

BERLIN IN TRANSITION

Using Space Syntax to analyse the relationship between land use, land value and urban morphology.

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0 Abstract

The paper explores the relationship between land use, land value patterns and the morphology of the urban grid in the commercial property market. Berlin is used as a unique case study in this relationship because the dramatic spatial changes with the division and recent reunification of the city offer an example of very marked urban morphological change. Intensive restructuring of land use and land value patterns since the fall of the wall (as evidenced in the development boom and more recently recession) are related to changes in the pattern of accessibility. Reconstructed maps of the historical distribution of land uses also allow the contemporary urban transition to be seen in the context of the longer term evolution of the urban economy. A series of axial maps are used to trace the urban morphology of Berlin from the seventeenth century to the present day and relate the development of land use patterns to the spatial structure. The contemporary transition is then analysed by correlating the axial analysis with property market data of commercial rental contour maps and a database of the location of office and retail buildings of the recent wave of development. The findings show that both in the longer term and in the present day, the morphology of the grid plays a fundamental role in the organisation of urban property markets. The contemporary shift in land values shown in rental contours is directly related to the shift in global integration from the postwar West Berlin Centre into the former East Berlin area of Mitte where no market in land existed during division. The redistribution of land uses can be shown to be strongly related to the pattern of integration, particularly in the current redevelopment of areas that had been so peripheral during division like Potsdamer Platz on the Western side and Friedrichstraße in East Berlin, which since the fall of the wall are once again in the core of the city. Further research on applying Space Syntax to analyse more detailed property market data from Berlin using Geographic Information Systems is outlined.

1 Introduction

As the estate agent saying goes, “three things are important in the property market: location, location and location”. However the exact nature of the relationship between market processes and their spatial organisation in the city is not clearly understood and elicits little consensus. Indeed, the spatial organisation of the property market is not only a difficult problem for urban theory but is also a major practical concern for developers. This is especially true for the office market; despite its meteoric rise in importance over the last 20 years, it is still not possible to say that the role of such spatial variables as accessibility or centrality are clearly understood.

Berlin in the 1990s represents a unique opportunity to study the relationship between property market processes and their spatial organisation because there has been both a radical change in the spatial structure of the city and a large development

04.1

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04.2

boom¹. It is clear to all developers that the new Berlin emerging after the wall has a new spatial organisation. Property agents have had to completely rethink ideas about where the centre of the city is and which are prime locations for commercial purposes within this new geography. Reunified Berlin is thus essentially a new urban structure which has necessitated an economic re-valuing of location both by commercial tenants, who must reconsider where the best place to be is and how much they are prepared to pay for it, and by developers currently building an enormous amount of floor space in Berlin. The change in the accessibility of different locations within the city is itself a phenomenon with which everyone in the market must contend.

It is this phenomenon of a changing urban structure and a changing market, perhaps unique in Berlin for its extremity, that is the case study for ongoing doctoral research. The focus is the relationship between the three variables of land use, land value and the urban spatial structure. The hypothesis is that *there is* a systematic relationship between these variables and that this relation should be evidenced in the profound changes to all three that are taking place in Berlin. Space Syntax techniques of configurational analysis are used to provide purely morphological accessibility data on Berlin's changing spatial structure to which the patterns of land use and land value can be related.

Firstly, evidence about the historical development of this relationship in Berlin's evolution as a city will be presented. Then a more detailed focus on the period since the fall of the wall will be made.

2 Berlin Before the Wall

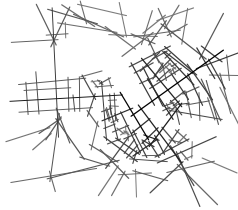
In 1987 the Berlin Senate published a series of reconstructed historical maps to mark the 700th anniversary of the founding of the city (Aust and Stark 1987). These maps offer a unique opportunity to trace the morphological development of a city with accurate axial analysis because cartographically precise maps of the street network from 1650 have been reconstructed with reference to the archaeological record and other available sources. The maps also contain contemporary land use categorisations of the urban past. Key differences such as residential, industrial, commercial (office and retail) uses, continuous shopfronts and public buildings are coded using the German building use code (*Baunutzungsverordnung*) and represented in colour.

As data sources, the historical land use maps have some limitations that must be recognised. Before the mid-nineteenth century the maps tend to describe most of the city as 'mixed area'. This partly reflects the lack of more clearly specialised building structures in the archaeological record before industrial urbanism but also reflects the research problem that the maps are based on very fragmentary evidence before more detailed surveying and address book data began to be collected in the nineteenth century². However, with the industrialisation of Berlin the pattern of land uses begins to reflect modern categorisation with a clear distinction between the Central Business District, shopping streets and the more residential areas.

The way in which the distribution of commercial land uses, especially the concentration of the Central Business District, emerged with this expansion of the city can be shown to be very strongly related to the changing pattern of accessibility.



Figure 1. Axial Map of Berlin in 1650 (Global Integration). Early Berlin was made of the twin cities of Kölln (on the island South-West) and Berlin (to the North-East) at a crossing of the river Spree.



04.3

Figure 2. Axial Map of Berlin in 1690 (Global Integration). With the first major extension of the towns fortifications by 1690, strategic lines moving Westwards extend the core of the city around the Schloß (Palace) to the ceremonial axis Unter Den Linden- the darker horizontal line to the West.

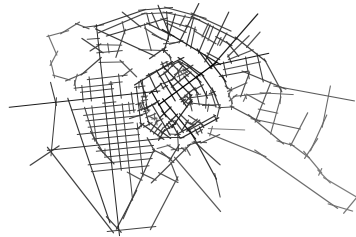


Figure 3. Axial Map of Berlin in 1750 (Global Integration). Residential expansion of Berlin to the West created the gridlike area of Friedrichstadt.



