Urban Regeneration as Self-Organisation

Michael Batty

Centre for Advanced Spatial Analysis (CASA)
University College London (UCL)
90 Tottenham Court Road, London W1T 4TJ, UK

m.batty@ucl.ac.uk
www.complexcity.info

Wednesday, 22 June 2011

(Re)defining (Re)generation

Cities are living, self-organising systems that grow organically from the bottom up. They are composed of entities – people and buildings – that have limited life spans and have to be renewed continuously, although medical and technological innovations are changing the length of these cycles quite dramatically. People are living longer and it is increasingly easy to either redevelop buildings quickly or to build them in materials that have greater durability. But to survive and to respond to new challenges, cities are continually regenerating and renewing themselves. Indeed, regeneration is the mark of any living system, and in cities, most activity that takes place can be considered as part of this process of renewal. New growth or absolute decay tends to be a relatively small proportion of the total change. Indeed, cities are continually in flux as people and their activities respond incessantly to changed circumstances which involve shifts in movement patterns, locations, the use of buildings, and in social preferences.

Whether or not the processes of regeneration are sustainable and lead to a better quality of life is not assured simply because a city reproduces itself. Cities change through positive feedback. Change builds on itself and if there is growth or decline, regeneration might reinforce the cycle, each wave of change building on the previous, often spreading out as well as polarising through intricate patterns of diffusion. Growth is easier to track as a positive feedback, good examples being gentrification where one group, usually the richer, takes over the buildings that were once occupied by the poorer. Once richer people decide that a neighbourhood is 'desirable', the first movers start a cycle of cumulative causation which results in prices being bid up to the point where the poorer occupants are either forced to leave if they rent or are attracted to sell through rising prices. The most visible example of this cumulative causation leading to decline is the vacating of the city of Detroit which has fallen in

population from 1.4 million in 1970 to half that today, with the consequent abandonment of whole areas of the inner city and a greening of what were once prosperous residential areas.

A key feature of systems that regenerate themselves is that they do so spontaneously. To do so otherwise would require control of every basic element of the system and it thus follows, that systems of any complexity must effect self-regeneration through self-organisation from the bottom up. In city planning, regeneration has come to mean something a little different. Urban regeneration is now usually structured through planned interventions which are anything but spontaneous, and often conflict with processes that are intrinsic to the survival of the system itself. Sometimes *spontaneous regeneration* can be stopped in its tracks by attempts at *planned regeneration* which tends to be manufactured from the top down. A city is composed of layer upon layer of interactions which represent a multiplexing of networks acting to deliver energy, information, materials and people to its parts in such a way that the networks contain great redundancy. If fractured, cities usually continue to work although if their key hubs are attacked they will break down. In the same way if they become overloaded, their networks jam but in general, because they operate from the bottom up through the actions of millions of individuals, they tend to adjust easily and quickly to changed circumstances.
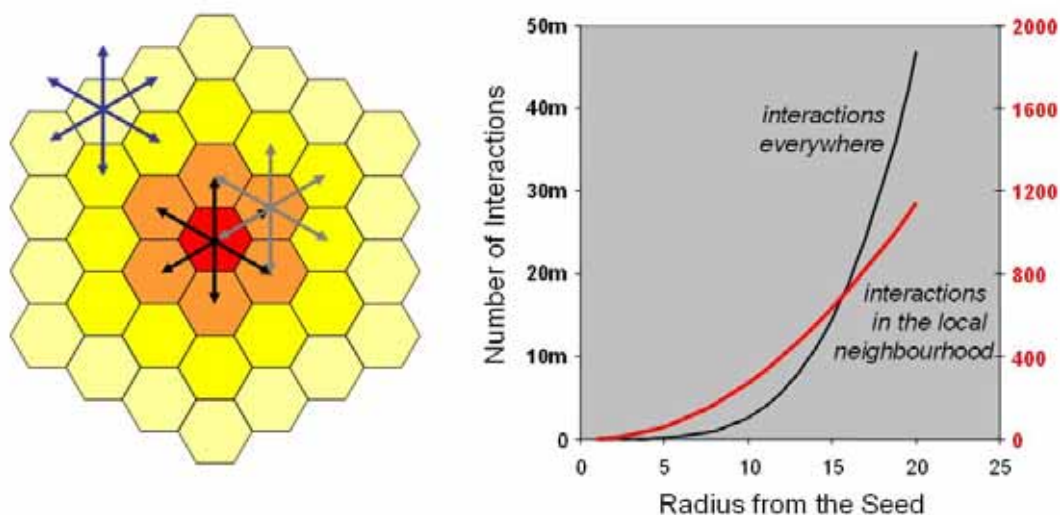

Figure 1: How a Seed Planted in the Urban Landscape Influences it s Neighbours by Diffusing Its Success Through Interactions

We provide a picture of this process in Figure 1 where we show in abstract terms how such processes generate positive feedbacks as spirals of prosperity or decline which diffuse across the urban landscape. We show an idealised urban landscape broken into regular cells or locations where activity can be located, with the arrows indicating how adjacent cells influence one another. When we plant a seed of growth, say the central red cell in Figure 1, then the cells around it become activated and the innovation diffuses as waves: the red cell generates orange, the orange yellow, the yellow beige, and so on. The number of cells and the number of interactions – in this case 6 for each cell – grow approximately in proportion to the area of the circle πr^2.

