making this map, in which he recommended the use of a theodolite and ranging rods first to plot the principal streets, and then from their setting out to survey by-lanes courts and alleys. He recommended that readings be set down in a data book for transfer to the map, section by section.

\(^3\) A larger version of this plan is to be found in the pocket at the end of this thesis.
then repeated and aggregated to form a city.

Both propositions rest ultimately on order concepts. The distinction, though a fine one which is occasionally difficult to 'make stick' in reality, seems to entail a difference in the point of impact of order. In a top-down conception of order, uniqueness, insofar as it exists at all, is inherent in the design concept and is built directly into the overall configuration. In a bottom-up view, the design elements (the local parts) are identical as shape abstractions, but they acquire uniqueness through their concrete placement within the overall configuration - for example, by being located at the centre or at an edge, or by some geometrical transformation such as handing or rotation. The relational idea here is minimal, a locally applied rule to guarantee the spatial adjacency of the parts.

There is however a third possibility, again an order concept but one which contains the seeds of a theory of the relationship between parts and wholes which combines the concept of a unified, global and geometrical design with that of the repetition of a local motif. This is exemplified in Newcourt's design, which introduces the concept of hierarchy as the explicit relational principal by which parts may be combined to guarantee both the integrity of the overall composition and the identity of the local elements.

The evolution of these ideas in modern town planning will be touched on in the Final Discussion. The interest here is that Newcourt's proposition for the redesign of the City is based on the proposition that a community defined by religious practices - the parish - should form the basis of a spatially defined, clearly identifiable higher order physical unit within the City which would intervene between the (spatially bounded) household and the wider spatial compass constituted by the community of citizens. The proposition thus invokes the idea of a natural physical order which appears to correspond to a natural social order. Local neighbourhoods, each defined by an urban superblock become physical mediators between the primary elements of the town, the set of buildings or closed cells, and the overall physical form of the city as defined by the continuous structure of

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1 these ideas are formulated and discussed at length in Hanson J and Hillier B, The Architecture of Community, in Architecture and Behaviour.
public open space.

Newcourt's idea is undoubtedly attractive in its simplicity. It gives a practical directive to resolve what seems to be the difficult question of how to generate and control the growth process in a complex urban object. It answers a question which is a constant source of debate amongst analysts and designers alike: how the sub-areas of the city - districts, neighbourhoods, localities, precincts and the like - are formed into a larger whole.

Quite simply, the parts/whole question is a question about urban structure; the appeal to some physically defined, natural neighbourhood at a local scale reduces the problem to one of order and thus brings it within the grasp of intuition. The appeal to order in this instance assumes that through the recursive application of some simple design principle at a number of ascending physical scales, the resulting urban object remains 'under control' however large it gets or however many levels of hierarchy are identified in the corresponding social formation. If the idea has any validity, it becomes practical to intervene systematically at levels other than the extremes of the individual dwelling and the town structure plan. The attractiveness of the proposition is that it limits the scope of the problem by identifying some putative 'unit' of urban structure above which the designer apparently need not take account of the global workings of the city.

The point about the parts/wholes problem in urban form is that it is a general problem about the structure and functioning of cities. The idea of the 'natural neighbourhood' is proposed by many as the answer to this question in traditional and unplanned cities. Usually the same authors advocate some form of 'neighbourhood unit' as the equivalent in modern town planning. The complex of ideas seems so natural that it is seldom brought into question. Where it is, it is usually examined from a social perspective, to show that physical contiguity is no guarantee of real or perceived community identity. Network theorists have been at pains to show that social groups are

1 as defined in the opening Problem Definition of this thesis
2 the most thoroughgoing case is Mumford, L. In Defence of the Neighborhood, but other writers who have put this point of view include
3 this material has already been dealt with in brief in the Problem Definition and Literature Review.
not bounded in the ways which the correspondence model requires, and that to prop up these non-groups with physical spatial gestures is therefore irrelevant, but this quibble does not really challenge the basic tenet that if space matters to society it is through some hierarchy of scaled socio-physical correspondences.

This investigation is able to take another viewpoint. It follows that if such a theoretical entity as a natural neighbourhood exists within traditional cities, it should be apparent in the physical fabric alone without reference to society. Clearly, order-based analyses are not sufficient to settle the issue, since these rely on those very characteristics which, it is argued, are 'inchoate' or not fully-developed in disordered, organic urban forms like the Restoration City. The matter can only be resolved by tackling the physical description of complex urban forms at the level of structure. This chapter therefore sets out to investigate the physical fabric of the City as recorded by Ogilby and Morgan in 1677 to see if beneath the apparent disorder, any such entity as a natural neighbourhood can be shown to exist.

A study of this nature has both a specific and a general interest. The general significance lies in the fact that the City is frequently cited as the exemplar of the general proposition about the hierarchy-correspondence relation between space and society in traditional or 'organic' towns. It is thought to be a clear case of a naturally-evolved town from which the surface characteristics which can be ascribed to geometric or visual order are completely absent. The claim is therefore that the City is unmarked by the imprint of global political processes. Nonetheless, it is suggested that the City has a clear structural continuity with more recent, regular, planned neighbourhood units. It is widely believed that as recently as the beginning of the nineteenth century the City was a collection of natural neighbourhoods, in which it is taken for granted that social identity is supported by a degree of physical self-containment. If this is the case, then this should be revealed directly by configurational analysis.

However, according to the findings of previous chapters, the City appears from its foundation to have been morphologically differentiated in its parts, although the precise way in which this was
achieved seems to have varied with historical period and phase of growth. This is clearly at odds with the hierarchical order-based concept of a correspondence between clear physical domains and bounded social groupings which was outlined earlier, since this implies an identity of local elements. To the extent that morphological differentiation in the sub-areas of the City exists, then some alternative formulation about neighbourhood grouping to the hierarchy/correspondence formulation may emerge which is capable of a more general application to naturally-evolved cities.

The specifics of the case lie in the fact that at this time the City is known to have had a 'devolved' institutional structure - wards, parishes, and trade groupings were all locality-specific or at least regionalised within the City. This might be suggestive of correspondences between space and society. Other aspects of social life are which are widely thought to have been systematically spatialised, point in the opposite direction to a non-correspondence of society and space, the spatially proximate relationship of rich and poor being a case in point. The location of important nonresidential buildings may have been such as to exploit systematically some aspect of morphology.

The investigation of the parts/whole question as initially posed in the 'natural neighbourhood' proposition does not require an immediate appeal to other 'diagnostic' features, such as the location and strength of the City's institutional forms or the networks formed in space-time by patterns of everyday life. However, a modest aim of the chapter is to explore the extent to which these known socio-cultural phenomena can be shown to have spatial correlates. If the relation is found not to be straightforward; that is not a correspondence, projection or reflection of social groups and institutions, then this wealth of

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1 this was the starting point of a recent historical investigation by Power, who set out to test the assumption that the diversity of London neighbourhoods is a distinctive feature of the City which has arisen from the imprint of distinct social and occupational groups upon the parishes and quarters they colonise. Power suggests that this is directly reflected in the diversity of physical environment in the different parts of the City. Power, M.J., The social topography of Restoration London, in Beier AL and Finley R, London 1500-1700 the making of the metropolis, Longman, Harlow, 1986, p.199. Some of the key findings of this study will be reported later in the chapter.
information may provide some clue to an alternative hypothesis about the social strategy which was adopted in relation to the deformed urban grid of the City.

The Spatial Correlates of Neighbourhood.

In what follows, the known sub-areas of the City - particularly the wards and parishes - will be examined in the light of arguments by the proponents of neighbourhood unit planning about how these are thought to have received their physical form. This will be set against the historical evidence reviewed in earlier chapters and alongside that provided by the urban grid itself. However, it is worth rehearsing the 'conventional wisdom' insofar as it specifies the spatial correlates of the natural neighbourhood concept with sufficient precision to test for their existence in the space structure of the City.

Neighbourhood unit planning as it has developed in the United States and Britain over the last few decades has a clear view of the spatial characteristics which are believed to have existed in the 'inchoate neighbourhoods' of traditional European cities. This view permits the size of sub-areas to be specified and the condition of their boundaries to be determined: 'the unit should be bounded on all sides by arterial streets sufficiently wide to facilitate its bypassing instead of penetration by through traffic'. Other principles suggest that an open green heart should be located in the geometric centre of the neighbourhood, together with sites for those institutions which have 'service spheres coinciding with the limit of the unit'. Designers are cautioned to 'avoid assigning central or interior locations to any institution that frequently draws together large crowds of strangers'.

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1 one of the clearest statements is by Perry, C.A., The Neighborhood Unit Formula, first published in Housing for the Machine Age, Russell Sage Foundation, 1939, pp 49-76 and reprinted in Housing in the Neighborhood, pp 94-114.
2 this is done in several ways. Perry's preferred calculation was based on the area required to generate the population of a primary school. Others use a standard travel distance to local facilities, a preferred total population, or sheer physical size. For a city centre location, Perry advocated a unit of about 30 acres or 12.14 ha.
3 ibid. p.95.
4 ibid p. 101.
5 ibid p. 102.
several neighbourhoods. Pedestrian routes should channel movement to these centres of commercial activity which should be 'bunched rather than strung along a street' \(^1\). Prescription extends to aesthetic preoccupations. Each sub-area should aim to develop a distinctive character, and to advertise its existence by architectural devices like 'symbolic portals' \(^2\) as well as through the choice of materials and the elevational treatment of individual buildings. Sub-areas should correspond to a real or perceived community, amongst whom physical propinquity and daily contact should foster a sense of neighbourliness and civic identity\(^3\).

Translated into the terms of traditional cities, these principles mutate as follows.\(^4\) The process of historic growth has, it is argued, naturally brought about sub-area identity within traditional cities, particularly since the expansion and consolidation of most historic towns has tended to take the form of a series of bursts of frenetic building activity followed by periods of relative stagnation. This process generates a type of city in which the overall physical form arises as an aggregation of discrete sub-areas, each of which has 'a well-defined architectural character as well as an identifiable social face' \(^5\).

Because each sub-area arose spontaneously without overall coordination, the street system of each tends to be self-referential, at the expense of the overall network which tends to be relatively discontinuous and fragmented. Even if the precise boundaries of the quarters are not absolutely clear, they will tend to be separated by major streets and offset from one another, so that direct physical access from one part of the city to another is minimised. The physical autonomy of sub-areas guarantees that the neighbourhood circumscribes a sphere of daily movement and social encounter. The centre of a naturally-evolved sub-area is dominated by institutions (church) and some form of public open space (a market square). Each period of building activity is marked by its state of technological advance so 'characteristic modes of building buttress this

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\(^1\) ibid p. 106.  
\(^2\) ibid p. 105.  
\(^3\) ibid. p. 108.  
\(^5\) op.cit.p 115.
neighbourhood consciousness'. The estimate of populations in these natural neighbourhoods varies from 1,500-6,000 people. The size is governed by some view of the reasonable extent of normal pedestrian travel.

Mumford suggests that a clue to the identity of natural sub-areas might be given by the requirement for residents jointly to perform civic duties. Among the examples cited are that each quarter has its own section of the walls to defend (this was so of the wards of London); political unity based on common rights to elect representatives to the city government (also the case with wards); religious affiliation as reflected in church and parish boundaries (the City is a clear case where this had a major impact on the citizenry) or pattern of work through 'occupational association or zones, by means of which professions or industries of the same sort tend to form well-defined precincts' (Mumford himself uses London as an example) which pre-date segregation by wealth or income. Mumford argues that this process 'has never entirely been disrupted in the more organic growth of a great City like London' and hence can still be detected there today.

The main destructive influence on the survival of sub-areas is seen to be the modern necessity for through-movement - 'the emphasis changed from facilities for settlement to facilities for movement' - which, by creating a more global connectivity within the city, ruptures the self-contained world of the natural neighbourhood such that 'it is easier to find oneself in the city as a whole than to find oneself in the neighbourhood'. In this and the succeeding chapter, particular attention will be paid to the precise relation between local parts of the

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1 ibid. p. 116.
2 which verges on the lower end of what is thought viable in modern neighbourhood units.
3 this is a measure often used to determine the size of units in modern neighbourhood planning.
4 ibid. p.116. This view is supported by historians like Vance, who suggest that in pre-industrial cities guild members tend to co-habit within a particular parish, in neighbouring dwellings centred upon their guild hall. Vance, J.E., Land assignment in pre-capitalist, capitalist and post-capitalist cities. Economic Geography, vol 47, pp 101-20, 1971.
5 ibid.p.116
6 ibid.p 116.
7 ibid.p.117.
urban fabric and the global configuration of the City as it is given by the structure of the urban grid.

The importance of this line of argument for modern town planning will be looked at in the concluding chapter of this thesis. What is significant for this chapter is writers like Mumford set out a clear physical specification detailing the conditions under which 'inchoate' neighbourhoods might be said to exist. If the City of London is the epitome, it should be possible to identify within its global configuration spatially discrete entities which have some social significance in terms of occupational grouping, political or administrative association or common interests. The strongest empirically derived sub-area division within the City of London is the ward structure, but parish formation and guild association offer an alternative basis for more localised socio-physical groupings.

The Built Fabric of the Restoration City.

Although the Leake map made broad statements about the public space of the City possible in previous chapters, it did not permit the kind of detailed topographical analysis which is necessary to establish the validity of the natural neighbourhood concept, which is made possible when armed with Ogilby and Morgan's plan. Within the fire damaged area of Leake's plan island blocks were shown in outline, so it was impossible to envisage the forms taken by the buildings, yards and gardens, and the network of small lanes and alleys which made up the fabric of the city. All these difficulties are resolved in Ogilby and Morgan's map. The City which it portrays will therefore be presented as if for the first time, and only afterwards will comparisons be made with what is thought to have gone before.

A visual inspection of the Ogilby and Morgan map (Fig 6:02) reveals some immediate and striking features. In the 1677 map, the boundary of the City is clearly delineated at the walls, which are almost completely intact save for a short length in the west of the City along the east bank of the Fleet Canal\(^1\) and a small breach in the north at

\(^1\) destroyed in the immediate Post-Fire rebuilding, with the dredging of the New Canal and the building of wharves and underground warehouses from the River Thames to Holborn.
Christ’s Hospital. From the point of view of permeability, the walls present a major obstacle to movement into and out of the City, which is channelled through the City Gates: Ludgate, Newgate, Aldersgate, Cripplegate, Moorgate, Bishopsgate, Bishopsgate and Aldgate. In addition, the map shows three small, ungated, local posterns; two in the north wall either side of the New Bethlehem, Moorfields, and the third adjacent to the Tower. These do not appear to have carried substantial amounts of through-traffic. There is only one river crossing at this time, London Bridge, although in what follows the importance of the river as a thoroughfare has to be borne in mind.

Upstream of London Bridge, the river did not present as much of an obstacle to pedestrian through-movement as it does today.

Within the walled area, the map shows that most of the damage caused by the Great Fire had been made good by 1677. Taking first the block structure and its relation to everyday buildings, the first impression is one of disorder. Island blocks appear to vary greatly in size, shape and composition. In line with current legislation, larger buildings ought to have been associated with principal streets and smaller buildings with minor streets. This would have paralleled the logic of neighbourhood unit planning, which also tends to group

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1 breached in the Middle Ages to enable the occupants of the Hospital to reach their graveyard, which was situated on land owned by the charity immediately outside the Walls.

2 this route was originally gated, but the gate was partially demolished in 1190, at the time that the Tower was extended and walled, and finally collapsed in 1440. It was never rebuilt and the route seems to have been checked by bars across the main streets leading from the Tower Liberty to the City on either side of the Walls, erected to collect toll on goods entering the City.

3 estimates of people using small ferryboats to cross the River are difficult to make, although it is known that the River was crowded with local traffic. This mode of transport was, in any event, confined to the slower waters above London Bridge.

4 in the wording of the Act for the Rebuilding of the City of London (1667) is as follows: ‘there shall be only four sorts of building: first and least sort fronting by-lanes, second sort fronting streets and lanes of note, the third sort fronting high and principal streets. The roofs of each shall be uniform. The fourth and largest sort of mansion for citizens or other persons of extraordinary quality not fronting the three former ways’, source. Milne,G. The Great Fire of London. Historical Publications. London, 1986, p117. The Lord Mayor was empowered to designate all streets within the City under one of the three categories - high or principal streets, streets and lanes of note, and by-streets, alleys and courts - and to stake-out the intended width and length of each in the ruins before rebuilding commenced.
similar classes of dwelling and occupant together. However, within the City itself this principal is not followed consistently and most frontages contain a mix of property sizes.

Urban blocks within the City are not laid out in the strips which would result from the division of the block in conventional burgage plots. The basic landholding unit within the City seems to have been wider than a burgage plot, with several buildings lining the route and one or more jump-over blocks or entries leading to an interior zone of yards and courts. Urban blocks are not under single ownership. On the contrary, each may have several property holdings which may or may not be permeable to neighbouring holdings on the different faces of the same block.

Many street frontage properties were owned by the livery companies and other institutional landowners\(^1\). The basic pattern of development of a plot seems to have been that first a single house was erected parallel to the street. This was then replaced by a row turned gable on to the street. Finally these were augmented by a back to back development of closed courts and yards around the property boundary in the hinterland of the plot. Large private houses were the exception. Throughout the City these were embedded in the heart of the block with access by way of an alley leading to a front courtyard. This pattern of development differentiates the internal structure of urban blocks in the City sharply from those found in other historic English towns.

A by-product of the structure of urban blocks within the City is that everywhere the mansions of the wealthy are contiguous with everyday dwellings, and everyday dwellings with the hovels of the poor. This degree of spatial contiguity is unacknowledged by the literature on natural neighbourhoods, which prefers space to associate the homogenous elements within society and to separate the heterogeneous.

A recent study by Brown\(^2\) has linked this unique growth process to the presence of a secondary system of routes within the interstices of...

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1 before the Dissolution by the Church.
2 Brown F, op.cit.
Fig 6:03 - 1 large urban block close to the walls below Moorfields, in the headwaters of the Walbrook.

Fig 6:04 - an axial transcription of this part of the City with the number of urban islands noted.
the urban block. On the basis of computer simulation, Brown argues that 'breakthrough' between the yards produced by the interior zone development of individual property holdings, increases in the City as blocks develop whereas in simulated systems it does not occur with sufficient regularity to prevent deep courtyards from evolving. He argues that 'Where, as was so often the case, the interior zone was the domain of the lower classes - craftsmen, artisans and the labouring poor - it would be less easy for the inhabitants to maintain a close relation with the street. That this was achieved, and so consistently, suggests considerable collective thought and action.' Brown thus concludes that 'breakthrough' seems to be intervening systematically to maintain a shallow interface between dwellings and streets as plots evolve.

The importance of 'breakthrough' in constructing a secondary and almost invisible system of circulation within the City is well-illustrated by considering the large urban block in the north of the City immediately below Moorfields (Fig 6:03). In the subsequent transcriptions of 'important' routes within the City this always appears as a single island. However, the full axial map reveals a well-developed secondary route system which divides the main block into 18 separate islands (Fig 6:04). This is an ubiquitous feature of the City and, particularly where encroachments have narrowed routes, one which makes the non-arbitrary division of the City into its principal urban blocks (or conversely, the continuous system of main routes) particularly difficult.

Most City blocks are heavily developed, backland development is rife, and the Ogilby and Morgan map shows few green gardens in the interstices of the blocks. All those shown are in the east around Bishopsgate. The mediaeval City bears no relationship to the 'rus in urbe' which lies at the heart of modern neighbourhood philosophy. The intermural City is also characterised by a lack of large-scale, public open space. There is no cartographic evidence in the City of any attempt to scale public spaces to correspond to local faci or neighbourhood centres.

1 ibid p 273.
2 this point will be dealt with in more detail in the next chapter.
3 named streets, visually long and wide routes, and so on.
Fig 6.05 - an open space map of the City in 1677
Newgate and Honey Lane Markets can be picked out on the map in the west of the City, north of St. Pauls. These are planned 'improvements', taking market trading out of the adjacent thoroughfares. A similar clearance on the site of St. Mary Woolchurch produces a market space, the Stocks Market, opened up at Cornhill intersection. Several major buildings have a small apron at the main entrance, notably the Guildhall. Others, like the Royal Exchange, have open, interior courts. These open areas are the exception rather than the rule, and there is nothing to suggest that there was any tendency for localised open spaces to be associated with different regions within the City.

The two striking large-scale spaces, at the Tower and around St. Paul's are a product of the only two monumental buildings of the City. Both are historically associated with public gathering places. Tower Hill was a place of public execution and contemporary prints show the open space of Great Tower Hill filled to capacity on these occasions. It is known that the Folk-Moot met beside St.Paul's, but this popular assembly was defunct well before the Great Fire. The place was, however, still used for outdoor preaching. Despite the association of large-scale buildings and public space, however, the relationship in both cases is of simple non-contiguity - of preserving the free-standing nature of the building - and is not given added significance by adapting urban space to emphasise the building's symbolic role through geometry. Both functioned as gathering places for the entire citizenry.

So far as the remainder of the street system is concerned, this is clarified by the figure-ground transcription shown in Fig.6:05, in which all the public space of the City is shown in black on a white background. The transcription highlights the considerable degree of small-scale backland development of both the nondistributed (closed court and yard) and distributed (lane and alley) variety in the City at this time. The map also indicates the shape properties the spaces

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1 this was short-lived, and was covered by the Mansion House in 1753.
2 attracting people from the entire metropolis and beyond, on occasion.
4 rules preserving unbuilt space around the Tower are thought to have had to do with not building within a bow-shot of the Tower; in the case of St.Paul's and other churches it was necessary to be able to walk round the outside of the building in connection with religious ceremonial.
produced by infilling the backlands of island blocks. Here, convex articulation takes the form of squarish courts of various sizes entered by narrow passages which often pass under the buildings. On the main streets, roads are narrow but of a more or less uniform width, everwhere pressing to the back of the building line.

The street grid of the City appears highly deformed and irregular despite the many 'improvements' to the layout mentioned earlier. In the main, the existing street layout is reproduced without any major dislocation of the complex network of land and property ownership which had shaped the physical form of the pre-Fire plan. Thus, although some streets which had been designated as major thoroughfares were substantially widened and most minor lanes were made at least 14 feet wide, there had been little attempt in the rebuilding process to geometrize the City in accordance with the contemporary principles of town planning.

Nontheless, despite its deformation, it is possible on the basis of the Ogilby and Morgan map to identify a clear east-west emphasis in the primary street grid of the City at this time. The widest and straightest of these routes is that from Newgate in the west to Aldgate in the east, by way of Newgate Street, Cheapside, Poultry, Cornhill and Leadenhall Street. A narrower, but relatively direct east-west through-route runs from Ludgate to the Tower by way of Ludgate Street, St Paul's Churchyard, Watling Street, Cannon Street, East Cheap and Tower Street, and a third, internal east-west route runs to the north of the River along Thames Street. There are no strong east-west through-routes north of Cheapside. The most prominent streets are Lothbury/Throgmorton Street, which starts abruptly where Ladd Lane intersects with Wood Street west of Aldermanbury and veers sharply north along Broad Street towards the Wall at a point where there is no gate. A second route runs along the length of the wall on its northern boundary.

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1 as evidenced by the frequent complaints about 'encroachment' of buildings into the thoroughfare throughout the mediaeval period and into the early 19th century.
2 this route was specifically mentioned in the Act for the Rebuilding of the City of London, 1667, as needing enlarging and clearing of 'shambles'.
3 also mentioned by the Rebuilding Act as requiring widening.
Equally striking is the fan of streets radiating from Cornhill. The most northerly of these, Threadneedle Street, bifurcates to join the internal Broad Street, already mentioned, and continues on to strike the only north-south through-route at the time, from Bishopsgate to London Bridge by way of Bishopsgate Street, Gracious Street, Gracechurch Street and Fish Street. The third street of the fan, Cornhill is the wider and straighter of two routes to Aldgate. The more southerly, narrower, and more tortuous route by way of Lombard Street and Fenchurch Street rejoins Leadenhall Street just before Aldgate Bar.

The Bishopsgate-London Bridge through-route aside, long north-south routes seem more difficult to pick out on the map. To the north of Cheapside, a series of streets run north-south in the north-western quadrant of the City. St. Martin le Grand is a narrow continuation of the very much wider Aldergate Street which terminates at Newgate Street. Wood Street runs from Cripplegate Bar in a straight but narrow line to Cheapside; Aldermanbury is wider but more deformed, and reaches Cheapside only by a chicane into Milk Street. The remaining prominent north-south streets Basinghall Street and Coleman Street focus on Lothbury, not Cheapside. East of Coleman Street lies a major island centering upon Drapers Garden, beyond which blockage in the street grid the radial pattern from Cornhill predominates.

South of Cheapside, the north-south streets occur at frequent intervals. Several run all the way from Cheapside to Thames Street. Others are shorter, linking two adjacent east-west main streets. The density of streets decreases from west to east. The only route which clearly crosses Cheapside is the New King Street/New Queen Street route from the Guildhall to the River. This is a major planned 'improvement' to the mediaeval grid. Its significance lies in the fact that the principal route from Westminster to the Guildhall at this time was by the River Thames, and the new road was clearly seen as a ceremonial route between the two centres. Dowgate Hill and Walbrook link the river to the important Cornhill intersection, but east of this line there are no obvious long north-south links other than the major route from Bishopsgate to the Bridge already mentioned.

1 The southern part of this route, from Gracious Street to the River was similarly widened under the same legislation.
Fig 6.06 - an outline of the City with the visually distinctive areas of the grid annotated A-H
Having identified what seem like the major streets, other features come into view, which suggest that the City of Ogilby and Morgan was spatially distinctive in its parts (Fig 6:06). The dense rows of streets (A) between Thames Street and the River, coupled to the large (for the City) open areas along the quayside give this southern extremity of the City a distinctive linear pattern. This was in part a product of legislation. The whole area had been raised by a metre with rubble from burned-out houses, and building along this embankment within approximately fifteen metres of the River had been prohibited by the Act of Rebuilding, 1667.

South of Cheapside, in the south-west between St. Pauls and Wallbrook the street grid (B) seems particularly dense and the blocks formed by the grid are shot-through with a complex pattern of closed courts and through-permeable alleys. Most secondary development is small-scale, but some space within the blocks is more open and unbuilt. Almost everywhere where this occurs, it is as a result of land not having been taken up in the immediate aftermath of the Great Fire¹. North of Cheapside, the pattern is similar as far east as Coleman Street (C). The north-west area between Coleman Street and Bishopsgate (D) is fringed by strikingly long, narrow, close-spaced alleys, particularly in the vicinity of the Wall.

East of Walbrook in the south-eastern part of the City (E), there is less backland development, and where this occurs it is both much shallower to the main street grid and not so through-permeable. The area between Fenchurch Street and Threadneedle Street (F) is, by contrast, riddled with narrow, through-permeable alleys. Within the island formed by Leadenhall Street, Gracious Street, Fenchurch Street and Lime Street these enlarge into a system of interlinked open-air markets within the interstices of the block (G). East of Bishopsgate, in the north-east quarter of the City (H) the major street grid defines a few, large islands characterised by a fringe of shallow courts around the perimeter of the blocks, and penetrated by long, wandering, through-permeable lanes and alleys with some larger, open spaces.

¹ To prevent depopulation to the suburbs, owners had to develop their plots within 3 years or the land would revert to the City Corporation and would be sold for development. Most of the larger gaps in the fabric were a product of ownership disputes and compulsory purchase orders.
located within the heart of the blocks.

These observations suggest that the distinctiveness of the City in its parts is indeed a property of spatial morphology. The City seems not to be composed of locally similar elements but of dissimilar parts which are aggregated and bound together by the line of the walls, and limited within their confines by the dynamics and constraints which govern the global structure of the street grid. Moreover, since there seem to be pronounced physical differences in the street grid and in the shapes of the islands contained by it, this begs the question as to whether these observable differences bear any relation to the structure of City neighbourhoods, whether these be purely a product of spatial configuration or bear the imprint of society and its institutions.

Whatever the answer, the question also arises as to the relationship between the parts and the whole. One possibility is that this coming together is merely fortuitous: that is, the parts are simply collected together in a spatially contiguous relationship whilst preserving local independence and discreteness. This would imply the dominance of the 'neighbourhoods' of the City over the overall development of the configuration. This possibility would lend credence to the view that the City is indeed a collection of distinctive and relatively self-contained urban quartiers. At the other extreme, it is conceivable that the differentiated parts might nonetheless be subordinated and integrated within a more global urban design. Under these circumstances, the concept of the inchoate neighbourhood unit would require a radical reformulation. A third possibility is that the City is more broadly differentiated into sub-areas, with the four quarters either side of Cheapside and the Walbrook exhibiting different morphological characteristics.

As a result of this, a methodological procedure will be adopted of inspecting the City in quarters. The east-west division will be made on the line of Walbrook, not only the administrative east-west division of the mediaeval City but also in the approximate geometrical centre of the east-west extent of the City within the walls. The north-south division will be made along Cheapside, again not only the clearest line but also the one which is geometrically central to the line from the
Fig 6.07 - The ward boundaries in 1677. Areas where the boundary runs along the line of a street, lane or alley are marked in solid black.
walls to the river. All important configurational features in which the City seems to differ in its parts will be examined to see if differences in the distributions of spatial and other properties emerge.

**Correspondence and overlap in urban space.**

The boundaries of the wards at the time of Ogilby and Morgan are shown abstracted from the plan in Fig 6:07. Technically speaking, the map portrays the ward structure in the form which it assumed after the Great Fire. However, this is generally thought to be identical to that of the preceding period and thus it presents a reasonably precise spatial picture of the administrative and governmental structure which was set up in the City during the Saxon period.

Many authors have noted the lack of congruence between ward boundaries and physical features within the City. That this is so, is immediate and striking. Bishopsgate and Langborn Wards are almost split in two, and in each case the segments are connected only by the width of a major street which maintains spatial continuity. Farringdon Within is physically split, with a small part in the north-west of the City near the walls being discontinuous with the major area in the south-west. At the wall, Aldgate and Farringdon Within do not cross the physical boundary, whilst Bishopsgate, Cripplegate, Coleman Street and Aldgate all do. The Tower Liberty prevents the wards in this part of the City from reaching the wall at all. This already presents some puzzles for the 'incoate neighbourhood unit concept' for it is clear, particularly where wards cross the wall, that

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1 in this figure, the ward boundaries are shown with a chain (ooooooo) and where this corresponds to a route, the chain has been blacked in solid. The City wall is marked with a dash-dot line (_______)

2 there is only one place where the boundaries cannot be traced with absolute clarity, and that is in the north-west, at Farringdon Within, where a section of boundary continues for several houses into the adjacent ward. This seems most likely to have been a transcription error, since it does not enclose space.

3 for a description of the genesis of the ward structure, see pp... of chapter...

4 Bishopsgate itself, and Lombard Street/Farringdon Street respectively.

5 broken apart by the Liberty of St. Martin le Grand, and Aldersgate Ward.

6 except in the discontinuous area in the north-west.

7 not all are linked through a gate and some, like Farringdon in the north-west, do not even have a postern to link the intermural ward with its suburban segment.
daily contact and social intercourse are severely impeded by the irregular shape of wards.

The 25 wards of the intermural City are set out below.

<table>
<thead>
<tr>
<th>Ward</th>
<th>Neighb' r.Index.</th>
<th>Size Ha.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01. Aldersgate</td>
<td>- 5</td>
<td>8.5</td>
</tr>
<tr>
<td>02. Aldgate</td>
<td>- 6</td>
<td>55.5</td>
</tr>
<tr>
<td>03. Basinghall</td>
<td>- 3</td>
<td>9.5</td>
</tr>
<tr>
<td>04. Baynard Castle</td>
<td>- 3 (+ river)</td>
<td>37.25</td>
</tr>
<tr>
<td>05. Billingsgate</td>
<td>- 3 (+ river)</td>
<td>18</td>
</tr>
<tr>
<td>06. Bishopsgate</td>
<td>- 8</td>
<td>30.5</td>
</tr>
<tr>
<td>07. Bread Street</td>
<td>- 5</td>
<td>15.5</td>
</tr>
<tr>
<td>08. Bridge</td>
<td>- 4 (+ river)</td>
<td>11.5</td>
</tr>
<tr>
<td>09. Broad Street</td>
<td>- 6</td>
<td>52</td>
</tr>
<tr>
<td>10. Candlewick</td>
<td>- 4</td>
<td>11.5</td>
</tr>
<tr>
<td>11. Cheap</td>
<td>- 6</td>
<td>20.5</td>
</tr>
<tr>
<td>12. Coleman Street</td>
<td>- 4</td>
<td>25.75</td>
</tr>
<tr>
<td>13. Cordwainers</td>
<td>- 5</td>
<td>15.25</td>
</tr>
<tr>
<td>14. Cornhill</td>
<td>- 5</td>
<td>8.5</td>
</tr>
<tr>
<td>15. Cripplegate</td>
<td>- 8</td>
<td>31.5</td>
</tr>
<tr>
<td>16. Dowgate</td>
<td>- 4 (+ river)</td>
<td>20.5</td>
</tr>
<tr>
<td>17. Farringdon</td>
<td>- 7</td>
<td>57</td>
</tr>
<tr>
<td>18. Langborn</td>
<td>- 9</td>
<td>23</td>
</tr>
<tr>
<td>19. Lime Street</td>
<td>- 4</td>
<td>9.5</td>
</tr>
<tr>
<td>20. Queenhythe</td>
<td>- 4 (+ river)</td>
<td>21.5</td>
</tr>
<tr>
<td>21. St. Martin</td>
<td>- 2</td>
<td>5</td>
</tr>
<tr>
<td>22. Tower</td>
<td>- 4 (+ river)</td>
<td>42.5</td>
</tr>
<tr>
<td>23. Tower Liberty</td>
<td>- 3</td>
<td>22.75</td>
</tr>
<tr>
<td>24. Vintry</td>
<td>- 4 (+ river)</td>
<td>18</td>
</tr>
<tr>
<td>25. Walbrook</td>
<td>- 8</td>
<td>15.25</td>
</tr>
</tbody>
</table>

The size of wards, measured within the walls varies greatly. Measured roughly\(^1\) the largest, Aldgate, Broad Street, Farringdon and Tower are nearly seven times the size of the smallest, Aldersgate, Basinghall, Cornhill, Lime Street and St. Martin's Liberty. Mean ward size is 23.45 ha. This average is not dissimilar from that of 30 ha. postulated for a modern inner city neighbourhood unit, but the actual size, occupation density and population distribution of wards which this mean disguises is substantial. Again, looking at the average population density of wards, the figure of 10,000 which this computation gives is about the upper limit for modern neighbourhood unit design, although this does not take account of the actual distribution which varied widely.

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\(^1\) that is, by eye on a 10 x 10 grid. Each unit represents 10,000 sq.m. or one hectare.
All the larger wards are close to the walls. The shape of wards is such as to make area-perimeter ratios difficult to standardise. Wards within the City display convex articulation of two sorts. Some, like Vintry, are regular in overall shape, but have locally jagged boundaries. Others, like Farringdon, have jagged boundaries locally but in addition take up a highly irregular overall shape. This overall irregularity is difficult to reconcile to the neighbourhood unit ideal, since it reduces the possibility for conceptualising the ward as a physical entity, particularly when it is experienced as a built reality rather than in plan.

This articulation of boundaries in the ward structure of the City has an important effect on the neighbour condition of wards. Were the ward structure of the City to have taken a perfectly rectangular form, then each block would have exactly four neighbours\(^1\). The non-rectangular outline of wards has a simple 'socio-physical effect of increasing the number of potential neighbours for the majority of cases. If adjacency over a short distance is counted as sharing a common boundary, but corner joining is disallowed, then the average number of adjacent neighbours of wards within the City is 4.96. Those along the riverfront suffer by not being able to make joins on all four sides, but even these have an average of 3.7 neighbours. In the centre of the City this rises to 4.6, while those wards which abut the walls have an average of 5.8 neighbours. The lowest value is that of St. Martin's Liberty, which is enfolded by two wards, and the absolute highest is Langborn, which has 9 neighbours. That the articulation of the boundary enhances neighbour adjacency seems to run counter to the natural neighbourhood concept, which stresses the degree of self-containment and physical discreteness of neighbourhoods to a degree which does not allow for physical interlock.

More important than area-perimeter ratio is the boundary condition of wards, since this is one area where the 'inchoate neighbourhood unit' might be expected to assume a clear physical form. It has been suggested by some historians\(^2\) that the wards were originally determined by the lines of the principal roads, so that the road

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1 disallowing corner joins.
2 such as Lethaby, *VR. London before the Conquest*, Macmillan, London, 1902.
Fig 6:08 - the set of named streets in the City of 1677
marked the boundary between adjacent wards. This would be in line with the expectations of the proponents of natural neighbourhoods. A ‘weak’ version of natural neighbourhoods would anticipate that where this was not the case, the road network would still be such as to render access from one quarter of the City to another difficult.