Figure 4. Axial Map of Berlin in 1850 (Global Integration). This pattern of growth to the West has shifted the global core out of the walled city into the Friedrichstadt area with Friedrichstraße and Unter den Linden as the most globally integrated lines. By 1850 the settlement had grown outwards from Friedrichstadt and begun to link formerly independent villages into the continuous urban form.



Figure 5. Axial Map of Berlin in 1940 (Global Integration). By 1940 the area of the Hobrecht plan has filled spaces between the city and outer villages and forms a continuous urban fabric radiating from Mitte.

Figure 6. Relationship of Local to Global Integration in 1650.

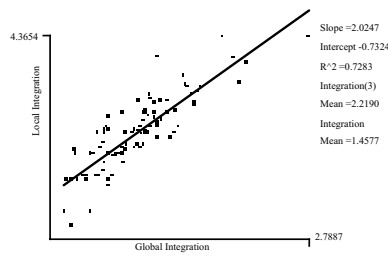
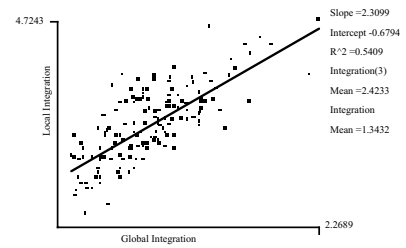


Figure 7. Relationship of Local to Global Integration in 1690.



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Figure 8. Relationship of Local to Global Integration in 1750.

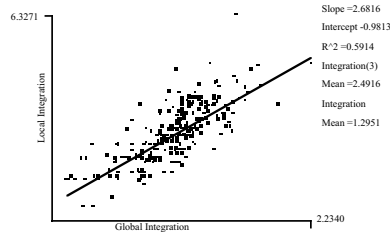


Figure 9. Relationship of Local to Global Integration in 1850.

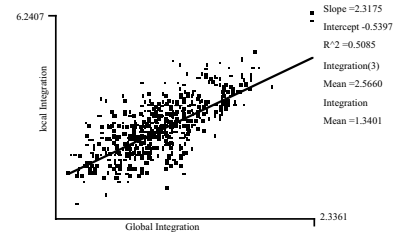
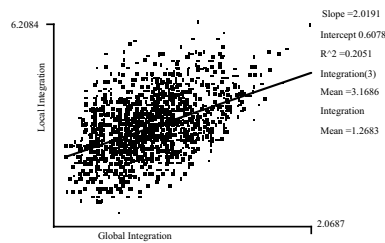


Figure 10. Relationship of Local to Global Integration in 1940.



Axial map models reveal a clear process of morphological change as Berlin grew, with the global integration core of the city shifting Westwards as the built area expanded. This can be seen in figures 1 to 5 of global integration of Berlin from 1650 to 1940.

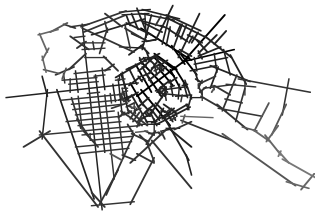


Figure 11. Berlin 1750 Step Depth from Rathausstraße.



Figure 12. Berlin 1750 Step Depth from Friedrichstraße.

Early Berlin was made of the twin cities of Kölln and Berlin at a crossing of the river Spree. The two-town structure is clearly visible in the 1650 axial map of figure 1: the most globally integrated line was the Rathausstraße that formed a continuous axis through Berlin passing the town hall and bridging across the river to the Schloß (Palace) in Kölln. The global integration core can be seen to shift as the city developed Westwards. By 1750 the structure of integration has been more dramatically influenced by the new residential expansion of Berlin to West governed by court that created the gridlike area of Friedrichstadt. The highly integrated morphology of this area led to a break in the relation of local and global cores, with the new North-South axis of Friedrichstraße (a full four steps of depth from the global integration core) as the most locally integrated line.

This shift in the relation of local and global can be seen in the correlation of these values: the outlying point of the scatter for 1750 in figure 8 is the highly locally integrated Friedrichstraße. The enlightenment expansion had led to a new area strongly focused around Friedrichstraße and quite autonomous from the old, walled city. The early core of Rathausstraße obtained global importance from its bridging role across the river but ceased to be so significant locally as the morphology grew westwards without prioritising this link, as can be seen in the step depth comparison of figures 11 and 12. By 1850 the settlement had grown around the Friedrichstadt area and begun to link formerly independent outer villages into the continuous urban form, as

can be seen in figure 4. This pattern of growth to the West has actually shifted the global core out of the walled city into Friedrichstadt with Friedrichstraße and Unter den Linden as the most globally integrated lines.

The axial map of Berlin in 1940 (figure 5) shows the integration structure of the city once it had filled the area of the Hobrecht Plan and reached the height of population before the war. The global integration core of the city is in the area known as ‘Mitte’ with the three lines of Friedrichstraße, Unter Den Linden and Leipziger Straße as the most important routes. The star-shaped intersection of highly integrated lines at the Western end of Leipziger Straße was the Potsdamer Platz, reputedly continental Europe’s busiest traffic interchange before the war.

With the expansion of the city came the land use changes typical of industrialisation in the development of a Central Business District where a clearly visible core of commercial buildings are clustered. This is shown in figure 16 of the land use pattern in 1940. The location of this CBD has developed following the core of global integration very clearly; it spreads out from the old core of the medieval city to concentrate around Friedrichstraße and Potsdamer Platz. Thus the centre of accessibility shown in the axial map has been taken over by commercial land uses.