This exponential effect is even more powerful – it is super-exponential - if each cell influences every other in the growing system, and the graph shows how this kind of positive feedback generates such growth. To an extent, this is what we hope for of regeneration for as areas regenerate spontaneously, then the 'DNA' causes the cell to 'grow' to form other cells.

In an equivalent way, Figure 1 has a mirror image as a process of decline with a bad cell affecting its neighbours and in turn making them 'bad'. This is much more akin to the way industries in the past begin to decline with one industry failing and destroying the linkages to neighbouring industries, often leading to a spiral of deindustrialisation. There is also uncertainty as to how much the seed affects its neighbours and if we build this into the model, diffusion becomes more random. As the life of any activity generated comes to an end, it needs to be renewed. The wave-like structure of regeneration that occurs as old activity is replaced with new is also subject to uncertainty and ultimately the original structuring of the city in areas of like development is destroyed through differential renewal, thus mixing land uses. We show a picture of this in Figure 2 which is a simple version of the model shown in Figure 1. This breeds wave after wave of regeneration which successively mix the cells in terms of the time when they are developed. This picture makes it clear that whenever we look at any piece of urban fabric which has been subject to change, it becomes harder and harder to detect what influenced what as the initial structuring washes itself away in the resultant mix (Batty, 2009).
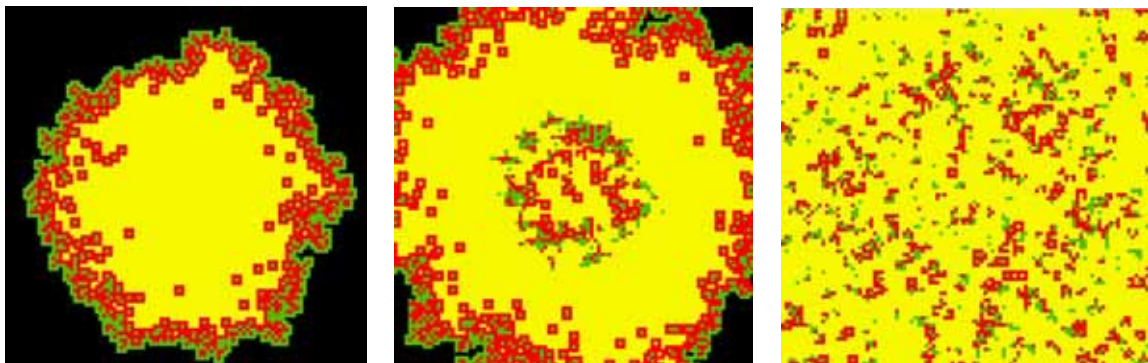

Figure 2: Successive Waves of Growth and then Regeneration Wash Away the Initial Structure (left) to Generate a Mix (right)

The trick of course for urban planning is to identify key points where a small change can lead spontaneously to massive change, for the better of course (Hamdi, 2004). We need to figure out that seeds can be planted that do not fall on stony ground, which will lead to regeneration that is sustainable from the bottom up, thus avoiding more and more investment from the top down. Growth as well as decline can be pathological and urban sprawl is often regarded as unsustainable. However, it is inner city decline in areas which once housed industries now transformed into highly automated, footloose forms requiring little labour, that fall into viscous cycles of progressive decline hard to break. Areas of such decline are to be found in most large cities whose industrial base has gone, only to be replaced with financial services and high tech, located elsewhere. Indeed, the proposal to locate the Olympics 2012 hub in East London at Stratford is primarily because there is much vacant, abandoned land.

Over the last twenty years, there has been enormous investment in the area which has led to little (Florio and Edwards, 2001). The mission now is to attempt an even bigger wave of planned regeneration which will kick in after the event has taken place for it is the legacy that is crucial to the regeneration (Hammond, 2011). Will this effort dovetail with the normal processes of self-organisation that serve to keep the city working? This we will attempt to assess here.

Identifying Critical Points for Intervention

Regeneration is part of this process of enabling the city's various networks to keep functioning, and declining areas that we might consider problematic, may be key to the processes of natural regeneration. If we interfere in them without understanding all their ramifications, such planned regeneration can be disastrous, leading to exactly the opposite effects than those intended. The causes of decline and poverty usually relate to industries that have long outlived their usefulness. The spiral of decline that sets in further impoverishes the remaining population as the youngest and brightest leave, and with an aging population and workforce, such areas become increasingly unattractive for new industries and services. Many regeneration problems simply try to address these issues by providing new infrastruture which is everything but a new basis for jobs. Housing is one of the classic remedies but all this succeeds in doing is providing updated residential facilities for the same population. Injections of new population are rare for regeneration is never thought of in terms of new selective in-migration.