**Fig 6:07** shows that the view that wards are separated by major through streets contains little of real substance. In the east of the City, the boundary between Bishopsgate and Lime Street wards with Aldgate is formed along the line of St. Mary Axe and Lime Street, but this is not a principal through-route. In the west, Baynard Castle and Farringdon are separated by a series of lanes, terminating at Puddle Dock Hill, and the north-south boundary of Baynard Castle ward with Bread Street and Queenhythe also follows minor streets. The boundary of Tower Liberty is in the public realm, but this is not a product of the road layout but of the interdict forbidding all building here. This is also the case with the boundary of Farringdon Within and Baynard Castle, which passes through St Paul’s Churchyard. The only boundary which is constructed along an important street, Trinity Lane, is that between Bread Street Ward and Queenhythe but even here the street concerned is important for movement about the City rather than into and across it.

The term street (as opposed to row, hill, alley, lane, place, yard or court) is generally acknowledged to have been reserved for main through routes within the City during this period. Taking first the subset of routes which were classed as streets at the time of Ogilby and Morgan (**Fig 6:08**) this simple-minded transcription follows all named streets along their entire length, irrespective of other factors like width, shape and connectivity to other streets and lanes.

The transcription shows the usefulness and limitations of the everyday naming of things, for the set of routes does not even constitute a system, let alone one which picks out the boundaries of natural neighbourhoods. Key routes like Thames Street, the north-south route from Bishopsgate to London Bridge, the new approach to the Guildhall, and the incoming routes from Newgate and Aldgate are identified in this way, but the map also contains a number of anomalies in the form of small ‘streets’ which do not connect with
Fig 6:09 - streets and major public highways within the Restoration City

Fig 6:10 - the set of visually most striking urban blocks and main routes: those shown dotted are less visually obvious, clear cut separations in the urban fabric.
others within the global system\textsuperscript{1}. An overlay on the ward structure shows no discernable relationship of the boundaries of these to these named street lines. Rather the opposite. Wards boundaries, as it has been already observed, seem to avoid following street lines.

Some main City routes seem to have been so grand that it would have lessened their dignity by referring to them under the general term of streets. Cheapside and Cornhill are a case in point. If those routes to which reference is made by a particular name only\textsuperscript{2} are added to the set of City streets (Fig 6:09) then the result is more lifelike, and begins to pick out the set of longest and widest thoroughfares which knit the City together. As a by-product of selecting for dominance in this way, it also begins to pick out some of the major urban blocks within the City fabric, particularly to the north of Cheapside. Despite this, the subset of these major routes again shows no consistent relation with ward boundaries.

A significant number of important routes are classed as lanes: Carter Lane, Bow Lane, Trinity Lane to name just three. These tend to be narrow, but nonetheless significant within the global configuration of routes. Most of these strategically significant lanes are south of Cheapside. However, widening the scope of the system to include all lanes would extend the scope of the system to one almost coincident with the through routes shown in the open space map of the City (Fig 6:05).

Visually and intuitively identifying the major discontinuities in the urban fabric given by what seems to be the most striking patterns in the structure of urban blocks (Fig 6:10), throws up precisely the same problem: that the main blocks are relatively easy to identify north of Cheapside, but that it is impossible to disaggregate the City below Cheapside in a non-arbitrary way \textsuperscript{3}. Ambiguity as to which are

\textsuperscript{1} perhaps in an attempt to elevate their status or, more properly, that of their occupants.
\textsuperscript{2} as opposed to the general class.
\textsuperscript{3} in making this figure, the least contentious candidates for fissure lines within the City were selected first and blacked in, and then further subdivisions were made by dotted lines where it was possible clearly to see block separations between those initial lines of cleavage. The resulting picture shows the degree of uncertainty, particularly in the south-west of the City, where the exercise serves only to raise questions about the first-
major and are which minor routes, and in how the small-scale blocks are aggregated into larger-scale ‘superblocks’\(^1\) seems to be intrinsic to the nature of the City. This is in direct contrast to the prediction of physical clarity which results from neighbourhood unit philosophies.

The breakup which results from the attempt to isolate major through routes/urban blocks has one advantage over the previous two in that it does pick out a street system, however contentious, where the previous maps did not. It replicates the streets shown in Fig 6:09 \(^2\), although it adds considerably to their number. It also compares well with Leake’s survey of the outlines of the major blocks after the Great Fire, particularly so in the south-west sector of the City, although Leake’s survey is more detailed. Even so, there is still no discernable relation between the boundaries of wards and the pattern of streets.

What this simple-minded procedure does reveal however, is that for the most part, ward boundaries pass through the heart of the urban blocks, tracing property boundaries \textit{en route} and only occasionally making contact with a segment of the street system. The boundaries of wards are cross-cut by the street system, not in a correspondence to it. This has a number of implications for the concept of the inchoate neighbourhood. The first is that the boundaries of the wards are rendered, for the most part, invisible. This is a significant departure from the theoretical model introduced earlier, which predicted clarity through some form of physical expression of the boundary.

This is particular so since what can be marked on a plan frequently cannot be seen in reality. Where boundaries pass through or along party walls, as they do for the most part in the City, it is not possible to visualise the resulting relational space structure from a point within

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1 This is an important feature, since even what appear to be clear island blocks within the City fabric in most cases turn out to have small scale alleyways running right through the heart of the block. Thus a block which, at first sight, appears clearly a separate physical element, such as that that in the north centred on Drapers Garden, can be shown to be shot through with alleyways which physically separate it into 18 smaller, physically discrete units. Thus the problem of identifying the physical elements of the City fabric is present at every level.

2 Apart from a few short, minor ‘streets’ in the west.
it. Even where buildings are not erected on both sides of the boundary so that a clear passage or yard is left to one side, this is indistinguishable from the multitude of passages and yards which are contained entirely within the ward. Indeed, it is equally plausible to argue a contrary position, that the lack of clarity in the boundaries of the City wards disguises differences of allegiance amongst physically adjacent neighbours whose political rights and duties lie in entirely different administrative units.

Of course, it could simply be the case that wards are defined by groups of streets, so naturally ward boundaries pass through the blocks, but this does not entirely accord with the way in which wards were thought to have originated in the Saxon period. If historians are correct in their view that wards were originally walled land-holdings, then it might be expected that routes would pass between these rather than through them.

Looking in more detail at the relationship between the street system and wards, the 'weak' hypothesis, that streets are offset or chicane at ward boundaries to make movement between adjacent wards tortuous, this does not seem to be the case either. Of the 1605 intersections in the Ogilby and Morgan map less than 1% occur at ward boundaries. For the most part, through or distributed streets do not acknowledge ward boundaries by any change of direction. However, Brown suggests that the build-up of non-distributed passages is governed by ward boundaries, with a strong tendency for these to terminate at the administrative boundary. Put another way, this would suggest that ward boundaries are dictated by the extent of individual landholdings, and that landowners were permitted to develop their plots by building back from the main street frontage without any requirement for co-ordination to maintain rights of way through the heart of the block. If Brown's thesis holds, a by-product of the ward boundaries is to restrict the growth of a secondary route network within the heart of urban blocks.

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1 presented in Chapter Four of this thesis
3 cul de sac
The view has been canvassed\(^1\) that wards were located centrally about a major route (literally as a centre of trade) to take advantage of through movement. This may well have been the case, but as a motive it is difficult to reconcile to the formulation of the 'inchoate neighbourhood unit' for it introduces through movement, particularly by non-residents, into the very heart of the ward. A comparison of the ward structure with the open space map suggests that this formulation too is fraught with difficulty, for while in some cases the relationship is clear\(^2\), in others there are several candidates for an organising centre\(^3\) sometimes running in diametrically opposite directions\(^4\), while in yet other cases there is no clear candidate for an organising centre\(^5\). The one statement which can be made without fear of contradiction is that the wards appear to take up a variety of positions in relation to the street grid.

Some clarification is therefore required as to which physical property - length, connectivity or 'syntactic' integration - is most influential in orientating gross ward shape in relation to the street grid. For this purpose, the axial map\(^6\) has been used as the basis of the analysis since it avoids the difficulties raised earlier for analysis by the ambiguities in describing and interpreting the street system of the City in an everyday, commonsense way.

The syntactic property of axiality looks at the longest possible one-

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\(^1\) For example, Page, V. London, its origin and early development, London, 1923.
\(^2\) Aldersgate, Basinghall, Bishopsgate, Bridge, Candlewick, Cheap, Cornhill, Cripplegate, Farringdon North, Langborn, Lime Street, Queenhythe, St Martin.
\(^3\) Aldgate, Baynard, Billingsgate, Bread Street, Broad Street, Cordwainer, Tower.
\(^4\) Coleman Street, Dowgate, Vintry, Walbrook.
\(^5\) Farringdon South, Tower Liberty.
\(^6\) Space syntax has two possible modes of breaking up space, convex and axial. The first attempts to look rigorously at the way in which the articulation of the facades of buildings creates and shapes the public realm, in terms of the spaces which vary from one another in terms of their two-dimensional organisation. Formally speaking a convex space is one in which any two points in the segment can be joined by a straight line. This is a local property. Insofar as this thesis is concerned with the large-scale organisation of the City, the second mode of breaking up space, axial analysis, will be used here. This looks at the extent to which lines of sight and unimpeded access through public space are 'bounced off' buildings by twisting and turning them to open up or block long views through the town.
Fig 6:11 - a complete axial break-up of the urban grid at the time of Ogilby and Morgan

Fig 6:12 - the set of through-routes in 1677
dimensional lines of both sight and unimpeded access which can be made between the facades of buildings as they are aligned along the streets and other public spaces. Rather than focussing upon the axial extension of lines of sight and access of any particular space, the property of axiality is used to break up the entire configuration of public space into the least set of lines of sight and access which covers all the spaces, and goes around all the island blocks in the system. This property has been found empirically to be strongly associated with use and movement patterns\(^1\). It is therefore of particular interest in considering the hypothesis that the space structure of the City in 1677 is one which organises ward structure in relation to main avenues of through-movement and street trade.

The complete axial break-up of the City area roughly within the Roman Walls at the time of Ogilby and Morgan is shown in Fig 6:11, and the sub-set of 'ringy' routes - that is, all those lines which permit access to another or to other parts of the system without reaching a dead-end - is shown in Fig 6:12. This distributed map, roughly speaking, picks out the structure of streets, lanes and alleys from that of closed courts and yards although, as before, it does so more rigourously than is implied by everyday nomenclature. All lines which form part of the system of through-routes, no matter how narrow and tortuous, feature in the distributed map. All courts and yards, that is, all culs-de-sac or nondistributed spaces no matter how large and imposing, feature only in the complete axial break-up of the City.

This transcription of the Ogilby and Morgan map shows a City densely packed with axial lines. The strong Cheapside line is 35 connected, and other important streets like Threadneedle Street, Cornhill and Lombard street have 16, 27 and 20 links respectively for the distributed system alone. The total system of public space at the time of Ogilby and Morgan, shows a system composed of 797 distributed lines and 937 nondistributed lines, giving a distributed : nondistributed ratio of 0.853:1. So far as the distribution of dead end spaces is concerned, 78% of spaces are one step deep from the system of thoroughfares, 17% are two steps deep, 4% are three and a minute fraction four steps from the distributed street grid. The mean depth of

\(^1\) Hillier, B. *Natural movement: how we came to predict movement without intending to*, 1989.
nondistributed axial lines form the grid of through streets in 1.258. There is no discernible difference in the distribution of deeper spaces by quarter, although in absolute terms the western half of the City has slightly more nondistributed space than the east. This result supports Brown's hypothesis that the effect of 'breakthrough' is to render the hinterland of urban blocks shallow to the distributed since it is clear from these figures that deep *cur-de-sac* spaces are rare in the City¹.

The act of drawing the axial maps is, in itself, revealing. One of the striking features of the City which occurs time and time again, so much so that it seems not to be accidental, is that axial lines just about squeeze through between facades, or run for distances close to the face of a facade without actually being blocked by the buildings. There is considerable overlap between lines, which tend to merge at an obtuse angle rather than join sharply at right angles. Where lines do meet at an acute angle, they still glance off the facade rather than hit it at right angles². The only building where an important route leads up to a dominant facade is at the main entrance to the Guildhall; in all other cases it is almost as if the main facades and building entrances were located so as not to dominate the system of streets in this way. This will be discussed in more detail later in the chapter.

The black shading on the distributed map picks out all triangles formed between two adjacent axial lines running along the length of a street for some part of their length and a third, crossing at right angles. This differentiates the 'trivial islands' from true 'island blocks' formed by buildings, so that these 'trivial islands' do not contaminate measures dependent on the numbers of 'rings' of open space created by the layout of the urban blocks. In the City at this time there is a great deal of small-scale overlap of axial lines. However, the City does not contain a pattern of local 'strong points' which might form the local foci of a system of 'organic' sub-areas. In

¹ the property of there being a large number of nondistributed spaces including some deep *vandering* courts in every part of the City is a global one. However, the presence of nondistributed spaces is primarily of local significance. Dead end spaces can only act as a starting point or a destination for movement, and not as part of the system of routes. The distributed map is therefore taken as a basis for examining the route system in relation to the concept of the natural neighbourhood.

the Ogilby and Morgan map, strategic 'strong points' which enable long views to extend from a key location in several directions, are limited to the west front and east window of St. Paul's and to the junction at Cornhill.

Intuitively, the City can be seen as topologically equivalent to an orthogonal grid which has been considerably deformed or pulled out of shape to create this property of 'just about axiality'. Just how deformed the City grid actually is, can be measured by comparing it to a perfectly orthogonal grid by the formula \( \sqrt{\frac{1}{x^2}} + 2L \) for grid axiality, where a perfect orthogonal grid would have the value of one, and where values of 0.25 and above indicate a relatively griddy system, and of 0.15 and below an axially more broken-up system. The figure for the distributed street grid of the City at the time of Ogilby and Morgan, with 797 lines surrounding 469 islands, is 0.0567 - comparatively speaking, axially a rather deformed grid.

Another way of picking up this property of axial deformity is the measure of the mean number of links, or connections between axial lines, in the system of that number of lines - the line-link ratio. For the City this is 2.009 at the time of Ogilby and Morgan. This should be compared with a tree, which always has a line-link ratio of 1, housing estates which tend to be below 1.5, small towns or villages which tend to be about 1.5 to 1.6, organic towns like the City 1.8 to 2.1, with neo-classical plans soaring towards or above 3.1, reflecting the increasing degree of strong, geometric axial organisation of the overall plan from the first cases to the last. The City at the time of Ogilby and Morgan is, therefore, performing normally on this measure for a large, overall well-ordered but non-geometric or non-regular organic layout. Comparable measures for a modern neighbourhood unit are 0.1178 for grid axiality and 1.806 for line link ratio. These figures too are comparable with those of the City.

\(^1\) Grid axiality is known to be strongly affected by size, so it should really be used here only to compare the different stages of the City grid, where the size is held relatively constant.

\(^2\) Robert Whitten and Gordon Cullen's scheme for the Borough of Queens, Jamaica, published in *The Neighborhood Unit Formula*, Perry op. cit.
Fig 6:13 - the 10% longest streets in 1677

Fig 6:14 - the 10% best connected streets in 1677

Fig 6:15 - the 10% most integrated streets in 1677
Fig. 6:13 shows the 10% longest streets\(^1\), Fig 6:14, the 10% best connected streets\(^2\) and Fig 6:15. the 10% best integrated streets of the City. There is a predictable relationship between length and connectivity: the longer the street, the more likely it is to carry many intersections with other streets. However, this relationship is not perfect and produces some imbalances in the relation between Figs 13 and 14. The south-west quarter of the City has 27 long streets but 35 well-connected streets, the figures for the north-west and the north-east are more finely balanced, 14:12 and 13:11 respectively, while the south-east has a ratio of 27:18 long:connected streets\(^3\).

The discrepancies are revealing. In the south-west, the majority of streets are better-connected than sheer length would predict. The street grid locally is everywhere densely interconnected. Many streets feature in both maps, but the area around St. Pauls and the Bow Lane area have several additional short well-connected streets. Several of these run north-south against the general trend and help to tie the local grid more firmly to Cheapside and the river. The opposite is the case in the south-east, where there are many long streets which conspicuously fail to knit the local street system together, particularly in the vicinity of the Tower.

Above Cheapside, the figures are more evenly balanced, but this does not imply that the same streets feature in both maps. Both areas have more long streets than well-connected ones. In the north-east, most of the additional long, poorly connected streets are close to the walls. In the north-west, most long but poorly connected streets make internal links either to Cheapside, or to the eastward and northern routes out of the City.

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\(^1\) for speed and convenience, only the first 15 are rank ordered in terms of length.

\(^2\) this figure shows the limitations of connectivity as a measure of difference between spaces. The values plot as follows: 1x1, 1x2, 1x3, 1x4, 1x5, 1x6, 4x7, 2x11, 1x13, 3x14, 5x17, 6x22, 5x28, 14x33, 10x48 and 15x59 (74 spaces or about 10% of lines). As the number of connections fall in the rank order, so the number of examples with that number of connections rises. Since mean connectivity or line-link ratio is 2.009, it follows that away from the extreme of highly connected cases, most spaces are one or two connected.

\(^3\) the totals are slightly different (81 long streets and 76 well-connected streets) because the numbers of streets differ at each mark off point, and all examples were included with each degree of connectivity or length.
The 10% best-integrated lines are more concentrated than either of the two previous maps. This is brought about in part by the bias in connectivity towards the south-west, which makes this region of the City not only better connected locally but also shallower to the remainder of the grid. The area to the north of Cheapside is underrepresented by integration, particularly in the north-east, but so is the south-east of the City around the Tower and, more surprisingly in view of the distributions of long and well-connected lines, the Blackfriars area in the west. The shape and build-up of the integration core will be discussed more fully in the next chapter.

Overlays of the three maps on the ward structure confirm that the relationship between these variables and ward shape is complex. Basinghall and St Martin’s Liberty each have a street at the geometric centre which is axially chicained to such an extent that it does not feature prominently in any of the maps. At the other extreme, Langborn has only one long through street, Lombard Street/Fenchurch Street, which passes through its approximate centre. The hour-glass waist formed by the two halves of the ward is made about the intersection with Bishopsgate, so there is no doubt as to the priority given to east-west orientation in this ward. This street features in all three maps.

Of the 25 wards, nearly half (11) carry one long street which traverses the ward along its long axis at the approximate geometrical centre and features in all three maps. Many of these have more long streets than well-connected or integrated ones. Cheap Ward centres about Cheapside on its longer east-west axis, but many key streets on all three maps intersect with it at right angles along its full length. Coleman Street and Lime Street each have a dominant street which runs not at the centre but close to a boundary.

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1 Aldgate = Leadenhall Street, Bishopsgate = Bishopsgate and Gracechurch Streets, Queenhylthe and Billingsgate = Thames Street, Langborne = Lombard Street/Fenchurch Street, Cornhill = Cornhill, Coleman Street = Lothbury, Cripplegate = Wood Street, Lime Street = Leadenhall Street, Candlewick = Cannon Street.
2 Aldgate=Crutched Friars, Candlewick=St Lawrence and St Martin’s Lanes, Cornhill=Finch Lane, Cripplegate=Aldermanbury, Queenhylthe=Trigg Lane.
Several wards (4) carry two high-profile streets which intersect in the heart of the ward at right angles\(^1\). Dowgate and the Vintry both have more long streets, over and above their well-integrated intersection. On the other hand, Walbrook has a well-integrated intersection which is not particularly long or well-connected.

Baynard Ward has several long streets and even more well-connected ones which form a local grid, but in integration Baynard is touched by streets which avoid the geometric centre of the ward and merely skirt the edges. Neighbouring Farringdon also has a local concentration of important streets around St Pauls which are longer and better-connected than integrated, but the remaining non-convex parts of the ward are segregated. Bread Street is in the opposite position of having a double-cross of streets which form a ring in the centre, as well as a u-shape of long, straight streets along three of its boundaries, but not all of these feature in either or both of the other maps. The neighbouring Cordwainers Ward has a similar centralised double-cross pattern which preforms well in integration but less well in length or connectivity, but here the outer boundaries of this ward are buried rather than expressed. Broad Street Ward has a convergence of east-west routes in the south around Throgmorton Street, Threadneedle Street and Broad Street which feature in all three maps.

Finally, Tower Ward has Thames Street, the New Quay and Tower Street which are all long and well-connected but, Tower Street aside, strongly segregated. Tower Liberty is in a similar position, with Woodruff Street and the Great Tower Hill area long, poorly-connected and strongly segregated. The City west of Baynard Castle is segregated, particularly in the Blackfriars area of Farringdon South where there are some long and/or well-connected streets.

For the most part, wards centre on a long street, or a group of streets which are locally significant in that they are well-connected. Some are clearly important routes from the outside, but the co-incidence of many of these highways with strong integration shows that their significance is not only to lead trade into the City but also to render

\(^1\) Bridge = Thames Street + Fish Street, Dowgate = Thames Street + Dowgate Hill, Vintry = Thames Street + Queen Street and Walbrook = Cannon Street and Walbrook.
Fig 6:16 - the streets above mean segregation in the City in 1677.

Fig 6:17 - the parish map as shown in Ogilby and Morgan's map of 1677. Parts of parishes which are bounded by streets are shown in solid black, and those areas where parish and ward boundaries coincide are shown in a heavy dotted line.
the internal global workings of the City shallow. Short but well-connected streets within a ward frequently play a role in reinforcing the local grid and tying it globally to long, well-connected streets in other wards. Integration seems positively related to the shape of wards, with squareness in shape relating to griddiness in integration and elongation in shape to a dominant axis. The exceptions share a common feature of discontinuity with the remainder of the City fabric. The longer and better-connected streets rise above mean segregation, but length and local connectivity is no guarantee of a more widespread integration.

This raises both a problem and a question for the concept of the inchoate neighbourhood unit. For the majority of cases, the street grid works to transcend ward boundaries and render the geometric centre of wards shallow to the entire City. This is precisely the condition under which neighbourhood identity is held to have been destroyed in the modern era. For the cases in which wards are globally segregated, the longer streets still rise above mean segregation, (Fig 6:16) which seems rather to confirm their importance in constituting the global street grid than their significance as local centres. Even segregation seems to be a global property of the perimeter zone\(^1\) rather than a feature of particular wards.

The question therefore arises as to whether it is the structure of parishes rather than of wards which is more intimately bound up with spatially identifiable sub-areas within the City, and it is to the parish map that the investigation now turns. The parish map\(^2\) of the City in 1677 is shown in Fig.6:17. For the most part parishes are considerably smaller than wards although, like wards, those nearer the walls tend to be larger by an order of magnitude than those in the centre. Clearly, most parishes within the City are too small to be taken seriously as candidates for a natural neighbourhood in anything like

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\(^1\) this has been argued elsewhere in the Chapters on Roman and Saxon London.

\(^2\) parish boundaries are identified by a dotted line. Where these are co-terminous with ward boundaries, this is shown by a chain (oooooo). Where the boundary is marked by a route, it is shown solid. Sites of parish churches are identified in outline and where these were reoccupied after the fire, the position of the church is indicated in solid black.
the sense intended by its proponents. All the earlier comments on the shape and neighbour condition of wards apply equally to parishes. The full list of parishes within the walls with their key is set out below.

<table>
<thead>
<tr>
<th>Number</th>
<th>Parish Name</th>
<th>Number</th>
<th>Parish Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>St. Stephen Coleman Street</td>
<td>12</td>
<td>St. Mary Cole Church (site)</td>
</tr>
<tr>
<td>8</td>
<td>All Hallows on the Wall</td>
<td>13</td>
<td>St. Alphage</td>
</tr>
<tr>
<td>14</td>
<td>St. Alphage</td>
<td>15</td>
<td>St. Alban Wood Street</td>
</tr>
<tr>
<td>16</td>
<td>St. Olave Silver Street</td>
<td>17</td>
<td>St. Michael Bassinghaw</td>
</tr>
<tr>
<td>18</td>
<td>Christ Church</td>
<td>19</td>
<td>St. Anne Aldersgate</td>
</tr>
<tr>
<td>20</td>
<td>St. Mary Steaining</td>
<td>21</td>
<td>St. Mary Aldermanbury</td>
</tr>
<tr>
<td>22</td>
<td>St. Olave Jewry</td>
<td>23</td>
<td>St. Martin Ironmongers Lane (site)</td>
</tr>
<tr>
<td>24</td>
<td>St. Mildred Poultry</td>
<td>25</td>
<td>St. Bennet Sherehog</td>
</tr>
<tr>
<td>26</td>
<td>St. Pancras Soaper Lane</td>
<td>27</td>
<td>St. Laurence Jewry</td>
</tr>
<tr>
<td>28</td>
<td>St. Mary Mag. Milk Street (site)</td>
<td>29</td>
<td>All Hallows Honey Lane (site)</td>
</tr>
<tr>
<td>30</td>
<td>St. Mary Le Bow</td>
<td>31</td>
<td>St. Peter Cheap</td>
</tr>
<tr>
<td>32</td>
<td>St. Michael Wood Street</td>
<td>33</td>
<td>St. John Zachary</td>
</tr>
<tr>
<td>34</td>
<td>St. Martin's Liberty (site)</td>
<td>35</td>
<td>St. Leonard Foster Lane</td>
</tr>
<tr>
<td>36</td>
<td>St. Vedast Foster</td>
<td>37</td>
<td>St. Michael Quera (site)</td>
</tr>
<tr>
<td>38</td>
<td>St. John the Evangelist (site)</td>
<td>39</td>
<td>St. Matthew Friday Street</td>
</tr>
<tr>
<td>40</td>
<td>St. Margaret Lothbury</td>
<td>41</td>
<td>St. Bartholomew Exchange</td>
</tr>
<tr>
<td>42</td>
<td>St. Christopher</td>
<td>43</td>
<td>St. Mary Woolnoth</td>
</tr>
<tr>
<td>44</td>
<td>St. Mary Woolchurch (site)</td>
<td>45</td>
<td>St. Michael Cornhill</td>
</tr>
<tr>
<td>46</td>
<td>St. Bennet Fink</td>
<td>47</td>
<td>St. Peter Poor</td>
</tr>
<tr>
<td>48</td>
<td>St. Peter Cornhill</td>
<td>49</td>
<td>St. Martin Outwich</td>
</tr>
<tr>
<td>50</td>
<td>St. Helens</td>
<td>51</td>
<td>St. Ethelborough</td>
</tr>
<tr>
<td>52</td>
<td>St. Andrew's Undershelf</td>
<td>53</td>
<td>All Hallows Lombard Street</td>
</tr>
<tr>
<td>54</td>
<td>St. Edmund Lombard Street</td>
<td>55</td>
<td>St. Benis Backchurch</td>
</tr>
<tr>
<td>56</td>
<td>St. Katherine Cree</td>
<td>57</td>
<td>St. James Duke Place</td>
</tr>
<tr>
<td>58</td>
<td>St. Katherine Coleman</td>
<td>59</td>
<td>St. Olave Hart Street</td>
</tr>
<tr>
<td>64</td>
<td>All Hallows Steining</td>
<td>65</td>
<td>All Hallows Barkley</td>
</tr>
<tr>
<td>66</td>
<td>St. Mary Abchurch</td>
<td>67</td>
<td>St. Nicholas Acan</td>
</tr>
<tr>
<td>68</td>
<td>St. Clement East Cheap</td>
<td>69</td>
<td>St. Bennet Gracechurch</td>
</tr>
<tr>
<td>70</td>
<td>St. Gabriel Fenchurch (site)</td>
<td>71</td>
<td>St. Margaret Pattens</td>
</tr>
<tr>
<td>72</td>
<td>St. Andrew Hubbard (site)</td>
<td>73</td>
<td>St. Margaret Pattens</td>
</tr>
<tr>
<td>81</td>
<td>St. Martin's Ludgate</td>
<td>82</td>
<td>St. Gregory's (site)</td>
</tr>
<tr>
<td>83</td>
<td>St. Andrew Wardrobe</td>
<td>84</td>
<td>St. Bennet Pauls Wharf</td>
</tr>
<tr>
<td>85</td>
<td>St. Peter</td>
<td>86</td>
<td>St. Mary Mag. Old Fish Street</td>
</tr>
<tr>
<td>87</td>
<td>St. Nicholas Cole Abbey</td>
<td>88</td>
<td>St. Austin</td>
</tr>
<tr>
<td>89</td>
<td>St. Margaret Nole (site)</td>
<td>89</td>
<td>All Hallows Bread Street</td>
</tr>
<tr>
<td>91</td>
<td>St. Mildred Bread Street</td>
<td>92</td>
<td>St. Nicholas Olave</td>
</tr>
<tr>
<td>93</td>
<td>St. Mary Mountaw</td>
<td>94</td>
<td>St. Mary Somerset</td>
</tr>
<tr>
<td>95</td>
<td>St. Michael Queenhythe</td>
<td>96</td>
<td>Trinity</td>
</tr>
</tbody>
</table>

1 Many City centre parishes are less than 5 ha. Population details are hard to come by, but one study by Finlay, R and Shearer, B. Population Growth and Suburban Expansion, in Beier A.L. and Finlay R eds. London 1500-1700 op cit. cites a total of 4,673 distributed in 7 parishes which gives an average for that sample of 670.

2 the first number refers to that printed in Ogilby and Morgan's Explanation and the second to that in Leake's map. The numbers are not consecutive, because parished outside the wall have been omitted here. Not all sites were preserved in the City as rebuilt. Where the site is known it is shown: where not it is identified with an *. The parish boundaries are shown dotted, and are highlighted with a chain where they correspond to that of the ward.
In looking at the relationship between wards and streets the importance of ambiguity in the physical delineation of the boundary has already been stressed. The relationship between parish boundaries and the street system is equally ill-defined. Some of the longer sections where streets define parish boundaries are also the boundaries between wards as, for example, in the case of the intermural street in the east, the streets in the vicinity of St. Pauls, and the post-Fire infill along the north bank of the Thames.

Apart from these exceptional cases, there is very little correspondence between the parish boundaries and the lines of streets. This is significant, for the number of main island blocks within the mediaeval City begins to approximate the number of parishes (137/96). It would have been perfectly feasible for each block to accommodate a parish, but this is never the case. As with the wards, the parish boundaries run along party walls within the hinterland of the urban blocks. For the most part they are so tiny that they straddle a short length of one or more streets. There is no tendency within the City for parish boundaries to be marked by street intersections or axial discontinuities. The relationship between streets, blocks and parishes seems to be completely arbitrary. Almost all the through streets of the City cross parish boundaries. A walk from Newgate to Aldgate takes the pedestrian through 15 parishes while from Bishopsgate to London Bridge the route passes through 9. Even a small street like Fish Street Hill contains three parish churches.¹

It might be expected that each ward is sub-divided into several parishes so that groups of parishes are completely outlined by the

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¹ St Nicolas Cole Abbey, St Mary Mounthaw and St Mary Somerset.
Fig 6.18 - Each of the City's wards, shown with its constituent parishes.
ward boundaries. To the extent that this were the case, it would imply that the parishes, which are communities of religious worship, draw together sub sets of the same people who are associated by virtue of ward membership for administrative purposes. These two levels of human grouping would correspond to a set of small scale physical units which collect together into a large scale spatial entity. This is precisely the kind of natural hierarchy of socio-spatial grouping to which neighbourhood unit proponents are drawn.

In the case of the City, there is rather little co-incidence of ward and parish boundaries. Fig 6:18 shows the parish structure overlaid upon each of the 25 ward boundaries, and the degree of overlap between wards and parishes revealed by this transcription is set out below.

<table>
<thead>
<tr>
<th>Ward</th>
<th>Parishes Within</th>
<th>Parishes in Overlap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldergate</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Aldgate</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Basinghall</td>
<td>1 corresponding</td>
<td>-</td>
</tr>
<tr>
<td>Baynard Castle</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Billingsgate</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Bishopsgate</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Bread Street</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Bridge</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Broad Street</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Candlewick</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Cheap</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Coleman Street</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Cordwainers</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Cornhill</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Cripplegate</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Dowgate</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Earringdon</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Longbarn</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Lime Street</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Queenhythe</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>St.Martin</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Tower</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Tower Liberty</td>
<td>-</td>
<td>1 all in Tower</td>
</tr>
<tr>
<td>Vintry</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Wellbrook</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>48 parishes</td>
<td>111 ie 56 parishes</td>
</tr>
</tbody>
</table>

In only one case, Basinghall, does the parish boundary correspond to that of the ward. This seems to confirm spatially the special status which this ward is thought to have had historically\(^1\). There is no 'pollution' of the spatially contiguous group of neighbours who jointly

\(^1\) as the place of Royal Residence and later the domicile of the King's representative within the City.
conduct temporal and spiritual affairs, for in this one instance they are co-terminous and closed. Yet even here, the boundary of the ward/parish is almost completely contained within the block structure so that there is no clear physical expression of the unity which is enjoyed by this peculiar institutional grouping.

At the opposite extreme, there are several cases where there is no correspondence whatsoever between the ward boundary and the smaller parish subdivisions which are overlaid upon it. The large and historically important parish of All Hallows Barking in the east extends across the boundary of Tower Ward into Tower Liberty, where it is the only intermural part-parish. Cornhill, Candlewick and Lime Street wards in the heart of the City do not contain complete parishes. In Candlewick, the parishes are small and straddle the ward boundary on almost every side. In Cornhill, the overlap is restricted to the point and the end of the wedge-shaped ward, and it is clear that parishes which lie predominately outside the ward have a small number of properties in the ward which give them a toehold while the parish of St Michael's Cornhill, which almost corresponds to the ward, reciprocates by having a toehold in Bishopsgate Ward. In Lime Street, two large parishes divide the ward equally between them. The northern parish, St Andrew's Undershaft, crosses into Aldgate and Bishopsgate wards. Half of the southern parish, St Dionis Backchurch, is in Langborn so Lime Street Ward has no parish church within its boundary. In Bridge Ward, the western boundary of the Ward forms a limit for the growth of parishes, while the eastern edge is straddled by all. Two of the parishes overlapping with Candlewick Ward stretch across Bridge Ward to reach the Thames.

The remaining wards lie between these two extremes. Farringdon completely contains one large parish, Blackfriars, in the west close to the walls and the river, and another smaller parish in the east, which is part of a group of small irregular parishes close to St Paul's which completely dissolve the eastern boundary of the ward. To the east of this, the parishes are large and pay no attention to the ward boundary nor, in one case, to the line of the walls. The same can be said of the parishes in the northern, spatially discrete part of the ward. Aldersgate, also close to the walls in the north-west of the City, shows a similar relationship between parishes and ward.
By contrast, St Martin’s, in the north-west has a dominant parish and two with a toehold. In Cripplegate Ward, also in the north-west of the City most of the parishes fit snugly within the ward boundary except in the west, where all cross into neighbouring Aldersgate and Farringdon Wards. A similar situation pertains in Coleman Street, and ward and parish boundaries run together for long distances in that part of Cheap Ward which is to the north of Cheapside. A greater degree of ‘fit’ is to be found between parish and ward boundaries in this area of the City except in the immediate vicinity of the walls.

Bread Street, Walbrook the southern part of Cheap Ward and the northern part of Queenhythe, Baynard and Dowgate Wards have a considerable degree of overlap. However, there is a greater degree of ‘fit’ between parish and ward boundaries close to the river in the west of the City. Cordwainer Ward boundary shows overlap in its northern half but ‘fit’ in its southern part.

In the north-east of the City the parish of All Hallows on the Wall stretches across three wards, Broad Street Bishopsgate and Aldgate, in a narrow band hugging the wall. To the south of this is a group of very large, contiguous parishes which fit neatly within the ward boundaries. Aldgate is large enough to completely contain two parishes, but for the most part parish boundaries overlap with that of the ward, including the very large parish of St. Katherine Cree which crosses the wall into Portsoken Ward.

Closer to the centre, this relationship breaks down, and parish boundaries once more overlap with the ward structure. In Bishopsgate Ward, large parishes in the surrounding wards1 maintain a toehold. In Broad Street, the same phenomenon occurs2. Langborn has overlap apart from in the wide part of the ‘hourglass’ on the boundary with Cornhill.

Tower Ward, in the south-east has one large parish, St.Dunstan’s in the East, which takes up the whole of its western half save for two parishes in neighbouring Billingsgate which have a toehold there. The central portion of Billingsgate contains three parishes in line which

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1 Cornhill, Lime Street, Langborn and Aldgate.
2 with Coleman Street, Cheap, Walbrook and, to a lesser extent, Cornhill.
Fig 6.19 - a selection of City churches showing their immediate surroundings.
run from the northern boundary of the ward down to the river, but the eastern and western boundaries are straddled by parishes.