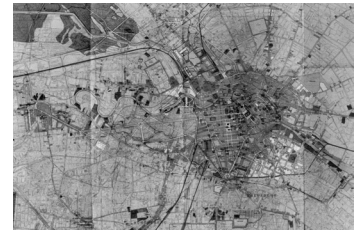
Writing in the 1930s, the Berlin geographer Louis described the commercialisation of this area around the streets of the global integration core:

“It had long been abandoned as a place of residence by members of the official caste, who had moved westwards, and since about 1860 it had also been losing its characteristic lower-middle class inhabitants through transformation into part of Berlin’s urban core. Only a few fringe areas were still essentially residential; otherwise the inner city had been invaded by uses such as shops, offices, warehouses, and workshops, as well as by the characteristic small cafes serving the workers. The process was reflected in urban morphology; the two or three storey houses built in the seventeenth, eighteenth and early nineteenth centuries...had been partially replaced by purpose built commercial buildings.” (Louis 1936)

3 The Divided City

The complex pattern of commercial land uses that had evolved in the centre of the city by 1940 was more or less completely destroyed by the war, as can be seen by the destruction of buildings shown in figure 17.

This concentration of bombed buildings in the city centre was known as the “dead eye” of city. Immediate damage to the built form was followed by the turbulent years of occupation leading up to the building of the wall in 1961. West Berlin’s industry, which had already lost about 23% of its pre-war capacity through wartime destruction³, lost a further 53% (or 70% of what remained) through Soviet dismantling in 1945. During the following blockade West Berlin emerged economically crippled as the island city cut off from former markets and suppliers in its surrounding areas that were the Eastern Zone. By 1989 only 7 of the top 500 German industrial and service sector firms had their headquarters in Berlin⁴.



04.5

Figure 13. Berlin Land Use Map 1850. This was the extent of the built up area at the beginning of industrialisation.



Figure 14. Hobrecht Extension Plan of 1856. This plan to manage rapid urban growth dominated the pattern of development until the first world war. It extended the major route structure by creating long radial streets out from the centre and filled in the areas between the peripheral settlements with semi-regular small grids. This period of urban expansion, known as the ‘foundation years’, saw the development of a metropolitan pattern of land uses with a recognisable Central Business District.

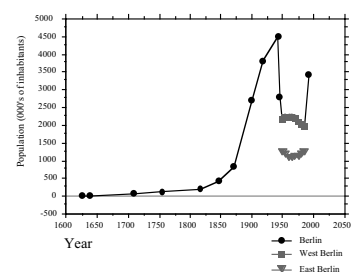


Figure 15. Population Development of Berlin. The rapid urban growth with industrialisation in the late nineteenth century is reflected in the population growth, reaching a peak in 1940 before the destruction of the war and division of the city.

04.6



Figure 16. Land Use Map of Berlin in 1940. The darker area is the concentration of commercial land uses in the Central Business District.

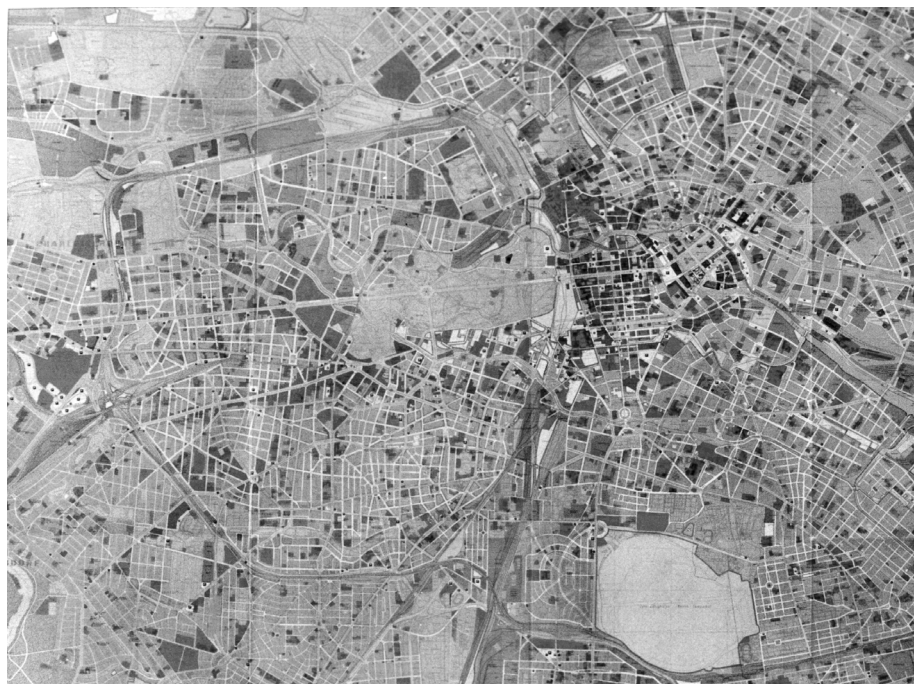
The radical spatial effect that the building of the wall had on the structure of the city can be seen in the map of global integration in 1986 (figure 20). The core of the city has shifted out of Mitte to two new centres: one in the West around the Bahnhof Zoo/ Kurfürstendamm area and the other in the East at the intersection of lines at Alexanderplatz. This new global integration core in West Berlin is exactly the location of the West Berlin Central Business District as it emerged in the years after division. Figure 18 of land use in 1986 shows the new concentration of core uses around Bahnhof Zoo and along the Kurfürstendamm. This West Berlin CBD developed quite quickly after the second world war and apart from some intervention later in the 1970s, it was relatively unplanned. Figure 19 shows the extent of the CBD, which formed a triangle shape around Bahnhof Zoo.



Figure 17. Damaged and Destroyed Buildings in Berlin 1945. Darker buildings were totally destroyed, lighter ones damaged but repairable.

In East Berlin the new integration core shifted Eastwards out to Alexanderplatz on the edge of the pre-war city centre. The land use structure of East Berlin where no commercial market in property existed (indeed where no Central Business District as such existed) was, of course, a different matter as market forces played no role in the determination of new building functions. However, the major redevelopment of a retail and entertainment 'centre' was at the Alexanderplatz, at the new core of integration. The effects of central planning in East Berlin are discernible in the land use pattern. A huge decrease in the number of buildings with core uses in Mitte is clearly visible in figure 18. This was partly a legacy of the loss of building stock in the war (resources were not available to rebuild much of the empty plots), partly a result of the loss of land to the wall itself and partly a result of the deliberate policy to prioritise housing over other uses.