The key is to find the right mix of activities, to plant seeds that lead to the regeneration attracting related activities because of their evident synergy. This does not necessarily require large scale investments but it does require activities that lead to new synergies. In fact, large scale infrastructure projects are probably the wrong types of activity for regeneration because the jobs they bring tend to be few – simply for building and then maintaining the infrastructure. In East London, all of the activities to date prior to the Olympic Games (with the exception of the Jubilee line extension linking Stratford to the city and west) have all been low key investments. The Olympics Games site will provide massive infrastructure whose success will be after the games are ended when the stadia are used for high profile events like premier division soccer. But the shopping centre complex that is being built will also draw people in as this area of East London is grossly under provided for in terms of retailing.

The biggest dangers, however, are that people will come into the area to shop and use the facilities but that much of the expenditure they generate will not benefit the local community. If one provides infrastructure and facilities for people to come to a place, they can equally well leave a place using that same infrastructure. East London's proximity to the City of London is however a major advantage and there are already some evident spill-overs but it is surprising there have not been more, given house price differentials. This raise the spectre, too, of house price rises locking out the local community as was the case in the London Docklands a generation ago and is the case in recent Olympics Games projects such as those in Sydney and Athens.

Tracing the Impacts

The multipliers that ripple through the city which are expressed in both physical terms as networks and less visible social and information interactions, condition the extent to which we can explore how effective regeneration might be. We have built a land use transportation model of how populations relate to employment, largely in terms of the simulating the journey to work and to shop. We divide the city up into small zones, like our cells in Figures 1 and 2, and we build the key urban networks through the various transportation modes – road, tube, bus and heavy rail – that link them together. There is a long tradition of building models of this kind largely to look at the impact of new transportation proposals but with this extended model originally built to look at energy and climate change in Greater London, we can ask many "What If?" questions; for example, what is the impact of locating 100,000 new jobs in the Olympic Games area which is what the Borough if Newham in whose authority this area sits is predicting as possible in the next 20 years (Newham, 2011). If this many jobs do materialise, there is no doubt there will be an enormous regeneration on the scale of the London Docklands but the key question is "will they materialise?" and if they do, "will the associated population live locally or commute in from elsewhere?". Some jobs will be pump primed but most will need to be generated spontaneously. The London Docklands is the nearest exemplar but this is London's second central business district, the escape valve for the City, and it unlikely to be repeated here.
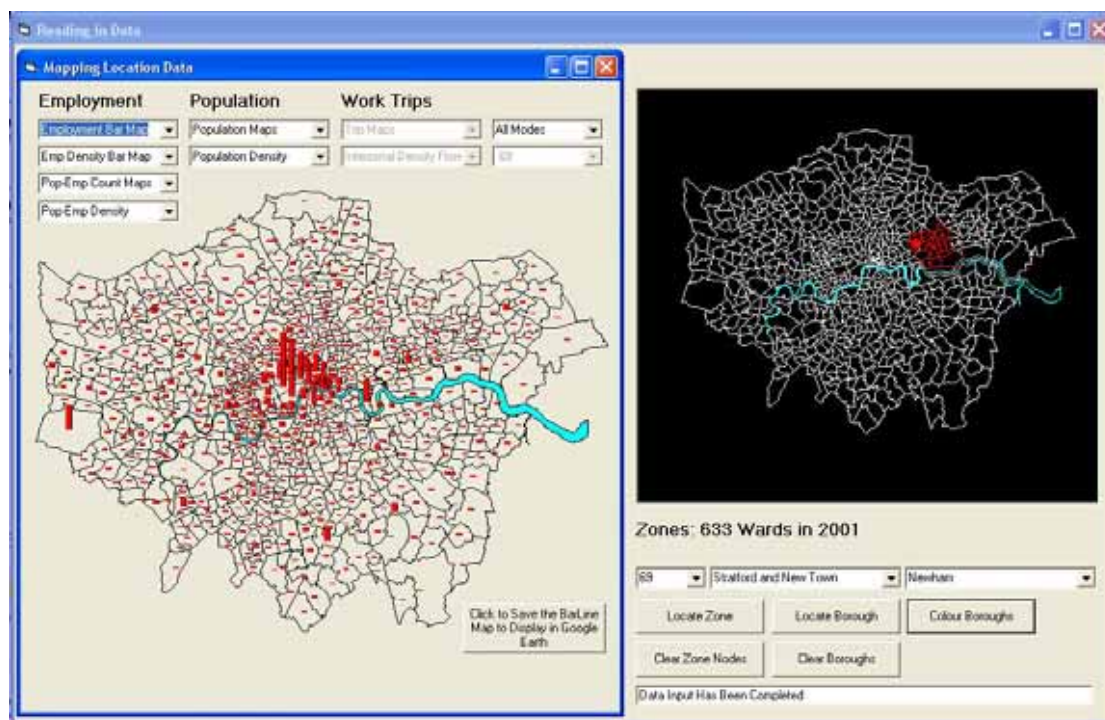

Figure 3: The Pattern of Employment Across Greater London (left) with the East London Olympic Games Site marked at Stratford (and Newham) (top right)