To summarise, the City is at this time composed of very large parishes around the periphery close the wall. In the north of the City, both west and east, there is a greater incidence of wards being subdivided into parishes which fit snugly within the ward boundary. This suggests that the wards arrived first, and the parishes followed later. In the south east the parishes are both large and in overlap with the ward boundary. These were early foundations which were established about the same time as the wards, in overlap. In the rest of the City the parishes are much smaller, some very small indeed. Here, overlap is the norm, although the small size means that some wards have space also to contain parishes. The degree of overlap varies from a toehold to a straddle. Near the river there is again a greater tendency to correspondence of boundaries, since parish and ward tend to move southward together as the river is encroached. Basinghall is the exception. In this single instance parish and ward boundaries are co-terminous.

The siting of the parish church within the parish seems equally arbitrary. Occasionally the church is close to the geometric centre which is in line with the picture drawn of the natural neighbourhood by its proponents. However, it is equally likely to adjoin the parish boundary. The church is usually, though not invariably, adjacent to a street but this is not necessarily the major route which crosses the parish. It is just as likely to be a side street. (Fig 6:19) Most, but not all churches are, at this time, street-orientated and freestanding, but most are not set within large plots and are separated from their neighbours by narrow alleys on one or more sides. A few churches are contiguous with secular buildings on one or more sides. There is no evidence for the provision of an enlarged public open space close to the church to act as a natural focus for local activity.

The nature and grouping of civic buildings has been the subject of speculation by neighbourhood unit theorists, so it is worth looking in more detail at the disposition of these within the overall City fabric. So
Fig 6:20 - the distribution of guild halls in the City in 1677.
far as public buildings\(^1\) are concerned, the size and scale of these is strikingly modest. Most of the guild buildings and the halls of the more recent trading associations like the Africa Company (36) and East India Company (41) had been replaced on their existing sites by the time the map was made, including the Guildhall (13) and Blackwell Hall (22) \(^2\).

These are spread throughout the City (Fig 6:20) with a slight tendency to differential clustering by quarter. The north-west area around the Guildhall has a major concentration of halls, as might be expected. The north-east has a small number of dispersed halls. Presumably, in this primarily residential district these were once private residences in the gift of prominent former members. The south-west sector has a small number of halls which tend to gather close to Walbrook \(^3\), and another small group which, because of their professional and legal functions, gravitate in the opposite direction towards the Fleet and the Inns of Court beyond. The south-east of the City, east of the Bridge has only three halls which suggests that this area was relatively unpopular. The centre of the City around Cheapside is also strikingly devoid of guild buildings. This indicates that there does not seem to have been a positive move by any of the guilds and associations to locate their hall in the main arena of commercial activity, public display and ceremonial.

A full list of the trade and guild halls within the City\(^4\) is set out below. Not all the trades, of which there were nearly two hundred in the Restoration City, are represented here since many minor companies did not possess their own hall. Others\(^5\) had premises outside the City walls.

1. Scotch Hall  
2. Apothecaries  
17. Painters and stainers  
18. Armourers  
33. Dyers  
34. Fishmongers

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\(^1\) the identification of public buildings is made unproblematic in Ogilby and Morgan's map since these are listed separately in the accompanying handbook, Ogilby and Morgan eds, *London Survey'd: or an explanation of the large map of London*, Whitefriars, 1677, reprinted by Margaray, H., Lympne Castle Kent, 1976.

\(^2\) the market through which all of England's trade in luxury cloth was channelled.

\(^3\) but not around Queenhythe Dock, which might have been expected in view of its historic significance for trade.

\(^4\) taken from the *Explantation* to Ogilby and Morgan's map, op.cit.

\(^5\) Glovers, Cooks.
Fig 6.21 - A selection of guild halls showing their immediate surroundings.
The twelve Great Companies are indicated with a *.  1

Guildhalls are set back from the street and, like mansions1, are approached through an alley leading to a front courtyard. As a result they too tend to be embedded in the block rather than directly related to the street frontages. (Fig 6:21) Guild buildings are not related consistently to ward and parish boundaries. Indeed some straddle them, the Goldsmiths, Mercers and Clothworkers being three clear examples.

The relation between the guild halls and the wards seems in some cases almost self-evidently one of functional specialisation by ward. Common sense expects the Bakers Hall to be located in Bread Street Ward, the Vintners Hall in the Vintry, Cordwainers Hall in Cordwainer Ward, and the Chandlers Halls in Candlewick, and the Fishmongers Hall in Billingsgate Ward. Nothing could be further than the truth. The Bakers Hall is in Tower Ward at the opposite end of the City to Bread Street. Cordwainer and Candlewick Wards have no guild halls at all. The Cordwainers have a hall in Bread Street Ward and the Wax and Tallow Chandlers in Cripplegate and Dowgate respectively. The Vintners are in the Vintry, but the Fishmongers are in Bridge Ward, relating more closely to one of the many locations where they sell fish than to where they land them.

1 most guilds acquired their first hall by purchasing a large private house rather than by commissioning a purpose-built hall.
Clearly there were associations between some trades and the ward structure. Vintners did concentrate around the Vintry\(^1\) and in at least one case, the Goldsmiths, the Company had clear regulations limiting the spatial scope of trading. Members had to have a shop in Cheapside to qualify for incorporation into the guild, and could only sell gold and silver vessels elsewhere than their shop by trading at the Royal Exchange. Even in this clear case, the Company Hall is not in Cheap Ward but in Aldersgate Ward, and the guild rules are silent on the place of residence of members. This is fortunate, since the centre of the City close to the Stocks Market in Broad Street Ward was favoured by goldsmiths as a place to live during this period. In other cases, the location of a hall clearly brings together members on a city-wide basis, the Parish Clerks Hall and the Inholders Hall being cases in point.

It is not even the case that Companies dealing in similar goods are located in a cluster. The building trades are represented in the City by the Plasterers Hall (8), the Bricklayers Hall (47), that of the Guild of Painters and Stainers (17), and the Joiners Hall (31). The same lack of spatial association applies to the various sectors of the cloth trade. Trades seem to choose the most unlikely neighbours. For example, the group of close neighbours 27–30 comprises the Halls of the Cutlers, Tallow Chandlers, Skinners and Innholders, who have almost nothing in common.

Both spatially and functionally the expectations of common association by functional specification seems to be confounded by the cartographic evidence. Because guild membership produces strong ties of association, there is no need to reinforce these by spatial contiguity. Rather the opposite. Perhaps it is the case that guilds can emancipate their members from rules restricting residence precisely because membership guarantees spatial association on a regular basis.

A study of the small scale parish populations, for which detailed occupational data is available, makes the lack of any consistent

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\(^1\) though this is a clear case of the perpetuation of a function on the site of what was once a foreign enclave of wine importers within the City, which has been more fully discussed elsewhere.
relationship between particular trades and localities clear. Power has produced detailed picture of the occupations of the occupants of 20 parishes in the City in the year of the Great Fire. Power's main interest was in testing the hypothesis first proposed by Sjoberg that "social and occupational segregation is an inevitable part of any pre-industrial city, past or present" and that this might be expected to reveal itself through a concentric population distribution, with the elite of society concentrated at the centre of the city and the poorest and most disadvantaged sections of society at the periphery. As a by-product of carrying out an investigation into where the rich and poor of London lived at the time of the Great Fire, Power established the occupations of householders in the central area of the City. There does appear to have been a measure of concentration of occupation, and particularly of shops in particular localities. Stow suggests this to have been the case historically, and Power's data shows that this propensity to cluster is particularly the case with the professions and also with some of the more polluting trades like metal workers and leather workers. In some cases this extended to occupational groups living together as neighbours, though not exclusively so. Although there was some occupational clustering, most parishes contained a mixture of occupations even where one or two occupations were over-represented in a particular street. As a result Power was able to state conclusively that 'neighbourhoods were not exclusive to a group'.

2 Sjoberg, G. The Pre-industrial City, New York, 1960 pp.97-100, and 118-23.
4 through an examination of the hearth tax returns for a sample of 20 parishes. The hearth tax is a crude measure of wealth of a household, since the act itself made the assumption that householders with less than two hearths might be exempted on the grounds of poverty, whereas those maintaining more chimneys would not be permitted to avoid tax on any grounds whatsoever.
5 in Stow's day mercers and haberdashers were to be found on London Bridge, goldsmiths in Cheapside, drapers in Candlewick Street and Watling Street and Skinners on Budge Row and Walbrook. Stow lists 23 occupations altogether which he considered to be locality specific, and only in four cases does he suggest that this cohesion was being lost.(pepperers/grocers, pastel workers, bow makers, mercers/haberdashers)
6 who are represented to three and one half times the expected extent in St.Stephen Walbrook when set against the trend for the 20 parishes.
This is in line with the findings of Keene and Harding, who carried out a similar investigation of a group of parishes centred on Cheapside\textsuperscript{1} for the period 1100-1666.\textsuperscript{2} Their survey, conducted over a period of several centuries, points to a considerable degree of fluidity in the occupational make up of particular areas of the City. They found that 71\% of the sample studied moved within two years, with the cheapest properties having the highest turn-over of tenants. Many moved within a small spatial compass, and this has led the authors to speculate that mobility 'reinforced rather than undermined a local sense of community'.\textsuperscript{3} Wealthy citizens were also found to be physically mobile, though the duration of each stay tended to be longer and moves tended to be across a greater distance than in the case of poor citizens. According to Keene, moves take place in a predictable pattern, which appear to have been dictated by stages in the life career events of individual merchants.\textsuperscript{4} This suggests that social networks in the mediaeval City may have had a global significance\textsuperscript{5} over and above the benefits which derive from neighbourliness. If these findings have any relevance to neighbourhood unit planning it is in casting doubt on the permanence, the local nature and the closure of social networks in a pre-industrial city like London.

On the question of wealth as opposed to occupation, Power is equally categoric. The average wealth of parishes as exhibited through the hearth tax records shows a broad relationship to centrality, with parishes favoured with large dwellings grouped in the centre of the City and those with greater numbers of smaller homes near the wall and along the river front. However, Power suggests that the wealthier parishes straggle from east to west, with three distinct concentrations,

\begin{itemize}
  \item \textsuperscript{1}Keene, D., \textit{Cheapside before the Great Fire}, ESRC, London, 1985.
  \item \textsuperscript{2} According to the Cheapside survey, in 1425 the occupants of a row of 8 houses in a typical City street, Ironmonger Lane, were a cutler, a pursemaker, an embroiderer, a pinner two merchants and two tailors, with a wealthy mercer occupying the large house to the rear. In 1666 the same eight houses were lived in by a bricklayer, an engraver, a coat seller, a victualler and a attorney, together with two single women in separate households. The plot behind had been divided into three, and was occupied by a parish priest, a silkman and a lawyer.
  \item \textsuperscript{3} Ibid p.17.
  \item \textsuperscript{4} Ibid p. 18
  \item \textsuperscript{5} Argued general principle by Hanson, J., \textit{Hunters and Gatherers}, and Hillier and Hanson, \textit{Social Logic of Space}.
\end{itemize}
Fig 6.22 - Power's map of wealth, distributed by parish and measured through the average number of hearths per dwelling.

Fig 6.23 - the major civic buildings recorded in Ogilby and Morgan's map of 1677
in the north-east around St. Helens, in the centre close to the Walbrook and in the south-west of the City near the wall (Fig 6:22).

However, within any particular parish this tendency serves to disguise great disparitities of wealth between immediate neighbours. Here Power finds that the larger dwellings concentrate upon major thoroughfares, in a direct relationship with the status of the street as a traffic artery. The street enjoyed a unique combination of status and vitality, the lane shares only the industrial vitality, yards tend to share only social status. At the other extreme, the incidence of absence of status among residents is also most pronounced in yards and alleys, less so in the lanes and least noticeable in streets. Power concludes that on the street, there was more air and light, more room, and a crucial advantage, the world and its purse passed by. In a man was in business selling a commodity or service, street frontage was almost a necessity. Here too there tends to be a micro-scale concentric arrangement, but with a reverse emphasis so that the wealthy are spread around the perimeter of the block and the poor are concentrated in the centre. Choice of residence and rents are both regulated by commercial advantage, which relates directly to the ability to take advantage of the 'passing trade'. The exception is the wealthy enclave (Power's word) of citizens whose income and mode of social interaction are such as to permit them to distance themselves from the hurly-burly of street life.

The programme of civic rebuilding, including the Exchange Building, the Customs House, and Christ's Hospital had taken place by the time of Ogilby and Morgan's Map (Fig.6:23). There seems to be a concentration of public buildings in the Bishopsgate area, historically an area of luxury mansions untouched by the Great Fire, and a (predictable) cluster of nautical buildings in the area between the Tower and London Bridge behind the wharves where seagoing ships

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1 ibid p.208.
2 ibid p. 209. In support of this last type, Power cites the propensity of titled people to live in yards, and cites the example of Half Moon Court in St. Botolph Aldersgate, which had six gentlemen and a bishop amongst its 34 residents, with an average dwelling size of 7.8 hearths.
4 ibid p. 209.
5 whose social relationships are maintained independent of space in forms of transpatial solidarity.
Fig 6:24 - the immediate surroundings of selected civic buildings.
Fig 6.25 - the main markets of the City in the Restoration period.
were berthed. Charitable institutions seem to be located at the periphery of the City and the major organs of trade, the Compters and the Exchange, close to Cheapside and Cornhill, but the small numbers of all these types of civic building make generalisations difficult. ¹

The list of civic buildings recorded in Ogilby and Morgan’s map is set out below.

1. Physicians College
2. Christ’s Hospital
3. Dean of St. Paul’s
4. Prerogative Office
5. King’s Printing House
6. Doctors’ Commons
7. Wood Street Compter²
8. Syon College
9. Poultry Compter
10. Merchant Taylors’ School
11. Fire Monument
12. Pay Office
13. Gresham College
14. Excise Office
15. G.P.O.
16. Navy Office
17. Trinity House
18. Customs House

Local conditions vary markedly. (Fig 6:24) Gresham College has a ward boundary running through it. Market buildings will be considered separately below.

Market trading had been rationalised after the Great Fire, and commercial activity was increasingly taking place in purpose-designed buildings like the Royal Exchange. The sites of the City’s many street markets as recorded in Hugh Alley’s ‘Caveat’ of 1598³ are also shown in the overlay of ‘habitual standings’ (Fig 6:25), though should not be forgotten that trading activity was ubiquitous in the City at this time, and hucksters and other street vendors were able to peddle their wares at certain times of day provided that they were continually on the move.

The Stocks Market is now the focus of widened streets, including a new dog-leg street, Princes Street, which connected the Stocks Market with Lothbury. The goldsmiths bankers and important merchants all took houses in this area, together with the Jews. This concentration of individuals offering credit facilities⁴ and money lending, creating a vitally important financial centre in the heart of the City⁵.

¹ this subject will be dealt with at greater length later in the chapter.
² The compters were debtors prisons.
⁴ the goldsmiths were an important source of credit at the time and the Company and several of its prominent members were ruined in the second
Fig 6.26 - a selection of City covered and open market areas

C. Honey Lane Market

B. Leadenhall Market
A. The Royal Exchange.

D. Newgate Market.
Fig 6.27 - the parishes in the area of St Mary le Bow, Cheapside, in 1400, and in 1677.
(Fig 6:26) local conditions. The post-Fire markets tended to be in more segregated positions than their pre-Fire predecessors. This shift will be discussed in more detail in the subsequent chapters, when this localised and localising phenomenon will be set alongside changes in the nature of trade generally within the Restoration City and in the centuries which followed.

Local identity - global relatedness: the parish of St. Mary le Bow.

Up to this point, the main effects of space which have been stressed are to disguise the cleavages between the social units of the City (wards, parishes) and to enable local residents throughout the City selectively to take advantage of the movement potential afforded by the urban grid to maximise trade advantages. Perhaps the best way to illustrate this practically speaking is to consider the potential offered by space for the occupants of a typical City centre parish, the parish of St. Mary le Bow, an average sized parish in the geometric heart of the City.

If the set of parishes surrounding St Mary le Bow as illustrated by Keene and Harding in their Cheapside study are compared to those shown in Ogilby and Morgan (Fig 6:27) then it is clear that the fluidity which has already been noted in respect of the occupants of parishes extends to the very parish boundaries themselves. One church, St Thomas of Axe, has even disappeared altogether in this half of the seventeenth century by debts undertaken at Royal behest and in the national interest. This eventually led to the foundation of the Bank of England, and these debts to prominent goldsmiths were the earliest form of national debt.

5 later to become the site of the Bank of England.

1 For no other reason that that it has been well-documented by historians

2 Keene D, Cheapside before the Fire, op cit.
Fig 6:28 - the parish of St Mary le Bow, 1677
limited part of the City for which we have continuity of data over several centuries. Clearly one effect of constant rebuilding over many centuries is to shift even 'physical facts' like parish boundaries over time. Despite a degree of flux in the surrounding parishes, the boundaries of the parish of St Mary le Bow have remained more or less the same over the centuries.

The parish (Fig 6.28) has 22 houses in two blocks to the north of Cheapside, 55 houses west of Bow Lane, in part of a larger block located between Cheapside and Watling Street and 49 houses east of Bow Lane between Cheapside and New Queen Street. A further 15 houses form part of a fourth block south of Watling Street. The average number of hearths per dwelling at the time is 5.32, which makes the parish reasonably wealthy though not outstandingly rich. The houses vary a great deal in size, and it is clear that some of the parishioners, particularly those in the interior zone of the blocks, did not enjoy salubrious living conditions.

The back gardens of some of the houses east of Bow Lane are in St Mary le Bow while the houses are in the neighbouring parish of St Anthony. St Mary Aldermany also has some properties in the south of this block, while St Pancras, Soaper Lane has others in the north. Within this one small island block, spatially contiguous neighbours worship in four separate churches. This is also the case with two of the three other blocks encompassed by the parish. All Hallows Bread Street and St Mildred Bread Street both have properties in the block to the west of Bow Lane. All Hallows Church actually adjoins the boundary with St Mary le Bow and divides the interior zone of the block all the way to Cheapside. Technically some properties straddle this boundary, though for the most part the line within the party walls. In the north, the building of Honey Lane Market had deprived two parishes of their churches so that the neighbours of the St Mary le Bow houses must have worshiped elsewhere, perhaps at St Mary le Bow which was the nearest church just across Cheapside. Again, close neighbours in Watling Street, only stone's throw apart, worshiped, paid their dues, celebrated life career events and were eventually laid

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1 this is also clear from the number of churches which 'disappeared' as a result of the post-Fire rebuilding.
to rest in three different churches. This is a picture which is replicated wherever one looks within the City.

The ward boundary crosses the parish, following Cheapside for some part then wandering diagonally through the block to the east of Bow Lane. The church is in Cordwainers Ward. Houses in the parish at one end of Cheapside are in Bread Street Ward while those at the other are in Cheap Ward. Again, close neighbours a few houses apart owe allegiance to and elect aldermen in three different wards, while some of their neighbours across the street elect to a fourth, Cripplegate.

The occupational structure of St. Mary le Bow includes dealers, victuallers, professionals, workers in wood and textiles, as well as builders and carriers. There are no metalworkers or leatherworkers listed in the parish at the time, but historically there had been a large concentration of leatherworkers in the houses north of Cheapside. Cordwainers Ward and Cheap Ward, where the majority of the residents live, have no guild halls within their boundary. The company halls of the residents of St Mary le Bow are are spread throughout the City. The builders would go east to Tower Ward, victuallers south to the Vintry and the professionals west to Farringdon Ward to conduct affairs of business. Practicing trades or professions would disperse parishioners throughout the City, bringing them into contact with fellow-traders who lived in a host of other parishes and wards. It is inevitable that these meetings provided an opportunity for members to exchange local knowledge.

Parishioners would need to travel City-wide to satisfy their daily marketing needs. The nearest general produce market is the newly-erected Honey Lane Market, but the purchase of meat would take residents to Newgate and to buy fish might entail a trip to Billingsgate. The Stocks Market and Leadenhall Market are also nearby. Food purchases, however, are just 'the tip of the iceberg' and all the necessities of life from clothing to candles would have to be sought from the multitude of small manufacturers and traders who relied on the purchasing power of City residents. The City is in this sense an

1 round about 1300.
Fig 6.29 - three axial steps from Bow Lane
'organic solidarity', and the cogency with which Durkheim\(^1\) has argued that these relations of mutual interdependence through economic specialisation bind society together at a global level, should not be overlooked when it comes to spatial considerations. The requirement to transact means that the physical dispersion of these daily necessities has to be overcome by the construction of a global use and movement interface.

Within the parish there are no non-residential buildings other than the Church, which draws people together within a narrow spatial compass. This is an unfortunate by-product of the choice of parish, but were there to have been any guild halls or civic amenities within the parish this would have brought regular influxes of strangers into the area. These tend not to be located at the junctions of important though streets but buried in the interior zones of the blocks, which exacerbates the penetration by strangers into the heart of the local neighbourhood.

The streets anyway produce this effect. In St. Mary le Bow Cheapside, the main artery of trade for the City, forms part-boundary and part-link. Bow Lane which bisects the parish is well-integrated, so regular movement through the heart of the parish past the church is inevitable. Watling Street in the south of the parish is also well-integrated. The secondary system of yards is all above mean integration, which is no doubt an advantage to the large numbers of selling groups and craftsmen who operate out of small workshops within the parish. Centrality and accessibility, as Power has shown, is the key to prosperity. An inhabitant of Bow Lane has a twofold advantage in accessibility. Not only does the world pass by the door, but also three axial steps take him or her over much of the City. (Fig 6:29)

Many parishes were much smaller and their interrelations more complex than St Mary le Bow, and their ability to construct face-to-face relations within many overlapping social networks correspondingly greater. The residents of one small parish enter into a range of spatially-defined sub-groupings which require them to

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construct linkages with many different people from all over the City and beyond. It is difficult to envisage a situation where more global interlinkage could have been 'designed for' within the system. Individuals, each rigorously pursuing their independent way of life, guarantee the knitting together of the whole City.

That this would not happen if there were spatial clarity can be illustrated by imagining a 'thought experiment' to tidy up St Mary le Bow and give it the spatial clarity of a neighbourhood unit. The first step is to place the church at the centre of the parish and rearrange the parish boundaries to ensure that the parishioners occupy the whole of the two urban blocks either side of Bow Lane in the blocks bounded by Cheapside, New Queen Street, Watling Street and Bread Street. All the neighbouring churches could be similarly located at the centre of their parish, to distribute their parishioners evenly and maximise distance between them. Worship would turn the parish inward, away from the neighbours across the street.

The next step would be to narrow Bow Lane to make it refer to the parish, so that the world would be encouraged to pass around the edge not through the centre. Offsetting the streets which define the parish boundaries would further reduce visibility and casual movement from one part of the City to another. Making the ward co-terminous with the parish would ensure that the same people would meet for civic and religious affairs. This would simplify the administration, but would cut off the avenues into neighbouring administrative districts which the residents of St Mary le Bow currently enjoy. Given the broad occupational structure of the parish, it might even be feasible to concentrate production and trade within the area and give the parish its own general market in the yard next to the church.

The net effect of all these changes is that residents would have less and less reason to leave the confines of the parish. Streets would mark the boundaries of social interaction rather than their locus. Taken City-wide, this would mean that fewer and fewer people would pass the door and there would be fewer opportunities to meet new people or to use existing acquaintances as a springboard to new friends in distant parts of the City. It is conceivable to turn St Mary le Bow into a

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1 as at Basinghall.
Fig 6.30 - the example of a semi-lattice as shown by Alexander.
natural neighbourhood but it is necessary to reverse every spatial gesture and every social act which implies movement, to accomplish it.

Conclusion: The City as a Semi-lattice.

The main thrust of Alexander's seminal article, *A City is Not a Tree* 1 is to give a characterisation of the inner nature 2 of the traditional or natural city, and to distinguish it from that of the artificial or planned environments of the modern era. This principle he calls a 'semi-lattice'. Alexander's initial conceptualisation of a semi-lattice is physical and concrete. Defining any 'set' as 'a collection of elements which we think of a belonging together' 3 he suggests that the concrete elements of the urban landscape can be thought of in this way, and that any specific locality within the city 'derives its coherence as a unit both from the forces which hold its own elements together, and from the dynamic coherence of the larger living system which includes it as a fixed invariant part.' 4 Ultimately Alexander is concerned with the difference between overlapping and non-overlapping sets 5. A natural city would be an example of the former and a city composed of neighbourhood units would be an example of the latter. The structure of the first would be a semi-lattice and of the second a tree.

The example (Fig 6:30) which Alexander 6 gives of a semi-lattice is based on a study of the town of Middlesborough by the sociologist Ruth Glass. 7 Glass plots a number of key social systems within the administrative districts of the town (schools, clubs, shops) and maps the spatial compass of each activity. She finds not only that the various activity zones do not correspond to each other, but that they do not correspond to the administrative neighbourhood which they purport to serve. Activity zones do not correspond to each other, nor are they disjoint: they overlap.

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1 Alexander, op. cit.
2 he called it the abstract ordering principle, but more properly should be structure.
3 ibid p. 403
4 ibid. p.404.
5 ibid p.406.
6 ibid p.414.
7 Glass, R.
The relevance of this example to the City is clear. The City is a rather clear example of overlap in action. The message transmitted by Glass is, however, ambiguous. One conclusion which it is tempting to draw is that the physical attributes of space are irrelevant to neighbourhood design. The abstraction of the diagram gives an aspatial message which is curious in view of Alexander's argument, which started from the physical nature of sets.

Alexander was unable to show how a city might function as working as a semi-lattice in physical, plastic terms. This chapter suggests that physical space has a vital role to play, but that the nature of that role may be to assemble together the inhomogeneous and to disguise the differences beneath a cloak of physical contiguity. A second and equally vital component is to render the urban grid open and spatially unbounded, and hence to permit the development of a continuous interface between the most intimate sub-areas of the City and the global spatial configuration. In the case of the City the unfolding of social processes in space is anchored in the physical, but in a way which runs counter to the clarity with which designers have previously conceived of as neighbourhood. The spatial structure of the City and the disposition of its institutions within the urban grid is not just a question of complexity or overlap. As Alexander warns, 'the overlap must be the right overlap.......for overlap alone does not give structure. It can also give chaos.' Despite its apparent disorder, the City is not chaotic. It is ambiguous, and therefore capable of disguising social cleavages. In an important sense it works against the tendency for social groupings to close, by mixing people of different allegiances together in spatial proximity without declaring where the boundary between them lies. It is also well-structured, although the designer's 'basic intolerance for ambiguity' may find it a structure which is difficult to conceptualise wholistically. It is to this question, of conceptualising the global structure and relatedness of the City, that the next chapter is addressed.

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1 ibid p.424-5.
2 ibid p.423
3 An early specification for this was set out by the author in the conclusion to The Architecture of Community, (with Hillier) in a guest edited issue of Architecture and Behaviour. Vol 3 1986-7. pp. 269-271. This article, written in 1979, was the original research proposal for this Ph.D.
Chapter Seven: The Structure of Differences: an exploration of the global configurational features of the street grid of the City of London, as recorded in Ogilby and Morgan's map of 1677.

Introduction.

This is the second of a pair of linked chapters which sets out to explore the morphology of the Restoration City of London through an analysis of the Ogilby and Morgan Map of 1677. The previous chapter conducted a search for 'natural neighbourhoods' within the City. This chapter sets out to allow the City to 'speak back' about its global structure by examining a range of configurational variables - first order syntactic measures and their correlations, radius three integration and point depth entropy in relation to the four quarters of the City, and what appear to be its physically distinctive and spatially defined sub-areas.

It has already been suggested in Chapter Five that history has produced in the City not a set of similar parts with similar local identities but a set of historically and morphologically differentiated parts (differentiated morphologically because differentiated historically, e.g., in the Roman global structure, the Saxon town, the Tower and Fort regions, Blackfriars and the regions defined by the religious houses) whose morphological combination makes the global urban space structure of the City unique. This proposition will be examined in more detail in this chapter. The argument is advanced that the parts of the City have a specific experiential character which is structurally related to its historically generated morphological identity, and to a process of fine-tuning of the urban grid by which the whole comes to dominate the parts.

This formulation seems to answer some of the outstanding questions raised by Rossi about the fundamental nature of the city as a complex artificial and historically-produced artifact. However, it requires a more complex formulation of the parts/whole problem than the order-

1 for the detail of these measures the reader should consult the methodological prerequisites in Chapter Two of this thesis.
based view as the City as a set of locally similar elements (residential districts, quarters, study areas) which is fashionable today.

**Parts and Wholes.**

According to the findings of previous chapters, the City appears from its foundation to have been morphologically differentiated in its parts, although the precise way in which this was achieved seems to have varied with historical period and phase of growth. This is clearly at odds with order-based concepts which imply an identity of local elements. Moreover, the sociologically-defined concept of a city as a collection of 'natural neighbourhoods' does not seem to be supported by historical investigation. The City of London seems to work like a 'semi-lattice' in which local identity always goes hand in hand with global relatedness. This combination of local physical differentiation with a high degree of embedding and overlap within a global spatio-temporal network seems paradoxical.

Rossi\(^1\) suggests that the root of this apparent paradox lies in a theoretical insistence on classifying urban space functionally rather than typologically. He argues that 'any explanation of urban artifacts in terms of function must be rejected if the issue is to elucidate their structure and formation.'\(^2\) Rossi prefers the study of form as the means to elucidating the laws of urban space and structure.

This chapter follows Rossi's lead and sets out to investigate the structure of the urban grid of the Restoration City of London as recorded by Ogilby and Morgan. Priority will be given to describing the City as a spatial phenomenon, and to the search for physically distinctive sub-areas within the overall configuration of the grid. This is not to deny the relevance of social process and history but rather to admit that these are often contingent to an understanding of the everyday reality of a town, which is experienced physically as a system of configured street space to use and move about in.

**The depth picture for visitors to the City.**

\(^1\) Rossi, op cit. p 46
\(^2\) ibid. p 46
Fig 7.01 - Three axial steps from the walls
The first way in which most people experience the public space of towns and cities, at least initially, is as a visitor. Visiting a town, particularly a historic town, for the first time is for many a voyage of discovery. It is both a pleasure and an intellectual challenge to wander through the streets with intuition as a guide, experiencing the pleasure or surprise as each twist and turn reveals a new street picture. It is in a sense a test our grasp of the principles of urban space and structure to find the way to the town centre or market place without a map. The fact that the exploration of complex urban artifacts appeals widely to the human imagination is testified by the volumes which have been written on the subject, several of which try to 'explain' this phenomenon in terms of the human psyche. Syntax takes a more prosaic view, and suggests that towns differ in the extent to which they structure public space to makes their internal workings accessible to the visitor, and that the means by which the grid is rendered accessible of labyrinthine to the visitor is through the axial organisation of the street grid.

The unfolding picture of the City from the point of view of a visitor can be illustrated graphically by constructing an overlay on the axial map which starts at the City gates and counts the numbers of turnings needed to go from the edge towards the heart of the City along all possible routes. Spaces one axial step into the City are coloured red, spaces two axial steps into the City are coloured purple, and spaces three axial steps from the line of the walls are coloured pink. Fig. 7:01 records the extent of the system covered by the first three steps of this process at the time of Ogilby and Morgan, and Fig 7:02 completes the picture to show the total depth from the walls.

This transcription shows that three axial steps along many of the major routes take an individual from the walls to the main, geometrically central spaces in the system centred on the Stocks Market. The exceptions to this rule are at Ludgate, where three axial steps do not lead directly to this important junction but connect to spaces which are themselves within three steps of the Stocks Market, and Moorgate which was only built in the fifteenth century and does not 'fit into' the pattern of cross City routes which were by then

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1 Bacon, EN. Design of Cities. Thames and Hudson. London. 1975 is a classic exponent of this view.
Fig. 7:02 - three steps to total depth from the walls.
already well-established.

The route in from Aldgate is of interest in that it illustrates a more general principle of axial organisation in the City; that the selection of the longest axial line at an intersection will lead more directly through the global system of routes.\footnote{in this case by selecting Leadenhall Street rather than Fenchurch Street.} The sole north-south route through the City from Bishopsgate to London Bridge takes three steps altogether and by-passes the area around Cornhill whilst still preserving a three step depth to the intersection. To cross the City from any entry to any exit can be achieved in a maximum of six axial steps, using the 'longest line' principle.

The shape and spread of the three step map is revealing\footnote{an can be compared directly with the three-step map from Bow Lane in the heart of the City which was introduced at the end of the previous chapter, to show that a resident in the geometric centre of the City was within striking distance of a large proportion of the central, commercial area of the City and many of the main routes into and through its heart.}. The area to the north-west of St Paul's centred upon Newgate Market is covered within the first three steps. This, taken with the slight penetration of the Ludgate Hill line, suggest that St.Paul's is more axially orientated towards Westminster than to the City. The routes in through Cripplegate and Aldersgate mean that this part of the City is shallow to the Smithfield area immediately to the north. East of Aldermanbury, penetration is slight, and there seems almost to be a deliberate attempt to chicane streets and discourage through-movement across this area. The number of deep dead-end courts in this part of the City serve only to reinforce this impression of impenetrability.

By contrast, the link up from Southwark across London Bridge gives access to the majority of streets in the area south of Cornhill, including to the heart of Leadenhall Market. The newly constructed import/export quays downstream of the bridge, and the quays adjacent to the Fishmongers Hall are also reached by this process. The area of coverage is much greater, approximately four times the size of that in the west despite there being only one route at one step deep into this part of the City. The remaining gates (Bishopsgate, Aldgate) do not give access to the eastern parts of the City immediately inside.
the walls but concentrate movement down into the heart of the City along the major incoming routes.

As a system, the longest and shallowest lines at the edge penetrate quickly from the periphery to the centre to form a deformed network of long straight routes coming into the City in all directions. Between these are zones of, on the whole shorter lines, which do not penetrate far metrically, but twist and turn to create axial depth. Thus although there is to a certain extent a 'depth gradient' from the periphery to the centre, this is not a pure product of metric distance. At the other extreme, the majority of deeper spaces from the outside are concentrated in the south-west of the City, particularly upon the small grid of streets to the north of Queenhythe which marked the focus of the Saxon township. A more scattered concentration of deeper spaces is to be found north of Cheapside in the vicinity of the Guildhall.

The depth picture for inhabitants of the City.

So far the concept of depth has been used to look at the pattern of axial depth of the City from its boundary, taking this to be the line of the old Roman walls. Depth exists where it is necessary to pass through a number of intervening spaces - as defined by axial lines - in order to reach any desired space: shallowness where the route between spaces is more direct. But the concept can be applied just as easily to any line in the system in order to consider the distribution of the pattern of lines in relation to it; i.e., how far away or how close all other lines in the system are from the initial line of interest.

This pattern of depth from a chosen point can be captured numerically to give a precise index of the relative depth or shallowness of any spatial system seen from one particular point; the integration value of the space, formally known as its relative asymmetry. This can be calculated for every point in the system to give a distribution of depth values for every space. The crucial point is that every space is thus assigned a value that characterises its relation to all other spaces in that system, thus providing a global index of relative integration or segregation for each space. The mean of all the depth values

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1 already referred to in the methodological prerequisites in Chapter Two but now explained briefly here in main text.
Fig 7:03 - the map of 58 integration value.
RRA) will then represent the depth or shallowness of the system as a whole. In the City of Ogilby and Morgan, this value is 0.7625. If we consider mean RRA as giving a crude interpretation of the amount of hierarchy present in the system as a whole in the sense of representing the average directness or indirectness of connections between spaces, then it can be seen that the City does not exhibit much hierarchically organised space; on the whole, spaces are rendered relatively shallow or direct to each other.

More interesting than the measure of mean RRA is the actual pattern of distribution of the more integrating or shallowest and the more segregated or deepest spaces in the City. If the axial map of the City is taken, and the axial lines are plotted, beginning with the most integrated, then the core of most integrating spaces can be unfolded. Fig 7:03 represents the 28 most integrated spaces in the City, accounting for 5% of the total integration value (as opposed to lines) in the system at the time of Ogilby and Morgan.

The pattern made by this distribution is striking. The first few lines immediately sketch out an excentric core of long lines which extends over much of the centre of the City with an imbalance in the core towards the river in the south and to the east. Cheapside is the most integrated space in the City as a whole - i.e., that space from which all other streets, lanes and alleys are most easily accessible. The second line in the core crossing Cheapside at right-angles about half way down, is that of New King Street, the northern portion of the new street which connects the Guildhall to the River. Cornhill, Threadneedle Street and Lombard Street follow, confirming the importance of the Stocks Market in the route network of the City. The line of Walbrook is next, followed by the lower half of the Guildhall

1 practically speaking, this compares any system to the values of a diamond-shaped distribution for that number of spaces.
2 usually, but not invariably, integrating lines are connected together into a continuous system of relatively shallow spaces known as cores. Cores in towns from all parts of the world take up different but characteristic shapes and sizes. Most are, topologically, variations on a 'deformed wheel'.
3 for comparative purposes, the reciprocal of RA is taken, since integration is a low value, whereas the remaining syntactic measures are high.
4 although both Threadneedle Street and Lombard Street are quite narrow, suggesting that sheer size is not a sufficient indication of the relative importance of streets in drawing the City fabric together.
Fig 7:04 - the map of 5% most integrated lines
line along Queen Street. These, together with Old Change, which enters the core in 10th place, shift the core southwards, pointing in the direction of the River, whilst lines 8, 9, 11, and 12 are short lines at the Stocks Market, all deriving their importance from their direct relationship to this integrated intersection. Line 13 drops from Cheapside at Bow Lane, line 14 extends further down Walbrook and line 16 runs south from Cheapside along the east of St Paul’s Churchyard, all pushing riverwards from Cheapside. Lines 15 and 17 along Cannon Street, consolidate the core in a southerly direction, parallel to the river.