The axial map also highlights the 'inner city fringe' phenomenon created by division: areas along the wall are highly segregated despite their geographical centrality. This is particularly clear for Kreuzberg and Wedding in West Berlin because the 'C' shape of the wall created areas bounded on three sides and thus broke the majority of global links to the city that these areas had. This led to a peculiar characteristic of



04.7

areas that were highly locally integrated and yet globally very segregated. This spatial change was followed by changes in land use. In residential areas of West Berlin near the wall the huge drop in housing prices led to a very different population mix that was typified by socially excluded minority groups. Kreuzberg became the centre for German 'alternative' culture, famous for anarchist groups and the squatter movement that filled the empty 'Mietskasernen' apartment blocks. Neukölln and Wedding became areas of concentrated Turkish immigrant workers and their families. The main commercial streets near the wall were now far from the CBD and fell into disrepair; the Potsdamer Straße, which used to be the bustling main route into Potsdamer Platz before the war, was terminated at the edge of West Berlin by the wall and became notorious for 'fringe uses' such as prostitution and narcotics.

The divided city thus exhibited a total break with the past in terms of street morphology and the geography of commercial land uses. Division radically altered the pattern of accessibility by creating two integration cores far from the wall. Commercial uses abandoned the old centre of the city after the destruction of the war and moved out to the new centres of East and West Berlin.

4 Reunification

The profound effect of reunification on the pattern of global integration can be seen in the difference between the axial maps of divided and reunified Berlin in figures 20 and 21. The removal of the wall resulted in the move to one distinct new global integration core in the Mitte area. This reunified core is also structurally a much more concentrated one than the two centres during division, clearly prioritising three main lines of Friedrichstraße, Unter Den Linden and Leipziger Straße. Alexanderplatz is also very well integrated globally - partly due to the street widening measures during division. However, the Western CBD around Bahnhof Zoo is much less spatially strategic with respect to the city as a whole. On the global measure it lies well outside the core.

Figure 18. Land Use Map of Berlin in 1986.



Figure 19. Location of the West Berlin Central Business District. (Elkins and Hofmeister 1988)

04.8

Figure 20. 1986 Axial Map of Divided Berlin (Global Integration).



Figure 21. 1995 Axial Map of Reunified Berlin (Global Integration).

This spatial change has been followed by a restructuring of land value patterns and commercial land uses in the property development boom that has taken place. The city was transformed from the provincial island of West Berlin and the bankrupt capital of a small communist country to the new capital of Germany, the largest and the most powerful economy in Europe. The shortage of modern office buildings in Berlin combined with the interest from German and European companies to establish some presence in the city led to a rapid inflation of rental values, as can be seen in figure 26. As recession had hit the construction industry in London and Paris, Berlin was seen as the 'honey pot' for European developers who rushed to build modern office and retail space.

This property boom began the development of new spatial distribution of rental contours and commercial land use concentrations. As can be seen in figure 22, Berlin has two peaks in office rental contours after reunification. One is clearly the West Berlin CBD that had developed since the war. The Western prime area is around Bahnhof Zoo exactly where the core of global integration was situated during divided Berlin. The A1 streets shown in figure 23 of Kurfürstendamm and Tauenziehenstraße are the most integrated streets of the West Berlin axial map.

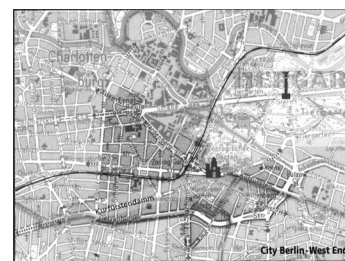
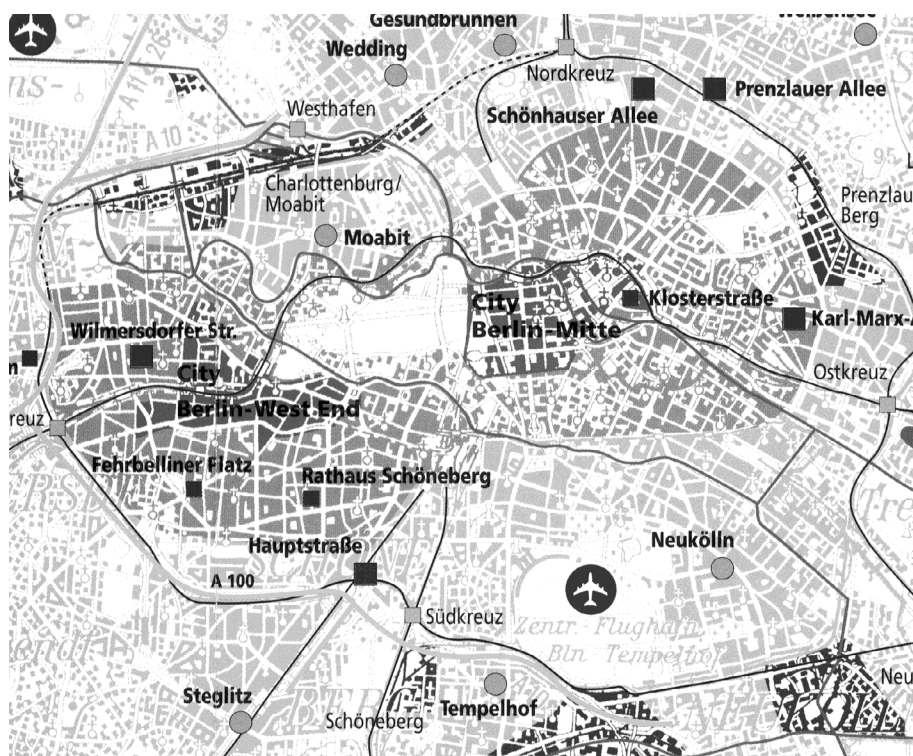


Figure 23. Western AI Prime Commercial Streets (Jones Lang Wootton).