One of the other big infrastructure projects is Cross Rail which is designed to link west to east London by 2015. Whether or not a greater proportion of the population will drift west even though there are new jobs in the east is a critical question that our model is designed to answer as it codes much of the logic of linkage and transport that

we associate with regeneration (as in Figure 1) into its structure. A visual walk through of how we might assess these impacts using data from our model in map and 3D form begins in Figure 3 where we show the highly concentrated pattern of employment across London with Stratford and its borough marked out. In Figure 4, we have imported all this data into Google Earth where we show employment as a bar map, population density, and the transport flows into the Stratford hub. The proximity of the City is evident in terms of jobs and the advantages of the area are graphically demonstrated in Figure 5 which shows the relative accessibility – nearness of places to one another (highest red to lowest blue) overlaid with the tube lines that serve the area as well as the Olympic stadium.
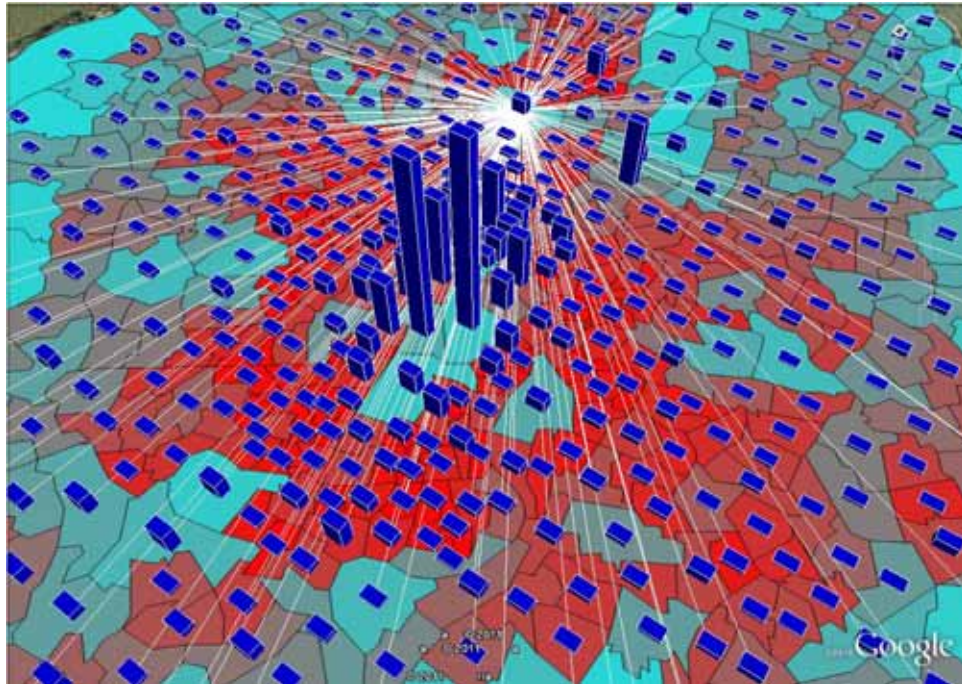

Figure 4: A Bird's Eye View of Westminster and the City of London with Stratford Beyond (upper centre).
The bars represent employment volumes, the red to blue colouring represents population density from high to low by ward, and the white flows are traffic volumes centred on Stratford.

The key to assessing the regeneration is to develop a series of scenarios where we plug new jobs, new homes, new retailing, and new transport links into the area and then predict using our model what the impact will be. We can develop various scenarios in this way and here we will develop two: first simply locating 50,000 jobs and the current planned housing into the key cells around Stratford and then doing the same by adding twice that many jobs – 100,000, putting in the planned Cross Rail from west London into the area, and adding new retail employment sites, already approved and planned. In Figure 6, we simply plug in the jobs and show the population which is generated and redistributed by this regeneration. In essence what we need to demonstrate is that the population which is generated from these jobs stays largely in the area and does not move out to what are historically more attractive areas. Figure 7 shows that although the scale of these jobs and the new housing leads to largest absolute changes in population across East London, when we examine the percentage change, apart from a small area in Stratford itself, much of the population