The first line north of Cheapside to enter the core, Lothbury running eastwards from the front of the Guildhall, does so at only 18th place. The next line is the most easterly of the 5% value core, following Bishopsgate and Gracious Street to triangulate the fan radiating from the Stocks Market. Line 20 pushes south from Cheapside, whilst lines 21 and 22 shift the core in a westerly direction, to begin to make a smaller fan at the St. Paul’s end of Cheapside along Newgate Street and Paternoster Row, whilst line 24 extends the eastern ‘fan’ a short distance up Broad Street. Lines 23, 25, 26, 27, and 28 balance the southerly extension of the core from Cheapside by pushing northwards at intervals along its length.

By 5% value, the integration core takes the shape of a ‘square wheel’ that has been ‘deformed’ by pulling the ‘hub’ apart along the line of Cheapside. What results is a fan of ‘spokes’ at each end, St Paul’s and Cornhill interchange, and a line of spokes between, either side of Cheapside. The ‘rim’ of the wheel is partly formed on three sides but not on the fourth, in the western sector of the City.

Extending the core to 5% of lines (Fig 7:04) raises the core to 40 lines and consolidates the picture at 5% of value. Line 29 completes the western ‘fan’ by extending it along the route north of St Paul’s cathedral towards Ludgate Street. Lines 24, 32 and 39 push eastwards, extending the Cornhill ‘fan’ slightly, but not as far as the City walls. Lines 30 and 33 create a partial second ‘rim’ along Thames Street in the south, and lines 31 and 38 add a third link across the ‘spoke’ of Queen Street. Lines 34, 35 and 36 are new ‘spokes’ hanging
Fig 7:05 - the map of 10% integration value

Fig 7:06 - the map of 10% most integrated lines
off Cheapside. Line 40 extends the northerly 'rim' westwards along Catteaton Street.

At 10% of integration value and 56 lines (Fig 7:05), the core is still consolidating the coverage given at 5% of value by a process of infill. The only line which extends the core in scope is line 46, which runs down Gracechurch Street and Fish Street to London Bridge, sketching in an extended 'rim' in the east to the intersection with Thames Street. Lines 42, 44, 45, 48, 49, 50, 52, 53, 54, 55, are all short additions to the 'elastic hub' of Cheapside, line 43 extends the existing 'spoke' of Friday Street southwards, and lines 41, 47, 51 and 56 all take a similar relation, 'hanging-off' the principal 'spoke' which crosses Cheapside at right-angles by way of New Queen Street/New King Street. The 'square wheel' still dominates - as does the south and east emphasis in its shape and extent.

Between the core at 10% of value and 10% of lines (Fig 7:06) a numerical increase from 56 lines to 80, the core undergoes a minor phase of expansion heralded earlier by the extension of the eastern 'rim' marked by line 46 to London Bridge. The southern 'rim' expands eastwards along Thames Street to meet this eastern 'rim' and infill it with a grid of integrating lines. A parallel process takes place in the south-west. Almost no new lines are added to the core north of Cheapside and the few additions which are made are restricted to the north-east of the City. The northern 'rim' which began with Lothbury is completed along Throgmorton Street at line 62, and Leadenhall Street pushes out beyond the eastern 'rim' almost to the walls at line 72 of the integration core.

To sum up, the integration core of the City in 1677 is rather restricted in size and scope. It is only fully permeable to the edge of the City at only one point, London Bridge, leaving a wide semi-circular band of lines around the perimeter of the intermural City and only one other line reaches the river, that of Queen Street. The overall shape is still that of a 'square wheel' core which has been bisected and pulled apart at the 'hub' along the line of Cheapside. This bisection is marked by a 'principal spoke' on the King Street/Queen Street line. Other 'spokes' hang off either side of Cheapside and fan out from the two 'half-hubs' at either end of Cheapside, at St. Paul's and the Stocks Market.
Fig 7:07 - the map of 50% segregation
Marking the periphery of the 'square wheel' is an incomplete 'rim', totally unformed along its western edge, formed early and almost completely consolidated by later additions to both intersections on the northern edge, and formed early and completed on its eastern edge. The southern 'rim' is the only one to have expanded with the core, from an early inner 'rim' to a later, major complete 'rim' close to the river.

The mode of growth of the integration core is through a series of waves of expansion, in which long lines push the coverage of the core outwards, followed by consolidation, where lines are added to fill out the density within its established coverage. The thrust of the core is eccentric, loaded towards the south and east. This shows itself in two ways; by the direction of expansion and by the order of infilling with lines, both of which first favour the south and east and then redress the balance to maintain a 'square' shape.

The map of the 50% most segregated spaces in the City in 1677 (Fig 7:07) is equally revealing. Three properties of the distribution are immediately striking. Firstly there are very few segregated spaces in the heart of the City between St Paul’s and the north-south route from Bishopsgate Street to London Bridge, in the area south of the Guildhall, and those which do exist tend to be singletons or small groups distributed across the surface, rather than dense clumps of contiguous, segregated lines. The exception is the wharves around Queenhythe, which were noted earlier as being particularly 'deep' with respect to the outside of the City. Despite being geometrically half way to the centre of the semi-circle formed by the walled City and the River, these lines are picked up as a deeper than average pocket with respect to the City as a whole.

Secondly, in the areas closer to the walls the converse is the case; there are almost no lines which are more integrated than the average, and those which are tend to be singletons rather than clusters of connected lines. Particularly dense is the concentration around the Tower, including some lines1 which were previously noted in (Fig 7:01) as being shallow when considered from the outside. Other areas

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1 Mincing Lane, Mark Lane, Tower Street and the wharves around the Customs House.
shallow to the outside but deep when considered overall are to be found in the west, around Newgate Market, and in the north-east, in the laterals giving onto either side of Broad Street and Bishopsgate Street. A dense concentration around Blackfriars in the west is, uniquely, geometrically at the edge of the City but segregated both with respect to the outside and to the system of all spaces within the City. The most segregated spaces of all are clustered in three areas of the City: the Blackfriars area, below Moorefields and close to the Tower.

The third property of interest is that the separation between integration and segregation is particularly strong in the City of 1677. To an unusual degree, lines within the core of 10% most integrated spaces do not connect to lines which are more segregated than average. This confirms earlier investigations of the Roman and Saxon townships.

Taken together, the relation between depth from the outside and generalised depth shows that the interface between visitors to the City and inhabitants of the City is differently constructed in its different parts (Fig 7:06). In the Ogilby and Morgan map depth from inside is occasionally complemented by shallowness to the outside as in the case of the New Quay wharves (A), Newgate Market (B), and the area of the Roman Fort (C) (all marked in green). In other areas, such as Blackfriars (D), Tower Liberty (E), Dukes Place in the north-east of the City (F), Queenhythe quays (G) and the area to the north of the Guildhall around Drapers Garden (H) depth from the outside is accompanied by depth from the inside, making these areas difficult to reach either as a stranger to the City or as an inhabitant (all marked in red).

In other parts of the City, extreme depth from the outside is offset by extreme shallowness to the inside. The south-west of the City (J) is the striking case in point (marked purple). The area is much more orientated to being a destination for within-City journeys than to being easily accessible to strangers. The area in the south-east (K) is very shallow to penetration from the outside and is also reasonably shallow to the inside, though less so than in the south-west (marked
Fig 7:09 - routes which are shallow to the perimeter of the City and to the integration core.
orange). The line of the Walbrook marks a clear divide between these two sub-areas.

Generally speaking, the roads seem to take up a variable position with respect to these spatially distinctive sub-areas. Some of them sit between the major through-routes (B, D, E, F). Others, particularly those which have a shallow RA dimension (J, K) straddle some major through routes but are bounded by others. The relation between sub-areas and routes is not clear cut, yet another case of ambiguity in the spatial construction of the City.

This is particularly so, since key globally-orientated routes are shallow in both maps (Fig 7.09) and therefore could well be expected to perform directly the complex role of interfacing inhabitants and strangers, as well as in either containing and channelling movement between sub-areas (by the connecting streets being few in number and short in length) or in accessing the whole sub-area of the City which lies in their immediate vicinity. These shallow streets are themselves, as it were, a distinctive 'part' of the City. It is surely no accident that these are the streets of the open air general produce markets. These streets produce the inversion of geometric depth and syntactic depth in the integration/segregation maps of the Cities; spaces at the geometric heart of the City are shallow in terms of the axial system and spaces close to the periphery are deep with respect to the City as a whole; this, despite the overall shallowness of the City when viewed from outside.

The first of the syntactic measures, RA, which describes how accessible a space is as a destination for all other spaces in the system, therefore points to a square 'wheel-like' structure of spaces which covers the central area of the City leaving large and dense clumps at the periphery. Such a strong central core area and such large concentrations of segregated spaces, when set against the generality of towns¹, are comparatively rare and striking. Set against depth from the outside, the City seems to divide itself into spatially distinctive sub-areas which differentially act as a destination for inhabitants and for strangers, and therefore to construct different kinds of

probabilistic interface between them. This will be touched on in the Final Discussion, but it is worth recalling even at this stage that the sub-area structure of the City which is sketched here on the basis of physical, morphological distinctions, does seem bear a relationship to the sub-areas of the central area of the modern City which performed differently in terms of their observed 'movement interface'\(^2\).

On the other hand, the morphologically-defined sub-areas which are proposed here bear no discernable relation to the ward or parish boundaries which were the subject of the previous chapter, and only the most tenuous of relationships to the institutional framework of the City as defined by the location of non-residential buildings\(^3\). There is a tenuous though discernable link to the average wealth of parishes.\(^4\)

The disposition of morphological differences within the sub-areas does however make historical sense in terms of the 'four quarters' distinction made in earlier chapters, for the differences noted between the sectors were primarily a product of configuration. This is also 'responsible' for sub-area differences. Major lines of cleavage between the four quarters also separate groups of sub-areas. This is most striking at Walbrook. The configurational differences which bring about the differential interface characteristics within the sub-areas (chicaining of streets and the like) also influence the sectorial analysis.

**Choice as a measure of global movement.**

Another way of measuring spatial patterns syntactically looks at how much a particular space figures as a choice for real or simulated journeys from all spaces to all other spaces in the system. The more it is an important choice, the more it might be considered to influence global relations of through-movement. This measure, which is termed choice because it shows how much of the total route choice in the whole system each space represents, is calculated by taking all the

\(^2\) see Chapter Two.

\(^3\) There seems to be some degree of concentration of guild buildings in sub areas C and H and a dearth of them in J and K, some concentration of civic buildings in F. The location of markets has already been dealt with.

\(^4\) the three foci of wealth remarked upon in the previous chapter seem to relate to sub-areas J, K and and F, but the data for the City is both incomplete and in a form (averaged for the parish, rather than assigned to precise physical locations) which does not make this comparison easy.
Fig 7:10 - the map of 5% high choice lines.
axially simplest routes from all spaces to all other spaces, and then computing the proportion of the total movement in the system which passes through any space.

Choice theoretically should indicate which lines are likely to be on popular routes from all points to all other points in the system. In other words, whilst integration is a static or steady state property of depth from each point in the system, choice is a dynamic aspect which deals with the route properties, in this case simulated and based on random selections of journeys by computer through the system. Insofar as a large urban complex like the City is likely to render citizens relative strangers to each other and to the different local milieu within the City outside the immediate locality in which each lives, choice might be expected to contribute to a global spatial picture of the City. Specifically, it is thought that choice will indicate the streets which might play a significant part in predicting inhabitant movement about the overall urban grid. This relationship of choice to global movement between sub-areas seems to be the case in the modern City, where it correlates better with movement than RA.

Fig 7:10 represents the map of the first 5% of high choice lines - 40 spaces - in the 1677 map of the City. Cheapside is the first to enter this core, followed by the west end of Thames Street, New King Street, Cornhill, and part of the centre of Thames Street. Already, it can be seen that this map is discontinuous in its build-up and more extensive in its coverage. Lothbury is the next to enter the core, followed by New Queen Street at number 7 and Lombard Street at number 8. Lines 9 and 13 complete the long line of Thames Street just north of the river, while Bishopsgate Street/Gracious Street at 10, the southern part of Broad Street at 12 and Threadneedle Street at 14, begin to sketch out the rough extent of the Cornhill 'fan'. The order of appearance of these lines is quite different from that of the integration map.

Lines 15 and 16 complete the north-south route between Bishopsgate and London Bridge and line 17 extends Leadenhall Street almost to Aldgate. The next line, 18, extends the core to the west down Paternoster Lane almost to the walls. Lines 19 and 24 fill in prominent east-west routes along Old Fish Street and Cannon Street. Line 20
Fig 7:11 - a comparison of routes featuring in the integration core and the choice core at 5%.
extends Fenchurch Street. Lines 21 and 29 mark a significant portion of London Wall. Line 22 pushes up Coleman Street in the direction of the walls. Strong global choice lines link Cheapside to the walls in the west along Noble Street/Foster Lane, lines 23 and 28, and down St Anne’s Lane to Aldersgate, line 35. A second line along Wood Street, further east, is picked up at 25 and 34. Line 26 links Thames Street to St. Paul’s. Lines 27 and 31 pick out Tower Street in the east. Line 30 is Throgmorton Street. Line 32 is the line coming in from Aldgate, and 38 completes the route westward and to the south. Lines 33, 36 and 37 are all in the area of Blackfriars in the west. Line 39 fills in the ‘fan’ in the remainder of Threadneedle Street and line 40 runs along Old Change to Watling Street, south of St Pauls.

All in all, at 5% of high choice lines the contrast with the 5% integration core is striking - its coverage is far more extensive, stretching along the river frontage in an unbroken line, running along the northern boundary of the City, pushing strong lines in the direction of the northern boundary at several places to the north of Cheapside and southwards towards the river, stretching from the Stocks Market 'fan' as far as the walls at Aldgate, and fanning out around St Paul’s almost to the western limits of the City. The map includes a substantial number of spaces that do not even feature in the 10% integration core. The order of appearance of lines suggests a 'leapfrog' pattern with discontinuous lines appearing close to the periphery and then being 'backfilled' in the direction of the City centre.

The global choice core at this stage is rather like the 'square wheel' integration core constructed at a larger scale, with some important routes featuring in both1 (Fig 7:11). Other strong choice lines feature in the shallow stages of depth from the walls2 while others are in neither of the two previous maps3. Previous studies by Peponis4 using choice have suggested that it may define natural sub-areas, but this does not seem to be the case everywhere in the City, where strong choice lines run through the centre of some sub-areas yet mark a

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1 shown solid in Fig 7:11.
2 shown dotted in Fig 7:11.
3 shown in red in Fig 7:11.
Fig 7:12 - the map of 10% high choice lines.

Fig 7:13 - streets which are only in the 10% high choice map.
cleavage between others. Intuitively some strong choice lines seem to be providing local accessibility to more labyrinthine sub-areas, like the Blackfriars area or those around the Tower and Drapers Garden, and it is these pointers to concentrations of segregation which are peculiar to the choice map.

Raising the core to 10% of lines and 80 spaces (Fig 7:12) clarifies the picture. The greatest number of lines is added in the Blackfriars area, enfolding the cathedral in a double arc, pushing out along Newgate street to the walls and connecting the Blackfriars area to the east along Knight Rider Street and Old Fish Street. Another set of global choice lines is to be found in the north-west between Cheapside and the Guildhall. Almost no new lines are added in the north-east, other than around the perimeter inside the wall. Several lines are added in the area of the Tower but almost none in the heart of the City, other than down part of Walbrook and along Abchurch Lane.

The characteristic noted earlier of choice acting as a pointer to local concentrations of streets holds up well under scrutiny in the 10% map\textsuperscript{1}. If the set of lines is abstracted which features only in the 10% choice map and not in the map of 10% best integrated lines (Fig 7:13) then it can be seen that these are concentrated in the segregated 'rim' of the perimeter zone. In some areas, such as the maze of alleys east of Coleman Street (A), Dukes Place (B) and Blackfriars (C), and the area of the Roman Fort (D) strong choice lines both bound the region and point into the heart of the area. In other cases, high choice lines seem to border an area, as in Newgate Market (E), north of St Paul's (F) around the Tower (G), and close to the waterfront (H). The area around the Guildhall (I) is pointed at by several high choice lines. Whilst all the central area high choice lines are well integrated, not all of the best integrated lines are also high choice spaces. Other features to emerge are the occasional occurrence of free-floating lines (33, 70), and a striking degree of 'incompleteness' in the grid of streets which is highlighted by the 10% choice map. Time and again, a regular block of

\textsuperscript{1} good examples are line 58, lines 57 and 80, line 65, line 48 lines 18 and 43, lines 52 and 78 - the numbers here refer to the order of entry into the choice core.
streets is almost, but not quite completely outlined by high choice lines, so that the omission seems intuitively inexplicable.

Looked at in terms of the other maps of syntactic properties examined to date - depth from outside, integration and segregation - the global choice map picks out a combination of the longer shallower lines coming into the City from the outside and the longer integrating lines, whilst avoiding segregated lines on the whole. This suggests that choice is selecting for congruence in the two types of global syntactic properties; of acting as a destination for journeys and of acting as a route for journeys through the system. However, a second important role which has emerged from the analysis of choice is that of accessing the more segregated parts of the system and in this capacity it may indicate the presence of local sub-areas, by pointing at them rather than by bounding them.

Local measures of connectivity and control.

So far, both the properties which have been explored are global configurational properties, in the sense of examining features of the spatial configuration in relation to all other spaces in the system. Two further syntactic measures look at spaces purely locally: connectivity and control value, and it is to these that attention will next be given. One indication of the local nature of these two measures is that they tend not to yield continuous cores. In this respect the process description of the build-up of lines is not quite so informative as in the two previous cases, and it is the distribution of lines at any selected state which gives the clearer picture.

The first of these, connectivity, has already been mentioned earlier in relation to line-link ratio, where the mean number of connections per axial line for the City is 2.009 for the City of Ogilby and Morgan. Whilst this figure is clearly of interest in comparing one town with another, it does not do much useful work in picking up the clear differences between well-connected lines like Thames Street, in the Ogilby and Morgan map, with its many warves leading down to the

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2 examples here are linking line 72 to line 32 in the extreme north-east, or completing the line of the wellbrook by continuing lines 62 and 42 to Thames Street, but there are many other equally telling examples. Again, numbers refer to order of entry into the core.
Fig 7.14 - the map of 5% best connected spaces
River, and poorly connected ones like the warves themselves, nearly all of which are connected only two ways.

The connectivity of a space is literally how many spaces intersect with it (in contradistinction to the RA/integration which looks at the distribution of all the spaces in the system at whatever depth those are from the root) is the most local measure in syntax, since it does not give any information about the properties of neighbouring spaces, just how many each space has - and in practice this turns out to be the limitation of the measure in looking at the spatial organisation of large systems like towns.

Fig 7:14 is a map of the 5% best connected spaces in the City of London at the time of Ogilby and Morgan. The distribution of this map is strikingly different from earlier maps in that it is heavily biased towards the south-west quarter of the map. Thames Street, at number 1 in the core, with a connectivity of 41 lines, is in this sector, followed by Cheapside at number 2, with a connectivity of 32. The eastern end of Thames Street follows at number 3 with a connectivity of 28, Cornhill takes 4th place with a connectivity of 27, and Lombard Street is at 5 with one of 20. East Cheap is in eighth place with 13 links. Unlike the global maps, which build up space by space, it is clear from the numbering of this map that the picture of most-connected spaces builds up, after these first few lines, in batches.

From this point on, the numbers of links begins to decline rather rapidly, whilst the numbers of spaces with that many links begins to rise equally sharply. The next batch of lines to be added to the map are all between Cheapside and the River, filling in more of Thames Street, part of Cannon Street and and Fish Street. The next pair of lines fill in the remainder of the wedge of streets at Cornhill interchange along Threadneedle Street and up Gracious Street and Bishopsgate Street. The wharves east of Queenhythe follow at number 13, and in 14th place is more of Thames Street. Five lines share 17th place, all but one in the south-west sector of the map. Six lines are added in

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1 in fact this map is slightly more than 5% with 46 spaces, as opposed to 40 for all other 5% of lines maps. This is because connectivity increases in batches, and 14 spaces shared a connectivity of 10 lines, bringing the number slightly over the 5% mark.

2 Tower Street
the next batch, at 22 lines, filling in part of London Wall and the
wharves of the New Quay east of Walbrook, as well as yet more of the
south-west sector. Of the five lines at number 26, two are outside the
south-west sector, St. Martin le Grand in the north-west sector and
more of the New Quay.

To reach 5%, 14 lines are added in 33rd place. Two are in the north­
west sector, both ways through the wall at Cripplegate into Wood
Street and into Aldermanbury through an ungated break in the walls.
Two more in the north-east quarter are also principal routes:
Bishopsgate Street and Leadenhall Street. The two in the south-east
are Botolph Lane and St. Mary Hill. The remainder are added in the
south-west sector. By 5% the map of connectivity has picked out a
considerable part of the riverfront, and parts of all the longer, wider
and straighter east-west routes. Trading streets and routes into the
City feature prominently in this map.

Because this measure is local, then it was initially hoped that it might
identify important streets within sub-areas. This proved not to be the
case, though the City is differentiated by quarters in its distribution of
well-connected streets. The most 'blocked' area in terms of through
movement, the south-west sector where there are no gates, has the
most highly connected lines, the north-east the fewest: only the
through routes from the gates. This finding suggests that the
connectivity of streets in sub-area J, the site of the Saxon township
above Queenhythe, is indeed strikingly different from that in other
parts of the City. It has already been remarked in the chapter on
Saxon London that this part of the City is more geometrically regular
than other areas, and the large numbers of well-connected streets also
points to the fact that there exists a 'grid within a grid' in this area of
the City.

The north-west sector comprises all routes from the gates including
the section of the wall containing Moorgate, and Lothbury below the
Guildhall. The south-east sector has the next- highest number of well­
connected lines, including the route to the bridge, streets close to the
river and trading streets. The southern part of the map is, therefore,
conspicuously well-represented in terms of highly-connected lines.
Fig 7:15 - the map of 10% best connected spaces

Fig 7:16 - the map of 5% control value
To raise the numbers of lines in the core from 5% to 10%1 requires the addition of only those spaces with 9 and 8 connections (Fig 7:15), giving what is in effect a core of slightly less than 10% of lines. At 10% the imbalance in the quarters of the map is rectified somewhat, particularly in the north-west, but the north-east sector is still poor in well-connected lines: three lines are added, all completing the major routes from the gates. The additional lines in the south-east quarter are along Fenchurch Street, completing the route to Aldgate or in parts of the New Quay. Additional lines in the north-west are also organised around routes, particularly north from Cheapside to the Guildhall and Moorgate, where no direct route exists. In the south-west sector additional lines are concentrated in the area between Carter Lane and Thames Street, but not on the riverfront, which is particularly poor in wharves2.

The final first order syntactic measure is that of control, which takes into account the amount of choice a space represents to its immediate neighbours as somewhere to go. The more it is an important choice, the more it might be considered to control local relations. This measure is still a local measure, but it discriminates more finely between the local properties of different spaces in the system. Like connectivity, this measure might be expected to identify important streets within sub-areas, particularly in the more segregated parts of the system where it is conceivable that some geometrically central street might act as a local focus. This has indeed been the case in towns which, like the City, have extensive areas of continuous segregation.

It is clear from the map of those spaces accounting for 5% control value (Fig 7:16) that the City of 1677 is characterised by a few, extremely powerful control spaces. Only five spaces account for 5% of control value as opposed to 17 for 5% of integration value, and three of these are along the riverfront. Cheapside and Cornhill are the other two high control lines in the system. Since this measure is highly

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1 slightly less than 10%, 71 as opposed to 80 lines. Adding the next batch would have added another 28 lines, bringing the total to 99 lines, rather more than 10%.

2 the major wharf was St. Paul's Wharf, the route to which is picked out in the 5% map of high connectivity, but the bulk of Baynard's Castle took up much of the riverfront in this area.
Fig 7:17 - the map of 10% control value.

Fig 7:18 - the map of 5% high control lines.
localised, it would not be expected to form a continuous core as in the case with the global measures, but it is striking how clearly the lines are orientated towards the two most important locations in the City: the river and the Stocks Market.

The 10% control value map (Fig 7:17) adds a further 10 spaces to those of the first map, constructing an almost continuous core which extends from Cheapside, through Cornhill and Lombard Street to Bishopsgate Street, Gracious Street, Gracechurch Street and Fish Street down to London Bridge and the river. East Cheap and the whole of Thames Street are included in the continuous parts of this 10% high control value core. The free-floating lines are Carter Lane in the west, and parts of the New Quay either side of Walbrook at Three Cranes Wharf and in front of the Customs House1.

The map of 5% of lines as opposed to value (Fig 7:18) again differentiates sharply between the different quarters of the map. The north-west quarter picks out Newgate Street at 16, and Cripplegate, 29, and the northern boundary of London Wall, 18, but also the area of Basinghall Street behind the Guildhall, line 19, which is not on any major route. The New King Street approach to the front of the Guildhall at 25, and Lothbury, crossing it at right-angles, 20, also feature in this part of the map. In the north-east, four new lines are added, the remainder of Bishopsgate, 23, and Wormwood Street on the wall at Bishopsgate, 33, Leadenhall Street, 30, and Threadneedle Street, 36. In the south-east, part of Fenchurch Street comes into the map, at 39, and St. Mary Hill, at 40. Parts of the New Quay, 28, 24 and 37, are also picked out as significant controlling lines. Sherborne Lane, 36, is of interest in that it is a short line in the centre of a large-scale aggregate of island blocks, and not such an obvious candidate as the major through routes. In the south-west, the last part of Thames Street, 32, and the minor east-west cross-routes along - and - ,22 and 26, are picked up at 5% of control, but so is the line of St. Paul's Lane/St. Bennets Hill down to St. Paul's Wharf, 27, and three small streets east of this line, Shoemaker Row, 34, Knight Rider Street, 35, and Blackfriars, 31.

1 both, therefore, not trade wharfs as such, but foci of governmental control.
Fig 7:19 - the relationship between connectivity and control.

Fig 7:20 - the map of 10% high control lines
Indeed it is this difference in numerical emphasis between the quarters which is the most striking feature of the 5% map of strong control lines. This is particularly clear when the major through routes to the City gates are considered in relation to the global choice map. It is clear that the longest sections of the major routes into the City acquire high control value by virtue of intersecting with several other streets along their length, whilst the shorter sections do not, and as a result of being weakly connected locally, do not construct a control core.

The relation of this measure generally to connectivity is strong. Fig. 7:19 shows the seven lines which are in the 5% control core which are not among the 5% best-connected spaces of the City. These include the northern end of the King Street/Queen Street route to the Guildhall. This part of the street is globally very strong and is deriving local benefit from its strategic role within the City street grid. A further three of these are also high-choice spaces, but three do not feature in any previous map. Although this tells us that these spaces are locally strong, none are at the centres of the sub-areas identified earlier, and the relation of high scoring control lines to these is as ambiguous as that of the previous measures.

The map of 10% high control lines (Fig 7:20) again highlights differences in the way in which the quarters of the City perform configurationally. The north-west quarter has a clear north-south bias by 10% of lines, with only one new member in an east-west direction, number 51, Swan Alley off Coleman Street, as opposed to 11 new north-south links. Again, these take two forms; longer major routes, which tend to be contiguous with other strong control lines, and short, free-floating routes deep within a major block, like line 415. The north-east quarter has only four new lines, three of which, 43, 52 and

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1 like Blow Bladder Street between Newgate Street and Cheapside in the west, or the central part of the route from Lombard Street to Fenchurch Street in the east.
2 the southern end is better connected.
3 it is the number 2 integrator and the number 3 high choice space in the City as opposed to number 7 in both measures for the section close to the river.
4 sometimes central, sometimes peripheral
5 Angel Alley, not named on the Ogilby and Morgan Map, but keyed into the Explanation.
static
*
CN connectivity  *  RA destinations
*
local******************global
*
CV control  *  GC through-routes
*
dynamic

Fig 7:21 - a model of first order measures

Fig 7:22 - lines featuring in all four core maps at 5%
56 are of the free-floating variety and the last, 78, on a route from an unmarked opening in the northern Wall to Broad Street, conforming to the earlier observation that high control lines in this sector of the city are mainly route-orientated. In the south-east quarter, lines are added along the broad sweep of Crutched Friars, 65, down Abchurch Lane, 59, and around the waterfront, 58, 62 and 75. In the south-west of the City, there is by now a preponderance of east-west lines, in contrast to the north-west sector, with New Queen Street, 79, the only major route, like most of the north-south lines1 in this sector, hanging from Cannon Street. Compared to the other quarters, this area has few short, free-floating lines, 72 and 73 being the only candidates.

Comparisons and correlations.

The 'theoretical' inter-relations of the first-order2 syntactic measures is set out in Fig 7:21. The correlations between these measures will be looked at eventually for the whole net, and not just the core of those 5% or 10% of lines which perform 'best' in each of the variables. However, it is clear that a small number of key streets appear in all four core maps (Fig 22). These spaces are, by definition, both locally and globally strong spaces and at the same time combine both static and dynamic descriptions of the configuration of space within the City. These denote three distinctive areas of the City's activities. The riverfront is the locus of the import/export trade, Cheapside and the streets around the Stocks Market and Gracious Street form the centre of commercial exchange, and Lothbury is the stage for City government and ceremonial.

The static/dynamic local variables correlate well for high value spaces. Only 7 of the 5% high control spaces are not within the 5% of best connected spaces. On the global static/dynamic side, half the 5% best-integrated spaces are high choice spaces, but the compression of the integrated core into the geometric centre of the City inevitably leads to important spaces at the periphery performing well on choice but

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17 in all are connected to this line, as opposed to 4 north-south lines in other parts of the sector. 45 connected to Cheapside, 66 to Ludgate Street, and 31 and 80 west of Thames Street.

2 syntactic variables or direct measures of the spatial configuration: local state, connectivity; global state, integration; local dynamic, control; and global dynamic, choice.
Fig 7.23 - lines featuring in three or two core maps at 5%.

\[ y = 6.812x - 5.259, \text{R-squared: .241} \]

Fig 7.24 - scattergrams of integration/connectivity and integration/choice.

\[ y = .125x - .118, \text{R-squared: .264} \]
not in integration. The local/global dynamic variables relate well
together (Fig 7:23). High choice lines which do not feature as strong
control spaces tend to link streets which themselves perform well on
both dynamic variables. Streets which are high control spaces locally
but which are not globally strong are either new quayside spaces or
located in the more orthogonal south-west sector of the City. The
local/global static variables are poorly related. Apart from the 8
streets which feature in all four maps 5 more are added, all in the
south-west.

Some spaces are unique to one form of description and hence present
more of a puzzle. There are many lines close to Cheapside which
feature only in the 5% of best integrated spaces, while Sherborne
Lane, the extreme east of Thames Street and Knight Rider Street in the
west feature only in the 5% of high control streets. A few streets
north of Cheapside feature only in the 5% of high choice spaces and
others in the south-west feature only in the 5% high control spaces.

However, most streets are not highlighted within the top 5% or 10% for
any dimension of analysis, so a more rigorous way of looking at the
relations between syntactic variables is through the correlations of
first order syntactic variables (Fig 7:24). The correlation which is
generally considered to give a significant result for use and movement
is the reciprocal of integration/connectivity, known formally as
intelligibility. This expresses the extent to which the axial
information which is available to an individual moving through a
particular space and understanding how it relates to its neighbours,
also gives reliable information about the large-scale structuring of the
system as a whole. In other words, in terms of the relation of parts to

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1 the exceptions being Basinghall Street in the north and Sherborne Lane in
the south-east.
2 Fenchurch Street, Coleman Street, Throgmorton Street
3 Watling Street, Bow Lane, Old Change
4 relations among the first-order measures or correlations between
syntactic variables are known as second-order measures because they are at
one remove from the pure properties of the spatial configuration.
5 measuring the degree to which the number of immediate connections from
a line are a reliable guide to the importance of that line in the system as a
whole: that is, the extent to which the whole can be read from the parts - see
the Methodological Prerequisites in Chapter Two.
6 the hypothesis is that integration leads to intelligibility and intelligibility
leads to a stronger movement interface. In most urban layouts, the best
wholes posed earlier, it is the extent to which information derived from the parts is also information about the whole. This might be understood to be how intelligible the global system is from the local.

Typical urban areas\(^1\) tend to have an intelligibility correlation of about 0.45, while unintelligible systems will tend to have values of 0.2 or even less, where a value of 1 is strong, and 0 is random. The predicted value for the City at the time of Ogilby and Morgan\(^2\) is 0.461 for a system with the same number of spaces. The actual value is 0.491\(^3\), +0.030 better than predicted. Despite its organic appearance and visual irregularity, the City performs normally on this measure.

A second correlation looks at the relation between the two global variables, taking the reciprocal of integration and the root of choice. This expresses the degree of agreement between to-movement and through-movement or accessibility as a destination and popularity as a through-route, giving the movement interface between inhabitants and strangers to the system. It gives a measure of the relation between the accessibility of a space as a destination for all other spaces in the system and its popularity as a through-route on real or simulated journeys through that system. The predicted value for the Restoration City is 0.523 for a system with that number of spaces while the actual value is 0.514\(^4\), negligibly worse (-0.009) than the sample study predicts.

Both these correlations are, of course, theoretical measures of use and movement so they have to be regarded with caution. But if syntactic variables give any indication at all as to which streets in the Restoration City were the busiest, and which were those that interfaced citizens with the throng of visitors and sightseers, shoppers, tradesmen and farmers 'up from the country' with their produce, and hucksters selling their wares, then the streets of the core do seem to

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\(^1\) on the basis of the syntactic data set of the UAS 75 towns study.

\(^2\) drawn from the study of a sample of 75 towns drawn from all parts of the world, which is used as a base from which to compare syntactic information.

\(^3\) significance .0001

\(^4\) significance .0001
make sense in terms of there the main trading functions and routes into and around the City were located.

To summarize, what seems to emerge is a picture of the City which has rather little hierarchy (or depth) overall, and a well-organised overall system of spaces which simultaneously relates the static to the dynamic and the local to the global. Within this overall framework, there occur something like local sub-areas which differentially relate the depth properties of the City from its perimeter to the integration core, in order to interface movement into and egress from the City to different degrees with the statistical pattern of use and movement generated among the inhabitants.

**Radius Three Analysis.**

The syntactic measures which have been presented so far suggest that the City is morphologically distinctive in its parts, but the analysis has not found there to be a structure of similiar constituted, clearly defined and discrete, segregated neighbourhoods linked together by a super-grid of principal through routes which traverse the city. There is no tendency towards the street grid to reflect ward or parish boundaries in a manner analogous to Newcourt's vision for a remodelled City. It has been argued that ambiguity features in the urban grid at every level, from the definition of streets and major blocks to the designation of routes as either the boundaries or the centres of gravity of local regions within the plan. So far as the syntactic definition of sub-areas is concerned, parts of the City have different local characteristics but these fail to add up to a clear and consistent picture which can serve as a basis to disaggregate the City systematically into its parts at the level of order. The question arises as to whether other syntactic measures confirm or complicate this picture.

Integration looks at the depth distribution of all spaces in a configuration from each space in turn. Control measures relations locally among neighboring spaces. It is possible to take an intermediate course, and examine the impact of integration among spaces up to three steps away. The value of this picture has already been demonstrated to a limited extent in the previous chapter in considering the spread and scope of a three step unfolding from Bow
Fig 7:25 - 5% radius three integration core
Land in the parish of St Mary Le Bow\textsuperscript{5}. Radius three analysis generalises this 'local view' for all spaces in the City. The expectation of a radius three analysis is that, to the extent that parts of a network are differentially connected within and between, this should be revealed by the rank order which will select those spaces which draw together local concentrations of streets and ignore the lines of cleavage between sub-areas, where linkages are consequently sparse.