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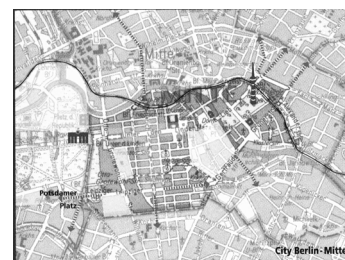


Figure 24. Eastern AI Prime Commercial Streets (Jones Lang Wootton).

Figure 22: Office Rental Contours in Reunified Berlin (Jones Lang Wootton)

However, along with this established office location in the West Berlin CBD is a new centre located in the former East Berlin. This has developed in the Mitte area, closely following the *new* core of global integration. The rental values for offices in this area have actually eclipsed those of the established Western CBD (figure 25). As can be seen in figure 24, the AI prime streets are also Friedrichstraße, Unter Den Linden and Leipziger Straße⁵ which are the most integrated lines of the reunified Berlin axial map. The rise of this area since reunification is even more dramatic when considered that it was in East Berlin and in relatively poor disrepair with almost no modern office space.

The spatial effect that the fall of the wall had on Berlin's two CBDs is revealed by looking at the way that the relationship of these two local areas to the city as a whole has changed. The scatter in figure 29 shows the 'local area effect' of the West Berlin CBD during division⁷. It forms a very tight scatter of its own crossing the regression line at the highly globally integrated end of the scatter for the city as a whole. The same area within reunified Berlin has a very different local area effect, it is now more layered, no longer at the most globally integrated end of the scatter and no longer such a tight fit around its own regression line. The same comparison for the Mitte area shows almost the exact opposite effect from reunification- within the East Berlin model Mitte does not exhibit much local area effect- its regression line is very close to that of the city as a whole. However, the Mitte area in reunified Berlin exhibits a very similar pattern to the position that the Western CBD had before reunification- it forms a tight scatter at the most integrated end of the spectrum crossing the regression line steeply. Relative to the rest of the city, Mitte has gained the kind of prime spatial position that the West Berlin CBD had during division.

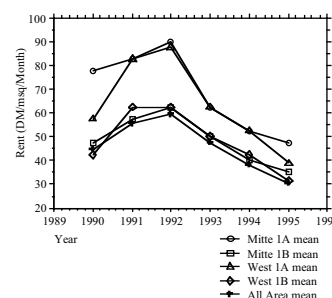


Fig. 25. Mean office rental levels in Various Berlin Areas. The West Berlin CBD has maintained its position as a rental hot-spot, but Mitte in former East Berlin is the new 1A district.⁶

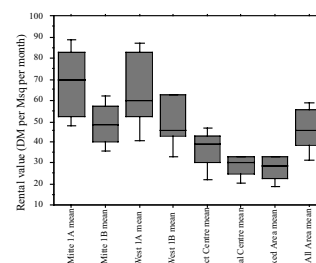


Fig. 26. Box Plot of mean office rental values (1990-1995). The greatest fluctuation in values through boom and recession has occurred in the 1A areas of the centre, the peripheral locations have shown much less variation.

Figure 27: Integration of West Berlin CBD (Highlighted) in West Berlin. Before reunification the area was highly integrated and had a strong correlation of local to global accessibility.

Figure 28: Integration of West Berlin CBD (Highlighted) in Reunified Berlin. The same area in reunified Berlin is relatively less integrated and has a much weaker correlation of local to global.

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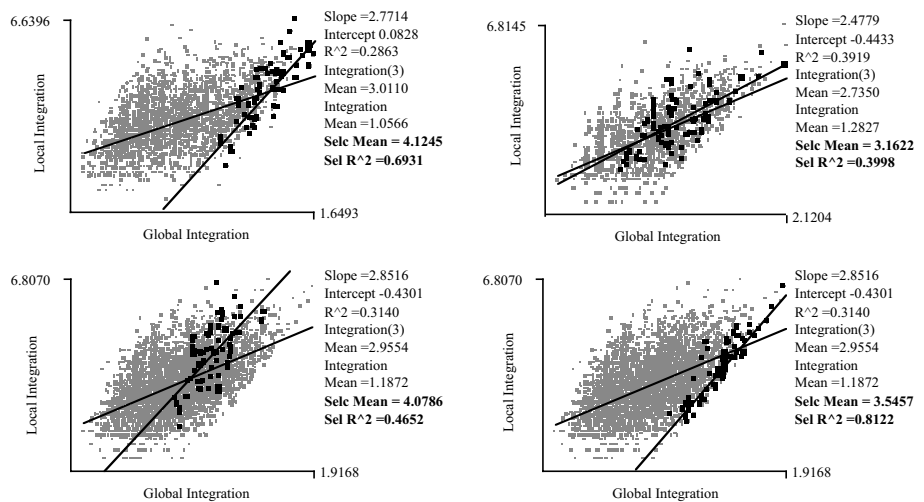


Figure 29: Integration of Mitte Area (Highlighted) in East Berlin. Before reunification, Mitte exhibited almost no 'local area effect' as can be seen in the very poor correlation.

Figure 30: Integration of Mitte (Highlighted) in Reunified Berlin. The same area in reunified Berlin is now the most integrated of all, and exhibits an extremely powerful correlation.

Figure 31. Local Integration in Reunified Berlin (radius=3). As has been found in many other Western cities, the most locally integrated lines are also the most important shopping streets.