leaks out west to the more prosperous areas south west of the centre. There is some population loss in the centre itself probably due to congestion charging working itself out still and this is graphically shown in Figure 8 which indicates the concentration of transport links in the corridor between the City and Stratford. But it is when we test the second scenario based on adding 100,000 jobs, building Cross Rail and adding retail and housing into the area that the real problems emerge. As we show in Figure 9, Cross Rail (whose line across the city is shown in Figure 10) tends to draw population into the new key hubs mainly in west London that come from the location of the new stations. This massive increase in linear accessibility across the entire metropolis leads to a complete reversal of population locations with the west becoming much more favoured both in absolute and proportional terms as Figures 9 and 11 show. The impact of growth in the Cross Rail corridor shown in Figure 12 is stark and far from letting Stratford retain its new found working population, it leaks west.
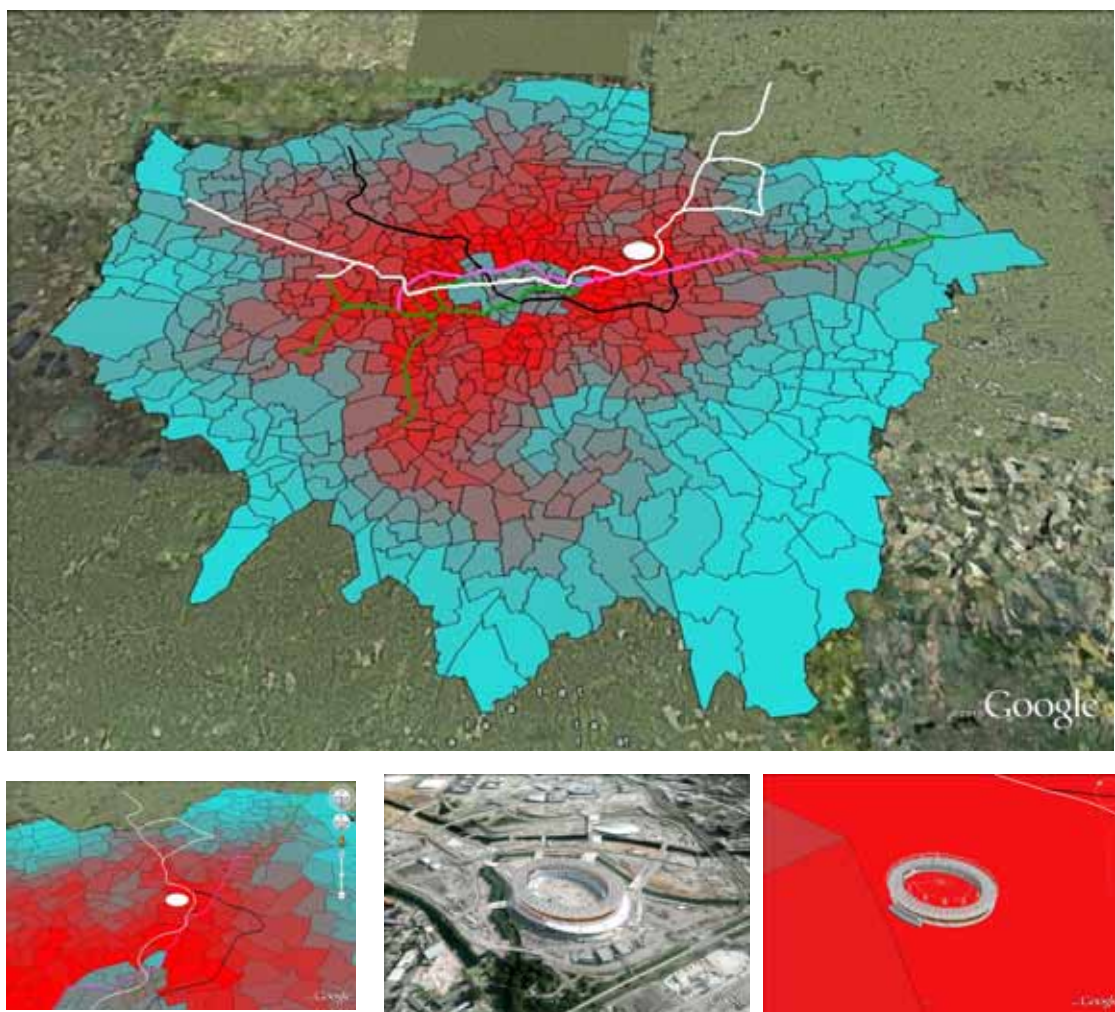

Figure 5: Transport In East London: Accessibility, Tube Lines in Stratford, and the Location of the Olympic Games Site

Accessibility is the relative nearness over all modes of transport of every ward to every other coloured from high (red) to low (blue). The Central, District, and Jubilee Tube Lines are shown with the Olympic Site marked by the ovals in each picture, as we zoom in.
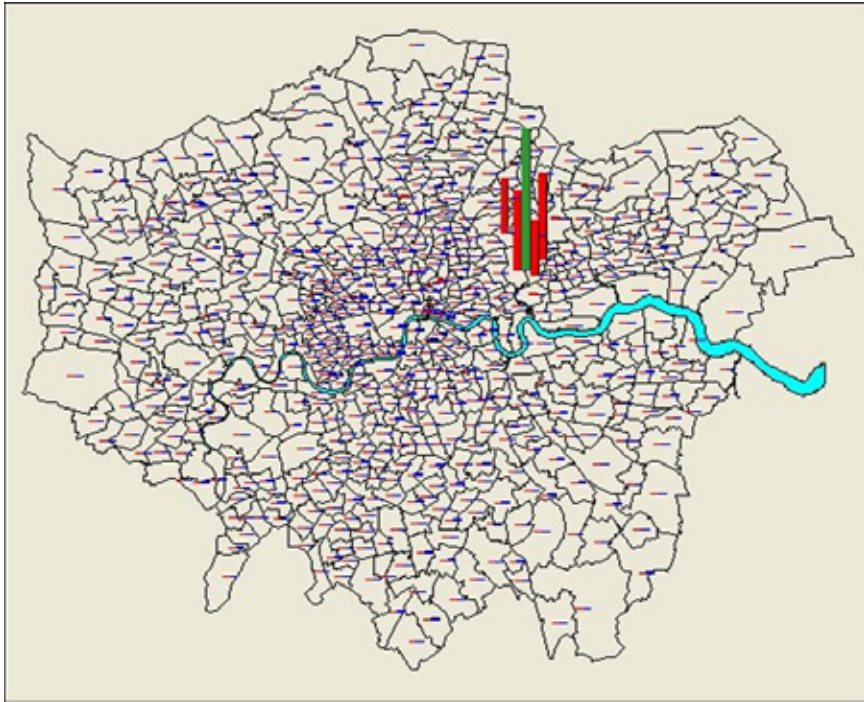
Figure 6: The Location of New Jobs and Housing in East London and Relative Shifts in Population