A recent study of traditional Algerian towns by Loumi \textsuperscript{6} finds that radius three analysis does indeed illuminate debate on the existence or otherwise of urban quarters in these townships. In this study, the integration core did not take the form of a deformed wheel, the characteristic shape in European towns, including the City. Rather, it passed mainly around the perimeter of the towns. Penetration into the geometric centre of his townships was slight, and directed mainly towards the market places and the mosques. Integration here seems powerfully related to the construction of an interface between inhabitants and strangers at the periphery of the town, where the market and other facilities are concentrated, while at the same time rendering the residential areas segregated and impenetrable. Radius three integration, on the other hand, formed a more or less continuous core of spaces running right through the heart of the settlement. Loumi suggests that this measure picks out spatially distinct quarters which are related to clan membership within the segregated residential areas, and links them together into a more or less continuous system of access. Loumi concludes that radius three integration in the Algerian context constructs an interface not between inhabitants and strangers, but among inhabitants.

The picture of radius three analysis in the City does not yield a separation into quarters or sub areas. On the contrary the 5\% of spaces which perform best on radius three integration (Fig 7:25) is almost completely congruent with that picked out by global integration. Cheapside is the first street in the rad3 core, followed by Thames Street, King Street (3), Cornhill (4), Lombard Street (5), Queen Street (6) and Threadneedle Street (7). Next into the rad3 core are the continuation of Thames Street, Walbrook and Old Fish Street. Lines 11

\textsuperscript{5} It will be recalled that this covered most of the centre of the City.

\textsuperscript{6} Loumi A, Ph.D. of the University of London, 1988.
Fig 7:26 - 10% radius three integration core
and 12 construct the southern part of the north-south route to London Bridge. Line 13 points up from the river to St Paul’s and line 14 continues eastward from Lombard Street along Fenchurch Street.

The remainder of lines are added in batches round St Paul’s (17, 26, 35, 22, 28, 23, 38) and at the Stocks Market (15, 16, 21, 34). Compared with integration, fewer of the streets in the central part of Cheapside feature in the rad3 core: three (36, 27, 37) as opposed to nine. By contrast, Thames Street and the streets leading up from the river are filled out more than in the comparable integration core. The shift away from the streets to the north of Cheapside to those close to the river is dramatic. The rad3 core also gives a more balanced account of important streets in the south-east of the City between Walbrook and the route to the bridge. Eastcheap is picked up by the 5% rad3 core.

Raising the core to 10% (Fig. 7:26) adds streets mainly in the south-west. The concentration is focused upon the site of the Saxon town and does not identify sub-areas or quarters in other parts of the City. This is unexpected, for the physical dispersion across the City of local first-order syntactic measures and the presence of clumps of contiguous segregated zones at the periphery held out a promise that radius three would select for locally powerful spaces in these areas. Once again, adopting a new measure highlights a different sub-set of streets within the global configuration of the urban grid.

The map does, however, demonstrate the unique character of this sub-area of the City for its coverage is pretty well identical with the area identified earlier as being particularly deep with respect to the outside. The property of being deep from the outside suggests that this area grew up with its own logic, and that the rest of city grew up independently around it. The fact that the area is locally well-integrated but not globally well-integrated is a product of the fact that it is the most grid-like part of the City and is therefore best-integrated to itself\(^1\). Taken together, these findings point to this area being more self-contained. There is, within the City, one self-referential and self-contained sub-area. The puzzle is that it is not one of many such sub-

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\(^{1}\) because it is most like the orthogonal square grid, in which each street is connected to half the others; all those running the other way. This is the ‘grid within a grid’ effect noted earlier.
Fig 7:27 - the 5% PDE core
areas. Radius three shows that this sub-area is a singularity rather than a regularity, and it suggests that whatever else the city is, it is made up of different phenomena rather than a repetition of similar local elements.

**Point Depth Entropy Analysis.**

The final measure in the 'syntactic armoury' is point depth entropy. PDE is like RA, calculated from the justified graph. It takes the distribution of depth properties from every point and calculates the relative entropy of the depth values set against the natural number system\(^1\). In a recent study of Brussels\(^2\) this measure picked out regionally significant but more localised streets as opposed to the grid of integrated streets at the centre of the City.

The first five spaces in the PDE core (Fig 7:27) are all in the extreme west of the City, centred on Thames Street. In 6th place is the other end of Thames Street above the Customs House, and more of Thames Street is added in 7th and 10th places. Number 8 is the street leading north from the bridge, while the 9th street is in the west linking St Paul's to the riverfront. Cheapside does not enter the PDE core until 11th place.

Nearly all of the next batch of lines (12-20) are all north-south lines hanging off Thames Street, including a singular concentration in the area of the new landing stage for the Guildhall at the Vintry. The exception, 13, is in the St Paul's area, along Carter Lane. Number 21 is Cornhill and number 22 continues the northward line from the bridge towards Bishopsgate, but 23 and 24 are both added in the St Paul's area in the west. Most of the remaining lines to 5% are added close to

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1 *unilinear sequence*. This has the effect that each depth counts like a probability, \(1/\text{total depth in the system}\). The more there is homogenisation of values the higher the value will, and the more differences there are between values then the more structure there is and the lower the value will be. The measure may be examining the width of the depth graph set against height: the more there is squareness then the more there is homogenisation, and the more the graph makes a pyramid or inverted pyramid then the more there is differentiation of values, but this is only a hypothesis at present and there does not exist a mechanism for reproducing depth graphs of large urban systems. See the Methodological Prerequisites for further details.

2 de Messeneer M, analysis of Brussels carried out at the UAS, Summer 1989.
**Fig 7:28** - the 10% PDE core

**Fig 7:29** - numerical data for the four quarters

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mov int .4643
K 799
the river. The exceptions are Lombard Street/Fenchurch Street (31, 36) and the remainder of Old Fish Street in the west (27, 35).

Building the core from 5% to 10% of lines (Fig 7:28) brings in Eastcheap (47, 69), the remainder of King Street/Queen Street to the Guildhall (54), more of the small streets to the south and west of St Paul's (63, 70, 71, 72, 76, 78), the eastward continuation of Fenchurch Street (75), and the remainder of Old Fish Street to the Walbrook (74). The rest of the new lines are all added close to the riverfront, particularly in the west around Queenhythe.

The 10% PDE core could not give a clearer message as to the importance of the river and of the east-west river route along Thames Street. A second east-west route is also constructed, immediately to the north along Old Fish Street/Eastcheap. By contrast, the east-west Cheapside route seems less significant. It is almost completely isolated apart from three links, by way of King Street/Queen Street, Gracechurch Street/Fish Street, and Bottolph Lane, all of which were straightened after the Great Fire. The area in the far west around St Pauls, centred on Carter Lane and Puddle Dock Hill, is also picked out strongly. Again, the PRE measure does not pick out a number of local regions but one: this time not a relatively self-contained area but a region from which the rest of the City is maximally differentiated.

**The Analysis of the Four Quarters.**

One of the features of the City which has emerged from the analysis is that it seems to exhibit different characteristics in its four quarters. The next step divides the City into four along what seem to be the natural lines of cleavage, along Cheapside and the Walbrook. A breakdown of the numerical data which results as compared with the whole City is reproduced in Fig 7:29, and the main values for the four quarters is reproduced in Fig 7:30.

Each quarter was analysed in three stages (Figs 7:31-7:34) to overcome the difficulty of identifying which were the lines of cleavage between the quarters. In the north-west, (Fig 7:31) the square area between Foster Lane and Coleman Street was looked at first. The area to the west containing Christ's Hospital was clearly a part of that sector, but its irregular, outcropping shape might affect analysis so it
Fig 7:30 - a comparison of the main values for the four quarters

Fig 7:31 - the stages of analysis in the north-west quarter

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No1. A = 94.  
No2. A + B = 132  
No3. A + B + C = 182
was added separately. Finally, it was not clear whether the area extended further east to Drapers' garden, so a third stage included this area in the north-west sector.

In the south-east, (Fig 7:32) a similar difficulty in deciding the extent of the area was found. It was not clear whether the quarter was bounded by Lombard Street/Fenchurch Street or extended further north to Cornhill. Both versions were tried, and the waterfront area was also added separately. The north-east sector (Fig 7:33) therefore was looked at first in terms of the residue of the previous largest-scale analyses, and then the 'ambiguous' areas between Cornhill and Lombard Street/Fenchurch Street and over to Coleman Street were added. Finally, in the south-west sector (Fig 7:34) the Saxon township was first looked at, then the waterfront area was added, and finally as in the case of the north-west sector the protruberance of Blackfriars was included.

The data tables reveal that syntactic properties do indeed vary by quarter. The north-east is more segregated and less well-connected than average. It is also relatively unintelligible: i.e., less intelligible than the predicted value for a system with that number of spaces. The better-connected and more integrated south-east is also less intelligible than it should be. The south-west is the most integrated and the best-connected by a long way, and it over-performs on intelligibility. The north-west area, which is rather segregated and poorly connected, also performs better than predicted. Thus the southern half is better-integrated than the average for the whole City and the northern half is much worse-connected than the average for the whole, though only the south-west rises above the mean for the entire City. The west of the City is more intelligible than the east of the City, and the whole is more intelligible than the parts. These results can be set against a data plot\(^1\) of the City which adds six sectors cumulatively and arbitarily from west to east in which, despite a great deal of irregularity in the shape of the system and an increase in size from 226-872 axial lines, the mean RRA of the system remains stable at a figure of between 0.7400 and 0.7600.

\(^1\) on the Horwood map of 1799, and for an area slightly larger than the intermural City. This data was retrieved in the early 1980's, before the full battery of syntactic measures was available.
Fig 7:32 - the stages of analysis in the south-east quarter

Fig 7:33 - the stages of analysis in the north-east quarter
Fig 7:34 - the stages of analysis in the south-west quarter
Fig 7:35 - the north-west quarter, a 10% integration core at three stages
Fig 7:36 - the south-east quarter, a 10% integration core at three stages.
Fig 7:37 - the north-east quarter, a 10% integration core at three stages.
The 10% integration cores of the quarters were plotted but these did not yield much in the way of informative results. There is no theoretical reason why these should have been expected to do so. Rather the opposite. Because the shape and spread of a core is known to be dependent on where the boundary is drawn, it is inevitable that the rather arbitrary division of the City into four will produce cores which shift arbitrarily with the equally arbitrary drawing of the sub-area boundary.

However, if the shifts in the core are looked at as symptomatic of bias in the structuring of the grid, then it can be said that in the north-west of the City (Fig 7:35) the area seems to have a more integrated character below the Guildhall at all three stages of analysis. The area immediately around the Guildhall also seems to have a clear, more segregated identity throughout. Adding the areas in the far west and far east do not produce integration there, which might indicate that they are relatively self-contained.

In the south-east, (Fig 7:36) the Roman grid is 'recalled' in the core at the first stage of analysis, and remains a dominant element in the area throughout. Adding the area to the north picks out the main through route up Cornhill, and shifts the focus of the core to the intersection of Fenchurch Street/Lombard Street with the road leading down to the bridge, but adding the waterfront restores the thrust of the core to the area once occupied by the Roman grid.

In the north-east, (Fig 3:37) the first stage picks out only routes separating the area around Drapers' Garden in the west from that of Duke's Place and St Helens in the east. Adding the southern central area and the streets in the west as far as Coleman Street indicate that the area immediately around Cornhill is a focus for integration in the area, and it may therefore have a character of its own. The lack of impact of the Coleman Street region on the sector's integration core strengthens the impressions gained earlier, that this district is relatively segregated.

In the south-west (Fig. 7:38) a 'shadow' of the Saxon township's core is recalled by looking at this area separately. The message that was conveyed by radius three analysis that this part of the City is like a 'town within a town' is supported by the shape of the core locally in
Fig 7:36 - the south-west quarter, a 10% integration core at three stages.
this quarter of the City, since it takes the form of a 'deformed wheel'.
The shift in the locus of integration to the waterfront when this is
added, confirms the result of suggested by PDE, that this too is an area
with its own, morphologically distinct character. Blackfriars and the
Newgate Market area are noticeably devoid of well-integrated lines,
and these stand out as separate and separated areas within the south­
west quarter.

The Architecture of the City and the Fallacy of Historical
Causality.

For Aldo Rossi\(^1\), the architecture of the city is not just 'the visible
image of the city and the sum of its different architectures \(^\)\(^2\). It is
also the construction of the city over time as an urban artifact which
encompasses physical morphology, history, geography, structure and
experiential reality. Rossi's aim in studying the city is to elaborate the
city's enduring elements, the 'permanences' within a process of
transformation which Rossi warns his reader against viewing solely
from a historical point of view.

For Rossi as for Poete\(^3\), 'the most meaningful permanences are those
provided by the street and the plan '\(^4\) This leads him to suggest that
a fundamental tool in urban analysis is to be found in the idea of a
study area, by which he means a spatially-defined constituent part of
the city. Rossi's answer to the parts/whole problem is thus to
postulate that there are, within any historically evolved city,
morphological and structurally defined sub-areas which are
recognisable because they are physically different from one another.\(^5\)
The principal lesson for architecture of the historic city is that the
relationship between these physically defined sub-areas and the

\(^1\) Rossi, A. The Architecture of the City, op. cit.
\(^2\) Ibid. p 21.
\(^3\) Rossi refers to Poete's concept of 'persistences' here, and argues that these
are revealed both through monuments as physical signs of the past, and
through the persistence of a city's basic layout and plan. For Rossi, the
suggestion that cities tend to maintain a steady trajectory through time,
keeping to the lines of their original layout and growing by reference to
older urban artifacts, is Poete's most important contribution to urban theory.
\(^4\) Ibid. p 59.
\(^5\) Rossi is very careful here to distinguish between his physical /typological
view and the more established sociological idea of su-area as neighbourhood
or community, p64.
'primary elements' of a city is responsible for configuring that city in a specific way.

The difficulty with this thesis is that whereas primary elements have clarity, in that they stand out in the plan and in volume, the spatially-defined sub-areas of the city are more difficult to identify. Thus, although Rossi insists that the plan is itself a primary element (and he is able to point to the German 'siedlungen' as examples of dwelling areas in support of this thesis) he somewhat ruefully concludes that although 'monuments are not the only primary elements, I always seem to end up using them as examples'. The 'natural' division of the historic city into sub-areas, dwelling areas, study areas, residential districts, morphological types remains, in the final analysis, contentious and elusive.

This chapter has attempted both to clarify Rossi's assumption and to put it to the test. It has addressed three related questions: are there physically distinctive regions or sub-areas within the City and, if so, what are they like physically and sociologically; what is the relationship between the sub-areas and the global whole; and what is the relationship between the sub-area structure of the urban grid and the monuments and other artifacts which are implanted within it.

In answer to the first question, it is argued that the City of London is indeed made up of sub-areas, but that these are morphological singularities rather than regularities and which 'correspond' to historical circumstances by embedding the physical outcome of events within the global urban fabric, rather than corresponding by a process of reflection to social groups. Each of the measures picks out a different physical entity. The Saxon township shows itself to be a relatively autonomous and self-referential grid: a 'town within a town' with precisely the character which Rossi asserts as peculiar to the

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1 this term is less easy to pin down in Rossi. He substitutes the term 'fixed activities' by which he means stores, public and commercial buildings, universities, hospitals and schools. He clearly means any physical artifact which contributes to stability or is capable of accelerating the process of urbanisation or influencing the trajectory of growth within the city over time like walls, gates, large buildings, monuments (always primary elements) and public buildings pp. 86-7
2 ibid p 81.
3 ibid p.99
concept of a study area. But this is the only part of the City where this characteristic holds. There is not a general tendency to physical discreteness and autonomy, any more than there is a general tendency for 'natural neighbourhoods' to exist within the City.

Thus, the riverfront has a different characteristic feature: it is that part of the City from which the remainder of the grid is, morphologically speaking, most differentiated. It is both the most strongly connected locally and the most remote globally. The depth pictures of the City from the walls and in integration reveal sub-area differences which relate to the construction of fundamentally different kinds of interface between inhabitants and strangers. Blackfriars, never fully a part of the urban grid of the City in that it originated as a monastic precinct, is an area which is inaccessible from within the City and from outside its gates. Many of the sub-areas which share this characteristic inaccessibility seem to have been the location of building complexes at some time in their history. Yet the waterfront and quays near the Customs House, the locus of international trade, is more easily accessible from outside the City than to its residents. Some candidates for 'sub-area status' are small - the area east of Coleman Street is tiny in area but substantial and labyrinthine in terms of its urban grid locally. The same is true of Duke's Place, and the grid of small streets between Christ's Hospital and Foster Lane to the north-west of St Paul's. Many of these smaller sub-areas were mentioned as standing out as being visually distinctive, when the pattern of open space in the City was looked at intuitively in the previous chapter.

At the same time, the grid accommodates all these different places, each with its specific, historically-acquired local identity in a way which still makes sense of the raison d'etre of the City. The parts of the grid which draw people in from outside the City and knit the system together internally accommodate the major trading functions: those which are segregated globally do not. However, these distinctions are never clear-cut and obvious. Areas merge imperceptibly at least as often as they are set apart by the line of a major route or other physical feature. It is necessary to take a more relativised view of the City than is currently fashionable amongst urban theoreticians. The relation between parts and whole is fundamentally ambiguous, and it is of the nature of the City that a
different sub-area picture emerges depending on the point of view of the observer.

It is this intrinsic relativism that needs to be understood in giving an answer to the second question; in specifying the relation between sub-areas and global whole. In one sense, the grid resists disaggregation into physically distinct parts. There does not seem to be any general relation between sub-areas and the routes taken by main streets, well-connected streets, locally important streets, or more labyrinthine 'moments' in the grid. The boundaries between sub-areas, insofar as these can be shown to exist as physically distinct entities, are unclear. The Blackfriars area is physically different in character from the spatially adjacent Saxon township, but the one merges imperceptibly into the other. The line of the Walbrook can be said to divide the area of the Saxon town from that formerly occupied by the Romans, but it can equally be said to form a seam which unites them, particularly since it is a prime integrator and therefore shallow to every part of the City.

In another sense it is a puzzle that the City coheres at all, for one of the more striking characteristics revealed by sectorial analysis is the generally segregated nature of parts of the grid. It is not so much that the City can be decomposed into discrete sub-areas as that it seems on the verge of complete fragmentation. The area in the north-west occupied by the former Roman fort is a case in point. Despite its geometrical regularity, this area is more segregated locally than the City as a whole, and adding the street grid of nearby Christ's Hospital and then the side-streets to the east of Coleman Street progressively increase the mean segregation of this quarter of the City. Paradoxically, the global mean integration of the City remains both constant and relatively shallow at about .7500. This is undoubtedly due to the powerful structuring effect of the integration core, which effectively holds the City together. Above all, the global structure of the City is a structure of differences: that is, of singularities rather than of order principles as reflected in the occurrence of morphological regularities.

The final question seems initially the easiest to answer, but in doing so it raises deep philosophical questions. History does seem to
differentiate the City. It is easy to say that these morphological differences are accounted for by historical facts like the location of the Roman fort, the building of the Tower, the planting of the Saxon township, the development of the quayside and the rows of warehouses which line it, and the relative stagnation of the north-east quarter and the meandering approach roads in that part of the intermural grid, but a moment's reflection shows that this means nothing unless it is possible to say what each of these measures is expressing, and how they relate to give an overall picture of the City.

The part played by historical events and that played by morphological constraints in the evolution of the City has already been referred to in the chapter on the Saxon and pre-Fire City of London, and will be dealt with again in the Final Discussion. It was argued there that features like the dominant east-west orientation of the grid, the differentiation of the four quarters, the characteristic pattern of peripheral segregation are all part of a stable morphological trajectory upon which the City became established at its Roman foundation. The argument established there, that the structure of the urban grid itself possesses conserving properties of equal or greater significance to the more obvious urban artifacts like city walls and gates, is one which can now be expanded to take account of the more localised sub-area effects which have been identified in this chapter. The self-referential sub-area of the Saxon township is a case in point. This is clearly a view which strikes a sympathetic chord with Rossi's conception of the 'architecture' of the city.

In brief, the City is differentiated by depth from the outside and by integration. This is a result of historical processes rather than of social groupings. However, from the point of view of urban space and structure, historical processes mean nothing without morphological results. Historical processes are ephemeral until they impress themselves in the physical form of the town. It is perhaps with good reason that 'power' so often seems to engage architecture in the interests of transforming the physical environment in its image, for in so doing it avails itself of a potency which far outlasts the impulse which causes forms to be designed and built. Yet each act of transformation - be it the building of a monastery, a fortress, a gateway or a new road - has to be seen as part of a global urban
configuration which is itself a social construction, and in which history also plays a part. For the configuration of the urban grid gives rise to an interface which both generates and controls human co-presence and encounter, and which is itself subject to processes of fine-tuning and adjustment as social and physical circumstances alter. This is the subject of the next chapter.

The structure of differences within the City is therefore a concrete instance of the priority which science must give to descriptions rather than causes in seeking to 'explain' things. A historical cause may relate to a noted effect, but the mechanism by which the one translates into the other is largely unknown. This is the case with the City, though Rossi might agree that it seems in some sense to be a product of the 'social logic' of space itself.

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2 though the social construction of space as a global 'movement interface' is suggestive
Chapter Eight: Into the Great Wen: a comparison of four maps spanning the period from 1677 to 1987 which traces continuity and change in the configuration of the urban grid of the City of London.

Introduction: The Changing Face of the City.

Conventional histories of the City stress its changing physiognomy. Redeveloped after the Great Fire, during the great nineteenth century office building programme and for a third time after the bombing of the Second World War, the one thing which is indisputable is that the history of the City is remembered through the evolution of the town plan rather than through the accumulation and preservation of individual buildings. These major upheavals are in any event intensifications in what has always been a continuous process of redevelopment. Before the Great Fire individual buildings had a short life expectancy. The late twentieth century is witnessing a similar phenomenon, and many of the modern buildings of the post-war era are already thought to be obsolete. The pace of redevelopment is again quickening; so much so, that it is becoming increasingly difficult to see the City's construction industry as a provider of permanent infrastructure.

This preoccupation with the appearance of the City has led to a neglect of morphological issues. It is frequently assumed that the modern City street grid perpetuates Saxon and mediaeval features. All the histories fail to comment on changes in the plan, other than to note the improvements which have been made to individual streets and the difficulties for a generalised accessibility which have resulted from the increasing spatial scope of the metropolis.

However, the cartographic record shows that in the period under review the street grid of the City has undergone innumerable small changes. The question arises as to whether these have any significance for the global structure of the urban grid. Does the modern street grid of the City indeed conserve morphological principles which are a product of its pre-industrial past? Is the process which can be observed in the topographical record over the ensuing centuries one of intensification of the properties given by the Saxon and mediaeval plan or of local fine-tuning to take account of the exigencies of
Fig 8.01 - the growth of London in the eighteenth, nineteenth and twentieth centuries
everyday life, or is it a more radical surgery which has subtly transformed the City into an urban structure which owes little to history?

This chapter sets out to trace the development of the City by using the map record to chart continuities and changes in the nature of the interface between citizens and outsiders as it is reflected in the two depth maps, from the outside and in integration, together with the measure of regionalisation, radius 3 integration, and of differentiation, point depth entropy. Through analysis, it is suggested that the global structure of the City has evolved in two ways: by reducing backland development to draw more functions close to the main street grid and render them shallow to each other, and at the same time by fine-tuning the main-through streets to make the entire City shallow to access from the outside.

It is, however, possible to detect an acceleration in the trajectory of the City's global configuration which emerged during the nineteenth century. As the City has become embedded in a large metropolitan region it has become very much shallower to its burgeoning hinterland, more of a moment in a larger fabric. At the same time, the inhabitant/stranger interface is compressed to fewer and fewer main through streets, with a striking diminution of localised complexity in the backlands.

These structure-related changes are accompanied, indeed reinforced, by a shift from structure to order. The modern plan is simple to comprehend. It is a predominantly radial arrangement of streets centering upon Bank Corner, where the City's major financial institutions are located. Thus the visual characteristics of the City, which originated in a regular orthogonal street grid in Roman times, have after many centuries of adjustment within a disorderly, deformed grid, reached the apparent opposite pole of order.

**The Evolution of a Modern Metropolis.**

The evolution of the City from the period after the Great Fire to the present day tends to be subsumed to the growth of the metropolis and to its eventual incorporation within the Greater London conurbation ([Fig 8:01](#)). Architectural interest centres upon the development of
the ordered and geometrically-regular streets and squares of the 'great estates' of the West End\(^1\), the scandal and human misery of the slums of the East End, and the 'revolutionary' modern housing prototypes of the London County Council\(^2\) estates. Thus although the Strand, Fleet Street, Cheapside and Cornhill are reported by a French visitor to London in 1725\(^3\) as the finest streets in all Europe and whilst a number of the City's public buildings are conceded to be of some architectural merit\(^4\), Summerson describes the City of this period as 'an organic growth', and more disparagingly as 'a city without taste...a philistine fort.' Compared with the 'golden age' of architecture in the West End, the City is portrayed by many architectural historians as a regressive institution, obsessed with such banal matters as sanitation, paving and the upgrading of its many workhouses, prisons and hospitals.

Throughout the eighteenth and nineteenth centuries, the population of the City was indeed steadily falling in relation to that of the metropolis as a whole. By 1700 it was 208,300, but by 1801 it was only 134,000 even though the City's importance as a centre of finance and international trade was steadily growing. London in 1800 was the largest and arguably the most important city in the world, and the City of London was its most significant powerhouse. It was both a mercantile stronghold, the centre of European trade, and the largest and most important port in Europe, the world's banking and financial centre raising capital for the industrial revolution and the manufacturing centre of Europe's luxury goods as well as the single largest consumer of produce and manufactured goods in Britain. Yet at

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\(^3\) Cesar de Saussure

\(^4\) Dance's Mansion House, Jerman's Royal Exchange and Soane's Bank of England
the time when Horwood made his great survey of the built-up area of London in 1799, only a sixth of the one million population of London were citizens of the 'square mile'.

More significant, by the time of Horwood London had ceased to be an association of three distinct cities; London, Westminster and Southwark, and had become spatially unified - a metropolis. Despite the City's attempts to control suburban growth it had become completely embedded in a much larger area. This new unified metropolis is described by Summerson as assuming 'a new, balanced completeness. Linked by metalled roads to the regional turnpikes, it is the appropriate capital of its age. ...as appropriate and finished as the walled city in the circumscribed days of the Plantagenates' 1. The picture of London which Horwood records is, according to Summerson, the last record of a world which can be encompassed by the human intellect; 'a city, (his emphasis) a rounded place of human habitation'. 2

This view, whilst undoubtedly romantic in the expression, does seem to contain rather more than a grain of truth. Whilst it would be disingenuous to describe London in 1600 as a pre-industrial city, since it derived as much of its vast wealth from the manufacture of luxury goods as it did from commercial exchange, the city in general and the City in particular appear to perpetuate a mode of existence which is relatively continuous with the past. It is indeed poised on the eve of a revolution in transport which was to signal the end of the City as a place to live, but these changes had not yet begun to make an impact on the built fabric of the City and Horwood's map seems at first sight little different from that of Rocque some fifty years before.

For Summerson, the Georgian era is the climax; the Victorian period which follows is 'the end'. The end, that is of architecture, for 'Victorian and modern London make another story, a story of industrial conquest, of technical ingenuities, of the great battle for

1 Summerson, Georgian London, op. cit p.23.
2 ibid. p. 23. For Summerson, the story of the subsequent growth of the capital is one of decline from the humane into a living hell where the city is 'locked in by vast dormitories which blot out the life of the village satellites. and create an anonymous wilderness; neighbourhoods without neighbours, whence the rich flee, and where poverty presses always ion the heels of hard gentility' ibid. p.23.
Public hygiene, safety and health, of the awakening of public responsibility for the condition of the poor, and, latterly, of the dawning that a city is a living creature which must be controlled and which, to be controlled, must be understood. ¹ According to this analysis, the topographical record might be expected to show a rupture with the past. The modern City might well be architecturally and morphologically quite different from that of the Georgian era since it is driven by concerns which are utterly different from those of the past.

After 1800, the growth of the metropolis was indeed to begin in earnest and with it the depopulation of the City. The creation of 18 acres of docks downstream of the City was the first sign. Buses² and railways³ followed, drawing the population of the metropolis in their wake. The population of the City in 1801 was 134,000. By 1861 it had fallen to 112,000 and by 1901 it was a mere 27,000 and by 1951 it was just 5,000. Today it is about 4,500 while the daytime office population approaches 500,000. During the same period, 1800-1950, the population of Greater London rose from just under 1,000,000 to nearly 3,500,000.

Of the early termini, the only ones close to the workplace were in the City of London, at London Bridge and Fenchurch Street. These were soon to be joined by many others.⁴ The Underground was brought into service in 1860's.⁵ The City's main public works during the 19th century were all concerned with improvements in transportation: the construction of King William Street, Prince's Street and Moorgate were conceived of as offering a more direct route to the newly-rebuilt London Bridge. The Fleet valley was spanned by Holborn Viaduct in 1859 giving a more direct access to the residential districts of the West End. Farringdon Road was constructed in the 1850's and was

¹ ibid. pp. 23,24.
² the first horse-drawn bus appeared in 1829.
³ the first train ran from London Bridge to Deptford in 1836, followed soon after by a line to Fenchurch Street.
⁴ Blackfriars 1886, Farrindon Street, Ludgate Hill, 1865, Holborn Viaduct 1874, Cannon Street, 1866.
⁵ first tube ran between Paddington and Farringdon in 1863.
linked to Blackfriars Bridge\(^1\), opened in 1669, which gave access from the west of the City to the south of the river. Queen Victoria Street, brought the traffic generated by this new cross-river route directly into the heart of the City at Bank Corner.

All these changes are faithfully recorded in nineteenth century plans of the City, and it is the necessity for detailed and accurate records for the purposes of these civil engineering works that gave added impetus to the foundation of the Ordnance Survey\(^2\), which produced its first large-scale skeleton survey of the City in 1840’s. Less obvious from the map record, is the fact that the physignomy and even the function of the City were in a process of transformation, for the City’s office blocks are of nineteenth century origin. Before 1800 the office building was virtually unknown: by 1900 most of the City had been rebuilt to accommodate them.

The Victorian period thus ushered in the age of the commuter, and the entirely new City which is the Victorian legacy was largely without a resident population\(^3\). The state housing programme of the London County Council\(^4\) was therefore of little relevance to the City and it is in the east, in the slums of Whitechapel and Bethnal Green, that the programme of clearance and modern ‘estate’ building began in the 1890’s.

The next phase of redevelopment took place after the Second World War. Within the City 225 acres were razed to the ground, as compared with over 430 acres in the Great Fire. Again, the LCC/GLC concentrated on housing, and property developers reconstructed the City. In 1954 the number of parish churches was reduced from 108 to 24. Of the many hundreds of trade associations a mere 84 Livery Companies remain, with only 28 halls in use. Several companies are still wealthy, and use their resources to sponsor education and charity, but their

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\(^1\) joined by Tower Bridge, 1886-9 and Southwark Bridge, 1819, which replaced the historically important landing stage at King Street/Queen Street and afforded a fourth river crossing into the heart of the City.

\(^2\) the modern Ordnance Survey dates from the Act of 1841, although it had its origins in the military cartography of the eighteenth century.

\(^3\) the blame for this is usually assigned to the devastation wrought by the Blitz, but it is in fact a much earlier phenomenon.

\(^4\) founded in 1889 to give the burgeoning metropolis a unified government, directly elected with power over the whole of the built-up area.
role in City administration and government is limited. In the closing years of the 20th century the face of the City is changing once more. Little, it seems, is left of the City of Ogilby and Morgan, Rocque and Horwood.

There is, however, a lesson to be learnt from the reconstruction of the City after the Great Fire. It has been suggested in the previous chapter that during this ‘great rebuilding’ the appearance of the City was transformed from a carpenter’s City to one which owed its appearance to the bricklayer, yet the City’s Roman and Saxon ancestry still seemed to exert and influence on the urban grid, and shadows of these previous urban forms can be detected within the configuration of streets of the Restoration City. Can the same be said of its subsequent evolution?

The City’s urban structure is both resistant to change and robust in the face of it, and many would argue that the City still preserves in its very plan an archive of the past. The historical continuity of many of the City’s streets from Saxon times has been verified by archeological investigation. As one author observes, ‘every square inch of the City is steeped in history...by means of the modern plan (the pedestrian) can perambulate the City streets and, by reference to earlier maps, visualise the City of London as Shakespeare knew it, as Dr. Johnson knew it, or a those who lived through World War II remember it.’

These sentiments are echoed by Olsen, who muses that ‘bearing in mind the revolutionary changes that shook English life and economy from the early seventeenth century, what is remarkable is not so much that the town planning which took place in London changed, but that it changed so little’.

If this is indeed the case, the study of the evolution of the City’s urban grid becomes more than an academic exercise; it is an example of ‘living history’.

This chapter therefore sets out to compare the global structure of the City of London immediately after the Great Fire, with its overall configuration today. Analysis is based on the major map series of the

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1 opening to Johnston and Bacon’s City of London through Five Centuries, London, 1972.
2 ibid, p.12.
City\(^1\), the first of which is the survey of 1677 by Ogilby and Morgan which was the subject of the previous two chapters. This provides a benchmark against which to plot changes in the topography of the City.

The second is the map of the City published by Rocque in 1746. Rocque is known to have taken bearings by trigonometrical observation from high points in the City and to have supplemented these with a measured ground survey. His account of the space of public access within the City and his record of different building functions are known to have been detailed and accurate although, unlike the previous survey, Rocque shows only the main block structure and does not identify every house.

The third map in the series is that produced by Horwood between 1792 and 1799. It thus pre-dates both the Victorian interventions in the street grid of the City and the wholesale amalgamation of island blocks into larger insulae, to accommodate railway stations, large housing schemes and commercial redevelopments.\(^2\) The Horwood map is described by Darlington and Howgego as the largest and most important London map of the eighteenth century. Until the production of the Ordnance Survey there was no comparable map of the City. Comparison with the modern Ordnance Survey reveals that it is a remarkable and accurate achievement, far in advance of any of the previous London maps\(^3\).

The final map is the modern Ordnance Survey, which records the

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1 There exists an extensive and accurate map record of the City dating from the middle of the sixteenth century. Darlington and Howgego's survey, considered to be the most extensive map record, lists some 421 examples. Other works consulted include that by Glanville, *London in Maps*, Connoisseur Books, London 1972, and the Map Catalogue of the Guildhall Library. For a map to be useful for analysis, it must be detailed (of the order of \(26^\circ\) to the mile or 1:2500 or greater) and accurate, showing the precise shape and extent of public space in relation to the form of buildings, yards and gardens. This eliminates a large number of maps, and coupled to the fact that copying was rife amongst the cartographers of the City, only a handful of independently surveyed, large scale plans exist.

2 In this sense, Horwood's map depicts the City just before the point when its 'organic' character began to be eroded by large scale planned intervention.

3 Stamford's overlay of Horwood's map on the first edition OS map shows that there are few discrepancies aside from the misnumbering of a few houses and misalignment in the line of some party walls, neither of which affects axial analysis.
Fig 8:02 - Ogilby and Morgan's map of 1677
contemporary City. Redevelopment is taking place so quickly within the 'square mile' that even SIM\(^1\) becomes rapidly out-of-date. The map record is therefore supplemented by an on-the-spot survey\(^2\). This map takes in the major road improvements of the Victorian and post-war periods, the insertion of half a dozen railway stations\(^3\) around the perimeter of the City, and the creation of several new 'precincts'\(^4\) and squares\(^5\) within the heart of the City.

The aim of the comparison is twofold. The first task is to establish exactly in what sense the modern City preserves in its spatial configuration any 'memory' of the morphological characteristics of its pre-industrial past. The second is to chart the nature and extent of any transformations which have taken place over the last three centuries, particularly where these appear to affect the 'morphological trajectory' of the City. These continuities and transformations will be set alongside the course of historical events.

**Continuity and change: four maps of the City.**

To recapitulate the observations of the last two chapters, the main visual features of Ogilby and Morgan's 1677 map (Fig 8:02)\(^6\) are as follows. The walls give clear physical expression to the City. A notable feature of the block structure of the City is the great variety displayed in the size and shape of islands and the range in scale of the individual properties and plots which constitute each urban block. Non-residential buildings other than the Tower and St. Paul's are relatively inconspicuous within the City. Public works are not, on the whole, monumental either in appearance or in relation to the street grid, though the newly-erected Newgate Market and the cleared Stocks

1 survey information on microfilm
2 carried out between 1985 and 1987.
3 Blackfriars, Cannon Street, and Fenchurch Street within the City and Holborn Viaduct, Aldgate and Liverpool Street just outside it.
4 a term popularised by the Abercrombie Plan for the redevelopment of the City after the Second World War. The most important one which was actually built was the Paternoster Square development immediately to the north of St.Paul's Cathedral.
5 Commercial Union Plaza, Old Change Court. The latest in this morphological 'stereotype' is the Broadgate Redevelopment, immediately to the north-east of the City.
6 a large scale version is to be found in the pocket at the end of the thesis - bound copies only.
Fig 8.03 - Rocque's map of 1746
Market area stand out in the plan, as do the Royal Exchange and the axis leading to the Guildhall. These developments suggest that the new public works projects sponsored by the City's government have been touched by the fashion for geometrically well-ordered designs.