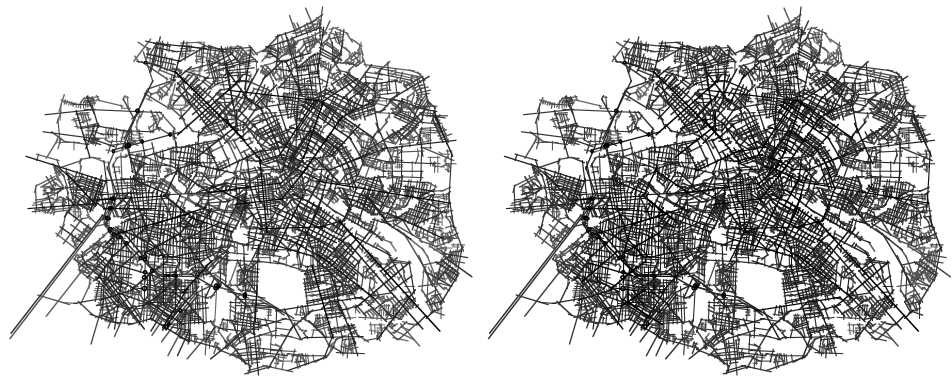


Figure 32: Radius 7 Integration in Reunified Berlin. One of the most oft cited aspects of Berlin is the polycentrality of its spatial structure, which is brought out in this radius of integration.

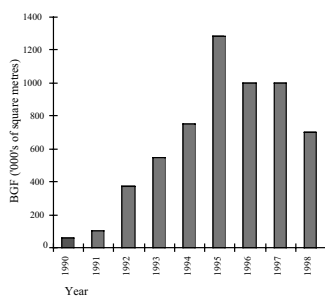


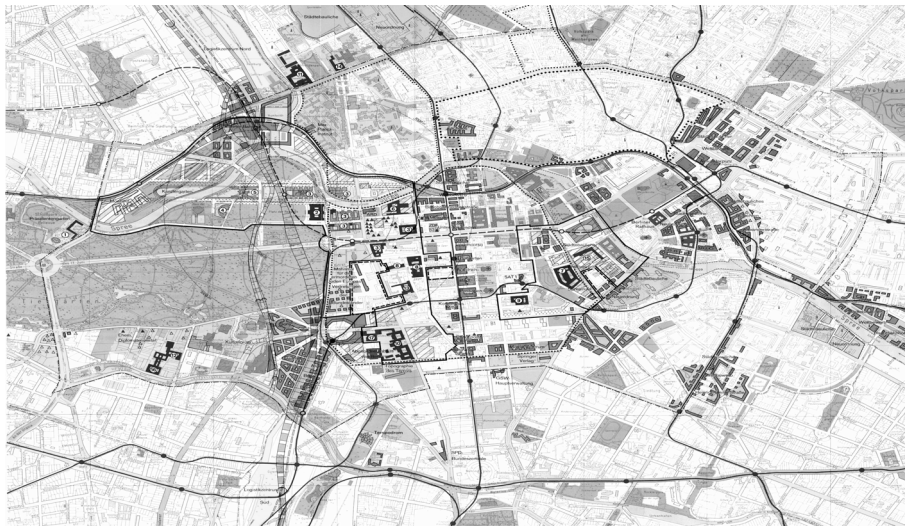
Fig. 33. New Office Building Completions. The 'snowball' effect of supply as more projects were finished can be seen upto 1995. After this point the amount of floorspace stopped growing as developers reacted to the slump by stopping many projects that were not yet too far into development..

5 The Supply Side

As well as the rise in rental values, reunification was also followed by a massive boom in new building to begin filling the deficit of modern office space in Berlin. Within 5 years around DM 65 billion of private investment has gone into commercial buildings in Berlin. This is without counting the large volume of projects not yet through planning. Between 1991 and 1998 at least 660 projects with 9.47 million m² gross floor space will be completed. The huge supply of new commercial buildings is transforming the land use structure of the city and also appears to be strongly related to the change in integration. These projects are mainly office (71% of floor space), but also have other uses- 12% housing, 10% retail, 3% Hotel/cultural uses and 4% industrial⁸.

Like the rental contours, the supply of new buildings has concentrated in two centres of the West Berlin CBD and Mitte in the East. However, the integration core of reunified Berlin in Mitte has attracted a much greater concentration of building activity than the Western CBD. 'City Ost' already has 15% of gross floor space completions compared to only 3% in City West⁹.

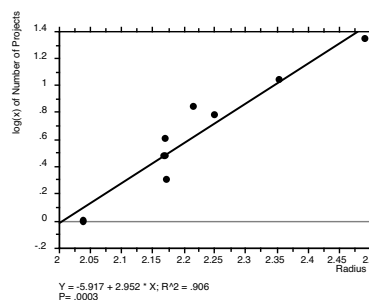
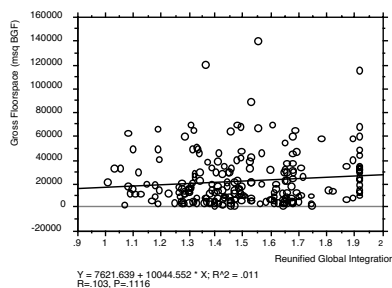
Given the strong resemblance of rental contours to the pattern of integration, it might be expected that the amount of floorspace in individual buildings would be related to the integration of their location. Would developers not wish to realise more floorspace on a more prime site? But the indications from a pilot study¹¹ of 250 buildings in 1994 suggests that this is not the case. As can be seen in figure 35, there was no relationship between building size and integration¹². Thus there are small



04.11

and large buildings in prime locations and, more ominously, small and large buildings in the more segregated locations. This could be the result of many factors such as speculation, site availability and planning restrictions. The landlords market in the boom years after the wall led many to believe that anything could be let in Berlin and thus little concern was paid to the choice of site location in some cases. The availability of developable plots combined with planning restrictions like the 5 floor eaves height in Berlin must also have an impact on the pattern of realised floorspace: it may just not be possible to build larger buildings on better integrated sites.