The green bar is 50000 jobs in Stratford, while the red and blue bars are gains and losses in population due to a restructuring across the metropolis
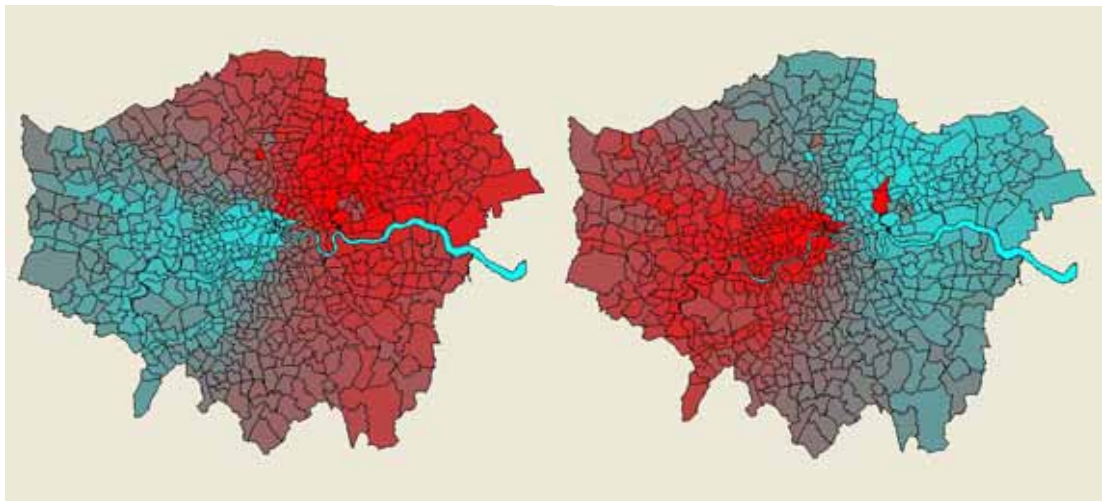

Figure 7: Mixed Blessings: Absolute Larger Gains in Population in East London due to Regeneration but Relative Percentage Gains in West London

These maps reflect a ranking of population gains from highest rank red to lowest blue. The left map shows that, in general, the east gains the most population, despite a shadow to the immediate south east of Stratford but the right map shows that relative gains tend to be higher in inner west London and along the Central Line, despite the highest relative gain being in the immediate vicinity of Stratford.
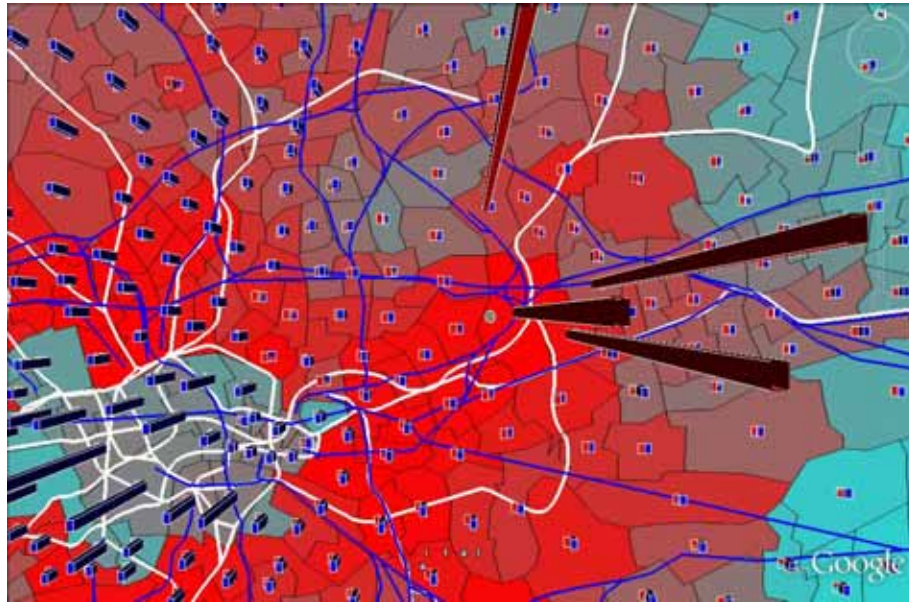
Figure 8: The Location of New Housing in East London Superimposed on the Overall Transport Accessibility Surface