The system of streets is a deformed grid, with some conspicuously wide thoroughfares and many small through streets. The City has a preponderance of dead end courts yards and alleys. Backland development is rife and there are few open spaces within the City other than around the Tower and St Paul's. The street grid appears to have a clear east-west emphasis, and is locally different in its parts. A recurring characteristic is that of ambiguity in how the spatial configuration - streets, blocks and morphologically differentiated sub-areas of the City - relate to social divisions within the City - wards, parishes, trade associations, and the like.

By the time of the Rocque map of 1746 (Fig 8:03) the line of the wall is less distinct. The wall is clear at the Fleet in south-west but the grounds of Christ's Hospital obscure its course north of Newgate Street. Although the wall still exerts a physical hold along the northern boundary of the City, five new streets enter the City from the Moorfields district, historically a poorly-connected suburb. Houndsditch is built over and, although the wall marks the limit of most of the extra-mural streets, breakthrough from the suburb does occur in a few places. The development of several new 'ring-roads' running parallel to line of the Roman walls masks the transition from City to suburb.

Within the City however, little appears changed. The Stocks Market now accommodates the Mansion House, one of the few freestanding buildings within the City. The concentration of public buildings in the north-west of the City has become more pronounced. The physically-defined sub-areas of the City which were so striking in Ogilby and Morgan's map appear even more differentiated and some new ones

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1 this has been dealt with in detail in a previous chapter
2 a large-scale version of this map is to be found in the pocket at the end of this thesis - bound copies only
3 though these were not actually demolished until the period 1760-66.
4 official residence of the Lord mayor.
5 as the representation of these in solid black confirms.
Fig 8:04 - Horwood's map of 1799
can be picked out\(^1\). The least-affected area seems to be the south-west quarter east of St Paul's, but then this area was one with a particularly strong physical identity in the first place. Elsewhere, the physiognomy of the the City appears to have aged, and in so doing to have become 'more like itself'.

By the time of Horwood’s map of 1799 (Fig 8.04)\(^2\) the City has lost its old spatial discreteness and the restriction which the walls had imposed on movement throughout the preceding centuries is no longer apparent. The City’s road system opens out to the growing suburbs, and routes come into the City from all directions. Blackfriars Bridge\(^3\) provides a new link across the Thames, despite the City’s entrenched opposition to cross-Thames links which it feared would weaken its stranglehold over the trade which flooded into the capital, and New Bridge Street on the western boundary of the City now provides a more obvious, though permeable and permissive boundary marker here than the Roman wall. Earl Street links Thames Street to this new north-south traffic artery. These changes are repeated around the entire City boundary. Many previously-existing streets have been widened and straightened to bring traffic more easily into the City, particularly from the rapidly-developing suburbs to the north and east. Apart from the major roads, the grid seems rather constrained within the City itself, despite the increasing emphasis on wheeled transport.

Looking in detail, it is immediately striking how little of the backland within the island blocks is shown as built space when compared with the two previous maps. The street frontages are still packed with buildings, but behind these the amount of secondary development around alleys and courts seems to have diminished. Even allowing for the decrease in population\(^4\) the retreat to the main street grid is

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\(^1\) the many yards around the Minories and Poor Jewry in the east, the dense alley systems of St. Martin le Grand and Drapers Garden.

\(^2\) a large-scale copy of this map is to be found in the pocket at the end of this thesis - bound copies only.

\(^3\) Until 1749 London Bridge was the only river crossing. Blackfriars Bridge, opened in 1770, was the third, with Westminster Bridge in between. many more river crossings were constructed during the nineteenth century, including Vauxhall, Waterloo,

\(^4\) from 208,300 in 1700 to 134,000 in 1801.
Fig 8:05 - the modern Ordnance Survey map.
striking. In block A on a prime site adjacent to St Paul's the number of houses on the plot has decreased from 121 in the Ogilby and Morgan Map to 67 in Horwood. All but 13 of these face the surrounding streets. Concomitant upon the decrease in the sheer numbers of buildings especially in the backlands, is a shrinkage in the amount of secondary courtyard and alley space within the City. Again, looking at the same block the shrinkage is striking and appears typical of the City as a whole. As with the buildings, the structure of public space appears to have shrunk in the direction of the major streets.

Although the buildings are for the most part domestic, Horwood's map is beginning to show an accumulation of sites to increase the scale of development, a trend which was to increase in the ensuing centuries. The new Bank of England building at Cornhill is the most obvious of these, dwarfing the Royal Exchange which was itself so striking in Rocque's map. This is one of many new buildings east of Cornhill, including India House, the Excise Office and a whole new building complex around Old Jewry and Crutched Friars. Elsewhere, the scale of building is modest - particularly when compared with areas of London outside the City. Horwood's map shows a scatter of smallish public buildings, across the entire city. Most are completely embedded in the everyday fabric of the City, apart from the concentration of significant buildings at Bank Corner which had been completed by the Bank of England.

The modern Ordnance Survey map (Fig.8:05) reveals that although the outline of the walls has been perpetuated in the road system, its effect has completely changed from that of presenting a barrier to through-movement to that of affording a major channel of movement around and into the heart of the City. The northern boundary of the wall is marked by a new dual carriageway, London Wall, as far as the site of Bishopsgate. East of Bishopsgate, the line of the wall is perpetuated in the pre-industrial street system which has been

1 some of the shortfall may, of course, be accounted for by 'laziness' on the part of the mapmaker in failing to depict all the minor properties, but in the light of his avowed intention to show every house, the wholesale omission of properties which this would imply is extremely unlikely. It does not seem to have arisen from mapping technique since in other parts of the map, such as the west and east ends of London and in Southwark, all this detail is given in full and even individual garden plots are recorded.
preserved along Camomile Street and Bevis Marks to Aldgate, and from there the Minories sweeps round to the Tower. In both these areas the new roads link the City directly into the extra-mural suburbs. In the west, the line of Farringdon Street (old New Bridge Street) is joined by Holborn Vidaduct to Newgate Street, and a widened St Martin le Grand linking to London Wall. Along the Thames, a new dual-carriageway and underpass directs through-traffic along Thames Street, under London Bridge and along Syward Street to Tower Hill. In effect, the City is completely encircled by a 'ring-road' which blurs the shape of the old City and expands it somewhat. A doubling in the number of bridges\(^2\) increases permeability from south of the river.

Yet more striking, are the changes wrought upon the internal street grid of the City. For the first time in its history the City seems to have acquired a focus, at Bank Interchange. This has been brought about by a series of new roads, the most important of which is Queen Victoria Street driving up from the historically inaccessible Blackfriars area to the very heart of the City, aligning itself with Threadneedle Street beyond and giving it a new, more geometric significance. A second new street, Princes Street/King William Street, intersects Bank Corner at 180 degrees. Bank Corner is therefore the 'hub' of seven radials, eight including the less obtrusive Walbrook.

Other changes are no less significant. New Change, east of St Paul's, links Cheapside to Cannon Street, which is wider and straighter than before. Moorgate brings traffic directly from the north to Princes Street and thence to Bank Corner in two moves. Most of the awkward angles in the City's route system have been straightened. Amongst the more notorious\(^3\) of these, the tortuous route along Throgmorton Street, Lothbury, and Gresham Street immediately south of the Guildhall has been straightened, and the southern route along Eastcheap to Great Tower Street which has had an elbow-bend since Roman times is now a gentle curve swinging down to Tower Hill.

The effect of all these changes is to turn the more-or-less orthogonal grid of the City into a radial grid - a transformation in the visual order.

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\(^2\) Southwark Bridge, Tower Bridge
\(^3\) in terms of historical longevity
of the City’s urban space pattern. The emphasis within the system has been changed profoundly by the 19th and 20th century programmes of road improvements. Bank Corner is the radial focus for the entire City, appearing to dominate the previously significant east-west cross-routes despite the fact that the river route of Thames Street and the more northerly route along Watling Street, Cannon Street and Eastcheap, Cheapside itself and the east-west route to the north of Cheapside, have all been strengthened by road-widening schemes.

Even so, a comparison of the street grids shows that the modern City perpetuates much of the gross form of the blocks and major streets shown on the Ogilby and Morgan map. Some lanes even keep to their 17th century widths as set out after the Great Fire. Much of the large-scale structure of the island blocks survives despite the fact that most of the late 17th and early 18th century buildings which once formed the blocks have been demolished. Most island blocks show some amalgamation of plots as a product of the increased scale of modern development, and there is a marked increase in the number of islands which have only one building or building complex. At the same time, there is a reduction in the complexity of backland development.

The roads in the north-west quarter are more or less unchanged in their gross form as far east as Coleman Street. The bulk of the Drapers’ Garden block is still identifiable to the east of Coleman Street, but the area is much more permeable than in the Ogilby and Morgan map. The streets in the eastern parts of the City are well-preserved despite the intrusion of Fenchurch Street Station. The street grid in the area around St.Paul’s can likewise be traced despite the building of a new ‘precinct’ at Paternoster Square. At a local level, the shape properties of the historic City can still be detected in the plan.

Much of the complexity of the network of lanes and alleys which were a source of local differences in the various sectors of the City mentioned earlier no longer exists. The distinctive linear pattern of

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1 as, for example, in the area around St.Andrew’s Hill.
2 this change in scale extends to the vertical: the buildings of the City were at the time of Ogilby and Morgan, confined by legislation to four storeys at most.
3 Refer to Conzen here.
development between Thames Street and the River has given way to a row of large buildings. The local variety in alleys and courts has largely disappeared. One exception is in the area between Fenchurch Street and Threadneedle Street where the network of lanes survives almost intact despite wholesale demolition and rebuilding. This survival illustrates a more general principle. Rights of access have ensured that through-permeability has been maintained almost everywhere under the buildings and through interior service yards, so that the street grid of the City survives the destruction of the buildings which define it. So far as public open space is concerned, the major change is in an increase in the numbers of buildings which now sit within a 'square' 2. The large spaces around the St. Paul's and the Tower have been all but obliterated.

There are fewer and larger everyday buildings in the modern City than there were at the time of Ogilby and Morgan 3. Island blocks with a predominance of modern buildings take one of two forms: either of a free-standing building set back from the building line to give a podium of clear space around its base designed to give building added emphasis; or a series of contiguos slabs set on the building line and surrounding a central service area and light well. Both developments have occurred in parts of an island block alongside a residue of small-scale buildings from previous centuries. In this sense the modern City appears more heterogeneous when compared with the overall modest level of all buildings at the time of Ogilby and Morgan despite an overall reduction in numbers.

So far as public buildings are concerned, these are today harder to identify, partly because what counts as a modern 'public building' is less clear than it was at the time of Ogilby and Morgan. Some

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1 though the 'feel' of these is undoubtedly very different, as are the shape properties of the new service yards and their relation to the buildings which define them.

2 as, for example, at Paternoster Square, or Commercial Union Plaza.

3 the intention here is not to give a history of particular developments but to sketch the consequences of development in general for morphology in particular.

4 everyday buildings have, for the most part, lost their residential function and are dedicated solely to commercial uses.
Fig 6:06 - open space in the City at the time of Ogilby and Morgan

Fig 6:07 - open space in the City at the time of Rocque
guildhalls remain\textsuperscript{1} although these have lost their 'public' function and are of largely historical interest. The City financial institutions which have replaced them as a source of power are concentrated around Bank Corner in the Bank of England, the Stock Exchange, the Royal Exchange and the Mansion House\textsuperscript{2}, but these are not so much buildings of public access as buildings which present a public image. Thirty Wren churches remain in the City. Most are open, and services are held there, although their parochial functions have been almost entirely lost\textsuperscript{3}. Most are contiguous with secular buildings. The Guildhall complex in the north-west of the City is one of the few City buildings which are 'public' in a modern sense. The administrative affairs of the City are handled there and it has been enlarged by a major public reference library on City affairs. The only other comparable buildings of public access and resort are St Paul's and the Tower.

All in all, the map of the modern City appears both less complex and more uniformly open in texture than any of the previous maps. This can be seen as a product of attrition at both ends of the urban scale - the road-widening programme has tended to make streets larger and more uniform whilst the increased scale of building has reduced secondary backland development to a system of service yards, interior courts and light wells.

These changes in the nature of the street grid within the walled area between 1677 and 1987 is clarified by a comparison of the four corresponding 'open space' maps of the City (Figs 8:06-8:09) The most significant change is recorded in the last of the series, which is much coarser than any of its predecessors. The proportion of black to white on the page has probably not changed dramatically\textsuperscript{4} but its distribution is entirely different, and is concentrated rather than diffused. It is possible to see clearly the increase in the size of major routes and note the elimination of small-scale backland development of both the nondistributed (closed court and yard) and distributed

\textsuperscript{1} including Apothecaries' Hall, the College of Arms, Innholders' Hall, Skinners' Hall, Stationers' Hall, Tallow Chandlers' Hall, Vintners' Hall.

\textsuperscript{2} with the 'big bang' the Royal Exchange has recently changed its function to a modern dealing rooms.

\textsuperscript{3} with the decline in residential uses in the City.

\textsuperscript{4} though it is almost impossible to measure this.
Fig 5:05 - open space in the City at the time of Horwood

Fig 5:09 - open space in the City today
Fig 8:10 - the axial map at the time of Ogilby and Morgan

Fig 8:11 - the axial map at the time of Rocque
Fig 8.12 - the axial map at the time of Horwood

Fig 8.13 - the axial map today
(lane and alley) variety. In some places the representation makes clear how new roads have sliced though the old fabric leaving it severed, but largely intact. Other areas, such as the blocks to the immediate rear of the Guildhall, have changed radically by dissolving the previous outlines and forming new ones.

The 'open space' map also indicates a shift in convex articulation, from the backland areas, where convex articulation took the form of squarish courts of various sizes entered by narrow passages which often passed under the buildings, to the main street grid where, despite an overall increase in the scale and width of principal routes through road widening, there seems to be more variation in width which is often deliberate, as in the design of the open spaces centred about St. Paul's. Previously roads were narrow but uniform, everywhere pressing to the back of the building line. Now there is more of a tendency both to articulate the width of street space and also to withdraw major buildings from the back of the building line to give them a forecourt in front of the main entrance.

The Axial Maps of the City.

A visual inspection of axial maps (Figs 5:10-5:13) confirms the extent of the transformation which has taken place within the City over the last three centuries. The earliest map shows a City densely packed with axial lines; the latest map appears relatively sparsely filled. Few routes survive axially unchanged. In almost all cases change takes the form of a reduction in the numbers of axial steps to travel the route: almost none have increased their axial deformation. Even those streets which survive have had their linkages into the axial system as a whole changed, in some cases dramatically. Again, most of these changes take the form of 'ironing out' axial deformations,

1 a good example is that containing Bucklersbury, to the south-west of Bank Corner. Much has been made of the historic 'triangular sites' in this part of the City. The sequence of maps shows that most of these are due to the impact of Queen Victoria Street in the nineteenth century.
2 as evidenced by the frequent complaints about 'encroachment' of buildings into the thoroughfare throughout the mediaeval period and into the early 19th century.
3 one clear counter-example is the area to the north of St Paul's Cathedral, open space at the time of Ogilby and Morgan, but now enclosed.
4 as in the few streets surviving in the St Andrew's Hill area.
Fig 8:14 – a comparison of Honey Lane and Leadenhall Markets, 1677 and 1746.

Fig 8:15 – a comparison of a block close to the Tower, 1677 and 1746.
changing the alignment of a street axially\textsuperscript{1} or punching a new continuation of an existing street through to link areas directly which were previously only indirectly related.\textsuperscript{2}

The preservation of a family likeness in the gross topology of the City hides a second major change, in the connectivity of those axial lines which remain. Taking the strong core of surviving axial lines along Cheapside, Threadneedle Street, Cornhill and Lombard Street, their respective connectivities have reduced from 35, 16, 27, 20 to 25, 9, 21, 19 respectively for the distributed system alone\textsuperscript{3}. This confirms the impression gained earlier that the density of axial lines in the City today has decreased dramatically when compared with the City of Ogilby and Morgan.

Ogilby and Morgan's map of the City yields a system composed of 797 distributed lines and 937 nondistributed lines, giving a negative distributed : nondistributed ratio of 0.853 : 1. Depth distributions are as follows depth 1-746; depth 2-159; depth 3-28; and depth 4-4. In other words, there is a striking\textsuperscript{4} attempt to render dead-end spaces shallow to the system of ringy routes. Comparable figures for the City of Rocque are 888 distributed lines and 657 nondistributed lines, yielding a positive distributed : nondistributed ratio of 1.351 : 1. Depth distributions are 1-504; 2-114; 3-32 and 4-7. The distributed street grid in Rocque has therefore become more dense, while the numbers of shallow (depths 1 and 2) \textit{cul-de-sac} spaces has fallen. There are, however, slightly more of the deeper \textit{culs-de-sac} (depths 3 and 4).

The extra through streets in Rocque are brought about in two very different ways. The majority are a result of the more complex and

\textsuperscript{1} A typical case would be the realignment of Lime Street and St. Mary's Axe to form one new axial line.
\textsuperscript{2} As in the line of Catteaton Street in the Ogilby and Morgan map, previously noted as a street which 'petered out' as it continued along Ladd Lane to its intersection with Wood Street. This line, now Gresham Street, continues on the trajectory of the old Catteaton Street line as far as St. Martin le Grand, just outside the line of the Walls. Another equally striking example is the 'rectification' of Thames Street, which petered out in the area of St. Andrew's Hill, then Puddle Dock Lane, at the time of Ogilby and Morgan.
\textsuperscript{3} And would be much greater if nondistributed links were added, since there are far more of these in the Ogilby and Morgan map than in the City today.
\textsuperscript{4} And according to Brown, systematic. (See the previous chapter on Ogilby and Morgan)
Fig 8:16 - the reduction in *culs-de-sac* in blocks in the south-west of the City, 1677 and 1746

Fig 8:17 - the St. Helen's area, 1677 and 1747
permanent market standings which have been erected at Honey Lane, Newgate and Leadenhall (Fig 8:14). A minority come into being by the joining together of what were previously courts, together with the construction of additional alleyways to accomplish breakthrough and linkage between major routes in the Drapers Garden area, along St. Martin le Grand, at Blackfriars and close to the Tower. (Fig 8:15).

The reduction in culs-de-sac has taken place everywhere. Along Coleman Street in the north-west the drop is from 21 to 16 turnings, on Cheapside it is from 10 to 8, while along St Martin's Lane and St Lawrence Poultney, two adjacent small street in the south-east of the City it is from 6 and 7 courts respectively to none at all. For the most part, these losses are absolute: that is they do not arise because courts become through-streets. This is a rare phenomenon outside the areas mentioned above. A block by block inspection is able to pick out which courts remain and which have disappeared in the 70 years between the two maps. Fig 8:16 shows a typical case.

The deeper areas are located in the St Helens area, which carried all the deep spaces in Ogilby and Morgan's map. Here some of the deeper courts have joined, while others have become blocked, but the family likeness between the two maps is clear. (Fig 8:17) Whereas this area accounted for most of the deeper spaces in Ogilby and Morgan's map, by the time of Rocque, other parts of the City were developing deep wandering courts. Examples occur off Newgate Street, Coleman Street, Great Tower Street and immediately south-west of St. Paul's.

Aside from these shifts, the shape of the street system is remarkably consistent between the two maps. Individual streets change their alignment slightly, frequently straightening out awkward blockages¹ and thereby altering their connectivity within the axial map, but the main impression gained from comparing the two maps street by street is that what has taken place everywhere is a fine-tuning of the grid and not radical change. It is not just that the connectivity of many street intersections in the axial is preserved, rather the actual angles of incidence of the axial lines are identical, so that it is clear that the street space is one and the same, even if the buildings which line it have altered.

¹ which must have presented an obstruction to carriages
Fig 8:18 - a comparison of Honey Lane and Leadenhall Markets, 1746 and 1799.

Fig 8:19 - St. Martin le Grand, 1746 and 1799
By the time of Horwood's map, half a century later, there are 682 through streets and 665 cul-de-sac streets, giving a distributed : nondistributed ratio of 1.03 : 1. The drop in the number of through-streets is remarkable. Just over 200 streets have been 'lost' from the street grid of the 'square mile'. The number of culs-de-sac remains stable\(^2\), though the distribution changes: at depth 1-584; depth 2-56; depth 3-15; depth 4-6; depth 5-3; and depth 6-1. All spaces above three steps are to be found in four deep wandering courts all in the eastern half of the City: Great St Helens, Little St Helens, and a large unnamed court on the opposite side of Bishopsgate Street form a striking cluster of locally deep courtyards, and the final one is in the backlands to the north of great Tower Street between Mincing Lane and Mark Lane.

The loss of through streets can be accounted for in three main ways. In all the areas which had grown complex and labyrinthine by the time of Rocque, due to the build-up of large numbers of short streets, simplification has taken place. This is true of both the market areas (Fig 8:18), all of which had been redeveloped with new market buildings in the intervening period, and of the more residential areas of Drapers Garden and St Martin le Grand. (Fig 8:19) A second reason for the drop is in the elimination of many secondary routes through the backlands of the major urban blocks, which would make sense if they were no longer lined with houses to serve as destinations (Fig 8:20). Almost none of the quays above the Bridge are through-routes\(^3\). A third source of reduction in axial lines is road straightening. The King Street/Queen Street route to the Guildhall drops from 2 axial lines to 1, that from Bishopsgate to the bridge from 3 to 2 and Thames Street drops from 6 to 5 steps. This fine-tuning is repeated everywhere and brings about a general reduction in the numbers of axial steps required to make any journey on the routes remaining within the City. Some areas are axially unchanged (Fig 8:21), but these are the exception rather than the rule.

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\(^2\) plus 8.

\(^3\) implying that their owners were keen to take access into private ownership, as opposed to the grand vision for a promenade stretching the length of the Thames envisioned by the architects of the post-Fire plans.
Fig 8:24 - the blocks between Cornhill and Lombard Street, 1799 and 1987.

Fig 8:25 - the area behind the Guildhall, 1799 and 1987
The corresponding increase by 80 in courts 1 deep can in some areas be accounted for by the stub-ends of what were secondary through-routes through the urban blocks which have shrunk back to the main street grid. (Fig. 6:22) There is a major shift in this direction along the wharves. Others are new, particularly in the south-east of the City. The two adjacent street which had lost their courts in Rocque have each acquired 4 in Horwood's map. (Fig. 6:23). Apart from in the St. Helens area, there is a definite shift towards shallow courts. The numbers of two and three step turnings have each been halved in Horwood’s map. All of this activity confirms the intuition that the City draws more closely to the main street grid during this period.

In the modern City (Fig. 6:13) there are 511 distributed lines and 86 nondistributed lines, giving a distributed : nondistributed ratio of 5.942 : 1; a massive reversal in the two types of space. This captures the precise extent to which cul-de-sac space has been eliminated from the City during this century. Today, all those nondistributed lines which remain are only one or two steps away from the distributed system: 79 spaces are one step deep from the ringy street grid and 7 are two turnings deep.

The number of streets 'lost' to the City during this period again approaches 2001 while the 'loss' in culs-de-sac is even greater, approaching 6002. These are massive transformations which cannot really be accounted for by any simple local process of fine-tuning. What has occurred is a global reorganisation in the public space of the City and the clearest indication that this is the case is that it is no longer possible to compare the local street grid of the City block by block and to trace continuities in the shape and trajectory of the majority of the local streets. The geometry of the City has altered dramatically within the last century, more so it seems that the phenomenal form3 the the streets will admit.

1 the actual figure is 171.
2 the actual figure is 579.
3 this difficulty in comparing old with new was far less acute in the case of the open space maps, which are based on the complete shape of public space and built form, than in the axial map, which is a reduction to the least route system.
Fig 6.26 - distributed axial map, Ogilby and Morgan

Fig 6.27 - distributed axial map, Rocque
One area where the main streets have held steady is that between Cornhill and Lombard Street/Fenchurch Street, a distinctive oculus of great antiquity. A comparison of this area in 1799 and now (Fig 6:24) reveals that here the main street grid holds good as far as the bridge apart from one slight change of route. East of the bridge, Leadenhall has been redeveloped to make it even simpler and more shallow than before, and the streets below Leadenhall have been straightened. The block east of Leadenhall has been simplified. However, all of the considerable number of closed courts and alleys have been eliminated from this area. It would be a mistake to see this area as in any sense preserving the characteristics of the pre-industrial City other than in a gross form for much of the complexity of small-scale backland development shown in Horwood's map has gone.

The number of distributed lines 'lost' in this area is small, 79-63. In the St.Martin le Grand area, the historic street grid has completely disappeared into just one block representing a drop from 39 through streets to just the 4 which outline the block. The riverfront is another area which has been completely lost to public use. Most cases fall between these extremes. The area behind the Guildhall (Fig 6:25) has been completely redesigned in the form of a more regular grid covering a different area of ground, so that it no longer makes sense to compare the numbers of axial lines in each map. Of course, some new streets are added to the street grid of the City, but these tend to be axially long so their numerical impact is slight compared with the great reduction almost everywhere else. Some new streets are axially chicained, but these are designed for pedestrians only; overpasses, underpasses, and the route to the east of St. Paul's cathedral. The reduction in the size of the street grid is not just accounted for by a simplification of the existing grid, but also by the elimination and restructuring of whole areas of the City so as to leave no 'memory' in the shape and configuration of the grid of what has gone before.

The axial maps of the distributed sub-systems for the four time periods are reproduced in Figs 6:26-6:29. Apart from clarifying the shape of the grid of through streets, the maps illustrate a further transformation in the space of the City which has been brought about in the modern era. The number of 'trival islands' decreases in the modern Ordnance Survey map, but the size of those which remain
Fig 8.28 - distributed axial map, Horwood

Fig 8.29 - distributed axial map, the modern City
increases. This means that in the City today there are fewer deformations in street lines and a predominance of wider, straighter streets, but that this regularisation still preserves the property of 'glancing off' building facades in a relatively open layout rather than using building facades to frame enclosed 'street pictures' with abrupt directional changes. The larger scale of overlap brought about in the more open street system of the City today means that there are more strategic locations in the City where it is possible to see a long way in several directions, particularly in parts of Cannon Street and Lower Thames Street, but also diffused widely across the entire City. This property is in evidence everywhere, but is not so marked in the north-east of the City as elsewhere. In the Ogilby and Morgan Map, these strategic 'strong points' were limited to the west front and east window of St Paul's and to the junction at Cornhill.

The second property, the lack of any consistent geometric relation of building facades to the axial structure, is preserved in the modern City, despite the fact that almost all the buildings have been replaced since the time of Ogilby and Morgan, often through a process of amalgamating plots so that, in theory, a more regular alignment of building facades and street lines could have been achieved. To take just one example, the radial routes centred upon Bank Interchange, the locus of several key City institutions including the Bank of England, the Stock Exchange, the Royal Exchange, the Mansion House, the system of axial lines defining the island blocks within which all these important buildings sit, slips past the facades of all these buildings rather than striking directly onto them, nor are the ends of the radial axes furthest from Bank Interchange end-stopped by the facades of major City buildings.

The shift in the grid axiality of the City since the Restoration is clear but not startling. The figure for the distributed street grid of the City at the time of Ogilby and Morgan, with 797 lines surrounding 469 islands, is 0.0567 - axially a rather deformed grid. For Rocque, the comparable figures are 888 lines surrounding 478 islands. The increase by 80 in the number of streets only brings about an increase of 9 islands, which suggests that the street system is becoming everywhere more tortuous and broken up. This effect balances out the localised increases in the density of rings, and therefore of islands, in
Fig 6:30 - step depth from the walls, Ogilby and Morgan's map
the particular areas noted earlier. The new market standings in particular, are regular in layout. Although they add islands to the system, they are more than compensated for by those lost from the quayside. Elsewhere, the tendency is for the urban blocks to become more irregular in shape, as evidenced by a slight decrease in grid axiality to 0.0515. Horwood, with 682 lines surrounding 405 islands moves back towards regularity, and gives a value for grid axiality of 0.0619. Comparable figures for the City today show 511 lines surrounding 359 islands, giving a grid axiality of 0.0817, still axially deformed but moving consistently in the direction of regularity. 1

The figures for line-link ratio tell a similar story. This is 2.009 at the time of Ogilby and Morgan, 1.838 in Rocque's map, 1.878 at the time of Horwood and 2.323 for the modern City. According to this measure also, the City dips in regularity in the early eighteenth century and then shows a tendency towards regularisation in the grid. The rise in the ratio goes against the fact that the numbers of connections on the longer lines have dropped significantly, and suggests that the City has moved towards homogeneity in connectivity, distributing connections more evenly throughout the spatial surface rather than biasing them strongly towards a few lines at the expense of others.

The depth maps for visitors.

The depth map from the walls based on Ogilby and Morgan's map is reproduced in Fig 6:30, and that yielded by the Rocque map is shown in Fig 6:31. The first three steps show that the realignment of Blow Bladder Stret have made St.Paul's more directly accessible to visitors approaching the City from the west, through Smithfield and up Ludgate Hill, but that easy access to the areas immediately to the south and east of St. Paul's has been reduced by encroaching on Great Carter Lane and the top of Adle Hill.

The central portion of the route from Bishopsgate to the bridge has been straightened. This has the effect of reducing the immediacy of access into the south-west grid of streets below Cornhill, though the side turnings from Bishopsgate/Gracechurch Street/Fish Street and the

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1 compared with Ogilby and Morgan, the sheer number of axial lines has dropped by 46% and the number of islands by 23%, accompanied by a 44% increase in grid axiality.
Fig 8.31 - step depth from the walls,
Rocque's map
export-import quays below the bridge, the Fishmongers Hall and the Steelyard are all shallow to visitors entering the City. A realignment of the route entering from Aldgate redirects through-traffic down Leadenhall Street towards Cornhill rather than round by Fenchurch Street and Lombard Street. This has the effect of making the streets above the Tower less directly accessible to visitors. A more direct access down Broad Street has little impact on the general accessibility of the City, but since this route leads only to Moorfields\(^1\) this is not surprising. The accessibility of Cheapside, and penetration into the area of the Roman fort and from the northern wall in the direction of Cheapside\(^2\) are more or less identical.

In the heart of the City, colour mixing is more diffused in Rocque than in Ogilby and Morgan. In the latter map, deeper spaces are largely restricted to the grid above Queenhythe. Straightening King Street/Queen Street makes this whole area more accessible to visitors; by implication this includes to visitors by boat from Westminster. The impact tails off as one travels west towards Blackfriars and east towards Gracechurch Street. The area centering on the Navy Office by the Tower has become more segregated in Rocque's map. Leadenhall, Newgate and Honey Lane Markets are all inaccessible to City visitors. Despite the greater accessibility of the main entrance to the Guildhall, the approaches from the rear and the streets east of Coleman Street are many turnings away and correspondingly difficult for the visitor to negotiate.

The fine-tuning and realignment of the grid which has taken place between the two maps has the effect of more firmly directing the visitor to the City into the principal trading streets, reducing the choice of route at the level of intuition by increasing the relative directness of the favoured street. More of the City is now rendered positively inaccessible to the incoming visitor. Previously, the elusive goal was unified; the relatively self-contained grid of streets in the south-west. It was large enough in area to impinge on the mind of the visitor and to encourage search. Many of the more diffuse pockets of

\(^1\) a place of resort for the citizens and the site of the new Bethlehem Hospital and burying ground.

\(^2\) despite the opening up of several new posterns. These are not accompanied by any move to drive routes directly into the heart of the City.
Fig 8:32 - step depth from the walls,
Horwood's map
segregation in Rocque's City are so small and separate as to be easily missed by the casual passer-by. In particular, the waterfront area picked out by Ogilby and Morgan's PDE core is now the largest inaccessible strip of contiguous space when looked at from the point of view of a visitor to the City some 80 years later.

The depth map from the walls for Horwood (Fig 8:32) reveals the impact of an enhanced accessibility from the perimeter which is brought about by the tearing down of the City walls. The whole of Thames Street, and many of the turnings off to the river, and the trading areas to the north, are rendered shallow to the perimeter. In addition to the turnings off the north-south route from Bishopsgate to the bridge which were previously easily accessible to strangers, the whole of the City to the east, with the exception of Leadenhall, is now shallow thanks to a series of new access roads from the docks and the East End. For the first time in its history, the northern suburbs are connected directly with the intermural City, and the inaccessible areas to the north of the Guildhall are, for the most part shallow. In the west, almost the whole of the St Martin le Grand enclave is opened up, and the new road leading north from Blackfriars Bridge has brought about an enhanced accessibility to this area for visitors approaching from south of the river.

The entire City, and not just the historically inaccessible perimeter zones, is opened up to penetration from the outside. Almost all the streets of the City can be reached in four axial steps from the perimeter. Some sections of street are deeper, but these are isolated moments in an otherwise open and permissive layout. The contiguous chunks of deep, labyrinthine and therefore ghetto-like space are now a thing of the past. The first time visitor to the City can easily make his way to the heart of the trading streets by following the longer streets which seem to lead to 'promising' destinations, since they reliably do so, and even if a stranger is side-tracked into a by-lane, a main route is almost always 'just around the corner'\(^1\). The retreat to the main street grid\(^2\) noted earlier has brought about a compression of the interface between inhabitants and strangers to the City.

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\(^1\) a useful feature in an era when maps were expensive to purchase and cumbersome to use.
\(^2\) and the loss of 200 axial lines.
Fig 8:33 - step depth from the walls today
The comparable map for the modern City (Fig 8:33) reveals a more thoroughgoing transformation in the extent of coverage at three axial steps. The number of lines at depth 1 has increased dramatically when compared with the Ogilby and Morgan map; 19, as opposed to 7. The majority of these new penetrating lines are short. The longer ones are, on the whole, identical with the main access roads of the Ogilby and Morgan map. However, despite the great increase in the numbers of lines at depth 1 it is not this which has had the greatest impact on the depth map but rather the scale of coverage achieved at depths 2 and 3. These two steps bring nearly the whole of the axial map into play.

The effect of 'ironing out' axial deformities within the major street grid of the City in the Victorian era is to render the entire City much more shallow from the outside, and not just the areas around the perimeter where the walls had been demolished by the time of Horwood's map. The result of Victorian road engineering is to bring the very heart of the City to the immediate attention of the visitor. Bank Corner has reduced from depth 3 to depth 2 from the outside, as has Cheapside. St Paul's Cathedral is enfolded by shallow streets. Cannon Street drives east-west across the Walbrook, historically a 'great divide' within the City. Gresham Street/Lothbury picks up movement onto the City from London Wall and directs it to Bank Interchange by Princes Street/King William Street. Almost all the significant and long streets of the City are within a turning of the perimeter. Almost all of the remaining streets of the City, even the apparently secluded ones between Cornhill and Lombard Street in the geometric heart of the City, are within 3 steps of the walls. The residue at 4 or more steps is slight. All these internal effects transform the depth of the City from the outside far more than the did the removal of the walls and knit its street grid together in a thoroughgoing way.

3 Lower Thames Street from the Tower end, St Mary Axe, Moorgate Street, Coleman Street, Gresham Street, Queen Victoria Street and Lower Thames Street at the Blackfriars end are all longer than the Ogilby and Morgan routes; the remainder of penetrating lines, some 31 in all, are shorter.

4 Queen Victoria Street and Cornhill excepted.

5 This is a remarkable feature of the modern City, for in many of the smaller streets the pedestrian feels that space is localised, yet this localisation is never brought about by depth from the main routes. On the contrary, it follows from what has been said that nearly every space is itself, or is connected to, a main route into and through the City.
### Table: Data Table for the Four Maps

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### Figures

**Fig 8:34** - Data table for the four maps

**Fig 8:35** - 5% integration core in 1677

**Fig 8:36** - 5% integration core in 1746
A data table for the four maps is reproduced in Fig 8:34. The mean of all the depth values (mean RRA) captures the depth or shallowness of the system as a whole\(^1\). In the City of Ogilby and Morgan, this value is 0.7625. In Rocque's map the value rises to 0.8300. This reflects the tendency for there to be pockets of relatively deep, rather ghetto-like space within the City like those shown in Figs. 8:14 and 8:15, and suggests that this is not a phenomenon of inaccessibility for strangers but also a more generalised distancing effect for the citizens moving from one area of the City to another which is brought about by the structure of the grid. Horwood's map yields a value of 0.7164\(^2\). The mean value for the modern City is 0.6100, confirming the intuition that the spread of spaces is in both cases a good deal shallower and more quashed down than the diamond shape. The modern City is everywhere much shallower than at the time of Ogilby and Morgan, not just for the visitor but also for inhabitants.