Figure 34. Major Building Projects in Reunified Berlin. The largest linear cluster of projects along Friedrichstraße (the most integrated line in the axial map) can be seen in the centre from North to South. The major cluster of development at Potsdamer Platz can be seen to the South West of Friedrichstraße and the planned redevelopment of Alexanderplatz (not yet on site) can be seen to the North East.¹⁰



The linear clustering of buildings does, however, appear to be strongly related to integration in the buildings of the pilot study. Figure 36 shows the relationship between sizes of project clusters on streets (the number of projects on an axial line, which varies from 0 up to the 25 projects on Friedrichstraße) and the mean integration of streets with that number of buildings. Here there is a strong relation to integration, and it is the radius 7 measure that best correlates. This is probably because the radius 7 has strong values for both the Western and Eastern CBDs and all the important radial lines. However, it has not yet been possible to control these preliminary findings for the amount of developable space along a line, and so this pattern is only suggestive until access to more data on available building sites can be obtained.

Figure 35. Relationship Between Individual Project Floor Space and Global Integration.

Figure 36. Relationship Between Mean Integration Radius 7 Values of Lines and Number of Projects (Log).

6 Recession and the ‘Selecting Out’ of the Property Market

Unsurprisingly, the massive glut of new office space coming onto the market through the building boom (combined with the general turndown of demand with the German recession) has resulted in a huge oversupply of office space in Berlin and a collapse in rental values from 1993 onwards. Developers have tried to respond to the collapse

04.12

in rents by restructuring the use mix of buildings away from office where possible: between the 1992-93 and 1994-95 surveys of the Senate, the office percentage of new buildings sank from 83% to 73% with housing rising from 5 to 10% and retail from 7% to 10%. The office percentage is also much lower in the project ideas that have not yet passed planning¹³.

However there is still a major problem of oversupply in the office market as evidenced in the low rents and high vacancy rates. Given the apparent relation of rental values to the pattern of integration, it will be interesting to see how the pattern of success and failure of new buildings (in terms of vacancy rates and achieved rental levels) in such a tenants' market is spatially organised. The enormous demand and limited available space just after reunification led to a sense that anything could be let in Berlin. With a much greater tenant choice, it seems fair to assume that there will be a more selective pattern of successes and failures. Given the strong spatial pattern of rental values, tenants might be expected to take space preferentially in the more integrated locations. Little data is available to date, according to Müller¹⁴, the sub-centres and peripheral developments outside the S-Bahn ring are proving much more difficult to let. Yet there are also strong indications that the disruption of so much building activity in Mitte is having a detrimental effect on letting in the prime locations like Friedrichstraße itself.

7 Discussion and Conclusions

The historical development of Berlin's Central Business District up to 1940 can be seen to follow closely the pattern of global integration as the settlement grew, stabilising in the area around Friedrichstraße known as Mitte. The subsequent shifting of commercial functions into two new centres in the two halves of divided Berlin has been shown to be clearly related to the radical alteration to the pattern of integration caused by the building of the wall. The reorganisation of land values and commercial land use concentrations in reunified Berlin back into Mitte also appears to be strongly related to the new pattern of global integration that prioritises that area. Property market indicators of rental contours for offices and the clustering of new projects correlate to the pattern of integration. However, there has also been much development in less accessible areas and the scale of building activity has led to oversupply. The tenants' market that has emerged in the recession means that there is a 'selecting out' of buildings by tenants, and their spatial preference revealed through rental contours appears to closely follow the pattern of integration. This interaction between development and the selective response of tenants is strongly related to the spatial morphology of the city and is shaping the new centre of Berlin after the wall.

These findings point to a conclusion that the changing morphological structure of the city (as shown by the integration values of the axial map) is significant in the spatial organisation of property markets. This poses a particular problem for urban economic theory: in order to explain the role of location in the property market under these circumstances, a theoretical approach is required that considers the spatial structure as an endogenous variable along with land use and land value. The tradition of economic modelling of land use and land value dating back from Von Thünen's original model¹⁵ to the new urban economics of the 1960s and 1970s characterised by Wingo¹⁶ and Alonso¹⁷ always had a role for space in the modelling of land use, but

only as an *exogenous* variable: land use and land value patterns emerge from the interaction of users competing in price bids for locations at varying distances from a *given* centre. Berlin poses an extreme example of the more general problem with this approach: if spatial structure is only considered as exogenous in the organisation of land markets and if its role in modelling is as distance from the centre, what can meaningfully be said about a city in transition such as Berlin, where nobody is sure where the new centre is?

The study of the transition in Berlin is very pertinent to the current reawakening of interest in urban economics characterised by theorists such as Krugman¹⁸, New approaches that apply ideas such as evolutionary self organisation to the modelling of urban systems are leading to a much more dynamic modelling of land markets, which suit the kinds of research questions that the reorganisation of Berlin presents. However, spatial structure in these modelling approaches has until now remained a neutral variable, the outcome of market processes rather than an active determinant in their organisation. In studying the new land use and land value patterns that are emerging in Berlin, we *are* seeking to understand a phenomenon of self organisation, but a critical element of that organisation is the change in spatial structure itself and this must be included in the model.

Space Syntax modelling provides a new tool for the analysis of the property market that is especially helpful in cases of marked restructuring such as Berlin after the wall. It provides accessibility data at a street by street level resolution (which any attempt to model the intricate spatial patterns of land value such as those shown in figures 23 and 24 requires) and this spatial data is completely independent of both the land use and land value structures themselves. This means that the purely spatial changes, the functional changes and the land value changes can all be observed independently of each other, without assuming a model at the outset where spatial structure is derived from market processes or vice versa.

Research using Space Syntax has a tradition of detailed empirical studies¹⁹ of space use patterns, particularly pedestrian and vehicular movement flows. This work has begun to open up a new approach to exploring the relation of spatial structure to land use with a focus on the role of movement patterns generated by the morphology of the urban grid²⁰ in the location of land uses. Most of this research has been at the level of detailed studies of urban areas; only in the 1990s with the development of desktop computing power has it been possible to model whole cities with Space Syntax and analyse the spatial structure at a truly global level. Also within the last few years, a revolution in the availability of empirical data on land use and land value patterns has begun, with the move to digital data storage organised spatially with Geographic Information Systems (GIS). For the first time, it is now becoming feasible to represent and analyse the spatial properties of city-wide databases of land use and land value at the resolution of individual buildings.