Big gains in absolute population in the three wards around Stratford but relative losses in parts of the City probably due to the increased accessibility of East London. This is compounded by Congestion Charging which is the low accessibility blue-y area to the bottom left of the map. Note the importance of the transport hub in East London where tube lines (white) and surface rail (blue) coalesce.
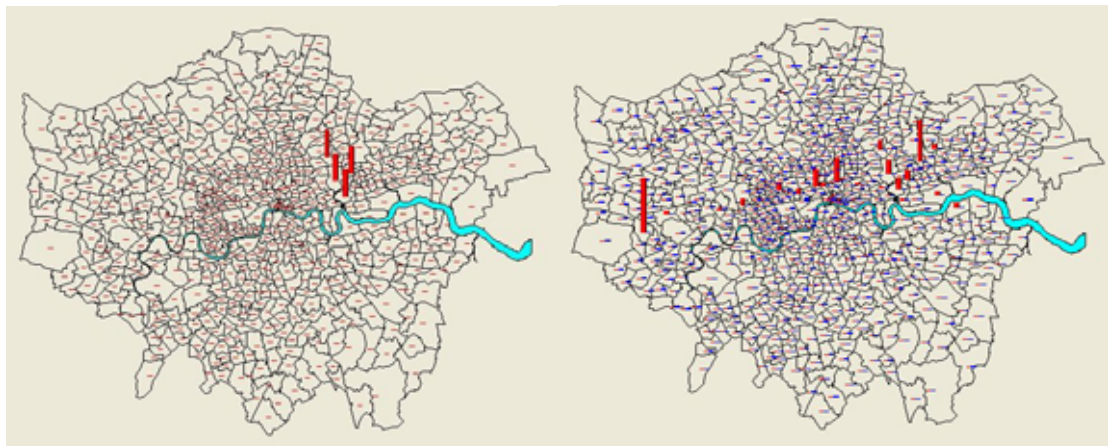

Figure 9: 100,000 New Jobs Located in East London and the Population Hubs Generated by Cross Rail

Due to increased accessibility from Cross Rail, many of the jobs generated in East London ultimately lead to population growth west along the rail corridor
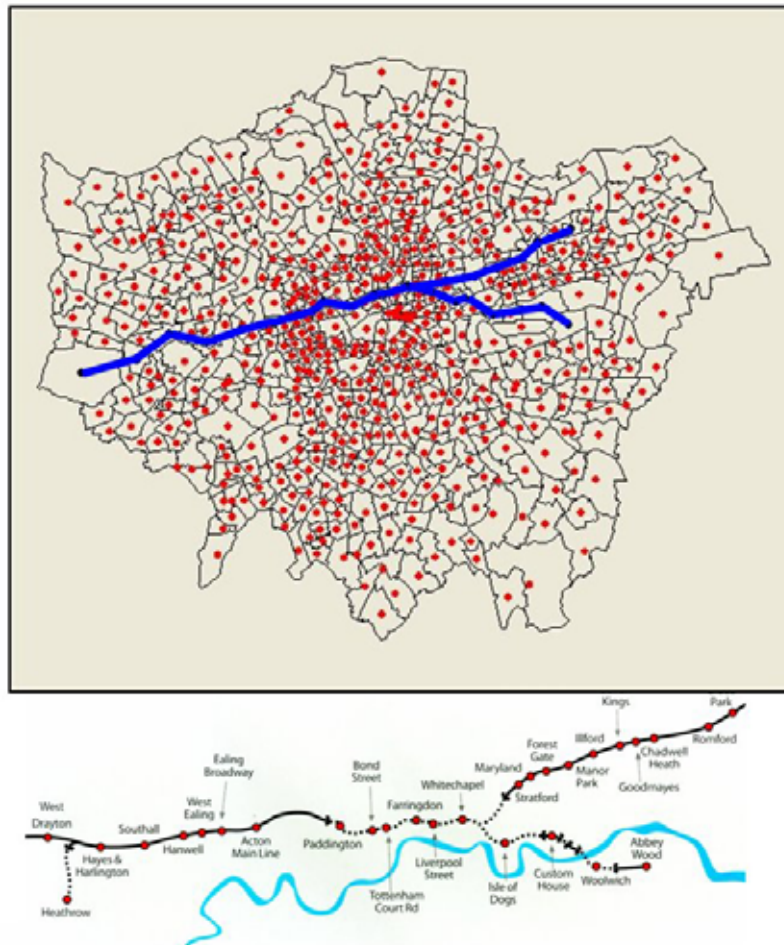
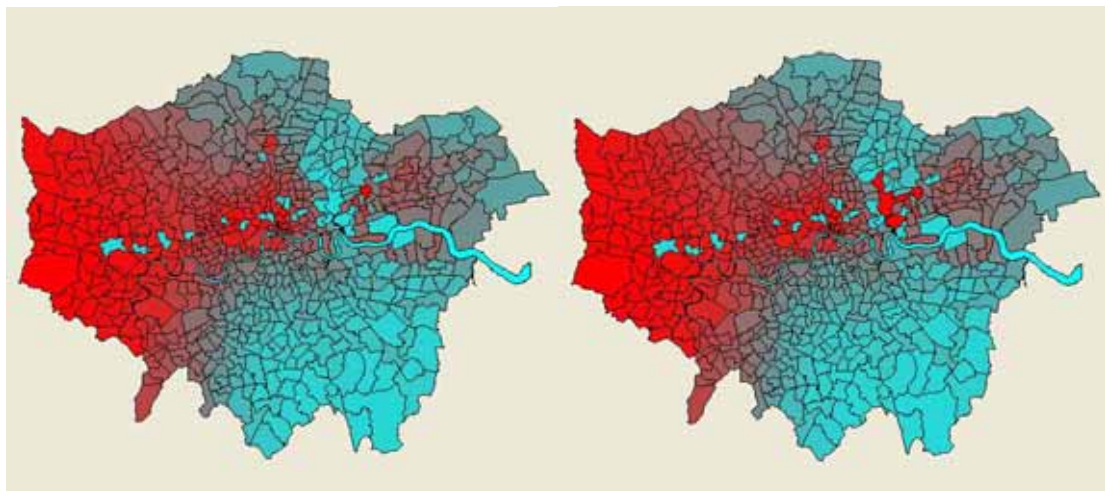*Figure 10: The Location of New Lines in the Cross Rail Project*