**The depth picture through integration.**

A comparison with the pattern of integration in the City over the three centuries of the map record is revealing of the extent of the transformation which has taken place in the urban grid. Mean integration is informative about generalised depth tendencies, but a much clearer picture is given by looking at the distribution of those spaces which draw the system together and those are generally distanced and inaccessible from all other spaces within the grid.

The shape, spread and thrust of the integration core, and the distribution of segregation in Ogilby and Morgan's map has been discussed in detail elsewhere. A comparison of the 5% integration cores in 1677 and 1746 (Figs 8:35, 8:36) shows that despite the fact that the City is more dense in axial lines, the core in Rocque is much more compressed. A slight realignment to the east and south\(^3\) is accompanied by a retraction of the remainder of the core towards Cheapside.

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\(^1\) practically speaking, this compares any system to the values of a diamond-shaped distribution for that number of spaces.

\(^2\) these values should be set against the random west-east input reported in the previous chapter in which it was reported that the mean RRA remained stable at values between 0.7400 and 0.7600 throughout the series.

\(^3\) towards Aldgate and London Bridge.
Fig 8:37 - 10% integration core 1677

Fig 8:38 - 10% integration core 1746
Fig 8.39 - segregation above the mean, 1677

Fig 8.40 - segregation above the mean, 1746
Fig 8.41 - build-up of segregation in the 1746 map
Cheapside is in fact the number 1 integrator, and the first 15 lines hang off Cheapside and extend it at either end, apart from the central part of Bishopsgate (6). The central part of Thames Street enters the core at 16: Thames Street has become more chicained by the mid-eighteenth century. The 5% core is then extended to take in the interstices of Mansion House Corner. Only at the very close of the 5% core does a ring form in the south-west (where the Ogilby and Morgan core was biased) by way of Bow Lane, Thames Street and King Street/Queen Street. A further small ring is made in the east by way of Eastcheap and Clements Lane to Lombard Street. The area around the Royal Exchange, the Mansion House, and the Bank are all becoming more easily accessible as destinations, at the expense of the area of the Saxon township in the south-west of the City.

Raising the core to 10% (Figs 8:37, 8:38) confirms that the emphasis of the core has indeed shifted across the Walbrook to the region between Threadneedle Street and the river. There is a tremendous concentration of shallow streets about the main through routes, not just either side of Cheapside but also along Threadneedle Street, Cornhill Lombard Street/Fenchurch Street and down Bishopgate Street/Gracechurch Street to London bridge. The south-west sector of the City fills out a little, but the emphasis here is not made by weight of numbers so much as by axial length. A few strategic lines are picked out as of global importance, but many others which were picked out by Ogilby and Morgan's map do not feature in Rocque's 10% core.

A comparison of the areas above mean segregation (Figs 8:39, 8:40) makes it clear that there has been a tremendous amount of small-scale, ghetto-like development in the backlands of the urban blocks, not just at the periphery but closer to the geometric heart of the City. The first 120 lines pick out a few tiny areas (A, B, C, D and E in Fig 8:41). From these, dense and more extensive areas grow, not by a cumulative process but by 'seeding' new clumps of segregation in the vicinity of the old (F, G, H, I and K in Fig 8:41). As mean segregation approaches these groups merge into the larger conglomerations shown in Fig 8:40.

1 a precursor of the Bank of England
Fig 8:45 - 5% integration core in 1799

Fig 8:46 - 10% integration core in 1799
There are differences in the distribution of segregation at the mean. All the zones are more densely filled with lines. Queenhythe is less of an enclave; Duke’s Place, Drapers Garden, St. Martin’s and Newgate are more clearly defined than before. The areas around the Tower and Blackfriars are more extensive. A new area close to Cheapside and including Milk Street and Aldermanbury, centres on the new market at Honey Lane. Parts of Leadenhall are also segregated. The segregation of market standings is in direct contrast with the pre-Fire situation, in which street trading centred on the grid of most integrated streets.

If depth from the periphery and integration are a common-sense way of looking at the system from the point of view of visitors and inhabitants respectively, then the potential for interfacing the two categories of pedestrian in street space (Figs 5:43, 5:44) has significantly altered. The inhabitant bias has gone from the south-west of the system. The inhabitant/visitor interface has shifted to the major internal through routes and the immediately adjacent streets. It has become at the same time more extensive and more linear. The areas which are shallow to visitors and relatively inaccessible to inhabitants have become concentrated in three areas in the west; Newgate Market, St. Paul’s and St. Martin’s. Small ghetto-like enclaves have proliferated, some only a stone’s throw from the inhabitant-visitor interface.

By the time of Horwood’s map at the beginning of the nineteenth century (Fig. 5:45) the 5% integration core has spread back towards the south-west quarter of the City. Cheapside is still the number 1 integrator, followed by Cornhill, Lombard Street and Threadneedle Street (2, 3, 4). The line of Gracechurch Street/Fish Street enters at 5 and Walbrook follows at 6. King Street/Queen Street is number 7. As the core fills out it begins to define a square of well-integrated streets centering on Bank Interchange and bounded by Lothbury, Eastcheap, King Street/Queen Street\(^1\) and Gracechurch Street/Fish Street. The compressed, square-wheel core of Ogilby and Morgan’s map has reasserted itself, but in a position slightly to the east of its previous position and centred more firmly upon Bank Corner. Like the Ogilby and Morgan map, Horwood’s core has ‘outliers’ along the riverfront and stretching out out towards Newgate and Aldgate. The focus on

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\(^1\) number 2 in Ogilby and Morgan
Fig 8.47 - segregation above the mean in 1799

Fig 8.48 - sub-areas in 1799
Bank Corner is made clear by raising the core to 10% of lines (Fig 8:46). The majority of new streets which enter the core are short streets between Threadneedle Street and Lombard Street/Fenchurch Street. As before, the 'rim' of the 'square wheel' is reinforced in parts by parallel well-integrated streets.

Segregation (Fig 8:47) is still concentrated around the periphery in a more continuous band of less accessible streets encircling the City. Leadenhall and the area of the Roman fort have become more segregated; Honey Lane and Blackfriars less so. The split between integrated centre and segregated periphery in the City is one of the most persistent features of the plan.

The interface between inhabitants and strangers brought about by the differential access from the perimeter and through generalised depth in Horwood's City is a comparatively simple one (Fig 8:48). The perimeter zone is shallow to visitors coming into the heart of the City but is relatively inaccessible as a destination for all the internal spaces of the urban grid; the centre is shallow to both. Leadenhall is a pocket of relatively deep space from both points of view.

It is this new locus of the integration core geometrically upon the hub at Bank Corner which is acknowledged in the road improvements of the ensuing century. As a result, for the first time in the history of the City Cheapside is not the principal integrator; this role has shifted to Queen Victoria Street (Fig 8:49). The second line to enter the core is another Victorian road improvement following the line of Prince's Street and King William Street. The third line is that of Cannon Street, again a product of Victorian road widening to what was previously an axially deformed route taking 7 axial steps. Cornhill comes into the core at number 4, Cheapside at 5, Lombard Street at 6, Walbrook at 8 and the line behind the Mansion House at 13, all reinforcing the strong 'hub' at Bank interchange in all directions of the compass.

The eastern 'rim' of Gracechurch Street/Bishopsgate enters at line 7, running more extensively than before, but no longer meeting London Bridge at the river¹. King Street/Queen Street enters the core in 9th place, and lines 10 11, and 15 indicate the position of a completely new

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¹ the Bridge was repositioned to the west of old London Bridge in 1831.
Fig 8.49 - 5% integration in 1987

Fig 8.50 - 10% integration in 1987
Fig 8.51 - segregation above the mean, 1987
western 'rim' in the area east of St. Paul's, replacing the 'fan' of the 1677 map. Line 12 continues along the eastern part of Cannon Street to link it more firmly to the 'rim'. Lines 14 and 17 link this Cannon Street intersection with Bishopsgate to the new bridgehead. Line 16, Upper and Lower Thames Streets, adds a second southern 'rim' to the square wheel, an almost identical southerly thrust of the core as in the 1677 map. Line 18 extends Queen Victoria Street to meet the eastern 'rim' at Bishopsgate, 19 augments the western 'rim' and line 20 places the northern 'rim', still in the 1677 and 1799 position along Lothbury. The emphasis in the core then shifts westwards as lines 21 and 22 thrust out from the 'rim' past the line of the old Walls in the west, in the direction of the West End. The remaining lines in the map of 5% of lines consolidate the core in the direction of the River, although at this stage in the build-up of lines there is less consolidation than took place in 1677. Nearly every line added to the modern core is necessary to fill out its main structure. Compared with the 1677 core, the 'hub' of the 'square wheel' is now firmly located at Bank Corner, and Cheapside has been relegated to a (rather minor) spoke radiating from that 'hub'. The 'spokes' which hung from Cheapside in previous cores have gone, and King Street/Queen Street is no longer the 'principal spoke' running at right angles to Cheapside. Between 5% and 10% (Fig 6:50) this more extended 'square wheel' core is consolidated south of Cheapside, and expanded beyond the 'rim' which was established at 5% in all directions. The thrust takes the integration core to the Walls at frequent intervals around the perimeter in the west and north, but not at all in the east - a reversal of the 1677 emphasis.

The map of 50% segregation (Fig 6:51) has also changed, though not so profoundly. The area around the Tower still forms a distinct clump of segregated lines, despite its increased accessibility from the outside. The segregated zone in the west at Blackfriars is extensive. Two further segregated zones are apparent; one around the rear of the Guildhall, the other in the area of Drapers Garden. The more or less continuous segregated band around the perimeter of the City in Horwood's day has shrunk to isolated pockets. All these areas are, today, shallow to the outside of the City and deep when looked at in terms of internal connectivity.
Fig 8.53 - radius 3 integration core at 5A, 1987
Fig 8:55 - PDE core at 5%, 1987

Fig 8:56 - PDE core at 10%, 1987
The relation between the step depth profile of the City from the walls and the structure of integration/segregation is now absolutely simple (Fig 8:52). The City is everywhere shallow to visitors, apart from a slight 'shadow' of depth in the area of Leadenhall Market, while the picture given by integration/segregation is a simple centre-periphery distinction again with a residual 'shadow' of more concentrated segregation closer to the centre in the Leadenhall area. The urban space structure is therefore globalised and visitor-biased: a simpler and more ordered version of the structure anticipated at the time of Horwood.

The City of Ogilby and Morgan was a city of differentiated sub-areas, each of which gave to and accommodated itself within a global whole. Hence the picture produced by local (radius 3) integration was different from that produced by point depth entropy (PDE) which was different again from that given by step depth and generalised integration. The City of 1967 has a much more uniform face. The radius 3 cores in the modern City at 5% and 10% (Figs 8:53, 8:54) are virtually identical to the respective integration cores. The most the most regionalised view is the most global view of the City.

Point depth entropy tells a slightly different story (Figs 8:55, 8:56). The central area of the City is picked out clearly at 5%, but there is less of a concentration of lines in this sector of the City than in either the comparable global (RA) or local (radius 3 RA) cores. By 10% of lines, the PDE core of the modern City shows the greatest differentiation within the modern City to exist between the west, in the Carter Lane area south of St Paul's cathedral, and the area below Fenchurch Street station in the east. From this point of view, the historic division of the City at the Walbrook into two separate settlements each with its own market, administrative duties, and ethos is perpetuated in the spatial configuration of the modern plan.

However, this is the only configurational account which differs from the story told by integration, and connectivity, control and choice cores also pick out a high proportion of the most integrated spaces in the modern City (unlike in the case of Ogilby and Morgan). The set of spaces which features in all four maps at 5% (Fig 8:57) draws the

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1eccentric towards the river
Fig 8:57 - congruent spaces in the 5% integration, choice, connectivity and control maps of the City in 1987
Fig 8.58 - congruent spaces in the 5% integration, choice, connectivity and control maps in 1677.
Fig 8.59 - justified graph from Cheapside, 1677

Fig 8.60 - justified graph from Cheapside, 1987
Fig 8.61 - justified graph from Queen Victoria Street, 1987

Fig 8.62 - justified graph from Queenhythe, 1677
Fig 8.63 - justified graph from Austin Friars, 1987

Fig 8.64 - justified graph from the Guildhall, 1677
outline of the 'square wheel' and reaches out to the east and the west, particularly towards the west. The comparable picture for Ogilby and Morgan's map is completely different (Fig 8:58) in that its emphasis is given to Cheapside, and the 'fans' of streets radiating from each end. Intelligibility for the modern City is 0.66, as compared with a predicted value for that number of spaces of 0.520 (i.e., + 0.139). Predicability is 0.64 as compared with a predicted value for that number of spaces of 0.577 (i.e., + 0.063). Comparative values of 0.491 and 0.514 respectively from the time of Ogilby and Morgan show that the City has considerably improved its 'movement interface'\(^1\) by the cumulative changes of the last century and a half.

The effect of these changes to the structure of the grid can be illustrated graphically by a comparison of depth distributions from some of the more prominent landmarks in the City. The unfolding City grid from Cheapside in 1677 (Fig 8:59) is eight steps deep, with a concentration of streets at three and four levels away. Cheapside in 1967 (Fig 8:60) is, by comparison shallow to most of the City. The deepest space is seven steps away, and most are only two or three steps away from the root of the graph. Yet Cheapside is not the most integrated space of the contemporary City, and the picture from Queen Victoria Street (Fig 8:61) is even more compressed, while the distribution of streets at each level of depth is more even\(^2\).

The deepest space in the City of 1677 is at Queenhythe (Fig 8:62). The shape of the distribution approximates a diamond-shape, some 13 levels deep with most spaces in the centre of the graph and a 'peaky' distribution at the extreme. The 'peaks' represent the deep, wandering courts of Great St. Helens. This goes some way to 'explain' the locus of the PDE core in the area of Queenhythe during this period, since PDE is

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\(^1\) Both intelligibility and predictability are attempts to capture numerically the relation between the workings of the urban grid for inhabitants and strangers. Intelligibility expresses the degree to which the global configuration can be read from the local street; predictability expresses the agreement between the extent to which space is configured to function as a destination for to-movement (measured by integration/segmentation) and as a through-route (measured by choice).

\(^2\) This is not necessarily 'a good thing' for the configuration of the grid seen from Cheapside is more differentiated than it is from Queen Victoria Street, and it is therefore a more structured picture which is given of the City as a whole. That provided from Queen Victoria Street is, comparatively speaking, homogenised.
Fig 8.65 - justified graph from the Guildhall, 1987

Fig 8.66 - justified graph from the west front of St Paul's, 1677
designed precisely to measure the degree of differentiation in the depth distribution from a point, and most of the streets in the immediate vicinity of Queenhythe will show a similar depth distribution to the diamond-shaped graph illustrated here.

The deepest space in the modern City is not at Queenhythe or at Great St Helen's, but it is in the same (north-east) quarter as the latter, and only a block away at that. Fig 6.63 shows the picture from the Austin Friars district, the deepest space in the modern City. The graph is quite different in shape from its 1677 counterpart; more of an up-ended pyramid than a diamond, with 11 levels of depth and most of the spaces 7-9 levels away. This indicates that it is a locally asymmetric area within an otherwise relatively shallow system. The distancing effects in the graph are all brought about in shallow in the graph, where the local labyrinthine qualities of the area exert maximum influence. The opposing point in the deepest space of the graph is under the railway at Holborn Viaduct.

The depth distributions from the apron of the Guildhall in 1677 and 1987 (Figs 6.64, 6.65) show a shift in the opposite direction. At the time of Ogilby and Morgan the graph from this location is approximately square, with roughly equal numbers at each levels 2 and 8 in the graph, and a total depth of 10. The Guildhall is slightly set apart, but only a little separated: the new direct access from King Street/Queen Street ensuring that this governmental building is not too distant from the main theatres of life. In the modern City, the total depth has reduced and, thanks to the road widening and straightening of the intervening centuries, the Guildhall is even more shallow to the majority of City streets. However, the deeper levels of the graph show a pronounced fall-off in the numbers of streets at these more distant levels so that the global distribution of streets away from the root is uneven. These effects are reproduced to a lesser extent in the equivalent views from the front of St Paul's (Fig. 6.66, 6.67).

The changing interface of the City of London.

The data table (Fig. 6.34) presents the changes which the City has undergone in the configuration of its street grid over the last three centuries in a summary form. The City is axially simpler, in that the sheer number of axial lines has fallen over time. This axial
Fig 8:67 - justified graph from the west front of St Paul's, 1987
simplification is accompanied by a fall in the number of islands. There is a virtual elimination of the nondistributed system over the centuries. A slight improvement in line/link ratio suggests that those streets which remain have become, on the whole, more connected locally, and more evenly so since at the extremes connectivity has fallen. Mean PDE distribution has gone up, perhaps indicating that the modern City is less differentiated at the extremes than in the past, but the entropy of RRA has decreased, which indicates that the City has become more structured overall.

Rocque's map is exceptional in that some, but not all of these trends, are momentarily reversed in the mid eighteenth century. The number of axial lines was falling at this time, but the number of distributed lines (i.e., through streets) actually increased, while the value for the non-distributed system (i.e., dead ends) dropped below the value for Horwood's map, half a century later. This system has the lowest line link ratio, and the number of islands actually increased as did the RRA of the system overall. Taken together, these figures suggest that the City was a developing rings of public circulation which were both axially articulated and surrounding a greater number of small, irregular urban blocks.

The question which arises then is how we are to interpret these changes. Reading backwards from present circumstances into the distant past is always contentious, particularly where the subject of study has undergone great changes as is the case with the evolution of the street grid of the City. We can, however, make two clear statements about the sub-area structure of the City today which relate the spatial construction of the urban grid to its empirically observed pattern of use and movement. The modern City has been found to have morphologically-defined sub-areas where the movement interface has a globally differentiated but internally consistent character. The empirically-derived sub-areas in the modern City - Leadenhall, Austin Friars, the area behind the Guildhall, the streets to the north of Cornhill and the well-integrated grid of streets in the geometric centre of the City below Gresham Street match the main sub-areas which are revealed through analysis as the 'theoretical'

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3 see The Sub-area Structure of the Modern City, p.104, Chapter Two for the details.
structure of the movement interface between inhabitants and strangers within the City today (Fig 6:52).

It seems as if we can rely on the relationships given between depth from the outside and generalised depth through integration to pick out a regionalised space structure which has implications for patterns of use. In the modern City, some of the segregated areas were found to over-perform in terms of the numbers of people observed using the streets for their degree of integration. This could result from the local built form conditions, particularly from the effects of tall office buildings which act as a magnet for larger numbers of people than the degree of integration of the space would normally produce by people passing through.

This may be the case to a limited extent, particularly in the Austin Friars area where large, tall building complexes exist. The area around the Guildhall has few buildings which are either so tall or so densely-developed as to obviously 'load' the grid in this way. Moreover, the origin and destination study which was carried out in the City, and which included a street in this area, shows that in terms of the construction of the interface between inhabitants and strangers throughout the City, between 2/3 and 3/4 of the people using the City streets are passing through the area. The more integrated the street, the greater was the average length of trips passing through, but even relatively segregated streets were used by a few people passing through on long journeys.

These findings indicate that the over-performance of the segregated sub-areas within the modern City may be a product of their shallowness to the City's extra-mural hinterland. The City of today does not, of course, have a wall and the street grid has been fine-tuned over the centuries to make the majority of streets at the perimeter shallow and accessible from the surrounding suburbs. This effect was already noticeable at the time of Horwood (Fig 6:32), and is very clear today (Fig 6:33).

Pedestrian movement about the City today may be generated more through a constellation of overlapping regions, rather than by movement towards and away from a dominant centralised core of
streets at the heart of the City, though these do still exist and form a strong, shallow and well-integrated region of their own.

What then might this imply for the sub-area structure of the past, where these differences between sub-areas seem spatially much more pronounced and where the City wall played a much more powerful role in limiting access to the main gates? If the example of the City today is anything to go by, then the large measure of agreement between the 'theoretical' analysis and the 'empirical' data suggests that the sub-area structures revealed by the analyses of the three previous maps may give a reasonably reliable indication of the use and movement characteristics exhibited by those areas historically. However, if the regional dynamics are in any sense given by the inhabitant/stranger interface as they are today, then the presence of segregated, deep sub-areas in the City at the time of Ogilby and Morgan and especially at the time of Rocque, may have rendered them more locally use-orientated, and possibly quieter than those areas which were shallow to people moving through the street system from the outside.

**Market forces and the power of markets: a speculation**

The outstanding question, then, is why the global configuration of the urban grid shifts over time to fine-tune and adjust the relationship between the parts of the City and the overall structure of public space. The story told by analysis is a complex one. It shows the gradual opening up of the City to its hinterland, not only at the boundary by the demolition of the walls and the creation of new routes from the extra-mural suburbs, but in more profound changes in the internal street grid to give a greater global connectivity. Though actual numbers of street intersections fall during the period in question, the spatial compass of those streets which remain increases, and short sections of street, elbow-bends and chicanes are all, for the most part, eliminated.

At the same time, by the time of Horwood the backlands of the islands are no longer dense with tenement blocks, and the urban network has retreated to the main street grid. The almost total elimination of

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4 in more senses than one.
this secondary route system produces a City which is much simpler to negotiate. Most culs-de-sac are only one deep from the main street grid, and therefore visually in touch with through-movement. The City has become more of a single global entity, rather than an accumulation of morphologically differentiated regions; the 'structure of differences' so characteristic at the time of Ogilby and Morgan.

The inhabitant bias in the street space of the City which manifested itself in the relative depth and self-containment of Saxon area in south-west, is eliminated early in the eighteenth century. As the centuries pass, the City becomes everywhere more shallow to the stranger and more integrated for the inhabitant. The route potential for both is reduced as the number of streets steadily falls, and the 'distance' between their experiences of the street grid as they enter or move about the City is correspondingly compressed so that both are co-present for more of the time in fewer and fewer spaces.

At the same time, the 'square wheel' integration core moves to centre on Bank Corner: a focus which reflects the consolidation of the City's major institutions in this area. The shape and spread of the core is constant; the thrust is changed from an eccentric loading to a centralised one, while more of the 'outliers' from the core reach out towards the west where suburban expansion is greatest, and where the political power of the Crown and Parliament reside. Less of a gesture is made to reach out to the slums of the East End where the industries of the City had chosen to relocate, but where a threat so social order was seen to lie.

In the Victorian period, the historic orthogonal emphasis of the street grid gives way to radial one. The Victorian City is a more ordered city, not just because of the increase in the scale of development to the point where more of the blocks accommodate a single, building on a regular ground plan but also because the street grid itself is regularised and tidied up. As a result, the modern City is more ordered, better integrated, more intelligible, more predictable, a more economical movement interface and, above all more globalised. In this respect, the modern City completes at the level of order a transformation which had already happened at the level of structure

\[1\] in the sense of mixing inhabitants and strangers
by Horwood's time. Morphologically speaking, the Georgian era is not, as Summerson suggests the end, but the beginning of a new phase in its development; as a simple visitor-orientated movement interface.

This opening up of the City to outside influences makes intuitive sense. As the City becomes more and more of a small spatial field within an increasingly large conurbation, if it is to survive as a potent force within the growing network of routes it needs to draw more and more of its internal structure shallow to the principal streets, which in turn have to integrate the whole City within the more extended supergrid. Seen in this way, the spatial logic of the global evolutionary trajectory of the City is rational.

It has already been pointed out that the mid-eighteenth century City of Rocque goes against the swelling tide of globalisation and that in this period the City undergoes a temporary increase in complexity and in small-scale, ghetto-like differentiation. Though there are more through streets in the City during this period, and fewer culs-de-sac than in the time of Ogilby and Morgan, and despite the loss of the advantage1 for the citizen in the opening up of the relatively self-referential, self-contained and small-scale grid of trading streets in the south-west of the City above Queenhythe, the walls of the City2 seem to exert a temporary stranglehold on the process of globalisation.

It is with this map, however, that one of the most puzzling features of the entire map sequence comes to the fore, in the move from integration to segregation of the general markets which began in the Restoration period and had its heyday in the middle of the eighteenth century. This seems so antithetical to intuition that it raises the whole question of the shifting inhabitant-stranger interface (and by implication its opposite) in a very precise way. Set against the precedent set by the extensive network of well-integrated street markets which were the historic focus of the City's production and exchange, it seems almost suicidal for this function to move into those parts of the grid which are more segregated for both inhabitants and

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1 if this it be
2 and possibly the intransigent and reactionary nature of the City Fathers for whom, as Grey puts it, 'it was as if the vast metropolis that stretched two miles and more from the walls either side of the City...had entirely escaped the notice of the Common Councilmen'. Grey, op.cit., p234.
visitors to the City, at a time when all other functions are drawing closer to the interface.

Again, two kinds of explanation can be offered up, not one. The first has to do with the changing nature of City markets in Georgian London and beyond: changes which are profound for the working life of the City. The second is to do with the potential offered by space itself to restructure itself internally in response to socio-cultural events. The City, it is suggested, is globalising not just to embed itself spatially more firmly within an expended urban supergrid, but in order to develop transpatially to serve the interests of a changing economy and a changing ruling group. In so doing, it effects a transformation in the nature of the interface which is to set the City upon a new, entirely modern spatial trajectory.

The major development in the City in modern times is in the construction of an entirely new kind of market place from that of the open, permissive and probabilistic street markets which had formed the basis of the City's economy since Saxon times. This new market place is first that of the banks and the insurance companies, and then in more recent times that of the commodity markets and the money market itself. Trade in all these markets is restricted to members of the relevant association. The process of trading is, in other words, more highly determined, and under these conditions space might have an entirely different role to play, not so much that of generating but rather in controlling social encounter.

The principal method of raising large amounts of capital and circulating money during the Restoration period was by bills of exchange. This was an open letter from one individual, addressed to another named individual, requesting him to pay a sum of money to a bill broker on his account, either on demand or at some agreed date. The system was haphazard and entirely dependent on mutual trust.

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1 as in the chapters on Saxon London and Restoration London, one has to do with historical events and the other to do with morphological constraints.
2 that is, by overcoming space to associate things and people who are physically discrete.
Bills were endorsed and passed about instead of ready money. The system was in effect an exchange of credits. Brokerage, the business of exchanging bills and making payment, took place at set times in the Royal Exchange. It was this business which was regularised in the banks 4.

The eighteenth century saw the rise of the bank as a new institutional force within the City. At its inception, the Bank of England was but the primus inter pares, 5 and there were dozens of private banking houses within a stone's throw of the Royal Exchange by the mid-eighteenth century. Much of the business of the banks entailed spatial proximity and a new pattern of encounter among the clerks who transacted this new form of business. Before the Central Clearing House was established in Lombard Street in 1775, the daily activity of the banks could only be conducted face to face. Clerks 6 walked first from bank to bank to exchange bills. Soon they began to make informal arrangements among themselves to meet at convenient 'half way houses', the coffee houses and taverns which were springing up in this part of the City.

Alongside the banks there arose in interest in speculation 7 in joint stock companies. Within the City, the new coffee 8 houses became the meeting places of men of business. The distinction between coffee house and saleroom for imported goods became blurred as merchants.

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4 The events which precipitated the foundation of the Bank of England are notorious. In 1672 Charles II was forced to close the Exchequer, thus ruining two prominent goldsmiths, Sir Robert Vyner and Alderman Blackwell, who lent money to many prominent people, including the Government, at interest. Blackwell also took money on deposit at interest, thus carrying out the two main activities of modern banking. By 1705, the accumulated interest owed was so great that the Excise was charged with repayment, the first item on the national debt. Child's was the first house in the City to concentrate purely on banking after 1690, in the Marygold, a former tavern in Fleet Street. The Bank of England was set up four years later, operating from the Grocers Hall in Poultry. It moved to its present site in Threadneedle Street in 1734.

5 it acted as banker to the banks, and occasionally steered individual houses through periods of crisis.

6 actually known as 'walks clerks'

7 the South Sea Company was formed in 1711 and 'burst' in 1721. Nearly 200 such companies were formed within the early years of the eighteenth century.

8 coffee was introduced to this country in 1650. The fashion soon spread, and was joined by the beverages of tea, chocolate and sherbert.
who preferred to do business in congenial surroundings deserted the Royal Exchange for the coffee houses around Cornhill. Coffee houses became associated with merchants dealing in specific commodities and many imperceptibly changed their function to that of a sale room for imported goods. In this way, the business of the City moved from the street to the sale room during the eighteenth century. Lloyd's marine insurance company had similar origins; founded in a coffee house in Lombard Street in 1691 it rapidly became the centre of international shipping news. The first newspapers had the same birthplace, and rapidly became widely available and avidly read. Others were willing to receive mail for regular clients, and hence the Post Office was born.

During the eighteenth century the City's wealth increasingly became dependent upon international trade rather than on the manufacture of goods or on street trading, and overseas investment companies like the East India Company were the new means to a fortune. In the second half of the eighteenth century, a second means was provided by raising capital for home industry and for the improvement of agricultural land. By the time of Horwood's map, the City was England's banker, the centre of overseas trade, and the largest consumer of the nation's agricultural and industrial products.

In the early nineteenth century the British Empire covered half the world, and its exploration and exploitation required vast capital sums.

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9 as for example in the case of the Baltic trade, the merchants of which frequented the Antwerp Coffee House in Threadneedle Street. This exclusive group was eventually to become the largest importer of foreign grain in England, as well as the centre of the world's shipping market. The Stock Exchange itself grew out of Jonathan's Coffee House in Change Alley.

10 Lloyd's insurance market in Leadenhall Street will now accept any insurable risk. Individual members form syndicates to underwrite the risk so rules of membership are correspondingly strict. Clients wishing to insure must place business through a Lloyd's broker. Fire insurance came into being at the same time.

11 by 1700 the City handled 80% of England's imports, 69% of exports, 86% of re-exports. She owned 140,000 tons of shipping, compared with just over 100,000 for the rest of the country put together.

12 at the peak of its prosperity it employed 4000 men in its Cutler Street warehouses. The Bedford family were amongst those who invested in voyages to India, often waiting two years to reap the (substantial) profits.

13 particularly for the coal and iron industries, and later for the cotton and woollen trades.
all of which were provided by the City\(^1\). The many imports which flooded into London from the colonies during the eighteenth and nineteenth centuries were the City's return on this capital investment, and each had its special market. In the case of perishable products or goods of variable quality\(^2\), each consignment was inspected on arrival at the City offices of the merchant before sales took place at auction or by private treaty.

However, where a product was standardised, as it was with many raw materials\(^3\), a broker could buy in advance of the goods being produced. This was a convenient arrangement, since it protected both buyer and seller from fluctuating prices. This was the principle on which the futures market was born. Forward buying helped to keep trade moving fluidly. By dealing in the relevant futures market a broker could 'hedge his bets' against fluctuating prices. The Commodity Markets, or Exchanges, were concentrated between the Bank of England and the River, in the traditional trading district of the City.

However, it is the work of the Stock Exchange and the complex operations of the money market which make up the bulk of the City's business today. Credit is the mainspring of the City's life since this market operates without money or goods changing hands\(^4\). International banking is centred on Bank of England, but many merchant bankers operate out of the City. The Stock Exchange deals in stocks\(^5\) and shares\(^6\). The foreign exchange market, for which there is no physical locus since business is transacted by international

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\(^1\) City money provided the investment capital for the colonies, the docks handled the vast colonial import-export trade, Lloyds provided the insurance, the Baltic Exchange organised the shipment of goods, the City sold the commodities and the London bullion market fixed the price of gold.

\(^2\) tea (Upper Thames Street), wool (Coleman Street Exchange), furs (between Queen Victoria Street and Upper Thames Street).

\(^3\) the most important were metals (Royal Exchange, Lombard Exchange, Leadenhall Street), but futures markets were also established in rubber, cocoa, shellac, jute, sugar (all offered at the Mincing Lane Sale Rooms) wool, maize and barley (Corn Exchange, Mark Lane, Baltic Exchange, Threadneedle Street and then St. Mary Axe).

\(^4\) unlike the bullion market, which actually handles gold (St. Swithin's Lane) and silver (Great Winchester Street, and Chancery Lane Vaults) in the market

\(^5\) money lent at a fixed rate of interest

\(^6\) money invested in commercial enterprise
telecommunications network, is the most complex of all the City's financial institutions.

Meanwhile, the traditional way of life of citizens was in decline. Industry moved out to the suburbs \(^1\) and the docks and warehouses were relocated down river. As the population of the greater metropolis increased even the general and food markets followed the customers, who were 'voting with their feet' in favour of a more salubrious existence in the outlying suburbs. These were rapidly engulfed \(^2\) by the growing metropolis. The new breed of bankers and speculators did not wish to live within the 'square mile' but in the airy villages to the north of London \(^3\), in the new estates \(^4\).

The evolution of the City's urban structure from the eighteenth century onward is all about spatialising these new institutions. Just as the urban grid accommodated and constituted its social relations with the monastic and military powers in previous eras, so it is that during the eighteenth century the main street grid is taken over by the spatialised commercial interface of an economy which operates through the transaction of symbols rather than goods; symbols whose catchment area is international in scope but whose manipulation is restricted in its membership. The inhabitant-bias of the trading interface of the previous era, as manifested in the relative depth from the walls by strong integration of the area to the south-west of the Walbrook where several of the more specialised food markets and areas of artisan production were located, is no longer of any commercial advantage. On the contrary, it is elsewhere in the City that the banks and joint stock companies tend to locate themselves: on the opposite side of the Walbrook in the area of the original Roman grid.

The forms of business transaction which are emerging in the early eighteenth century depend, just like market-trading, on face-to-face relations. These are however constructed in an entirely different way.

\(^1\) Silkwavers in Spitalfields, clockmakers and jewellers in Clerkenwell, tanners in Bermondsey, coach and furniture makers in Long Acre, and so on.
\(^2\) Knightsbridge, Marylebone, Paddington and St. Pancras.
\(^3\) Hampstead and Highgate, and parts of Islington and Hackney.
\(^4\) built for the Crown in Regent's Park, while the Portman, Harley-Portland, Southampton, Bedford, Grosvenor, Burlington, and Cadogan families had carved-up the greater part of the West End by 1800.
The new businesses does not depend on 'the passing trade' in any way. The more abstract paper transactions are conducted within a closed world of people who are already known to each other and whose credibility is therefore be taken at face-value. Clerks, brokers, clients, and company directors need to meet to 'make the market' every bit as much as the stallholder and his customer, but these meetings are not fortuitous and cannot depend on space to bring them about, except in a generalised way, by increasing accessibility. Business meetings now take place behind the closed doors of private rooms in the coffee house of the City\(^1\).

This generalised accessibility, both internally and to the outside world, is what seems to have occurred as the City became increasingly well-structured globally. Social relations were spatially projected across greater spatial distances The laying out of new streets and the realignment of others knit the City not only into the supergrid of the growing metropolis, but more importantly into the emerging national road network. The New Road\(^2\) which connected London to the northern network of turnpike roads diverted south along the City Road to Moorfields, to give a direct link into the east of the City. The purpose of this new road was to carry not only goods but people, and above all information\(^3\). For the market to operate, information was increasingly required about the state of the nation, the growth of crops, industrial production and political sentiments on a national level. Even today, the operation of the market depends on face-to-face relations\(^4\) and the exchange of information.

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1 this was not just the meetings of clerks to transact the common business of banking. Even the payment of dividends to prominent investors took place in this way
2 now the Euston Road
3 a milestone in this was the setting up of a national service of mail coaches in 1782 which increased the speed of the postal service to nearly ten miles an hour. The service was renowned for its accurate timekeeping, to the discomfort of the passengers whom it carried. The coaching business in London was run by a handful of inkeepers in the City who had stabling for horses arriving late at night and departing early.
4 although deals are made by 'phone or computer link, the City culture is space-dependent. Much of its business is conducted through meetings, exchanges of documents, and the like and its streets are thronged with clerks during office hours whilst at lunchtimes, the City's pubs are full of overflowing with businessmen and women (finally allowed to trade in the 1970s).
Fig 8.68 - the local grid of Newgate and Leadenhall markets, 10% integration, 50% segregation
The tendency to globalisation is already clear by the time of Rocque's map. Both local spatial gestures and major interventions in the street grid of the City suggest this to be the case. The cumulative effect of building activity on the urban grid is to increase the number of through streets and to reduce the depth of courts and alleys. Ironically, the overall effect is to make the City more segregated overall, for the process is taking place piecemeal and within the confines of the walls. Specifically, as the major grid globalises and loses its inhabitant-bias during first half of the eighteenth century, two kinds of local area get 'left behind' and it is the differences between these which suggest that the process of growth and change is not completely arbitrary, for the market areas of the City and its 'enclaves', both relatively segregated for inhabitants and strangers to the City, are systematically different in their local spatial make-up.

Everyone needs bread, but during this period these universal needs move to the secondary interface as the new economy gains the ascendancy. The markets of Rocque's map are more localised both spatially and in their catchment area. They do not have the same 'draw' that the luxury shops and selds of Cheapside exercised throughout the Middle Ages. They do, however, have a distinctive spatial form, which gives them local advantages.