The next stage of the Berlin research will link the spatial models presented here to land use data in a GIS created by the Berlin Senate for Urban Development²¹ and more accurate individual building data on rental levels and floor spaces for office and retail gathered by property consultants such as Jones Lang Wootton. Using GIS

04.14

as a platform for organising the data, the spatial patterning of rental levels and commercial floorspace can be represented with techniques such as choroplethic mapping. This linking of the Space Syntax model to empirical data using a GIS is important not only in order to test the statistical relationship of these variables to the integration values, but also to be able to represent these spatial phenomena more accurately. The analysis of individual building data will allow such spatial paradigms as the ‘rental contour’ that are so pervasive in the property market to be checked²². This will enable a much more detailed measurement of the relationships between accessibility, land use and land value.

If the initial similarities between the axial map and rental contours are borne out in studies of larger databases at the level of individual buildings, then it seems possible to use the axial map as a *spatial* modelling tool in predictive property market analysis. This would assist the modelling of longer term location trends in a sector where very little ability for prediction beyond experience and common sense currently exists.

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Notes

¹ The unusual character of the property market in Berlin that stems from its recent history (especially the reintroduction of the market in the East) raises many other unique research opportunities, but it is the spatial restructuring element that is the focus of this study.

² There are both advantages and disadvantages to the application of modern planning categories to historical maps. It facilitates comparison between the maps on the same basis over time, but is obviously not designed to capture the different kinds of land use patterning that occurred in the ‘pre-industrial’ city.

³ (Elkins and Hofmeister 1988)

⁴ (Ring 1992)

⁵ (Jones Lang Wootton 1995)

⁶ (Jones Lang Wootton 1995)

⁷ The concept of a local area effect is explained in more detail in ‘Space is the Machine’ (Hillier 1996)

⁸ (SenStadtUm and IHK 1995) *Office oriented buildings have been the overwhelming majority of investment inside Berlin with relatively little shopping centre development. Pure retail has been more dominant just outside Berlin where many new out of town shopping centres have been realised.*

⁹ (SenStadtUm and IHK 1995)

¹⁰ (Aust 1994)

¹¹ *This was completed for the author’s MSc thesis, which contains a more detailed explanation of the methodology and results (Desyllas 1994)*

¹² *This was also the case with other measures of integration and with the total or mean floorspace per street.*

¹³ (SenStadtUm and IHK 1995)

¹⁴ (Müller 1996)

¹⁵ (Von Thünen 1966)

¹⁶ (Wingo 1961)

¹⁷ (Alonso 1964)

¹⁸ (Krugman 1995; Krugman 1996)

¹⁹ *Many examples of this research are summarised in Hillier (1996)*

²⁰ *See particularly the ‘movement economy’ thesis (Hillier 1996; Hillier and Penn 1992)*

²¹ (SenStadtUm 1995)

²² *Especially in such a complex transitional market as is found in Berlin, it seems fair to assume that a much greater level of natural variation will be found in the data at the individual building level.*

References

- Alonso, William. *Location and Land Use: Towards a General Theory of Land Rent*. Cambridge Mass: Harvard UP, 1964.
- Aust, B. *Hauptstadtplanung Berlin*. (Map) Berlin: Senatsverwaltung für Stadtentwicklung und Umweltschutz, 1994.
- Aust, B and U Stark. *Die Städtebauliche Entwicklung Berlins seit 1650 in Karten*. Berlin: Senatsverwaltung für Stadtentwicklung und Umweltschutz, 1987.
- Desyllas, Jake. *After the Wall: A Spatial Analysis of Property Development in Reunified Berlin*. University College London MSc Thesis, 1994.
- Elkins, T and B Hofmeister. *Berlin: The Spatial Structure of a Divided City*. London: Methuen, 1988.
- Hillier, Bill. *Space is the Machine*. Cambridge: Cambridge University Press, 1996.
- Hillier, Bill and Alan Penn. "Dense Civilisations: the Shape of Cities in the 21st Century." *Applied Energy* 43 (1992): 41-66.
- Jones Lang Wootton, . *City Report Berlin*. Jones Lang Wootton Research, 1995.
- Krugman, Paul. *Development, Geography and Economic Theory*. Ohlin Lectures, London: MIT Press, 1995.
- Krugman, Paul. *The Self-Organising Economy*. Blackwell, 1996.
- Louis, H. "Die Geographische Gliederung von Gross Berlin." In *Landerkundliche Forschung: Festschrift zur Vollendung des 60 Lebensjahres Norbert Krebs*, eds. H Louis and W Panzer. 146-71. Stuttgart: Engelhorn, 1936.
- Müller. *Städte Report Berlin 1996*. Müller International Immobilien GmbH, 1996.
- Ring, Peter. "Industriestandort Berlin: Wissenschaftliche Analyse, Unternehmerische Bewertung, Politische Initiativen." In *Industriepolitische Konferenz der Senatsverwaltung für Wirtschaft und Technologie* edited by Peter Ring, Regioverlag 1992.
- SenStadtUm. *Digitale Umweltatlas Berlin*. Berlin: Senatsverwaltung für Stadtentwicklung und Umweltschutz, 1995.
- SenStadtUm and IHK. *Büroflächenbericht Berlin 1994/95*. Senatsverwaltung für Stadtentwicklung und Umweltschutz / Industrie und Handelskammer Berlin, 1995.
- Von Thünen, Johann Heinrich. *Isolated State*. Translated by Carla M. Wartenberg. London: Pergamon (orig. 'Der isolierte Staat in Beziehung auf Landwirtschaft und Nationalökonomie' Hamburg, 1926), 1966.
- Wingo, L. *Transportation and Urban Land*. Washington D.C.: Resources for The Future Inc, 1961.