Figure 11: Highly Localised Gains in Population in East London Generate Bigger Gains in the West Along Cross Rail

Unlike the regeneration which occurs without Cross Rail that has bigger gains in East London, absolute (left map) and relative (right map) gains go largely to West London. These are gains ordered by ranking. Note the pockets which are not connected directly to Cross Rail stations in the west.

Of course, this is a very artificial picture and it is inevitably an extreme scenario. But it does raise very basic concerns about what the long term future of this area will be like. There are many things that the model does not do with respect to building on the kinds of cumulative causation that could lead to a successful regeneration. All it does is assume that if the present patterns of behaviour and interaction persist, then the area will lose more than its fair share of investment to other parts of London. In a sense, this is what has been happening in the past and the trick will be to somehow get the mix right that reverses this pattern. This will require some very clever investment in jobs that are high value and resilient, and it will require some ingenious ideas about future transport. A revival of British manufacturing is being talked about. This would be a wonderful context in which to make it work as all the other supporting investment is there.
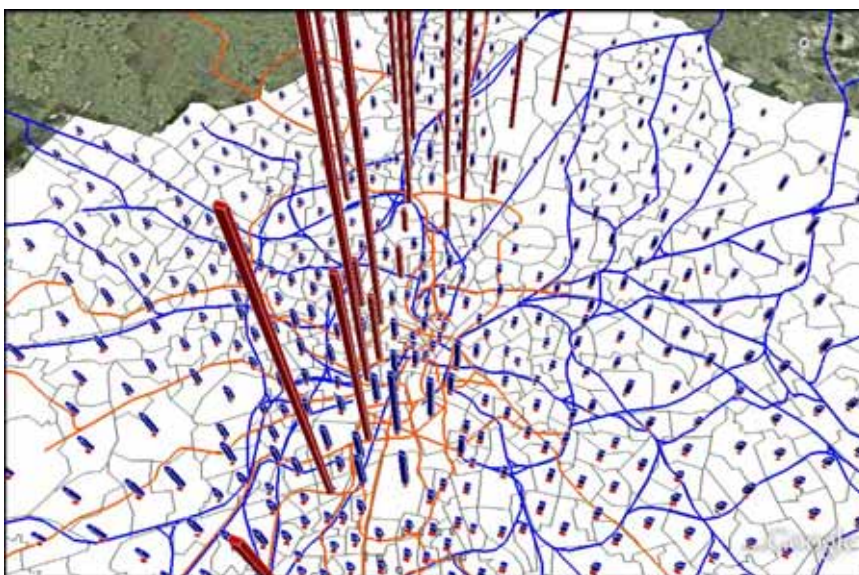

Figure 12: The Cluster of Transport Infrastructure and Growth in Population Along the Cross Rail Corridor Looking West into Stratford

Main line rail in blue, tubes in orange, and the bars represent new population in the corridor.

To make a success of the Olympic legacy, our model shows that it is essential to develop a sequence of investment opportunities in jobs of a high enough quality that they become self-generating. The notion that these must be in high tech is passé for there are other parts of London such as Soho and Hoxton that have much greater advantages and in any case, there are limits as to how far we can go in this globally competitive market. In one sense, the legacy is something that will only be successful if the area positions itself for the next new wave of industrial employment such as high value manufacturing and even then, this is a fiercely competitive market. The transport links will be second to none after Cross Rail and the new International Euro Star terminus are completed but good transport can take as many people out as bring them in. The trick will be to reverse the multiplier effects that attract people to live elsewhere and in this, selective investment will be required on all fronts.

References and Further Reading

Batty, M. A Digital Breeder for Generating Cities, **Architectural Design**, **79**, 4, July-August, Profile No 200, 46-49, 2009

Florio, S., and Edwards, M. Urban Regeneration in Stratford, London, **Planning Practice & Research**, **16**, 101– 120, 2001

Hamdi, N. **Small Change: About the Art of Practice and the Limits of Planning**, Earthscan Ltd, London, 2004

Hammond, E. London 2012: The Games are a Sideshow. The Real Story is the Urban-Renewal Program. From **Financial Times** 19 June 2011, available at http://www.slate.com/id/2297346/

Newham *Regeneration: Regen 38*, written evidence submitted by the London Borough of Newham, to the Parliamentary Select Committee on Communities and Local Government Committee, April4, 2011 available at http://www.publications.parliament.uk/pa/cm201011/cmselect/cmcomloc/writev/regeneration/m38.htm