Both the segregated 'enclaves' and the new market areas have a feature in common which 'disadvantages' them in the global integration of the grid. They are both composed of large numbers of relatively short, poorly-connected axial lines. The effect within the global grid is to draw integration away from the heart of the local configuration to the perimeter, so that it passes around the edge.

The three new market areas at Newgate, Honey Lane and Leadenhall have in common that they geometrically regular: they are more ordered in their internal layout. Were this to occur in a global layout the effect would be to homogenise the grid. As a local concentration of streets it has the effect of intensifying the grid locally. If just the local grid is modelled (Fig. 3:68) then the integration core is not confined to the surrounding streets but penetrates into the market.

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1 as, indeed, is Leadenhall Market today.
2 as shown in the chapter on Roman London.
Fig 6:69 - choice cores in the two markets
Fig 8.70 - the local grid of Coleman Street and St Martin le Grand, 10% integration, 50% segregation
Fig 8:71 - choice cores in the two 'enclaves'
area itself\(^1\). This is also the case with the 'choice' core (Fig 8:69). The regular intensification of the grid locally thus counteracts the segregationist tendencies of the grid globally to draw people into centre of the market place. The grid locally works rather like an 'urban village'\(^2\), favouring those inhabitants with local knowledge of the area.

This local integration of the grid does not happen in the case of the 'enclaves' like Blackfriars, St. Martin le Grand, Coleman Street, or Duke's Place\(^3\). Modelled locally, integration still passes around the edge\(^4\) (Fig 8:70) while high choice lines (Fig 8:71) are either at the periphery or fragmented in the centre, neither forms local shallow-to-deep cores of contiguous streets. This suggests that even locally, the separation between 'locals' and strangers is preserved by the configuration of the grid in a way which is labyrinthine and difficult to negotiate. This feature is preserved to a lesser extent in the simplified street grid of the ensuing Horwood map.

It is therefore unsurprising that several of these areas were notorious 'no-go areas' during the eighteenth and nineteenth centuries which were swept away with the road improvements of the Victorian and modern eras. St Martin le Grand was, of course, a Liberty within the City which gave its occupants a measure of protection against the law. Rights of sanctuary also existed at Blackfriars, and even before the Great Fire socially 'risky' activities like the theatre chose this area of the City in which to settle\(^3\). The area to the east of Coleman Street was one of great poverty while Duke's Place was a Jewry.

This line of reasoning is, of course, speculative and we shall never know if the conscious reasoning or sub-liminal collective will of the many individuals who participated in the globalisation of the City was actively engaged in bringing about the changes in its morphological trajectory which have been the subject of this chapter. That these

\(^1\) the effect is present, but less clear at Honey Lane
\(^2\) like Barnsbury village, one of the earliest areas investigated in the UAS. Its physical morphology and space use and movement patterns are fully discussed in Creating Life, Architecture and Behaviour, Vol3 No. 3, 1987.
\(^3\) the effect is present, but less pronounced in Duke's Place and Blackfriars because the boundary of the local area is itself less clear
\(^4\) an effect common in housing estates today
\(^5\) despite the attempts of the City Fathers to dislodge them.
have indeed occurred is beyond doubt. That they are a rational response to market forces seems, with hindsight, equally clear. Taken together these two 'facts' would make the ultimate question of 'motivation'\(^1\) superfluous were it not for the fact that architects are collectively capable of misreading the past and projecting future spatial strategies upon a fallacious understanding of history\(^2\). It is for this reason that Summerson, despite his romanticism, may well be correct in his observation that it is no longer sufficient to chart the unfolding course of urban space and structure. We need now to understand it.

\(^1\) whether individual or social

\(^2\) the 'neighbourhood unit concept' is a case in point, and it therefore will be discussed briefly in the final chapter.
Chapter Nine: Discussion.

A recapitulation of the main issues.

This thesis has its origin in three general and three specific issues for the design of architectural and urban space. The first general question was about the interplay of structure and order in design, which in turn raised questions about the visual and functional properties of built form. Is there a difference between understanding space as it is represented as a map or plan and as it is experienced by moving about within a building or settlement? Can the two viewpoints in any sense be regarded as identical and, if not, is there any mechanism that might enable us reliably infer the workings of a design before the act of building? The second was about the relationship between history and morphology, and the part that concepts like ‘continuity’ and ‘conservation’ might mean in respect of both history and morphology in relation to the urban grid. Can a street grid accommodate historical change and yet perpetuate morphological principles, or do the small, cumulative changes wrought by history transform the grid through time? In other words, what is the relation between morphological evolution and the history of events? The third general question addressed the issue of the kinds of relation that space might in principle have to society. Is its role simply to reflect social purposes or might the spatial forms which societies take do something else, perhaps even disguise social cleavages or work against the tendencies of groups to become bounded and thus to limit social relations?

The three issues which were specific to the City of London took the form of assumptions by the majority of authors writing on the subject. The first was that the urban grid of the City is of great antiquity, of Saxon or mediaeval origin. The second was that the City is an outstanding example of a town which has grown up organically, and hence the shape and form of the urban grid is unplanned. The final assumption was that the urban grid somehow corresponded to social groupings, in that the city is a collection of ‘natural neighbourhoods’. The first assumption was about the physical form of the grid, the second about its functioning, and the third was about the relations between the two. These assumptions have previously clouded
understanding, particularly in arriving at historical and morphological descriptions of the City as built form and social process, and they need to be solved on the way to addressing the general questions outlined above.

In order to disentangle these specific and general issues, it was therefore necessary to arrive at a clear description of the urban grid as space configured for social purposes. The main research task therefore became that of describing and characterising the urban grid the City of London, plotting its morphological continuities and changes over time, seeing if a sub-area structure could be identified on the basis of the configuration of the urban grid, and testing to see if this related to any kind of known social grouping within the City, be it the pattern of wards, parishes, occupations, wealth, or interest groups. The aim throughout was both to address these specific issues and to use the City as a vehicle to explore the more general questions outlined above.

**A spatial account of the City of London.**

Dealing first with the findings which have arisen as an answer to the specific questions relating to the history and evolution of the urban grid in the City of London, then a categoric negative answer can be given to the question of whether the pre-industrial City was a city of natural or inchoate neighbourhoods. This view would require the sub-areas of the City to be broadly similar in make up, and for each to focus inwards upon its own, clearly defined, relatively self-contained and autonomous local urban grid. Each sub-area would correspond to neighbourhood or community groupings.

Detailed investigation of Ogilby and Morgan's map of the City in 1677 confirmed that the City was not made up of a collection of natural neighbourhoods or functional precincts. Nor was spatial clarity found to be a feature of the urban grid. Rather the opposite. Every level of the urban fabric from the definition of the main urban blocks to the identification of important and minor routes seemed to be characterised by ambiguity. Thus, far from making rendering social relations clear and explicit, the distribution within the urban fabric of the important social groupings within the City at the time was masked and disguised by the manner of its spatial embedding.
In answering this question it became clear that, regarded spatially, the City is not in any event a collection of similar local elements, but rather of local singularities. The argument was advanced that the City did, and still does have a sub-area structure, but that this 'regionalisation' of the City is not socially derived or functionally specialised but rather historically differentiated. The global structure of the City is given by the unique combination of sub-areas which are historically generated and have a distinct experiential character - the Saxon town, the area of the Roman fort, the orthogonal grid in the east below Cornhill, Drapers' Garden where the headwaters of the Walbrook prevented building until relatively late in the City's evolution, Austin Friars, Dukes Place, the areas around the perimeter of the City where the religious houses were implanted - but whose morphological combination is fine-tuned and adjusted so that the whole comes to dominate the parts. Thus although sub-areas are a characteristic feature of the City throughout its history, these are not fixed and unchanging entities, and all are differentially embedded and subsumed to the necessity for global integration.

The issue of whether or not the City can be regarded as 'organic', a 'natural' as opposed to an 'artificial' city\(^1\), is therefore less than cut. It is not really accurate to say the City was unplanned, though it was clearly not 'designed' in the architectural sense of the word. Moreover, some historical differentiations of the urban grid were decidedly 'non-organic', notably the Roman and Saxon 'townships' and the same can be said of the Victorian road improvements which were implemented in the heart of the City around Bank Corner. However, there does seem to be a logic to the evolution of the street grid which is dictated thoughout by the main function of the town: first as a centre for the production and exchange of material goods and then as a centre of disembodied communications and a symbolic system of exchange within an international context.

It was suggested that the City's primary integration core up to the middle of the eighteenth century structured so as to draw people in from the perimeter and channel them into a core of shallow trading streets and markets which were also well-integrated and therefore

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\(^1\) to use Alexander's terms. Alexander C. A City is not a Tree, op cit.
Fig. 9.01 - numbers of axial lines against time.

Fig. 9.02 - decrease of *culs-de-sac* with time.

**Equation:**

\[ y = -3.872x + 8298.523, \text{ R-squared: .999} \]

\[ y = -2.652x + 5365.891, \text{ R-squared: .969} \]
easily accessible to the citizens of London. Since these streets were also the locus of shops and 
\textit{seals}, particularly of the wealthier merchants and traders in luxury goods, the system of main streets functioned simultaneously as a movement interface and a trading interface. This relationship between step depth along the routes as they lead into the City from the perimeter, and integration when each space is looked at as a destination for all other spaces in the system, was found to be the \textit{critical relation} in differentiating the sub-areas of the City. It seemed to indicate in a very precise way the manner in which an urban grid can encapsulate the potential both for mixing inhabitants and strangers in different degrees and for creating through differential potential access between the two categories, areas of relative business and quiet repose within the street space of the City.

The picture afforded by the map record does not, however, depict a static situation and changes in the extent to which these differences are constituted by the urban grid seem to accompany changes in the pattern of trade. The period before the Great Fire appears to have been characterised by a build-up of density and complexity in the compressed 'square wheel' core of well-integrated streets centred on Cheapside. This is known to have been accompanied historically by the disposition of different types of generalised and specialised markets which differed in their catchment area from a local appeal to the freemen of the City at one end of the spectrum, to a London, national and international and trade in the monopoly goods and luxury items at the other.

There seems to have been a gradual, steady and inexorable \textit{globalisation} of the grid from 1677 onward. From this period onward the numbers of axial lines constituted by the entire street grid dropped steadily (Fig. 9.01). The shrinkage of the backland system of \textit{cul-de-sac} courts and alleys took place consistently and at a rapid rate throughout the ensuing three centuries (Fig 9.02), until today the numbers of dead-end spaces which remain in the City are negligible. This alone suggests the increased premium which has been placed in this particular urban system on \textit{through-movement} in the more recent past. This spatial change, and the inference which may be drawn from it about the relative significance of through-movement is 
Fig 9.03 - decrease in through streets with time

Fig 9.04 - mean RRA plotted against time
supported by social trends. The indication is that these deeper, dead-end spaces were traditionally inhabited by two specific social groups: by the poorest workmen and day-labourers, whose jobs lay outside the home and who travelled to work rather than waited for trade to pass by the door, and by the very wealthy, who did not engage in trade. Both these groups moved out of the City altogether in the eighteenth century.

The globalisation of the system of through streets is not as obviously uniform through time, though the overall trend is clearly towards a rapid reduction in the complexity of the axial system of use and movement (Fig 9:03). The sub-area structure by the time of Rocque, shows that the City has lost the trading advantage given by the urban grid to local inhabitants, in that their local food and produce markets which were located in the west of the City within the area occupied by the old Saxon township, were relatively inaccessible to strangers approaching from the extra-mural suburbs, but well-integrated within the City's street pattern viewed internally.

This was not the only area to open itself up to a more global social influence, however, and by means of road widening and straightening the City's street grid generally becomes axially more direct as time passes, opening up large, and previously relatively inaccessible areas of the City to its growing hinterland. The mean integration of the City improves through time (Fig 9:04). As it becomes more and more of a small part of a large conurbation, it draws more of its structure of through-streets shallow to the interface, so that as well as becoming easier to negotiate as a street system which is orientated to accessing strangers from the outside, so too it is increasingly easy for people to traverse the City on internal, more local journeys. Thus, the City viewed through time both draws itself together as a street grid and embeds itself more firmly spatially within the growing metropolitan region.

The exception to this general trend was, of course, in Rocque's era where the main street grid underwent a period of growth as measured in the numbers of distributed axial lines. This temporary surge seems to have been produced by two distinct types of local intensification of the street grid during this period. The first was produced by the
building of small-scale, geometrically regular and permanent market buildings which, by virtue of their density of streets and 'gridiness' in morphology, embedded and integrated themselves particularly firmly within the local street grid. The second was a more labyrinthine type local 'enclave' which developed within the backlands of some of the larger urban blocks. These small sub-systems were made up of deep, anti-axial, wandering courts and alleys lined with the tenements and hovels of the poorer and less socially 'acceptable' of the City's inhabitants. These were segregated both globally and within the local street grid.

Both these types of local intensification of the grid were, perhaps, a temporary solution to the problems and paradoxes thrown up as the City street system globalised. The first was about how space might feature in maintaining a local market advantage; the second about how it might preserving a degree of anonymity. Both were short-lived. The globalising effects of simultaneously connecting the City's street grid to its surroundings at the perimeter, and simplifying its internal structure axially through a combination of street straightening and widening, and drawing the backland development shallow to the main street grid, had taken place by the time of Horwood.

The sub-area structure of the City is more or less the same today as it was then. In this very real sense, despite all the changes which have taken place in the City with the introduction of modern methods of transportation, its street grid maintains a regionalised pattern which was apparent well before these interventions took place. The main contribution of the twentieth century seems to have been at the level of the global structure of the urban grid, rather than in changing the sub-area distribution. However, the acceleration of this globalisation process, particularly the virtual elimination of any boundary effect at the walls, may have changed the patterns street space occupancy in the sub-areas of the City so that they have come to play a different role in the use and movement patterns of the City today.

This change seems to be from a pattern dominated by an over-arching centre/periphery relation in the orientation of the grid as a movement interface, to that of a constellation of overlapping patterns of activity
Fig 9.05 - rank ordered RRA of the City in 1677 and 1987, and a magnified version of extreme integration to show the increase in differentiation of streets in the modern era.
Bar Chart for column: $X_1$ integration

Observations
Fig 9.06 - relative entropy of mean RRA decreasing with time, indicating an increase in structure.
within the City, where the central area is a *primum inter pares*, just another, albeit well integrated and well-populated, sub-area.

These trends seem to be reflected in the relation between order and structure within the City as it existed historically and is found today. The City has had three well-ordered inputs into its global spatial fabric. The first two were in its distant past, in the orthogonal grids of Roman London and Alfredian, Saxon London. Both have left their mark historically upon the grid, but its principal trajectory has been as a deformed, well-structured grid of streets which looks visually disordered. The modern period has seen changes within the urban fabric which apparently change the City in the direction of more a orderly, but radial grid. Is this a return to order?

The rank ordered distribution of RRA suggests the opposite (Fig 9:05). Some parts of the City are more strongly integrated as a result of the new radial focus of streets upon Bank Corner, but other areas are equally strongly segregated. Despite the globalisation process and the overall reduction in RRA which has accompanied it, the differentiation between the extremes of integration and segregation (but not the absolute degree of segregation) has actually increased\(^1\) with time (Fig 9:06). The City is more strongly structured today as a result. If anything, the constellation of sub-areas in the City today yields a stronger urban structure than did the sub-areas of the past.

**A social interpretation of the urban grid of the City of London.**

The social logic of the City of London in the early modern period seems to have been one of noncorrespondence between the differentiated morphological sub-areas of the plan and the social groupings which were to be found within the City at the time. Space seemed to assemble locally a variety of people who had little in common other than neighbouriness and contiguity. Streets were not colonised by specific occupational groupings to a marked degree, and people with entirely different skills and occupations 'rubbed shoulders' with each other. Rich and poor were not stratified within the City other than by proximity to major routes and the house of a

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1 note that a **lower** relative entropy value means a **stronger** structure.
A rich merchant was likely to back onto and overshadow the hovels of poorer neighbours. Parish and ward boundaries were 'buried' within the party wall structure of the buildings so that these allegiances were scarcely ever expressed and reinforced by space. The disposition of markets and guild buildings, but even more importantly the very configuration of the street grid of the City, ensured that the streets of the City everwhere contained a mixture of 'locals' and people passing through, or making journeys to specific destinations within the immediate locality. Moreover, people seem to have moved frequently to take advantage of different local conditions within the urban grid during the course of their individual life careers. It has been argued by historians\textsuperscript{1} that this fluidity seems to have contributed to a global social cohesion within the City at the time.

It is fair to say that the streets of the City at this time were the locus of everyday transaction and encounter. It is this, if anything, which seems to have characterised the underlying form of social solidarity which was constituted in the movement interface of the City in 1677. The street space of the City seems to have been the space of what Durkheim has called organic solidarity\textsuperscript{2}. Durkheim has argued that, in organic solidarity, functional interdependence through the division of labour is the basis for social coherence and stability. Every member of society depends directly upon his neighbours to contribute to the general economy all those material and spiritual requirements which the specialisation of work means that he can no longer manufacture for himself. Mutual trust and social cohesion, he argues, are directly due to this functional interdependence. This interpretation would accord with the forms of social activity, transaction and encounter based on street trading which are thought to have taken place in the street space of the City in the seventeenth century and before.

The forms of group association which relied on closed membership, identity of beliefs and the mutual support and self-interest which the proponents of the 'natural neighbourhood' ascribe to urban space, were present in the early modern City, but these found their spatial-

\textsuperscript{1} such as Keene, D., \textit{Cheapside before the Great Fire}, ESRC, London, 1985
\textsuperscript{2} Durkheim E, \textit{The Division of Labour in Society}, Free Press, New York, 1964 edn. Durkheim's concept was based on the division of labour in cities in the Middle Ages and the early modern period. They were, in effect, the model for his concept of organic solidarity, pp181-190.
realisation indoors, in the guild buildings of the City. These associations between craftsmen seem to have been forms of social cohesion and solidarity along the lines of what Durkheim has called mechanical solidarity. Here, space obviously corresponded to group membership in that the guildhall was open only to the members of that specific craft, trade or profession, but most halls were not prominent buildings in the urban landscape and the members showed no marked tendency to live as a group in close proximity to their hall. It seemed sufficient to have a space set aside from daily life where members could meet together to celebrate their common identity. Crafts and guilds did not form their association on the basis of spatial proximity and contiguity. Their common identity reached across space and drew together people in different parts of the City who would not otherwise have met through daily routine.

It has been suggested that the dynamics of a growing trade within the City, right from its foundation in the Roman period, required the urban grid to respond by enhancing its global connectivity and relatedness. The spatial logic of a market economy is to take advantage of the 'passing trade'. Thus it is collectively important that the street pattern constructs an intelligible movement interface between inhabitants locally and strangers passing through, so that all may take advantage of the statistical distribution of people which is brought about by the configuration of the urban grid.

However, in the recent past, there has been a shift from a direct trade in goods and artifacts to symbolic trade in theoretical entities, information and capital. This symbolic trade still requires large numbers of face-to-face transactions to be made, but they differ in the way in which these are spatially embedded and constructed. Specifically, the locus of this trade has changed from the street to the sale room, office, bank, and dealing room, and the everyday transactional basis of the economy has now moved inside buildings. The globalisation of the urban grid is perhaps not only a way of spatialising the new financial institutions and affording them increased generalised accessibility, but also a way of marking this shift from a predominantly spatial to a transpatial form of solidarity.

1 ibid pp. 70-110.
2 i.e., over the last three centuries.
space
inside
buildings

guilds  banking
crafts  finance

celebration  transaction
identity  differentiation
mech.sol.  org.sol.

co-presence  vending
counter  street trading

space
outside
streets

Fig 9.07 - a model of the spatialisation of trade
in 1677 and 1987
Why, though, should the movement interface which is constructed outdoors, within the City's urban grid, be enhanced today, under those very conditions when the probabilistic basis for encounter seems to be less necessary to the daily pattern of work, meeting and social engagement? One speculation is that the urban grid may today play a different part. Clearly, it no longer constructs the space of an organic solidarity\(^1\) which is produced by a functional interdependence through the division of labour. Although this degree of functional specialisation still holds good in society at large, its expression within the urban grid of the modern City does not. The modern City is not a market place in which a vast array of goods and services are offered up for sale by a citizenry of tradesmen and artisans, to supply the each other and the rest of the world. On the contrary, the market of the City today is a more or less unified phenomenon, based almost entirely upon mutual understanding of the financial markets and on competition within what amounts to an artificially manufactured system of credit.

However, trust in this economy of transacted symbols, has to be built into the assumption that social goals are shared, and the collective interest is in ensuring that the 'financial bubble' does not burst. The basis of social solidarity seems to have changed in large measure to one which owes more to a Durkheimian mechanical solidarity raised to a symbolic level, but which is nonetheless based on an identity of beliefs, lifestyle, aspirations and common interests. It is this common identity and mechanical solidarity which City culture today seems to celebrate by projecting it into the streets and realising it, particularly at lunchtime, through co-presence and mutual awareness in the enhanced, compressed and globalised movement interface of the urban grid. The way in which common identity and social differentiation are spatialised within direct and symbolic trade seem to have reversed (Fig 9:07).

The spatial trajectory which the modern City seems to be embarked upon simultaneously contains the elements of globalisation and strong local regionalisation. This may foreshadow the development of middle-class 'enclaves' within the City, but it seems unlikely that these will duplicate the segregationalist tendencies which were found among

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\(^1\) Durkheim, E., *The Division of Labour in Society.*
the poor and socially undesirable sections of society in the eighteenth century. The first candidate, Broadgate, has already arrived - outside the Roman walls but so close as to be, to all intents and purposes, a part of the urban grid of the City.

Broadgate looks distinctive, but it seems to function like yet another sub-area of the modern City. It differs from its American counterparts, the Bonaventura Centre and the Portman Centre, in that it is both embedded spatially into its surrounding urban grid and is open and permissive in its membership. Yet 'membership' there is, for the crowds who throng there at lunchtime are mainly office workers and City people. The people who use Broadgate do not come from the surrounding office blocks, but are drawn into the area from some distance away. Their purpose seems simply to be there. The significance of all this is that the City seems not to be returning to some previous, more orderly but less well-structured state. Rather, the urban grid today seems to be developing a new kind of structure, and one which is appropriate to the forms of solidarity which prevail amongst its users.

Reflections on three general issues: structure/order, history/morphology, and the space/society relation.

These are the specific findings of the thesis for the evolution of the urban grid of the City of London. These findings do, however, provide a touchstone to the general questions which were raised at the outset, and which have significance not only for enhancing our understanding of how the City came to be as it is, but also for the act of urban design.

So far, the account has emphasized the changing interface of the City of London. Underlying continuities in the configuration of the street grid were, however, also identified and these must not be overlooked since they also have a contribution to make to the picture of the urban grid

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1 Use and movement patterns in Broadgate have been studied extensively by the UAS, and it was a part of a study which looked at the 'origin and destination' of static people in the City's squares. The comments which are made here are based on these empirical studies. Refer to the section on Use and Movement Studies in Chapter Two for further details.

2 The average journey length is over 400m, twice that in some of the City's larger but less well-used squares like Old Change Court near St. Paul's Cathedral.
by shedding light on the interplay of history and morphology. These continuities were the dominant east-west organisation of the grid, the importance of the Newgate Street/Cheapside line in drawing the street system shallow to itself, a consistent differentiation between the four cardinal quarters of the City and the persistence of its peripheral 'rim' of segregation.

The persistence of the Newgate Street/Cheapside line as the primary integrator in the City's street grid is instructive, for it demonstrates in a very clear way the interplay of historical events and morphological dynamics. This line was established as a three-step route crossing London during the Roman period and because of its strategic importance in linking the oulying areas in the west of the City where the fort and other military installations were located, to the trading settlement with its basilica and forum in the small grid of streets below Cornhill, it became the integration focus for the town. The shift in the integration core to the west, to the Saxon township above Queenhythe, had the effect of strengthening the focus of the entire street grid on Cheapside, and shifting the core westward to the new settlement. It also marked the beginning of a fan of streets at each end of Cheapside, particularly at Bank Corner. These may have resulted from the necessity to pass around St.Paul's and avoid the ruins of the Roman forum/basilica, whilst at the same time taking advantage of the existing regional road network and of the gateways which were already established at the Roman walls.

The integration focus of the town has shifted from east to west and back again, along a line between Cheapside and the river, ever since its inception. In the midle of the eighteenth century, as the street grid was beginning to globalise, the integration core actually contracted sharply back to the Cheapside focus. Only in the modern era, has a street emerged which is sufficiently globally embeded to rival Cheapside as the integration focus of the town: Queen Victoria Street. But this new street does not 'fit' easily into the observed use and movement pattern, and consistently it underperforms for its degree of integration. Spatially, Queen Victoria Street has the effect of a long random line superimposed upon a short-line grid.
This shifting, compressed 'square wheel core' is of theoretical interest, for the past seems to be retained as submerged influences in the grid. It is possible to recall these, by reversing the logic which caused the grid to change. If the City's mediaeval street grid is made wider and axially more simple than it seems to have been in 1666, at the time when Leake made his map, then it is possible to show in the integration core of the City the shapes of the Roman and Saxon grids. It follows that to evolve from these to the 1666 grid, the street system had to be expanded, intensified and deformed axially to yield a two-level spatial effect of widening the main streets and developing the backlands in other parts of the grid. The one draws the core shallow; the other creates locally more segregated pockets within the interstices of the grid. These are the mechanisms by which the grid must have evolved. The means are something else; that is, the history of the events which brought these changes about through a process of encroachments, widenings, and building programmes that cumulatively took the grid that way.

Other, more specific findings emerged in the course of the study. One of the earliest and most significant acts from the point of view of the City's subsequent morphological trajectory, was the decision to wall the City in an irregular shape during the Roman period. This decision was itself brought about by the configuration of streets and buildings which were already in existence in the closing years of the second century AD when the City acquired its walls, so this too was a morphological outcome of many historical events. However, the irregular shape which the walls took up may have constrained the grid so as to produce a tendency towards segregated space at the perimeter. The set of post-Fire plans demonstrate the range of possible distributions of integration and segregation on the site, once this feature is relegated to a minor role.

Modelling the grid seems to be of some use in investigating these issues. Understanding the effects of overall shape upon the potential for form and structure within the urban grid in the way which has been outlined above, the question of the City's military or civilian origin, the development of the Saxon 'township' and the local properties of markets and 'enclaves' at the time of Rocque were all enhanced by modelling aspects of the urban layout. Through
modelling it is possible to move beyond the apparent inevitability of
the forms which have actually occurred, to see what might have
occurred, given the morphological constraints within which all of
history operates. The insights which this experimentation gives seem
to particularly valuable where a conventional history is absent or
inconclusive.

The relationship between history and morphology records changes not
in unique social process but in the nature of the urban interface which
this implies. History deposits its peculiar idiosyncracies within the grid
which thus become a part of the City and leave their marks upon its
configured spatial layout. History does not go away. All the layers
deposited by historical events are constituted simultaneously within
the present form of the grid.

An urban grid is, it seems, a source of historic 'memory'. This lends a
new meaning to conservation: that of conservation through
morphology. The urban grid can, it seems, conserve principles of
urban form and structure in that it is a large accumulation of syntactic
events. Deformed grids are robust conservers of syntactic principles.
They can absorb a good deal of change without apparently changing
the principles of the layout or disrupting visual order characteristics.
Highly ordered forms are unstable. One non-conforming event can
destroy the visual order. Morphological continuity depends on streets
maintaining a broadly similar relationship within the grid locally and
as a whole and thus continuing to play a similar role in structuring
space. In this respect apparently 'organic' forms like the City have the
dege. Unlike historical conservation it does not depend on a once-and-
for-all fixing of particular buildings, building groups or street lines.
This is a more permissive view of conservation than than history
currently allows.

Finally, in approaching the City with the aim of giving a morphological
account, it was found necessary at every stage to discuss history, for it
emerged that the observed differences in the grid were the product of
historical events and not of social groupings. There are, it seems, two
kinds of 'cause' for urban form not one: a historical explanation, which
will give the particular circumstances which produce towns and
buildings, and a morphological explanation which will give the internal
logic which constrains the process of spatial unfolding without reference to purposes. The final form is given by the statistical workings of spatial laws encoded in a social form. It is necessary to ‘know’ both the laws and the form the encoding takes to understand how form arises.

Thus, insofar as history has a material, physical result, it becomes more significant for a designer to know the circumstances of history not less, for history as it is reflected in morphology is less anecdotal or scene-setting, and more a moulder of form. This view behoves the designer to regard the history of towns and buildings not just as the collective environment of architectural statements or monuments, but as a means to study how historical forces constituted in buildings shape and reformulate the urban grid. If there is more to the planning of public space through a process of fine-tuning the interface which it thereby created between inhabitants and strangers than is usually allowed for in studies of the vernacular, then the supposed ‘individuality’ of public buildings, where their long-term historic importance lies at least as much in their generalised effects in fine-tuning the urban grid as in their monumentality and obviously designed facadism.

So far as order and structure were concerned, it was initially suggested that order might usefully be reserved for those aspects of an urban or architectural layout which contribute to its visual, conceptual clarity. Order tends to be brought about by the repetition of similar, local geometrical elements. Structure was used to refer to the creation of differences between the elements within a configuration which are brought about by relating them together as a spatial system.

It was suggested that the distinction was necessary to solve the problem that a building user cannot be simultaneously everywhere within a configuration in order to see its visual logic. The user is only able to experience configured space as related discontinuities, and piece the whole together from the picture given by the parts. To do this well requires more information than simply that which refers to the space the user is in at the time. S/he needs to know how that
space contributes to and fits into the configuration as a whole: that is to relate the local to the global scale.

It was proposed that the way integration as generalised depth relates to local connectivity, to create a relation between the local and the global as the configuration is progressively experienced structures urban space intelligibly by creating a system of differentiated interior shallownesses. Thus, structure is about intelligibility for the user whereas order is about intelligibility as a conceptual scheme for the external observer.

The analytic distinction between structure and order is really a heuristic device rather than an analytic tool. However, if there is any general lesson for design to be learnt from the interplay of structure and order which emerges as a result of carrying out this study of the evolution of the City of London, it is in informing the debate about 'selfconscious' and 'unselfconscious' design. It is proposed here that the mind can read structure, often without being able consciously to articulate it. The attempt to impose order on structure is a conscious, reflective, discriminating act. The reduction of structure to order through typology is the way in which we most frequently try to deal with the continuum of urban space and form which the record of human settlement presents to us. All too frequently the thing we have mistaken it for, is understanding. An alternative way forward may be to be to raise the principles of structure to a level where of conscious thought, so that both structure and order can be used to reinforce each other so that the visual and the functional aspects of urban form together construct a spatial aesthetic.1

Finally, the idea that if space has any relevance to society it is through the articulation of a hierarchy of scales of private to public space which correspond to different levels of grouping within the community seems not to be a universal recipe for design. The best example of the influence of this scheme of thought upon design is, perhaps, one of the oldest; that is, in Newcourt’s plan for the redesign of the City after the Great Fire of 1666. This study of the City suggests that Newcourt’s vision may not have accorded with the reality on the ground at the time. The fabric of the City seems at this time to have

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1 The concept of the spatial aesthetic is due to Hillier.
cross-cut, masked, disguised and even contradicted social groupings.

It seems possible that a better formulation of the role space might take in relation to urban society may be obtained through clarifying the dimensions of the inhabitant/stranger interface which is constituted by the urban grid. Insofar as the pattern of movement in a town is a function of its pattern of integration, the social function of the urban grid seems to be to generate and control an encounter field of co-presence and mutual awareness. This natural pattern of background use and movement is created and sustained by the grid and the disposition of the buildings within it. It is a statistical entity.

It has already been proposed that the social functioning of this movement interface within the City seems to have evolved to maintain access from the perimeter to the working heart of the capital and to differentially relate the sub-areas of the City together under evolving conditions of trade and social solidarity.

However, so far as design is concerned two further points emerge which are of more general relevance. The first of these concerns the definition of spatial scale in architecture. It has frequently been proposed as axiomatic that 'human scale is small-scale'. This study of the City suggests that the globalisation which seems to have taken place in the City as it became embedded within the growing metropolis may after all have preserved the human-scale of the City\textsuperscript{1} by maintaining the working intelligibility of the street grid. A second point which is implied by this study is that well-meaning intuition may not be adequate to guarantee the creation of lively urban places. It is necessary first to understand the principles of the existing, working grid if a designer wishes to take full advantage of the encounter potential which is already given by the built form. Intelligent design may already be capable of modelling and predicting the impact of development upon the background use and movement pattern of an urban area before the act of building. It may soon be culpable to ignore it.

Epilogue: Welcome Stranger

The opening contention of this thesis was that the ultimate purpose of the greater part of historical study and investigation is to inform present action, or if not to guide intervention in today's world, at least to advance present understanding. The burden of this thesis has been to show how the City of London may be understood to have functioned historically as a movement interface which generated and controlled a field of co-presence and encounter between inhabitants and strangers.

One significant new finding was that yielded by the small 'origin and destination study' which was carried out within the City's streets. This showed that between 2/3 and 3/4 of all the people using the streets of the City are strangers passing through. The likelihood that the majority of people in a street are strangers on long journeys is in direct proportion to the degree of integration of the street within the global urban fabric but, even in segregated areas, considerably more strangers were found than locals. Indeed, the more segregated sub-areas in particular were found consistently to over-perform in terms of the observed numbers of people using them as compared with the predicted value. The contemporary situation probably reflects that which obtained historically, and suggests that strangers were always present in the streets of the City in large numbers.

To anyone familiar with the architectural literature on urban neighbourhoods this contention may seem initially surprising and perhaps a little shocking, for we have become used to streets even in urban areas belonging almost exclusively to the people who live there. In architecture, history seems to have been used for the last generation\(^1\) to misinform about the nature of the urban neighbourhoods of the past. We have come to look upon the pre-industrial city as a collection of small-scale 'urban villages' or 'quartiers' where everyone knew his neighbours, and where strangers were conspicuous by their absence.

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\(^1\) probably the elements of the scheme of thought have been around for much longer, but it is only in the post-war period that they have come together as a scheme of thought which is taken to be so self-evident that it has become 'natural' and taken for granted, rather than consciously debated and argued as was the case in the formation of the ideas in the first half of the twentieth century.
Almost every writer on the subject of urban space in recent years suggests that we should exclude strangers from our city neighbourhoods. This has become almost synonymous with good urban design. Newman\(^1\) even uses historical examples to claim that strangers were 'mechanically controlled' by design in the past, and he shows designers how this should be done in future by 'cues and clues' like symbolic portals, labyrinthine entrances to local areas, and the elimination of non-residential uses from local streets. The idea that strangers are the villain of the piece and should therefore be discouraged from passing through urban neighbourhoods, together with its reliance on historical antecedents, can be traced back to Perry's neighbourhood unit formula\(^2\).

Newman cites Jane Jacobs\(^3\) as a mentor. Yet he fails to take note one of her most significant insights; the necessity for strangers in the streets of our towns and cities. For Jacobs, strangers characterise cities as entities: 'great cities are not like towns only larger; they are not like suburbs only denser. They differ from towns and suburbs in basic ways and one of these is that cities are, by definition, full of strangers......the bedrock attribute of a successful city district is that a person must feel personally safe and secure on the street among all these strangers'\(^4\), and this in a situation where the presence of large numbers of strangers is not confined to designated places of public assembly, but where it is normal for strangers to pass right by the door.

Jacobs' intuitions led her to formulate the proposition that 'a well-used city street is apt to be a safe street'\(^5\) and elsewhere 'by definition, the streets of a city must do the job of handling strangers, for this is where strangers come and go. The streets must not only defend the city against predatory strangers, they must protect the many, many peaceable and well-meaning strangers who use them, ensuring their

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\(^2\) the reader is referred here to the opening section of Chapter Six, when the idea of the natural neighbourhood was presented in detail.


\(^5\) ibid p.44
safety too as they pass through..... Everyone must use the streets. It seems that Jacobs may have articulated a very real property of urban living. Urbanity may depend on strangers, and not on their exclusion.

We are now reaping the consequences of misreading the lessons of the past, and the promise for 'community by design' along the lines of some supposed ideal drawn from history is widely held to be empty: a recipe for a variety of social ills from malaise, *anomie*, vandalism, crime and the under-use and abuse of public space within our towns and cities. The people who live in the new 'urban villages' are, it seems, not present in sufficient numbers to make places live.

This thesis challenges the assumption that strangers are an unnecessary evil in our towns and cities, for it is their presence not their absence which points in the direction of well-used, safe and lively streets. However, if we aim to welcome strangers and incorporate into future urban neighbourhoods all the advantages which they bring, then this heightens the need to bring understanding of the structure and functioning of the urban grid, as well as intuition, to the drawing board.

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1 ibid., p.45.
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